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**To:** <JTDAVIS@southernco.com>
**Date:** 10/31/2007 5:22:02 PM
**Subject:** Slides for tomorrow

Jim,

See attached.

Christian

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U.S.NRC
UNITED STATES NUCLEAR REGULATORY COMMISSION
*Protecting People and the Environment*

# Presentation to the ACRS Full Committee

## Safety Review of the Vogtle Early Site Permit Application

Presented by

Christian Araguas, Project Manager

NRO/DNRL/NWE1

November 1, 2007

# Purpose

- Brief the full committee on the status of the staff's safety review of the Vogtle early site permit (ESP) application
- Support the full committee's review of the application and subsequent interim letter from the ACRS to the Commission
- Address the full committee's questions

# Meeting Agenda

- Schedule Milestones
- Key Review Areas without Open Items
- Key Review Areas with Open Items
- Review of Geology, Seismology and Geo-technical Engineering
- Conclusion
- Discussion / Questions

# Completed Milestones

- Received Vogtle ESP Application - 8/15/2006
- Acceptance Review Completed - 9/19/2006
- Inspections / Site Audits:
  - Quality Assurance - 8/2006
  - Emergency Planning - 10/2006
  - Hazards & Security - 11/2006
  - Meteorology - 12/2006
  - Hydrology, Geology, Health Physics - 1/2007
- RAIs issued to the Applicant - 3/15/2007
- SER with Open Items issued - 8/30/2007
- Responses to Open Items Received - 10/15/2007

# Remaining Milestones

- ACRS Full Committee Meeting – 11/1/2007
- ACRS Interim Letter Assumed – 11/2007
- Advanced SER with no Open Items due to ACRS – 5/16/2008
- ACRS Full Committee Meeting – 6/2008
- ACRS Final Letter Assumed – 7/2008
- Final SER issuance – 8/6/2008
- Mandatory Hearing – Spring 2009
- Commission Decision Assumed – Summer 2009

# Key Review Areas

## 2.1 Geography and Demography

- Site Location and Description
  - Staff Finding: The staff concludes that with respect to site location and description, the relevant requirements of 10 CFR Part 52 and 10 CFR Part 100, Subpart B have been met.
- Exclusion Area Authority and Control
  - Staff Finding: The staff concludes that the SNC's exclusion area is acceptable and meets the requirements of 10 CFR Part 52 and10 CFR Part 100.
- Population Distribution
  - Staff Finding: The staff concludes that the proposed LPZ and population center distance meet the definitions in 10 CFR 100.3. The staff also concludes that the population data are acceptable and meet the requirements of 10 CFR Part 100

# Key Review Areas

## 2.2 Nearby Industrial, Transportation, and Military Facilities

- Staff Findings: Potential Hazards associated with nearby transportation routes, industrial and military facilities pose no undue risk to facility that might be constructed on the site (10 CFR 100.21(e))

## 3.5.1.6 Aircraft Hazards

- Staff Finding: Aircraft hazards do not present an undue risk to the safe operation of nuclear units at the proposed site. Therefore with respect to aircraft hazards, the proposed site meets the relevant requirements of 10 CFR Part 52 and 10 CFR Part 100.

# Key Review Areas

## 11 Doses from Routine Liquid and Gaseous Effluent Releases

- Staff Finding: Demonstrated that radiological effluent release limits associated with normal operation from the type of facility proposed to be located at the site can be met for any individual located offsite (10 CFR 100.21(c)(1))

## 13.6 Physical Security

- Staff Finding: ESP site characteristics would allow an applicant for COL to develop adequate security plans and measures for a reactor(s) that it might construct and operate on the ESP site in accordance with 10 CFR 100.21(f)

# Key Review Areas

## 15 Radiological Consequences of Design Basis Accidents

- Staff finding: AP1000, Rev. 15 DBA radiological analyses were shown to meet 10 CFR 50.34(a)(1) siting dose criteria and site-specific DBA doses were shown to be less than AP1000, Rev. 15 DBA doses, therefore site meets 10 CFR 50.34(a)(1) siting dose criteria for DBAs

## 17 ESP Quality Assurance Measures

- Staff Finding: Applicant has provided appropriate quality assurance measures equivalent to those in 10 CFR Part 50 Appendix B

# Key Review Areas

## 2.3 Meteorology

- The staff reviewed the regional climatology, local meteorology, onsite meteorological measurements program, short-term atmospheric dispersion estimates for accidental releases, long-term dispersion estimates for routine releases

- The staff verified site characteristics associated with climatic extremes, severe weather, and atmospheric dispersion (ex. extreme wind, tornado, short-term dispersion for accident and routine releases, etc.)

# Key Review Areas

- Meteorological Open Items
  - Provide a justification for using a 30-year period of record (1966 to 1995) to define the AP1000 maximum safety design temperatures. The staff believes these temperatures should be based on a 100-year return interval. (Open Item 2.3-1)

# Key Review Areas

## 2.4: Hydrologic Engineering

- Floods (ex. local flooding, flooding in rivers and streams, dam failures, tsunami, etc.)
- Low Water (ex. Low water conditions)
- Ground Water (ex. ground water use, release of radionuclide)

# Key Review Areas

- Section 2.4.8: Cooling Water Canals and Reservoirs
  - VEGP Units 3 and 4 do not rely on any external water source for safety-related cooling water
  - **Open Item 2.4-1** relates to initial filling and occasional makeup:
    - Permit Condition 2.4.8-1 precludes VEGP Units 3 and 4 from relying on any external water source from the site for safety-related cooling water other than initial filling and occasional make-up water
    - Alternatively, the applicant may propose a plant parameter such that no safety-related water is required for the proposed plants at the VEGP site other than initial filling and occasional make-up water
- Section 2.4.12: Groundwater
  - **Open Item 2.4-2:** The applicant should provide a more detailed characterization of groundwater pathways describing the current and future local hydrological conditions, including alternate conceptual models, to establish a suitable groundwater elevation for the site; alternatively, the applicant can provide design parameters for buoyancy evaluation of the plant structures

# Key Review Areas

- Section 2.4.13: Accidental Releases of Radioactive Liquid Effluents In Ground And Surface Waters
  - **Open Item 2.4-3** An adequate number of combinations of release locations and feasible pathways has not been considered
  - Transport of radioactive liquid effluent can follow multiple possible pathways – the pathway with the most severe release consequence is of interest for site suitability determination
  - Uncertainty due to spatially and temporally varying characteristics, now and in future, can alter groundwater pathways
  - Applicant described a single groundwater pathway to the northwest towards Mallard Pond; staff did not concur with dilution data and release points
  - Alternate conceptual models exist that may lead to migration of radioactive liquid effluent (1) to the west and through Daniels Branch, eventually to the southeast and (2) to the east toward the Savannah River through the Tertiary aquifer because of communication between the Water Table and the Tertiary aquifers

# Key Review Areas

## 13.3 Emergency Planning

- Complete and Integrated Emergency Plan
  - Submitted by SNC as part of ESP application
  - Agency Certifications (E-plans are practicable and they will participate)
  - Complete and integrated plan provides *reasonable assurance* that adequate protective measures can and will be taken in the event of a radiological emergency

# Key Review Areas

- Emergency Action Levels (EALs)
  - NEI 99-01 (LWRs) – NRC endorsement ongoing
  - NEI 07-01 (passive, advance LWRs) – NRC endorsement ongoing
  - Vogtle EALs based on NEI 07-01 – awaiting NEI 07-01 review
  - ITAAC will reflect some construction dependent EALs

# Key Review Areas

- Open Items
  - 13.3-4: The review and acceptance of the application's EALs for Units 3 and 4
  - 13.3-10: Discuss whether State and local agencies have reviewed the new ETE and provided comments, and discuss the resolution of those comments

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# Presentation to the ACRS Full Committee

## Vogtle Early Site Permit Review Status

## Section 2.5 Geology, Seismology and Geotechnical Engineering

November 01, 2007

# ACRS Full Committee Presentation
# Vogtle ESP Review Section 2.5

**Review Team for Section 2.5:**

- Sections **2.5.1** & **2.5.3** Technical Reviewers
  - Dr. Gerry Stirewalt, Sr. Geologist
  - Meralis Plaza-Toledo, Geologist
  - Laurel Bauer, Geologist
  - Dr. Russell Wheeler and Dr. Anthony Crone, Geologists (USGS)
- Section **2.5.2** Technical Reviewers
  - Dr. Yong Li, Sr. Geophysicist
  - Dr. Clifford Munson, Sr. Geophysicist
  - Sarah Gonzalez, Geophysicist
  - Dr. Charles Mueller, Geophysicist (USGS)
- Section **2.5.4** & **2.5.5** Technical Reviewers
  - Tomeka Terry, Geotechnical Engineer
  - Zahira Cruz-Perez, Geotechnical Engineer
  - Dr. Weijun Wang, Geotechnical Engineer
  - Dr. Thomas Cheng, Sr. Geotechnical Engineer
  - Dr. Yong Li, Sr. Geophysicist
  - Dr. Carl Costantino, Geotechnical Engineer (Brookhaven N L)

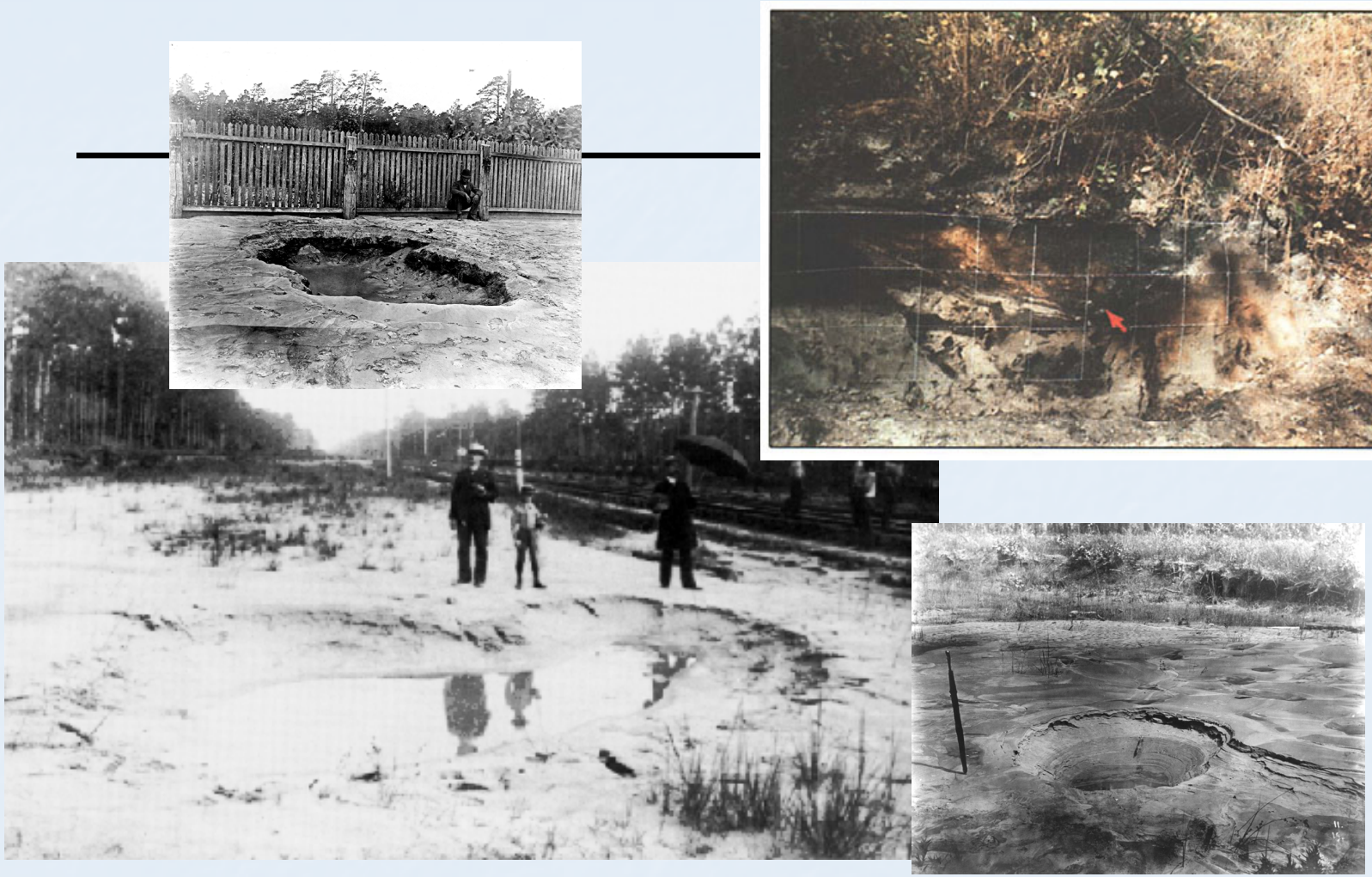
# ACRS Subcommittee Meeting Summary

- Met with ACRS Subcommittee on 10/24/2007
- Discussed key issues and open items
- Subcommittee focused on 4 issues
  - Update of Charleston Seismic Source
  - EPRI Regional Seismic Sources
  - Eastern Tennessee Seismic Zone (ETSZ)
  - Lack of geotechnical data

# 2.5.2 Vibratory Ground Motion

- **UPDATED Charleston Seismic Source Zone**
  - Applicant's update of the 1986 EPRI source model involved significant changes in geometry, and maximum magnitudes ($M_{max}$), and recurrence interval
  - Average recurrence interval of $M_{max}$ earthquakes decreased significantly, increasing the overall hazard
  - Update based on liquefaction features from historic and prehistoric earthquakes

## 2.5.2 Vibratory Ground Motion



# Illustrations of historic 1886 liquefaction features from the Charleston Area

# 2.5.2 Vibratory Ground Motion

- **Charleston Paleoliquefaction (Cont'd) (OI 2.5-5)**
  - NRC Staff requested additional paleoliquefaction data to support the applicant's conclusion that large earthquakes most likely do not occur further inland from Charleston
  - Based on recent discussions with the applicant, staff anticipates closure of this open item, assuming necessary documents are provided by the applicant

# 2.5.2 Vibratory Ground Motion

- **EPRI Seismic Source Update**
- Applicant used a Senior Seismic Hazard Analysis Committee (SSHAC) Level 2 process to perform the Charleston seismic source update
- The applicant did not update the following EPRI seismic source zones
  - Regional seismic source zones that encompass the ESP site (OI 2.5-1)
  - Eastern Tennessee seismic zone (ETSZ) (OI 2.5-3)

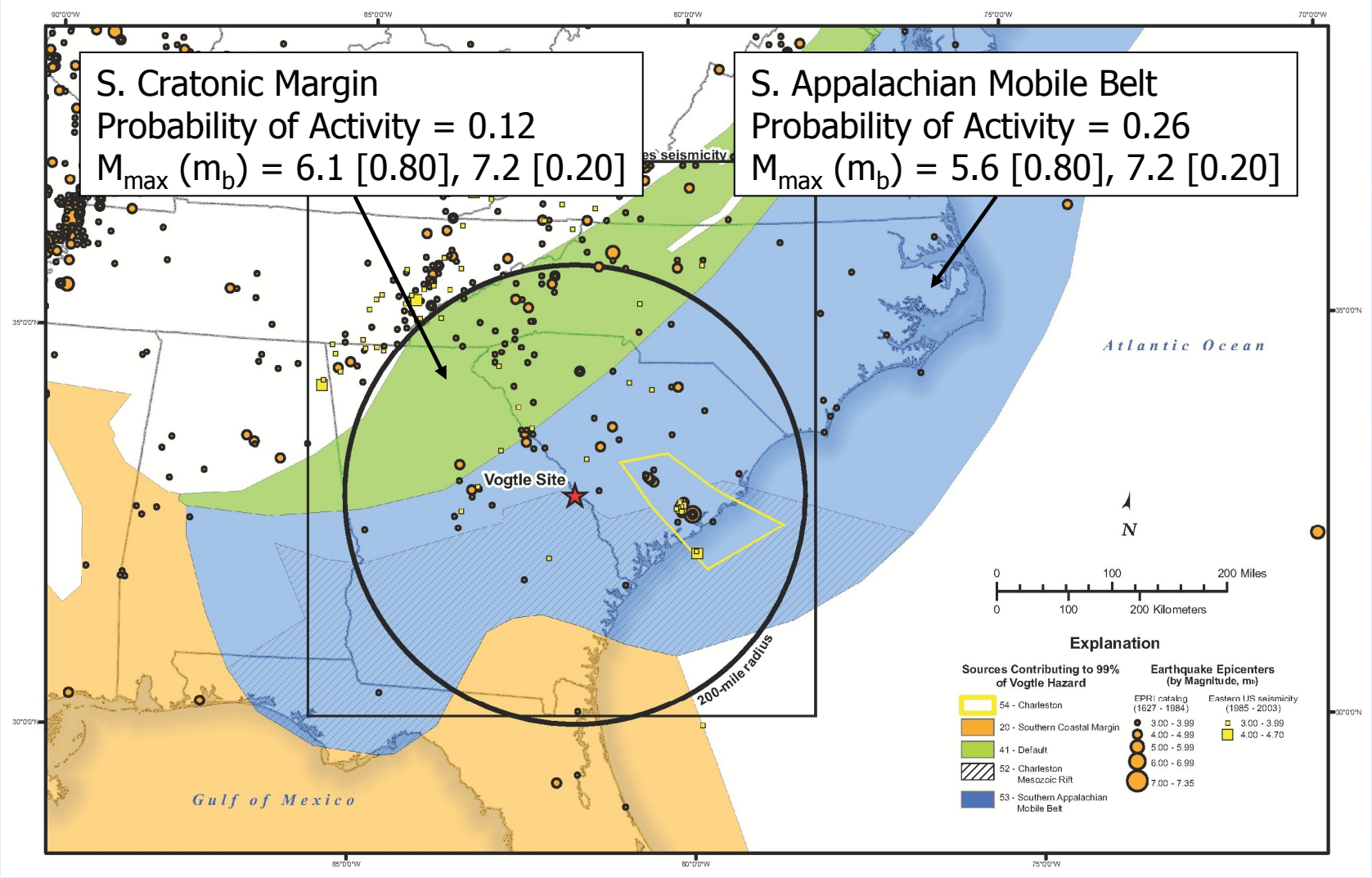
# 2.5.2 Vibratory Ground Motion

- **NRC Regulatory Guidance**
  - Another important purpose for the site-specific investigations is to determine whether there are new data or interpretations that are not adequately incorporated in the existing PSHA data bases[1].

[1] RG 1.165, Section C Regulatory Position, p. 1.165-4

- **Regional Seismic Source Zone $M_{max}$ and Probability of Activity (OI 2.5-1)**
  - EPRI seismic source zones were determined by six Earth Science Teams during the 1980s
  - Dames and Moore team assigned low weights for larger $M_{max}$ values and low probabilities of activity to two of their regional source zones

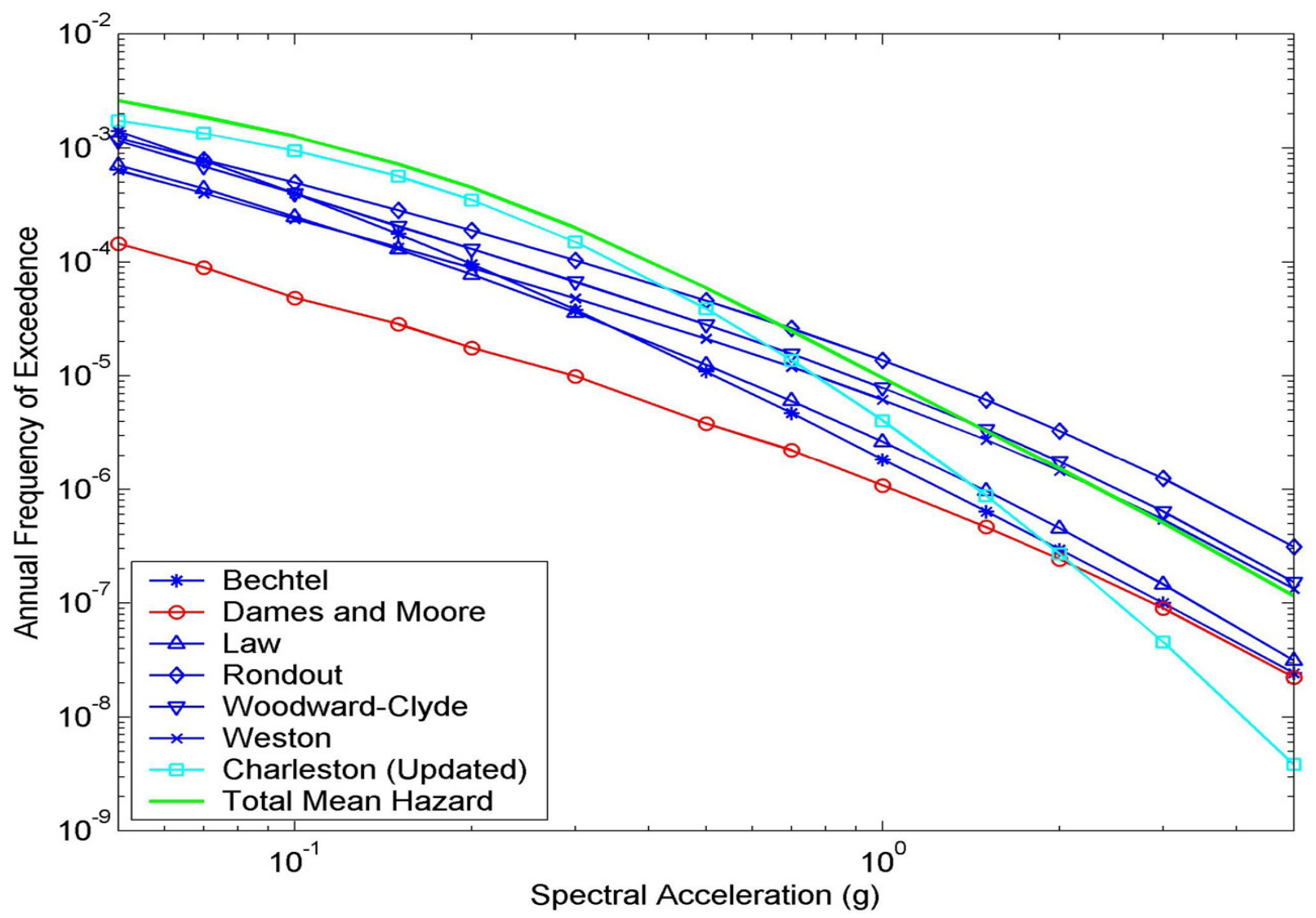
# 2.5.2 Vibratory Ground Motion




Dames and Moore EPRI Zones

# 2.5.2 Vibratory Ground Motion

## 10-Hz Total Mean Hazard Curve



# 2.5.2 Vibratory Ground Motion

- **Basis for the staff's question is the DOE study conducted for the Savannah River Site (SRS) in the early 1990's**
  - (DOE-STD-1024-92) "*Risk Engineering, Inc. has also found that the EPRI team of Dames and Moore does not fully account for historic seismicity near the Savannah River Site (SRS). One reason for this is the fact that the SRS host source zone was given a low probability of activity. Risk Engineering, Inc. recommended that the Dames and Moore seismic source input not be used to calculate the seismic hazard at SRS*"

# 2.5.2 Vibratory Ground Motion

- **Eastern Tennessee Seismic Zone $M_{max}$ (OI 2.5-3)**
  - Applicant concluded no new information has been developed since 1986 that would require significant revision to the EPRI seismic source model.
  - Staff believes more recent studies suggest revisions to the EPRI seismic source model may be warranted.
    - Studies suggest larger maximum magnitude earthquakes may be possible
  - Applicant performed limited evaluation and documentation of more recent scientific studies.
  - Staff and applicant are currently discussing the significance of the scientific studies to determine if an update is warranted.

# 2.5.4 Stability of Subsurface Materials and Foundations

- Applicant performed limited borings and tests to characterize soil properties of the load-bearing layers (Open items 2.5-11 through17)
- Applicant relied on results from VEGP Unit 1 and 2 investigations (1970s) for soil properties, such as internal friction angle, unit weight and undrained shear strength
  - Example: Undrained shear strain for the Blue Bluff Marl (The main load bearing layer)
    - Design value 10000 psf (based on Units 1 and 2 investigation)
    - ESP investigation results are between 150 and 4300 psf
  - In addition to the dynamic properties, actual site profiles greatly affect the site response analysis

# 2.5.4 Stability of Subsurface Materials and Foundations

- Applicant did not conduct any laboratory tests on soil samples to determine soil dynamic properties (Open Items 2.5-19 and 20)
  - Soil dynamic properties affect GMRS, and therefore, affect liquefaction susceptibility, slope stability and soil structural interaction analyses.
- The applicant conducted more explorations and testing on the subsurface materials after submission of the ESP Application as part of the LWA

# Conclusion

- SER defers general regulatory conclusion regarding site safety and suitability to FSER after open items addressed
- SER with Open Items Issued 8/30/07
  - 40 Open Items
  - 2 Permit Conditions
  - 19 COL Action Items
- Open Item Responses Received 10/15/07
- Reviewing Supplemental Information for Approval of LWA-2
- Next Interaction with ACRS 6/2008 on FSER (tentative)