PANTEX PROBABILISTIC SEISMIC HAZARD ANALYSIS CONCEPTUAL PLAN

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Presentation Outline

- Project background and objective
- Field and laboratory program to support site response analysis
- Conceptual Plan for updated Pantex PSHA
- Summary and conclusions
Project Background and Objective

- Develop a conceptual plan to update design basis earthquake (DBE) ground motions following a SSHAC Level 3 process.

- Describe tasks, schedule, and costs needed to update the PSHA, site response analysis (SRA), and DBE ground motions.

- Ensure that DOE Order 420.1, DOE Standard 1020, and ANSI/ANS Standards 2.27 and 2.29 are addressed.

- Address seismic source characterization (SSC), ground motion characterization (GMC) and SRA inputs to an updated PSHA.
Field and Laboratory Program to Support Site Response Analysis

- Assess adequacy of available data at the Pantex Site and within the Site near region and identify data gaps.
- Address logistical issues for accessing a secure site and working around security requirements.
- Recommend investigations for acquiring necessary data to reduce epistemic uncertainty for developing a technically robust PSHA and SRA. Recommended investigation should consider the following:
  - DOE, ANSI/ANS, and EPRI Guidance.
  - Input from SRA sensitivity study and peer review.
  - Site access limitations.
  - Programmatic constraints.
Field and Laboratory Program to Support Site Response Analysis

• Available Data and Information

➤ Relevant technical reports provided by NNSA and site contractor.

➤ Hundreds of well logs from the Pantex Site.

➤ Information on over 750 wells for Pantex and Texas Tech.

➤ Oil and Gas Logs (30) – Texas Bur. of Econ. Geology.

➤ Publications on the geology of the Texas Panhandle.
Field and Laboratory Program to Support Site Response Analysis

Existing Wells

Figure 2 - 3
Existing Wells of Interest at Pantex Site
Prepared For
Consolidated Nuclear Security LLC
Pantex Plant, Texas

Legend:
Investigative Wells
- PVC Casing (depth: ≥ 295 ft and < 500 ft)
- SS or Other Steel (depth: 0 - 500 ft)
- SS or Other Steel (depth: 500 - 700 ft)
- SS or Other Steel (depth: 700 - 900 ft)
- Contaminated Areas
- Perched Aquifer
- Limited and Protected Access Areas

Pantex Property Boundary
Field and Laboratory Program to Support Site Response Analysis

Regional Oil and Gas Wells

Legend:
- Panex
- Rex White
- 4206531353
- 4235930160
- Other Wells

Figure 2 - 5
Oil and Gas Well Logs Reviewed with Three Selected Wells for Estimating Vs

Prepared For
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Pantex Plant, Texas
Field and Laboratory Program to Support Site Response Analysis

- Extensive geologic information is available for the Mesozoic and younger stratigraphy at the Site.

- However, no reliable information exists on the Vs or dynamic properties of the stratigraphic units at the Site.

- Based on the limited review of oil and gas well data, Vs approaching hard-rock (9,200 ft/sec) is expected to be very deep (several 1,000’s ft).

- There are many investigation wells that may be usable for additional data collection.

- Regional oil and gas well data are available for estimating Vs for Paleozoic stratigraphy; an expanded evaluation of these wells should provide a defensible basis for Paleozoic Vs profile at Pantex.
Field and Laboratory Program to Support Site Response Analysis

- Select the most cost effective field and laboratory methods that provide reliable data for calculating shear wave velocity (Vs) and other dynamic properties.
  
  ➢ Includes re-entering selected existing wells assuming access is feasible.

- Utilize regional data in developing Vs profile for the Paleozoic stratigraphic sequence at the Site.

- Consider new boreholes for acquiring site specific material properties and Vs recognizing that drilling to hard rock is not feasible.
Recommended Field and Laboratory Program to Support Site Response Analysis

- Compile regional sonic data from oil and gas wells to develop Vs profile of the Paleozoic sequence.

- Down-hole geophysical surveys in 8 existing stainless steel-cased boreholes that reach depths to ~900 ft bgs.

- Conduct 7 SASW survey lines across the Site that are augmented with 2 MAM surveys to collect data to 1,500 ft depth.
Recommended Field and Laboratory Program to Support Site Response Analysis

- Drill and selectively core 2 boreholes to 1,200 ft.

- Conduct P-S suspension logging in 2 new boreholes and 5 existing PVC-cased wells.

- Obtain 10 to 12 samples and conduct laboratory testing to determine stiffness, damping, and nonlinear properties: 6 for RC/TS and 5 for cyclic triaxial testing from Blackwater draw and Ogallala Formations.
Recommended Field and Laboratory Program to Support Site Response Analysis

Location of Recommended Field Investigations

Selected Wells for Geophysical Testing

<table>
<thead>
<tr>
<th>Well ID</th>
<th>Well Depth [ft]</th>
<th>Casing Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTX6-1142</td>
<td>791</td>
<td>SS</td>
</tr>
<tr>
<td>PTX6-1141</td>
<td>676</td>
<td>SS</td>
</tr>
<tr>
<td>PTX6-1139</td>
<td>551</td>
<td>SS</td>
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<tr>
<td>PTX6-1086</td>
<td>299</td>
<td>PVC</td>
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<td>PTX6-1072</td>
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</tr>
<tr>
<td>PTX6-1095</td>
<td>256</td>
<td>PVC</td>
</tr>
</tbody>
</table>

Legend:
- Investigative Wells
  - PVC Casing (depth: 125 ft and < 500 ft)
  - SS or Other Steel (depth: 125 ft and < 500 ft)
  - SS or Other Steel (depth: 500 - 700 ft)
  - SS or Other Steel (depth: 700 - 900 ft)
  - Contaminated Areas
  - Perforated Aquifer
  - Limited and Protected Access Areas

Figure 2 - 15
Locations of Recommended Field Investigations
Prepared For
Consolidated Nuclear Security LLC
Pantex Plant, Texas
Elements of the Conceptual Plan for Updating the Pantex PSHA

- SSHAC Level 3 Tasks, Roles, Responsibilities, and Application.
- Seismic Source Characterization Model.
- Ground Motion Characterization Model.
- PSHA for Reference Rock Site Conditions.
- SSHAC Level 3 Site Response Analysis.
- PSHA at the Control Point and updated DBE Ground Motions.
- Documentation.
Conceptual Plan for Updated Pantex PSHA

PANTEX PSHA CONCEPTUAL PROJECT PLAN

- Existing Site and Site Vicinity Data
- New Field and Lab Investigations Data

SSC Model
- Existing SSHAC Level 3 CEUS-SSC Model
- Review of any relevant new data
- Report

GMC Model
- Existing SSHAC Level 3 NGA-East Model
- Review of any relevant new data
- Report

Hard-Rock PSHA

Surface PSHA and DBE Response Spectra

SRA Calculations

Pantex Seismic Hazard Report

SSHAC Level 3 Site Response Analysis

- Compile Database
- Workshop #1 – SRA Issues and Data Needs
- Evaluate Data, Methods, and Models
- Workshop #2 – Alternative Interpretations
- Develop Preliminary SRA Model
- Workshop #3 – Feedback
- Develop Final SRA Model and Report

SSHAC Level 3 Participatory Peer Review Panel

PSHA Peer Review Panel
For seismic source model the PSHA Team will:

- Use the CEUS SSC model; the accepted SSHAC Level 3 regional SSC model for assessing seismic hazard at nuclear facilities in the CEUS.

- As needed, define seismic sources to the west of the CEUS model and address human-induced seismicity.

- Review new information to determine impact on SSC model {including the impact of induced earthquakes to the east-northeast of the site}.

- Document the final SSC model in a Hazard Input Document (HID).

- Describe the SSC model in a chapter of the Pantex Seismic Hazards Report.
For hard-rock ground motion characterization model the PSHA Team will:

- Use the Next Generation Attenuation (NGA)-East GMC model; this SSHAC Level 3 model is still under development. The objective of the NGA-East project is to develop a new GMC model for all of Central and Eastern North America.

- Review new information relevant to predicting ground motion to determine impact on use of the NGA-East GMC model.

- Document the final GMC model in a HID.

- Describe the GMC model in a chapter of the Pantex Seismic Hazards Report.
Conceptual Plan for Updated Pantex PSHA

For site response analysis the PSHA Team will:

• Form a SRA TI Team who are responsible for convening three site response workshops consistent with the SSHAC Level 3 process.

  *The three workshops ensure that the SRA TI Team sufficiently evaluates site response data, models, and methods, and integration of relevant information to complete the SRA. A key focus of this effort is characterization of epistemic uncertainties and aleatory variability of the various site response inputs.*

• The objective of executing the SSHAC Level 3 process focuses on defining the complete set of site response inputs needed to quantify the spectral frequency-dependent amplification factors and their associated aleatory variability and epistemic uncertainty.
Conceptual Plan for Updated Pantex PSHA

Site response analysis SSHAC Workshops

- **Wksp 1 Significant Issues and Data**: Identify data for performing SRA and determine if data gaps exist, identify technical issues of greatest significance.

- **Wksp 2 SRA Modeling Approach**: Alternative interpretations related to SR modeling approach, inputs, uncertainties of site response data.

- **Wksp 3 Preliminary SRA Results and Feedback from the PPRP**: SRA TI Team presents SRA model, sensitivity analyses, and the technical bases for SRA.
Approach to Estimating Cost and Schedule for Executing the Conceptual Plan

Field and Laboratory Investigations

- Planned to run in parallel when schedule logic allows.
- Permitting requirements are a factor.
- Some tasks are dependent on completion of new drilling including sample selection for lab testing and P-S suspension logging.
- Overall duration of about 11 months.

SSHAC Level 3 PSHA and SRA

- SSC and GMC planned to run in parallel.
- SRA dependent on completion of field and laboratory program.
- SSHAC Level 3 process for SRA has a duration of about 12 months.

Report preparation and review completed about 4 months after SRA.
The Pantex PSHA Conceptual Plan describes the scope, costs, and schedule to update DBE response spectra and includes a field and laboratory investigations program to acquire the data needed to support an SRA.

Inputs to the PSHA are based on existing (SSC) and a soon-to-be completed NGA-East GMC model that were developed following the SSHAC Level 3 process.

New information will be reviewed and the models adjusted or supplemented, if needed.

The PSHA Conceptual Plan includes tasks to implement the SSHAC Level 3 process in carrying out the SRA.