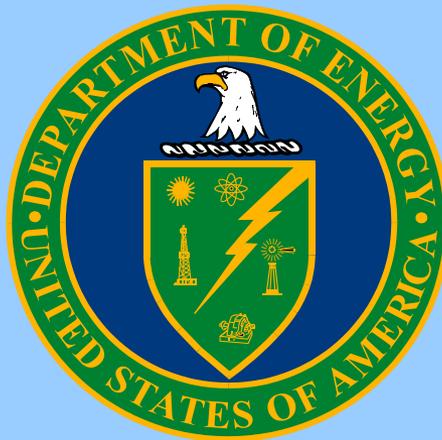


# Earthquake Research and Implementation Activities at DOE



**Steve McDuffie, Seismic Engineer  
Office of the Chief of Nuclear Safety  
U.S. Department of Energy  
9 November 2010**

# History

- ◆ DOE was once a leader in seismic and other natural phenomena hazard characterization and design; created the DOE “1020 series” of standards in the mid-1990s.
- ◆ The Department saw attrition of its NPH staff over the last decade.
- ◆ Major projects continued (Hanford, Savannah River waste treatment plants) and problems arose.
- ◆ The Chief of Nuclear Safety (CNS) is working to improve DOE’s performance in seismic and other natural phenomena hazard mitigation.

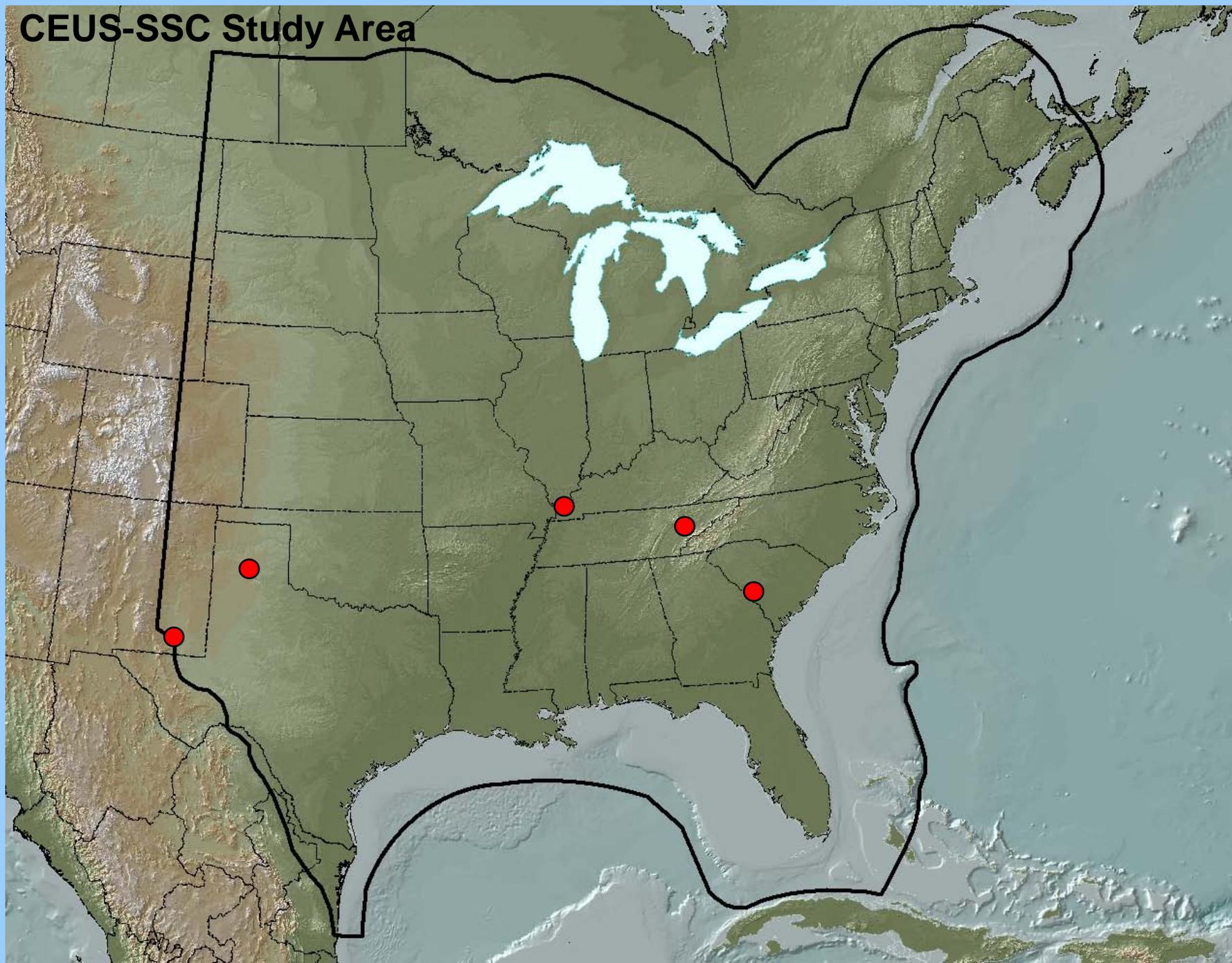


# Seismic Lessons-Learned Panel

- ◆ The CNS instituted the SLLP in August 2007 to provide DOE recommendations for improvement.
- ◆ Specific suggestions include:
  - ◆ Stipulate expectations, standards in contracts
  - ◆ Rigorous peer review of seismic designs
  - ◆ Enhanced involvement/oversight by DOE staff
- ◆ The Panel meets every 6-8 months to discuss concerns specific to DOE projects as well as more generic issues affecting nuclear facilities.



# CEUS-SSC Study Area



## **CNS Activities: CEUS-SSC**

- ◆ **CNS and DOE Office of Nuclear Energy partnered with EPRI, NRC to support the CEUS-SSC for Nuclear Facilities Project.**
- ◆ **A SSHAC Level 3 study to provide high confidence of capturing center, body and range of the informed technical community.**
- ◆ **Participatory Peer Review Panel.**
- ◆ **A regional model requiring site-specific enhancements.**
- ◆ **Slated for completion February-March 2011.**



# CNS Activities: NGA-East

- ◆ **CNS and Nuclear Energy again combining efforts to provide DOE's support, with EPRI, NRC, USGS.**
- ◆ **Five-year study to develop new attenuation relationships for the CEUS.**
- ◆ **As with CEUS-SSC, the results should improve seismic hazard calculations and ideally, reduce uncertainty as NGA-West did.**
- ◆ **CNS less directly involved in this effort so far.**



## Other CNS Projects

- ◆ Commissioned research paper, *Investigation of Seed Record Selection on Structural Response*.
- ◆ Commissioned topical report on modeling, seismic analysis and qualification of pressure vessels.
- ◆ Investigating potential problem with SASSI code.
- ◆ Planning future research into foundation input response spectra.
- ◆ Helped sponsor 2010 Earthquake Engineering conference in Toronto.
- ◆ DOE NPH conference planned for Sept. 2011.





**Hanford**

**Idaho**

**Los Alamos**

**Pantex**

**WIPP**

**Paducah**

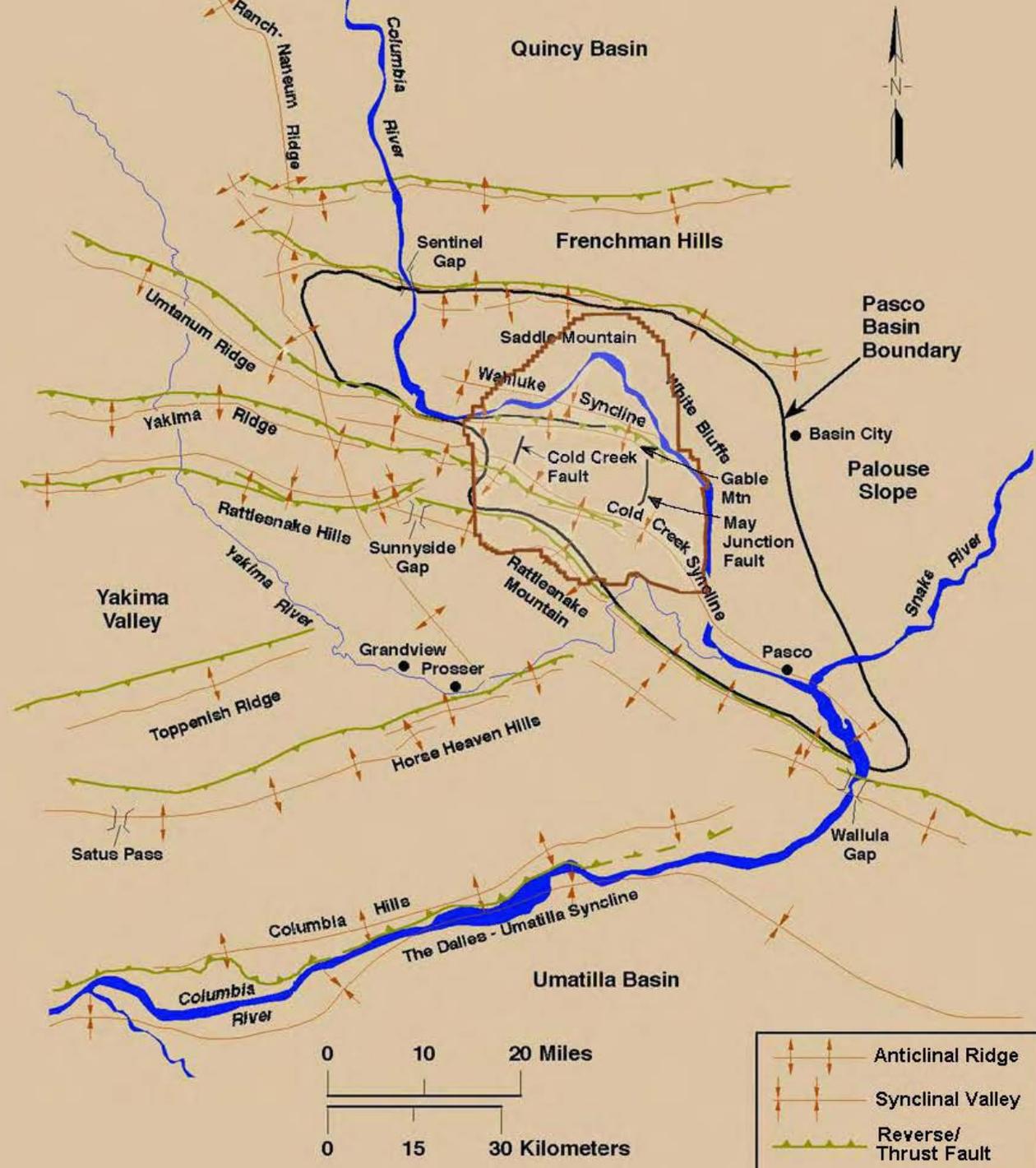
**Oak Ridge**

**Savannah River**

# **New Hanford PSHA**

- ◆ **DOE sites are required to review NPH assessments every 10 years, update if necessary.**
- ◆ **Operations at Hanford will continue for decades.**
- ◆ **Mid-Columbia Dam PSHA suggests higher hazard.**
- ◆ **Considerable uncertainty and contention in characterizing Yakima Fold Belt sources.**
- ◆ **SSHAC Level 3 study to examine seismic sources and attenuation expected to start soon.**





Quincy Basin

Frenchman Hills

Pasco Basin Boundary

Palouse Slope

Yakima Valley

Umatilla Basin

-  Anticlinal Ridge
-  Synclinal Valley
-  Reverse/Thrust Fault

0 10 20 Miles

0 15 30 Kilometers



# **Savannah River PSHA Update**

- ◆ **An effort is underway to update the Savannah River Site PSHA using the CEUS-SSC model.**
- ◆ **Project is reviewing existing site data, awaiting the CEUS-SSC results.**
- ◆ **CEUS-SSC model will be modified with any necessary refinements to local tectonic features, consider multiple attenuation relationships.**
- ◆ **Project will serve as a model for adapting CEUS-SSC for site-specific use: Level 2 refinement to Level 3 study.**
- ◆ **Completion scheduled December 2011.**



## **Idaho Site Review**

- ◆ **The Idaho National Laboratory is completing a review of the Idaho Site PSHA.**
- ◆ **Soon DOE expects to receive a recommendation to perform a new PSHA following SSHAC guidance.**
- ◆ **This effort is currently managed by the Idaho Operations Office, but is gaining interest from DOE Headquarters.**



# **Facility-Specific Design Work**

- ◆ **Considerable effort is ongoing with seismic design and equipment qualification at several facilities:**
  - ◆ **Waste Treatment Plant at Hanford.**
  - ◆ **Chemistry and Metallurgy Research Replacement at Los Alamos.**
  - ◆ **Uranium Processing Facility and Uranium Down-blending Facilities at Oak Ridge.**

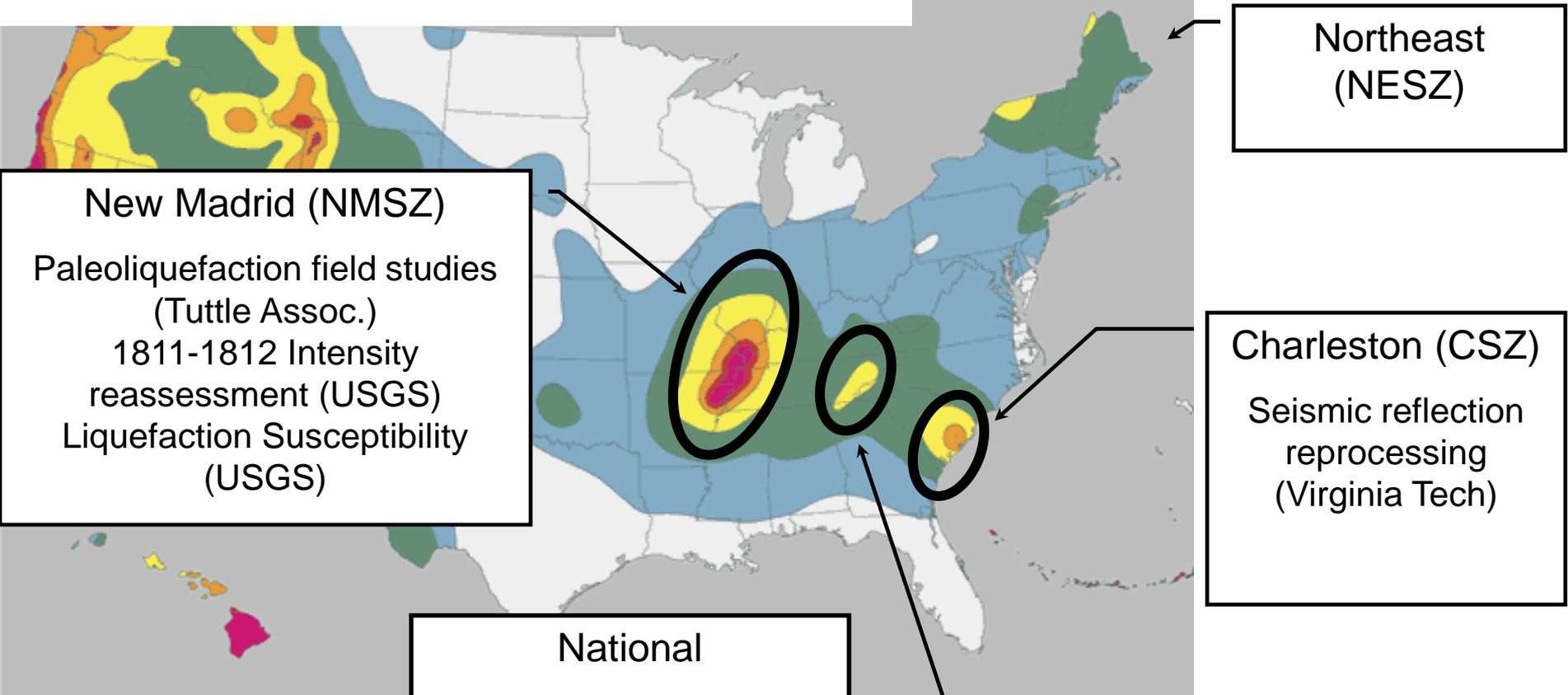


## **Other Site Activities**

- ◆ **Pantex and Paducah are due for their 10-year NPH reviews and will likely use CEUS-SSC results to update site seismic hazard analyses.**
- ◆ **Oak Ridge will need to perform 10-year review around 2013, will also rely on CEUS-SSC.**
- ◆ **A question on WIPP surface facility seismic design recently arose, will review analysis.**



# Additional projects supporting source Characterization in the CEUS



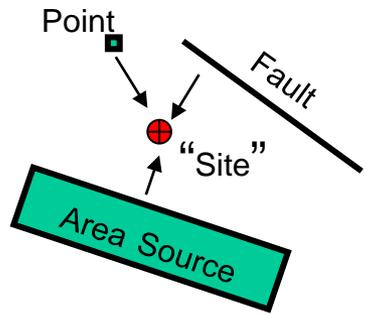
**New Madrid (NMSZ)**  
Paleoliquefaction field studies (Tuttle Assoc.)  
1811-1812 Intensity reassessment (USGS)  
Liquefaction Susceptibility (USGS)

**Northeast (NESZ)**

**Charleston (CSZ)**  
Seismic reflection reprocessing (Virginia Tech)

**National**  
Advanced National Seismic System (USGS)  
New Paleoliquefaction guidelines (NUREG)

**Eastern Tennessee (ETSZ)**  
Paleoliquefaction (Univ. of Tenn)  
Seismites (speleothems) (USGS)



# Summary

- ◆ After serving as a leader in seismic hazard characterization and mitigation in 1990s, DOE's performance slipped.
- ◆ A renewed focus over last 3-4 years is leading to improvements, learning from past mistakes.
- ◆ DOE is adopting national consensus standards for seismic hazard characterization and mitigation.
- ◆ DOE is open to working with other agencies (NRC, USGS) to share information and reduce duplication of efforts.

