Exelon Generation.

NP-12-0026
July 13, 2012

10 CFR 52, Subpart A

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Subject: Exelon Nuclear Texas Holdings, LLC
Victoria County Station Early Site Permit Application
Response to Request for Additional Information Letter No. 18
NRC Docket No. 52-042

Attached is the response to the NRC staff question included in Request for Additional Information (RAI) Letter No. 18, dated May 16, 2012, related to Early Site Permit Application (ESPA), Part 2, Section 02.05.02. NRC RAI Letter No. 18 contained one (1) Question. This submittal comprises the complete response to RAI Letter No. 18, and includes response to the following Question:

02.05.02-11

When a change to the ESPA is indicated by a Question response, the change will be incorporated into the next routine revision of the ESPA, planned for no later than March 31, 2013.

This submittal completes the Exelon response to NRC RAI Letter No. 18, dated May 16, 2012.

Enclosure1 is a compact disc (CD) containing the digital values used in preparing the RAI response.

If any additional information is needed, please contact David J. Distel at (610) 765-5517.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 13th day of July, 2012.

Respectfully,

Marilyn C Kray

Marilyn C. Kray
Vice President, Nuclear Project Development

D087
NRO

Attachments:

1. **Question 02.05.02-11**

Enclosures

1. **CD titled "Victoria County Station, Early Site Permit Application, Part 2, SSAR, RAI 2.5.2-11 Response, Digital Files, NP-12-0026, Enclosure 1, July 2012"**

cc: **USNRC, Director, Office of New Reactors/NRLPO (w/out Enclosures)**
USNRC, Project Manager, VCS, Division of New Reactor Licensing (w/Enclosures)
USNRC Region IV, Regional Administrator (w/out Enclosures)
EDMS

RAI 02.05.02-11:

Question:

This request for additional information (RAI) specifically addresses Recommendation 2.1 of the Fukushima Near-Term Task Force recommendations contained in SECY-12-0025, as it pertains to the seismic hazard evaluation. This Recommendation specifies the use of NUREG-2115, "Central and Eastern United States Seismic Source Characterization for Nuclear Facilities" (CEUS-SSC), in a site probabilistic seismic hazard analysis (PSHA). The NRC staff issued NUREG-2115 in January 2012, marking the completion of approximately four years of collaborative work between NRC, the Department of Energy, and the Electric Power Research Institute.

Consistent with Recommendation 2.1, as well as the need to consider the latest available information in the PSHA for the Victoria County Station planned reactor site, the NRC staff requests that Exelon Nuclear Texas Holdings, LLC (Exelon):

a) Evaluate the potential impacts of the newly released CEUS-SSC model, with potential local and regional refinements as identified in the CEUS-SSC model, on the seismic hazard curves and the site-specific ground motion response spectra (GMRS). For re-calculation of the PSHA, please follow either the cumulative absolute velocity (CAV) filter or minimum magnitude specifications outlined in Attachment 1 to Seismic Enclosure 1 of the March 12, 2012 letter "Request for information pursuant to title 10 of the *Code of Federal Regulations* 50.54(f) regarding recommendations 2.1, 2.3, and 9.3, of the near-term task force review of insights from the Fukushima Dai-ichi accident." (Agencywide Documents Access and Management System Accession No. ML12053A340).

b) Modify the site-specific GMRS if you determine changes are necessary given the evaluation performed in part a) above.

In order to minimize delays to the current licensing schedule, the staff requests that you respond within 60-days of receipt of this RAI or provide a schedule for your response within 30-days.

Response:

a) An evaluation of the potential impact of the newly released CEUS SSC model (NRC, 2012a) on the characterization of seismic hazard curves and the site-specific ground motion response spectra (GMRS) shows that mean hazard curves and spectral accelerations developed from the CEUS SSC model are not significantly different from the hazard curves and spectral accelerations developed for Victoria County Station (VCS) Early Site Permit Application (ESPA) (SSAR Figure 2.5.2-83) and confirms the original information in the VCS ESP SSAR.

The basis for this conclusion is a comparison of the VCS site GMRS with spectral accelerations developed from the Houston, Texas, "demonstration site" analysis provided in NUREG-2115, Chapter Eight (NRC, 2012a).

The three panels of Figure 1 show comparisons of mean hard rock hazard curves from several source models for 10 Hz, 1 Hz, and PGA response spectral accelerations. The heavy solid lines (from Figures 8.2-3j, 8.2-3k, and 8.2-3l of NRC, 2012a) compare hazard at the Houston, Texas, demonstration site for the current CEUS SSC source model (heavy red line), the USGS model developed for the National Seismic Hazard Mapping Project (Petersen et al., 2008) (heavy bright green line), and a "COLA" model (heavy black line) that has been used for nuclear power plant licensing applications between 2003 and 2009. According to the CEUS SSC report, the "COLA" model is the EPRI-SOG (EPRI, 1988) model updated with more recent characterizations for the New Madrid fault source, the updated Charleston seismic zone, and an update of maximum magnitude values for some seismic sources near the Gulf of Mexico to reflect recent seismicity. Additional details of this "COLA" model are not available in the CEUS SSC report (NRC, 2012a). Calculations of hazard for all three of these models use the EPRI (2004, 2006) ground motion prediction equations (GMPEs) so that the differences in hazard presented among the three models are attributable to differences in the source models themselves.

Also shown in each of these three panels are three additional mean hazard curves that have been included as part of this RAI response. The two olive green lines are hazard curves for the Houston (solid) and the VCS (dotted) sites from the USGS source model and USGS GMPEs. The difference, then, between the solid olive green and solid bright green hazard curves should arise from GMPE differences [EPRI (2004, 2006) vs. Petersen et al. (2008)]. The difference between the two olive green lines [solid and dotted] arises from their different locations within the USGS model.

The third additional line (dotted black line) in each panel is the hard rock VCS ESP SSAR hazard curve for that frequency. Since both the black dotted and heavy black solid hazard curves use the EPRI (2004, 2006) GMPEs and both use updated versions of the EPRI-SOG model these two lines might be expected to match each other closely. This is the case, in fact, only for the 1 Hz hazard curves. The reasons for the differences for the hazard curves at higher frequencies are unknown – and pertinent additional details of the "COLA" model are not available in the CEUS SSC report (NRC, 2012a) -- but could be caused by details of the geographic distribution of local seismic activity rates and/or difference in lower bound magnitudes used in the two analyses.

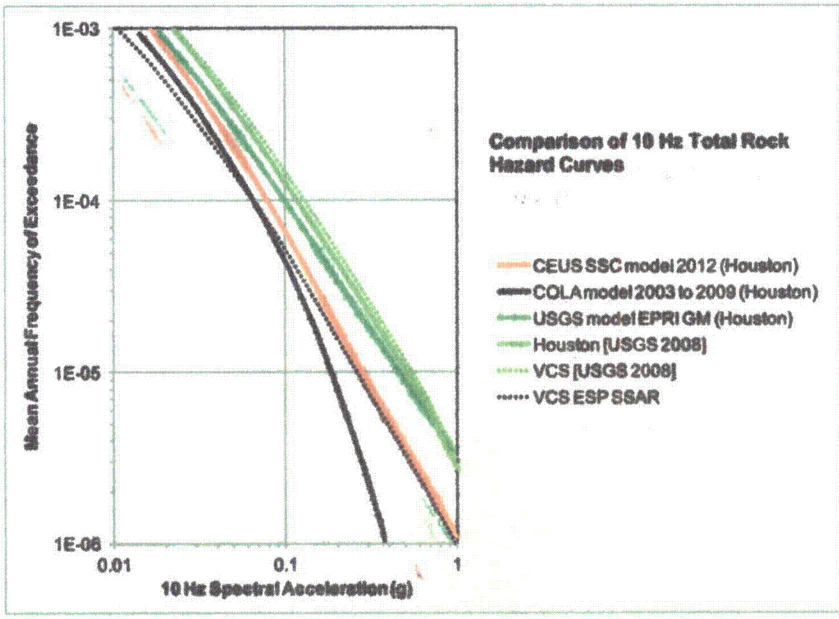

Figure 1a Houston demonstration site 10 Hz hard rock hazard curves: comparisons of several source models.

NOTE: "CEUS SSC model 2012 (Houston)", "COLA model 2003 to 2009 (Houston)", and "USGS model EPRI GM (Houston)" hazard curves from NRC (2012a) -- uses EPRI (2004, 2006) GMPEs with the cited source models. "Houston [USGS 2008]" and "VCS [USGS 2008]" hazard curves derived from 2008 USGS seismic source model and GMPEs [Petersen et al. (2008)]. "VCS ESP SSAR" hazard curve developed for VCS ESPA SSAR -- uses EPRI (2004, 2006) GMPEs.

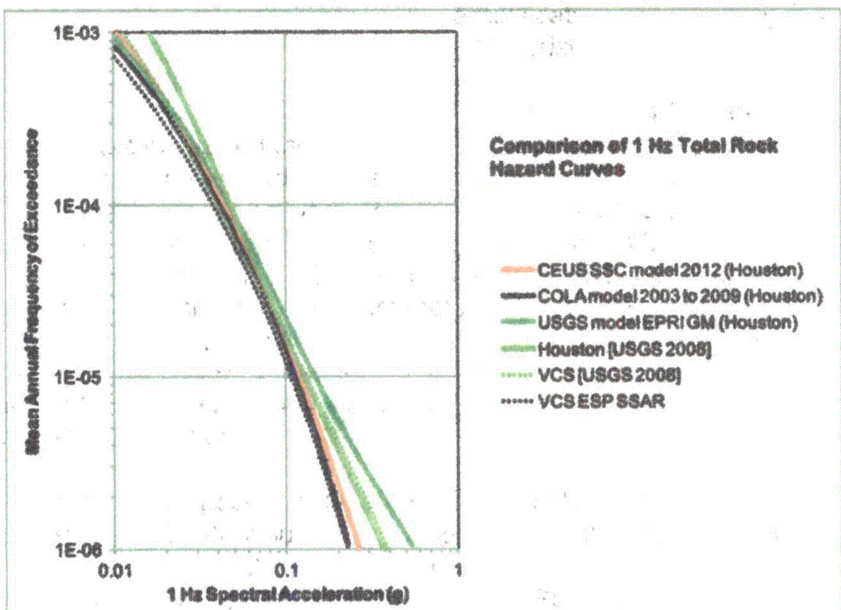

Figure 1b Houston demonstration site 1 Hz hard rock hazard curves: comparisons of several source models. See Figure 1a for hazard curves information.

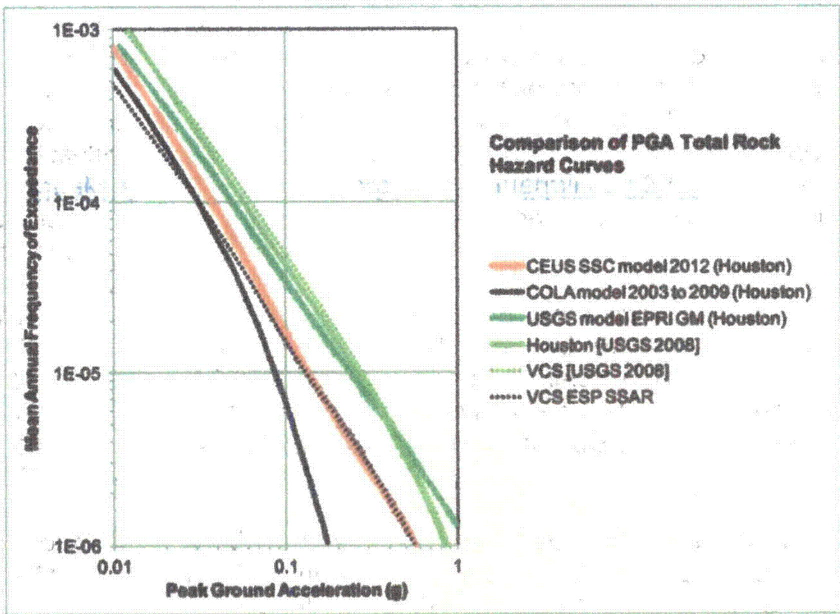

Figure 1c Houston demonstration site PGA hard rock hazard curves: comparisons of several source models. See Figure 1a for hazard curves information.

For the purposes of this response the two curves for which the comparison is most important are the current CEUS SSC source model hazard curves for the Houston, Texas, demonstration site (heavy red lines) and the VCS ESP SSAR (dotted black lines). For this comparison, values for the VCS site GMRS are taken directly from SSAR Table 2.5.2-27 of the VCS ESP SSAR for 38 frequencies ranging from 100 Hz to 0.1 Hz. These values include site-specific amplification factors going from rock to free ground surface soil responses at the GMRS horizon.

Values for CEUS SSC rock ground motions corresponding to 10^{-4} and 10^{-5} mean annual frequencies of exceedance (MAFEs) for the Houston demonstration site can be interpolated from the hazard curves tabulated in Table 8.2.3-1 in NUREG-2115 (NRC, 2012a) for 10 Hz, 1 Hz and PGA (taken as equivalent to 100 Hz response motions) spectral accelerations, shown in Figures 8.2-3a, 8.2-3b, and 8.2-3c, respectively, of the same report. One additional CEUS SSC-based pair of 10^{-4} and 10^{-5} MAFE Houston rock values was estimated by using the ratio of 100 Hz to 30 Hz rock motions from the VCS ESP SSAR and assuming that this ratio would be approximated by the CEUS SSC results for 30 Hz if they were available. The CEUS SSC rock results are modified to incorporate subsurface material amplification factors as described below.

The basis for the assumption that the ratio of 100 Hz to 30 Hz spectral acceleration developed for the VCS site would be approximated for the Houston demonstration site is that: 1) this ratio is stable for a wide range of critical magnitudes and distances, 2) both the CEUS SSC and VCS ESPA SSAR models use the same GMPEs, 3) the rock probabilistic seismic hazard analysis (PSHA) for the three frequencies for which comparison is directly made are very similar, and 4) the hazard in the Houston-VCS region varies slowly with exact location.

The basis for the assumption that earthquake hazard in the Houston-VCS regions varies slowly is that: 1) the historical seismicity pattern on which recurrence parameters are based is similar for both the CEUS SSC and VCS ESPA SSAR studies, 2) earthquakes in the region are sparse and do not cause significant differentiation in recurrence parameters within the region, and 3) the rock 10^{-4} and 10^{-5} MAFE results developed from USGS 2008 National Hazard Map Gridded data (http://earthquake.usgs.gov/hazards/products/conterminous/2008/data/) are very similar for the Houston and VCS locations (Petersen et al. 2008) (and see the solid and dotted olive green curves of Figures 1a, b and c).

The slow variation of earthquake recurrence parameters with location within the Houston-VCS region as shown in both the USGS 2008 (Petersen et al., 2008) and NUREG-2115 (NRC, 2012a) studies, as well as the detailed VCS region-specific evaluation of potential earthquake sources, all indicate that there are no identified potential local and regional refinements needed to the CEUS SSC model in the Houston-VCS region.

The results of NUREG-2115 are based on minimum magnitude specifications outlined in Attachment 1 to Seismic Enclosure 1 of the March 12, 2012 letter "Request for information pursuant to Title 10 of the Code of Federal Regulations 50.54(f) regarding Recommendations 2.1, 2.3, and 9.3, of the near-term task force review of insights from the Fukushima Dai-ichi accident." (NRC, 2012b) That is, the Houston demonstration site results specifically satisfy the minimum magnitude specifications for development of PSHA contained in Attachment 1 to Seismic Enclosure 1 of the March 12, 2012 letter.

As mentioned above, Houston rock spectral acceleration values from the CEUS SSC report must be modified to consider subsurface material properties like those found at the VCS site in order to make an in-kind comparison of the GMRS. The VCS site is underlain by soils to depths of many thousands of feet and is, therefore, characterized as a deep soil site. The VCS ESPA SSAR calculates site-specific factors for the amplification of the base hard rock motion by the deep subsurface soil column – see VCS ESPA SSAR Table 2.5.2-27. These factors are 1.2 for 10 Hz, 2.7 for 1 Hz, and 1.3 for 100 Hz (PGA). The CEUS SSC study develops site amplification factors for a generic "deep soil" site and so characterizes Houston.

Comparison of the generic deep soil subsurface material properties and amplification factors from the CEUS SSC report with the subsurface material properties and amplification factors from the VCS ESPA SSAR at frequencies of 10 Hz, 1 Hz, and 100 Hz (PGA) shows that the CEUS SSC amplification factors are similar or somewhat lower (approximately 0.9 for 10 Hz, 2.6 for 1 Hz, and 1.4 for 100 Hz [CEUS SSC report Figure 8.1-5]). Because the hard rock motion amplitudes for Houston and the VCS site are similar, and the VCS ESPA SSAR amplification factors are site-specific, the VCS ESPA SSAR amplification factors are used to estimate the CEUS SSC anticipated free-field ground surface seismic hazard curves.

Using the procedure recommended in RG 1.208 (NRC, 2007) (as defined in VCS ESPA SSAR Section 2.5.2.6) to develop GMRS spectra from 10^{-4} and 10^{-5} MAFE hazard curves, a hard rock "GMRS" was developed from the three CEUS SSC Houston rock curves and the additional 30 Hz point scaled from a VCS ESPA SSAR hard rock "GMRS" 30 Hz-to-100 Hz ratio. Again, these values were then assumed to be closely approximate to a CEUS SSC equivalent rock GMRS at the VCS site.

Next, these four points were scaled by the VCS SSAR site-specific amplification factors to get approximate and preliminary CEUS SSC VCS site GMRS points. These points are shown in Figure 2 along with the VCS ESPA SSAR GMRS spectrum. The figure shows that the estimated CEUS SSC VCS site GMRS points developed in this way are very close to, and not significantly above, the VCS ESPA SSAR points. Specifically, the 10 Hz, 1 Hz, and PGA (100 Hz) VCS ESPA response spectral accelerations are 9.2%, 11.5%, and 5.4% lower than the estimates of the CEUS SSC values based on the Houston demonstration site values.

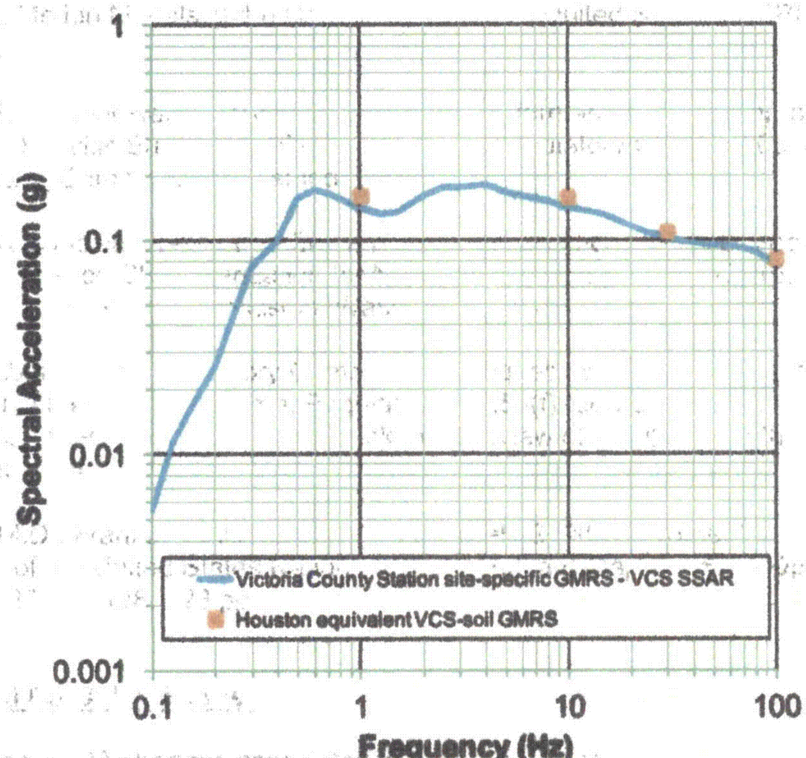

Figure 2 Comparison of the horizontal VCS ESPA GMRS (from SSAR Table 2.5.2-27), and the 2012 Houston CEUS SSC GMRS.

Therefore, on the basis of this evaluation, it is concluded that implementation of the CEUS SSC model for the VCS site would be expected to result in similar or slightly higher GMRS motions than predicted in the SSAR, but that this difference is not significant within reasonably expected uncertainty in the characterization of seismic hazard. Hence, it is concluded as not necessary to re-calculate the PSHA to implement the CEUS SSC model for the VCS site.

b) Because the VCS ESPA SSAR results and the estimated CEUS SSC results for the VCS site are not significantly different, this investigation found no reason to revise the seismic design basis in the VCS ESPA SSAR based on an implementation of the CEUS SSC (NUREG-2115) model.

RAI References:

EPRI, 1988, Electric Power Research Institute "Seismic Hazard Methodology for the Central and Eastern United States," 10 volumes, EPRI-NP-4726.

EPRI, 2004, Electric Power Research Institute "CEUS Ground Motion Project Final Report," EPRI Report 1009684, December.

EPRI, 2006, Electric Power Research Institute "Program on Technology Innovation: Truncation of the Lognormal Distribution and Value of the Standard Deviation for Ground Motion Models in the Central and Eastern United States," EPRI TR-1014381, August.

NRC, 2007, Nuclear Regulatory Commission "A Performance-Based Approach to Define the Site-Specific Earthquake Ground Motion," Regulatory Guide 1.208, U.S. Nuclear Regulatory Commission, Washington, D. C.

NRC, 2012a, Nuclear Regulatory Commission "Central and Eastern United States Seismic Source Characterization for Nuclear Facilities," NUREG-2115, U.S. Nuclear Regulatory Commission, Washington, D. C.

NRC, 2012b, Nuclear Regulatory Commission "Request for information pursuant to Title 10 of the Code of Federal Regulations 50.54(f) regarding Recommendations 2.1, 2.3, and 9.3, of the near-term task force review of insights from the Fukushima Dai-Ichi accident." (ML12053A340)

Petersen, M.D., Frankel, A.D., Harmsen, S.C., et al., 2008, "Documentation for the 2008 Update of the United States National Seismic Hazard Maps," USGS Open-File Report 2008–1128, 128 pp.

Associated ESPA Revisions:

There are no ESPA changes associated with this response.

Enclosures:

File **RAI_02.05.02-11_FigureDigitalValues.xls** is enclosed, which includes the digital values used in Figures 1a, 1b, 1c and 2.

ENCLOSURE 1

__CD titled__:

**Victoria County Station
Early Site Permit Application, Part 2, SSAR,
RAI 2.5.2-11 Response, Digital Files**

**NP-12-0026, Enclosure 1
July 2012**

__CD contents__:

File: **RAI_02.05.02-11_FigureDigitalValues.xls**