Exelon Response to May 9, 2014 Letter on Site Seismic Hazard Screening Items

Presented to US Nuclear Regulatory Commission

Jeff Clark – Exelon Fukushima Seismic Lead

June 17, 2014

Exelon Generation®

Introduction

Introduction

- Exelon has followed the approved process and guidance for development of beyond-design-basis site seismic hazard re-evaluations in response to the NRC 10CFR 50.54(f) Request for Information.
- Screening determinations and results have been performed in accordance with NRC endorsed Screening Prioritization and Implementation Details (SPID - EPRI 1025287).
- Exelon will present a detailed technical basis to demonstrate how process was followed and is prepared to discuss each of the areas of differences.

Exelon Objectives:

- Provide Exelon's bases for meeting the 50.54(f) letter and NRC endorsed guidance (SPID) used for development of the Exelon GMRS curves.
- Understand bases for NRC GMRS & SSE curve differences published in May 21, 2014 NRC memorandum.
- Provide the Exelon bases for site GMRS & SSE curves developed in accordance with approved guidance (SPID).
- Achieve resolution on the acceptability of Exelon's NRC submitted screening conclusions.

Exelon Response to NRC Questions for Clinton

Presented to US Nuclear Regulatory Commission

Jeff Clark – Exelon Fukushima Seismic Lead

June 17, 2014

Exelon Generation®

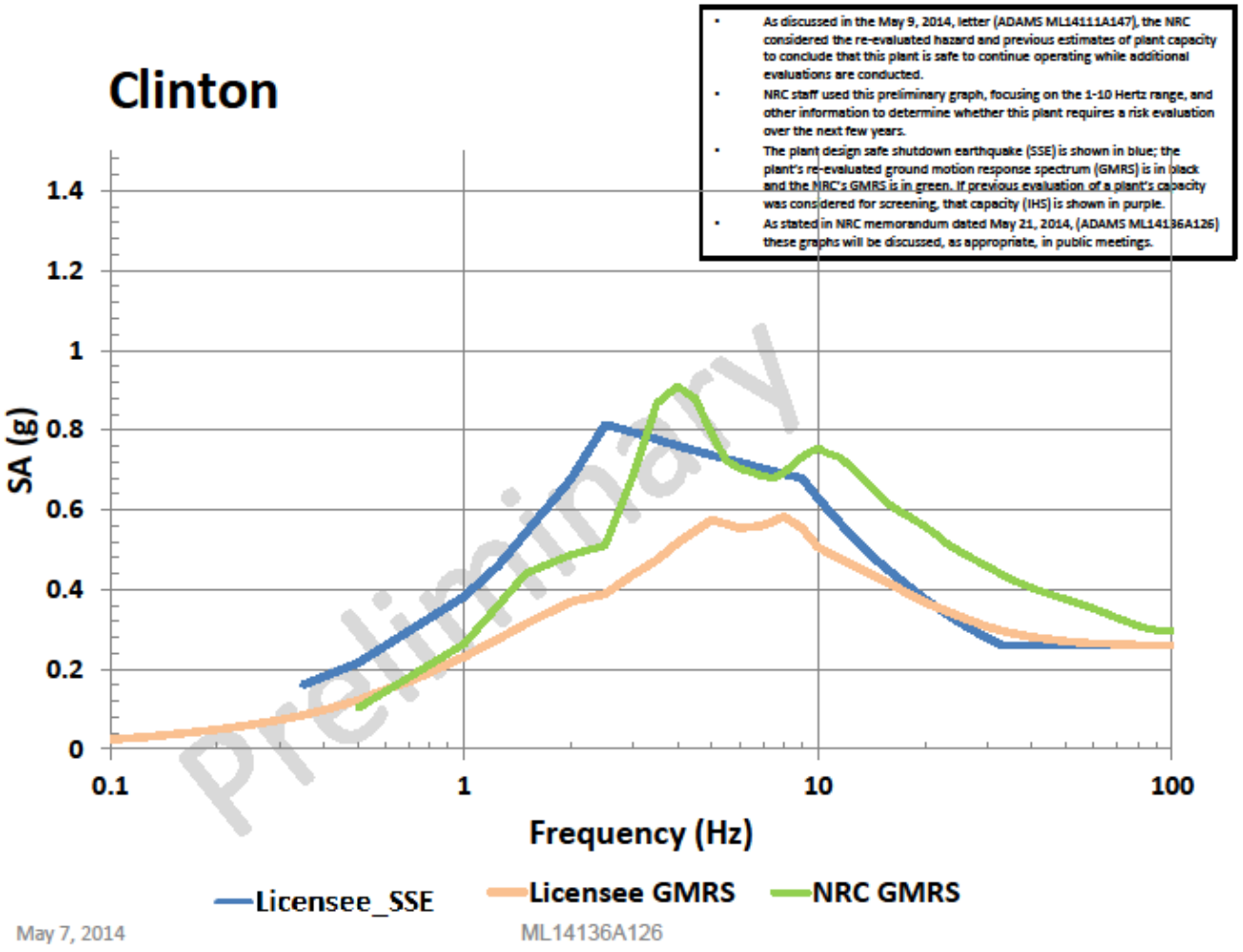
Clinton - Exelon Background

The NRC identified three areas where the NRC preliminary evaluation differed from the Clinton submitted report.

- **Item # 1:** The NRC weighted the Clinton Early Site Profile (ESP) data differently than the September 2013 soil profile submitted to the NRC by Exelon.
- **Item # 2:** Exelon used three base case profiles in the evaluation, whereas the NRC used one base case profile in its preliminary evaluation.
- **Item # 3:** Exelon used higher kappa values in the evaluations than the kappa values the NRC used in its preliminary evaluation.

Clinton - Exelon Background

The plot below illustrates the NRC preliminary GMRS curve, the reported Clinton GMRS curve, and the Clinton SSE curve.



Clinton - Exelon Response

NRC Item # 1:

- NRC weighted the Clinton ESP data differently than the September 2013 soil profile information submitted to the NRC by Exelon.

Exelon Basis for Soil Profile Considerations:

- As prescribed by section B2.0 of the SPID, Exelon considered soil data from both the USAR (original plant design) and from the ESP in developing input parameters for the seismic hazard analysis models.
- Soil profile data and ranges of parameters using USAR and ESP soil data were submitted to the NRC on September 12, 2013.
- Based on variability of soil profiles and resulting uncertainties across the Clinton site, three shear wave velocity profiles were used for development of the GMRS in accordance with the SPID, Sections B3.1 & B3.2.
- ESP considered two velocity profiles to include uncertainties in firm rock.
- ESP site is approximately ¼ mile from the Clinton site, yielding uncertainty.
- Exelon appropriately used available data from the USAR and ESP to develop the subsurface profile(s) following the NRC endorsed SPID guidance.

Clinton - Exelon Response

NRC Item # 2:

- Exelon used 3 base case shear wave velocity (Vs) profiles, the NRC used one.

Exelon Basis for use of 3 base case profiles:

- In accordance with EPRI SPID section B3.0 a best estimate base case profile and alternative profiles (upper-range and lower-range) are suggested to accommodate epistemic uncertainty (variability) in depth to hard rock site conditions, soil layer thicknesses and dynamic material properties (shear-wave velocity profiles & damping).

- Three shear wave velocity profiles were used for Clinton based on the levels of uncertainty that exist for the soil parameters described above and these profiles are considered to envelope the range of values in the soil and rock layers.

Clinton - Exelon Response

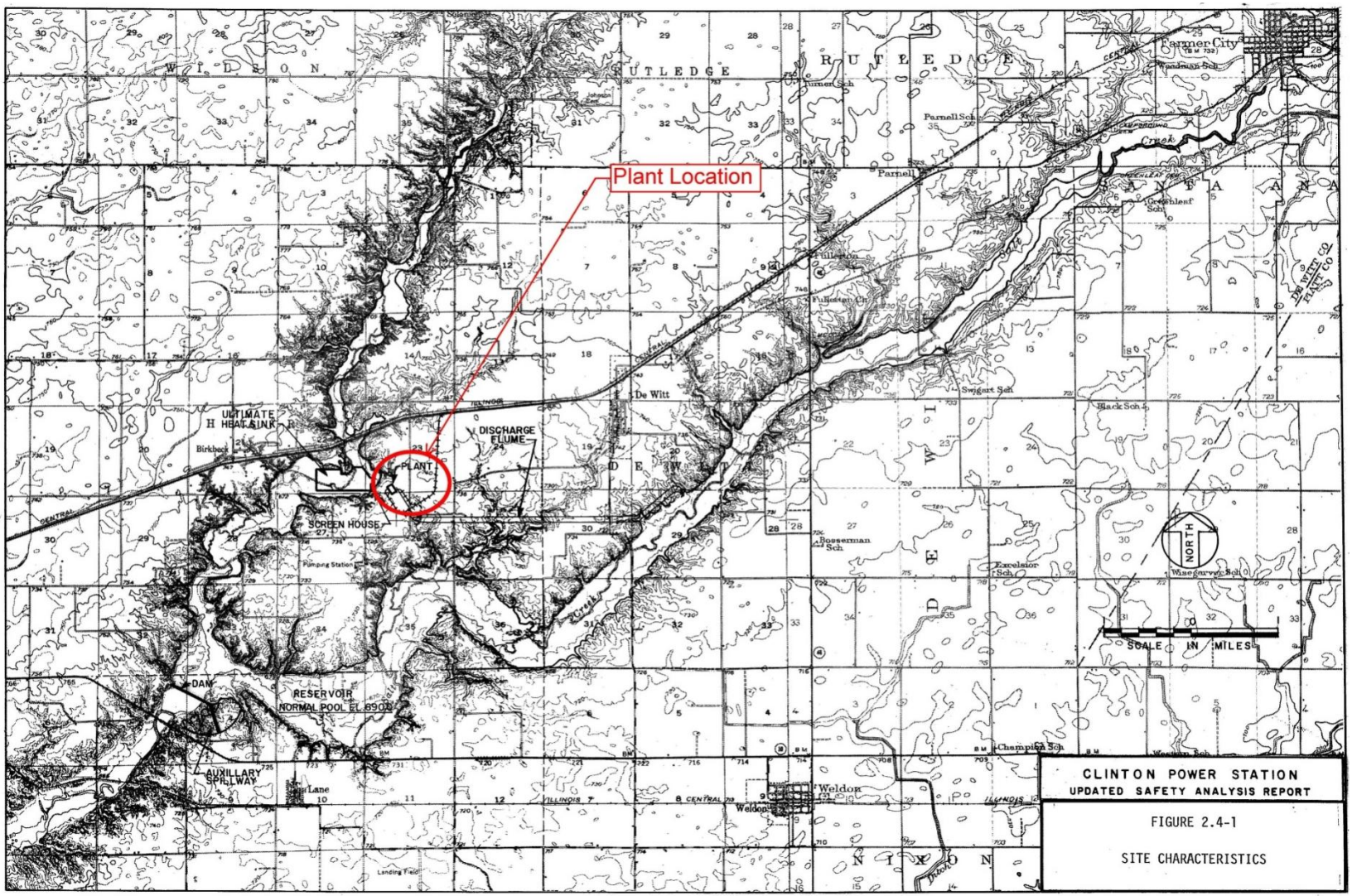
Exelon Basis # 2 (cont'd):

- EPRI SPID section B2.1 states the following:

  "For well-characterized sites with abundant high-quality data this uncertainty would be reduced, possibly eliminating the need to vary some of the site parameters such as the site profile." (this is not the case for Clinton)

- USAR Figure 2.4-1 on the following slide illustrates the general topography of the area where the plant is located.
  - Note that the plant is located at the confluence of two waterways where variability in the underlying soil profile would be expected.

Clinton - Exelon Response



General Site Characteristics

Clinton - Exelon Response

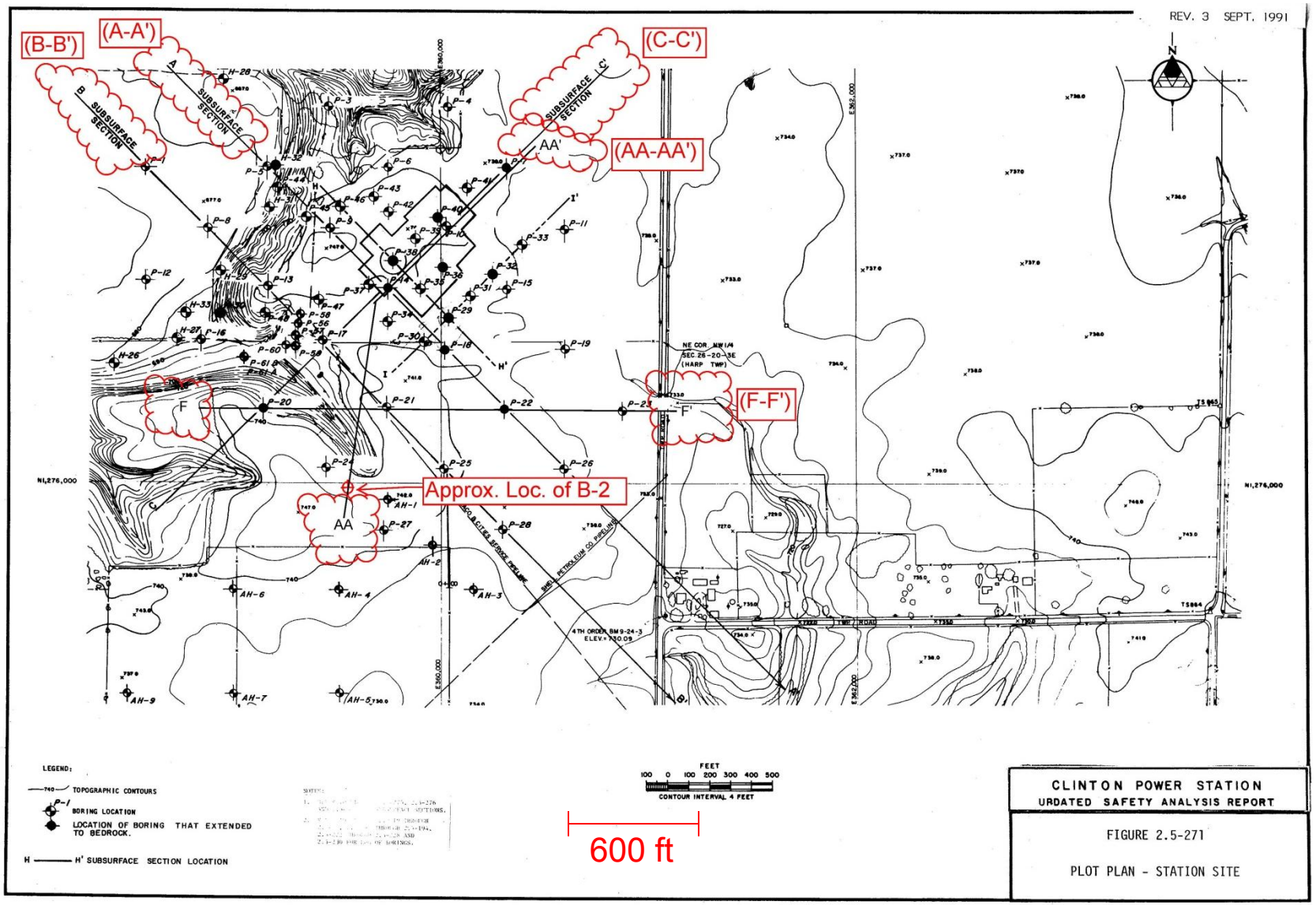
Exelon Basis # 2 (cont'd):

USAR Figure 2.5-271 on the following slide shows the plot plan of the station site.

- The figure illustrates the boring locations (P-series borings) and the plant location for original CPS construction over the site area.
- Boring B-2 from the ESP report (B-series borings) is located for reference.
- Data from available borings and test results were reviewed to develop the soil profile table (Table 1 in Attachment 3 to September 12, 2013 letter to the NRC).

Review of the cross-sections that follow illustrate the non-homogeneity of the soil profiles and soil properties.

Clinton - Exelon Response

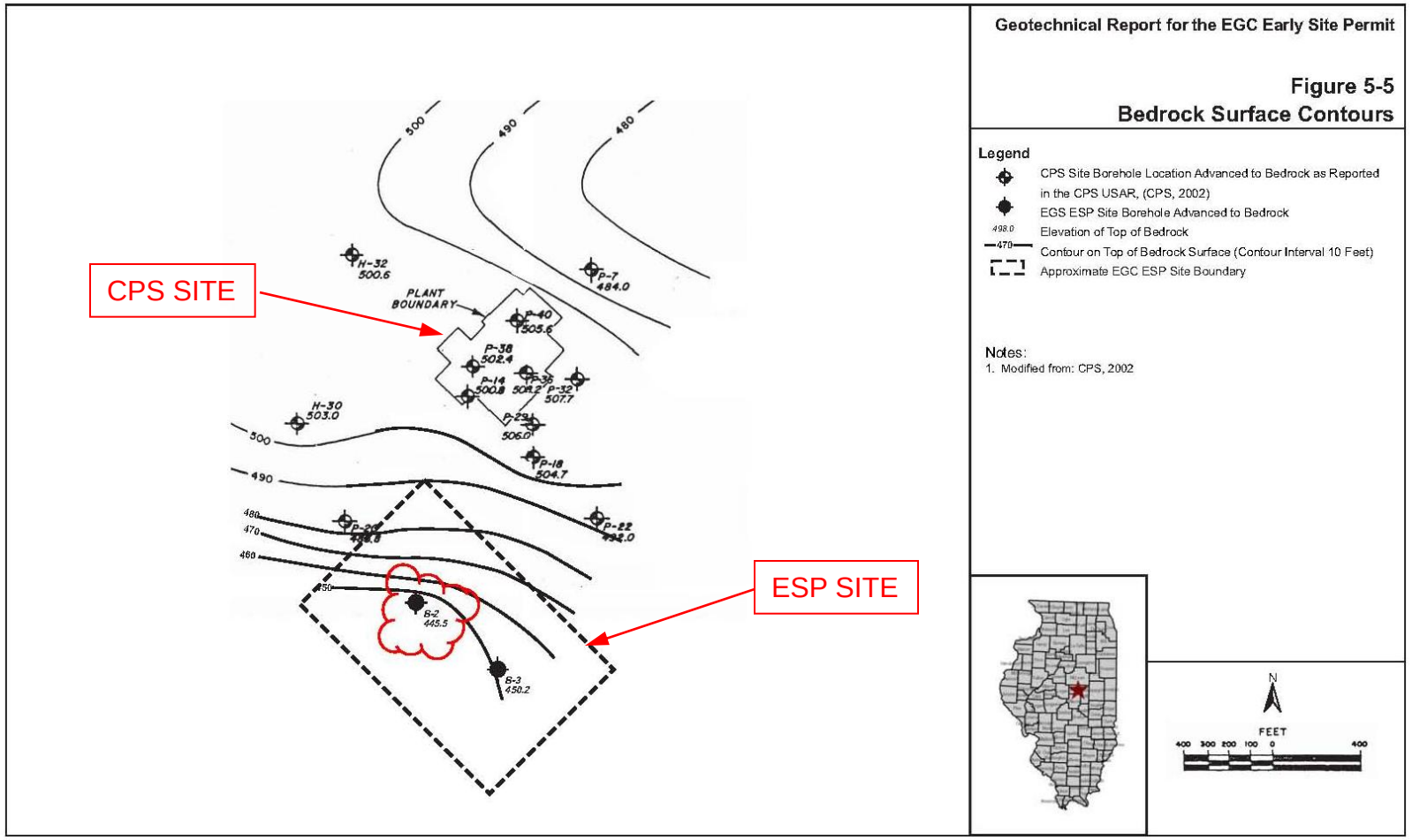


Boring Locations and Cross Section Definitions

Clinton - Exelon Response

Exelon Basis # 2 (cont'd):

- ESP Figure 5-5 below provides the ESP location relative to the plant (note boring B-2 is located approximately ¼ mile from plant).



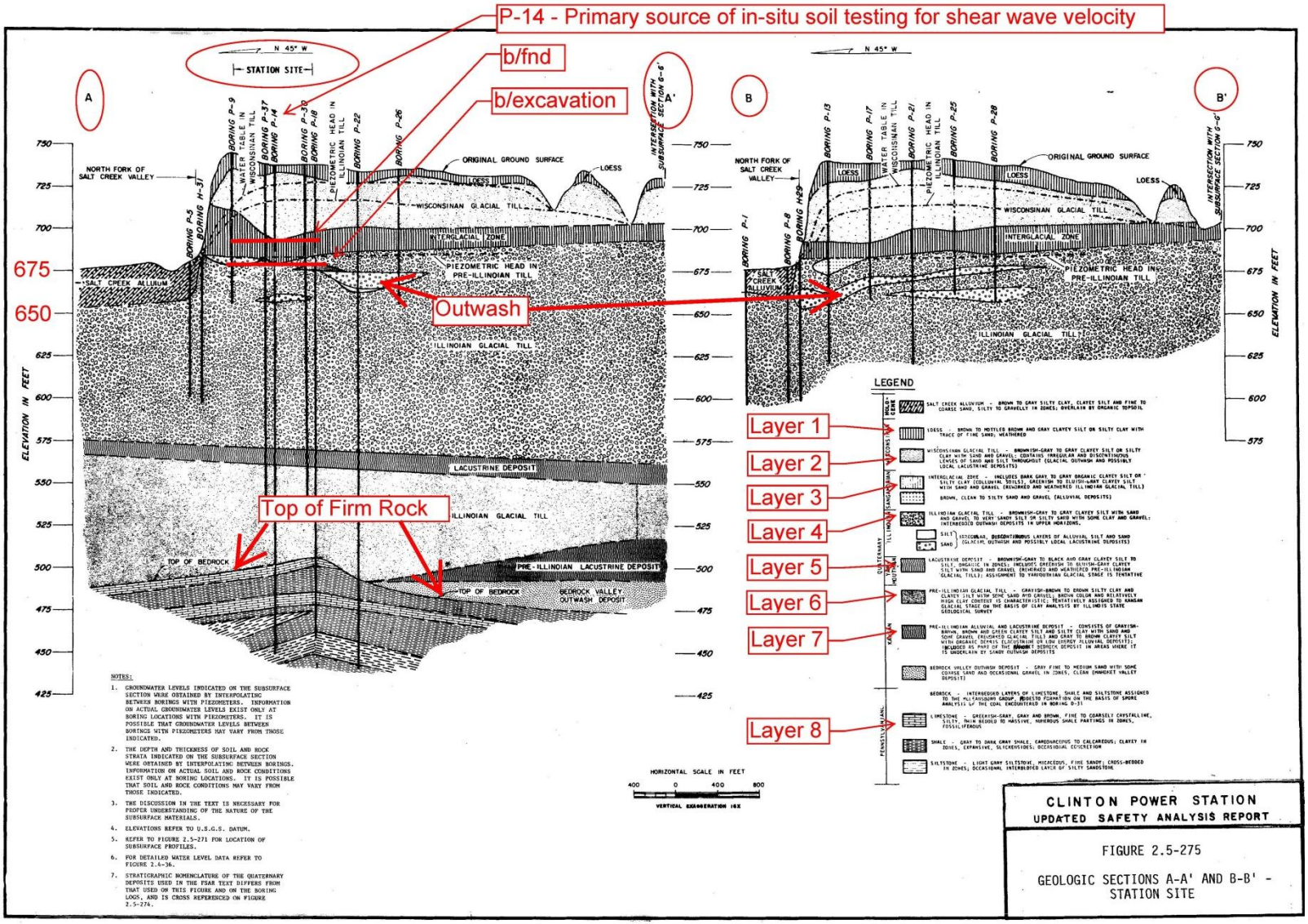
Clinton - Exelon Response

Exelon Basis # 2 (cont'd):

The following slides provide cross section figures that illustrate the non-homogeneity of the soil layer profiles at the CPS site and the ESP site.

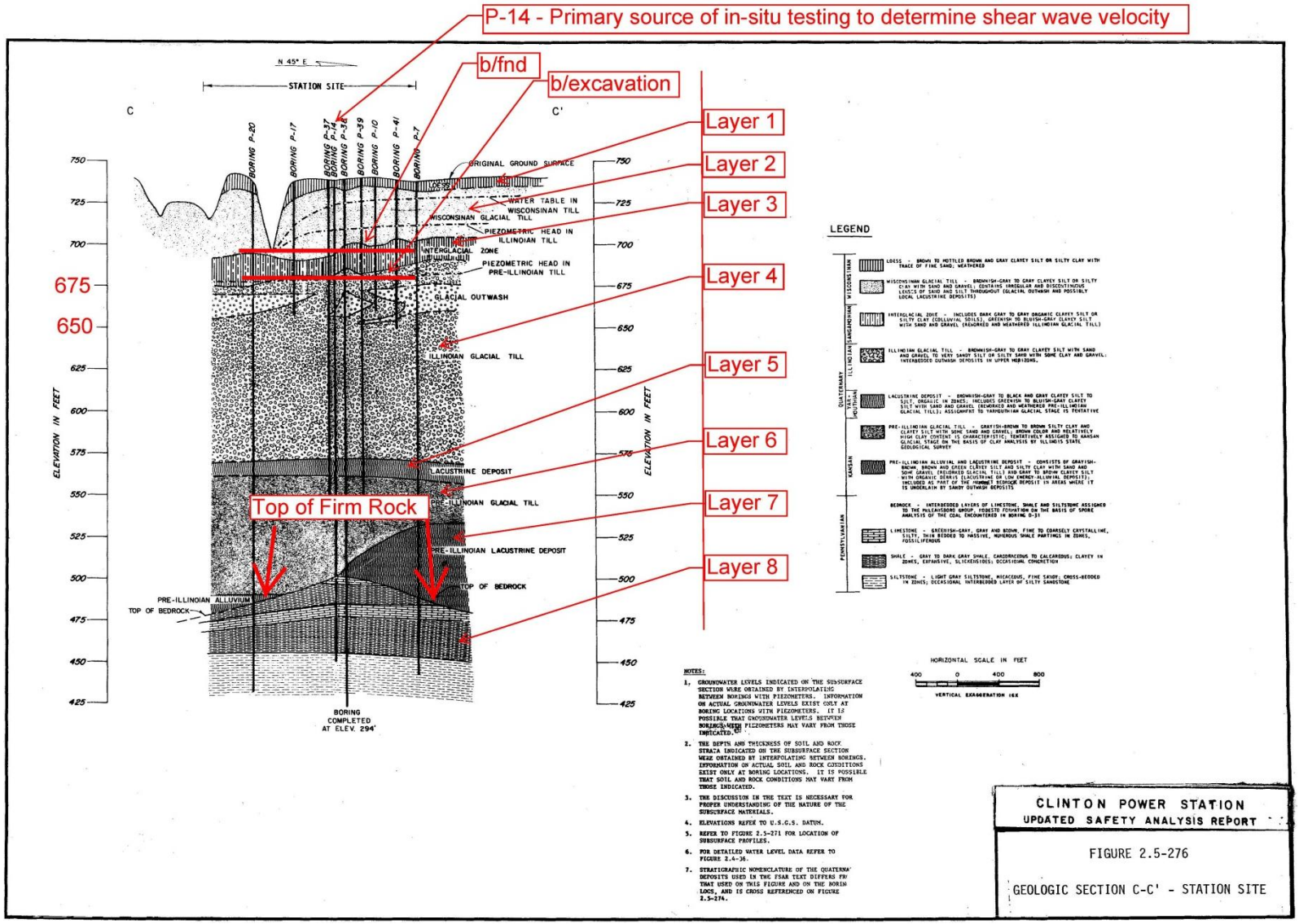
- In general, the figures show:
  - The elevation of the bottom of excavation and bottom of foundation level.
  - Variability in the glacial outwash deposits between elevations 650' and 675'.
  - The variability in the types and thicknesses of soil deposits at the top of firm rock (elevations vary at each cross-section)
  - The differing slope and thicknesses of firm rock layers.

Clinton - Exelon Response



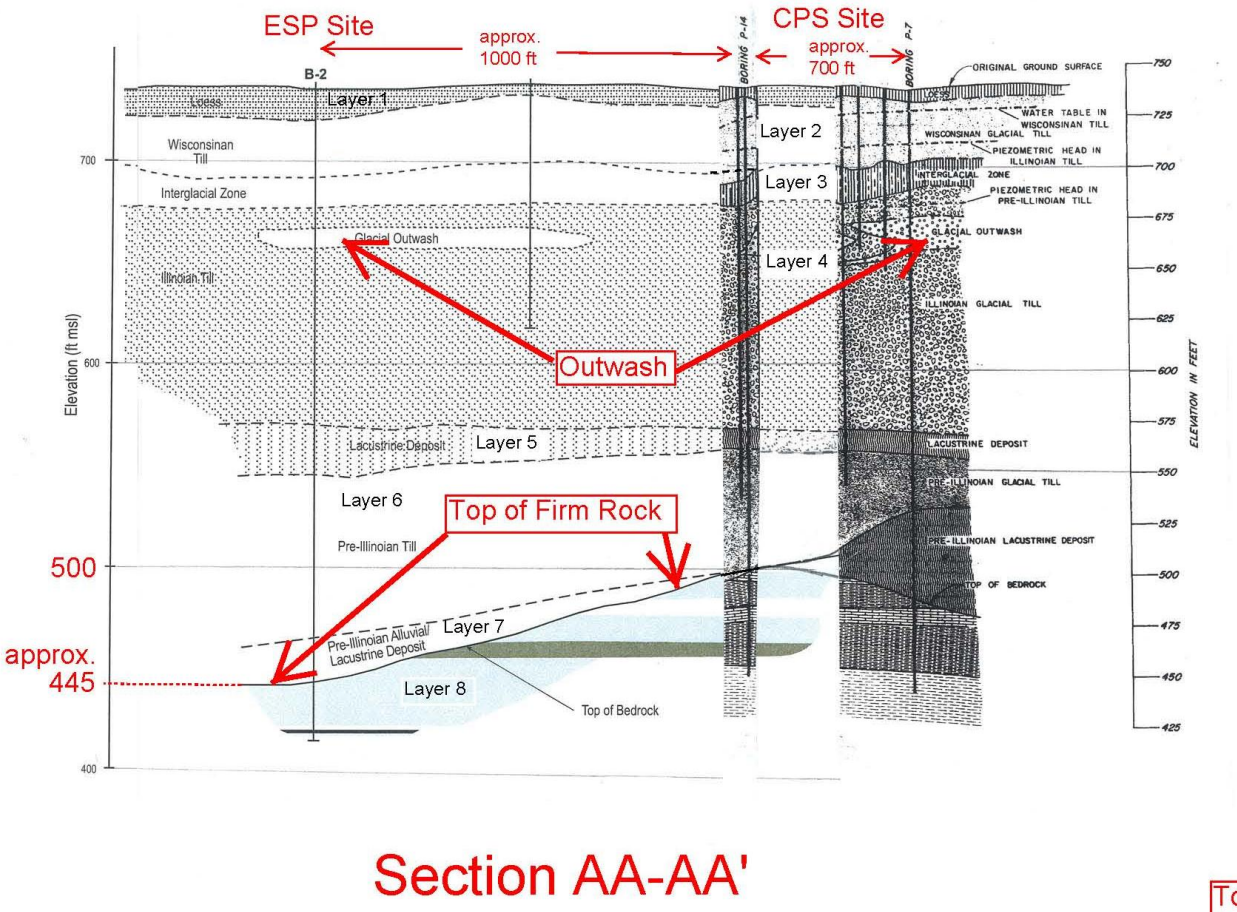
Site Cross-Sections A-A’ and B-B’

Clinton - Exelon Response



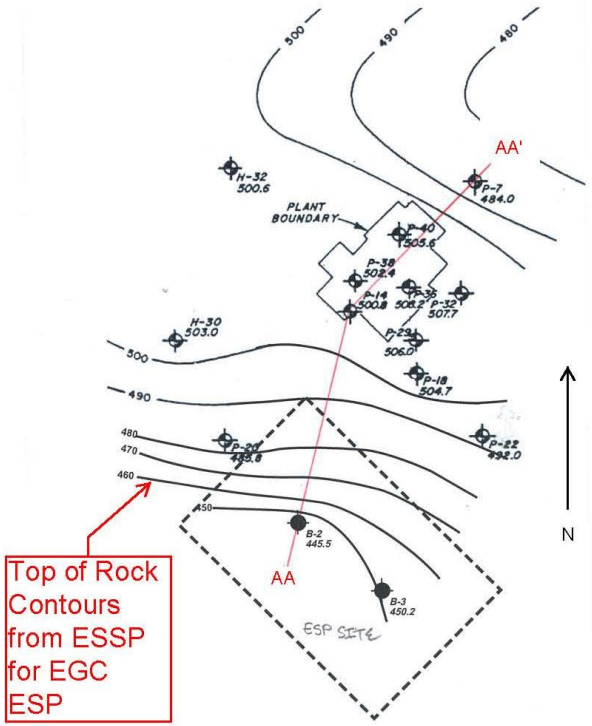
Site Cross-Section C-C’

Clinton - Exelon Response



Section AA-AA'

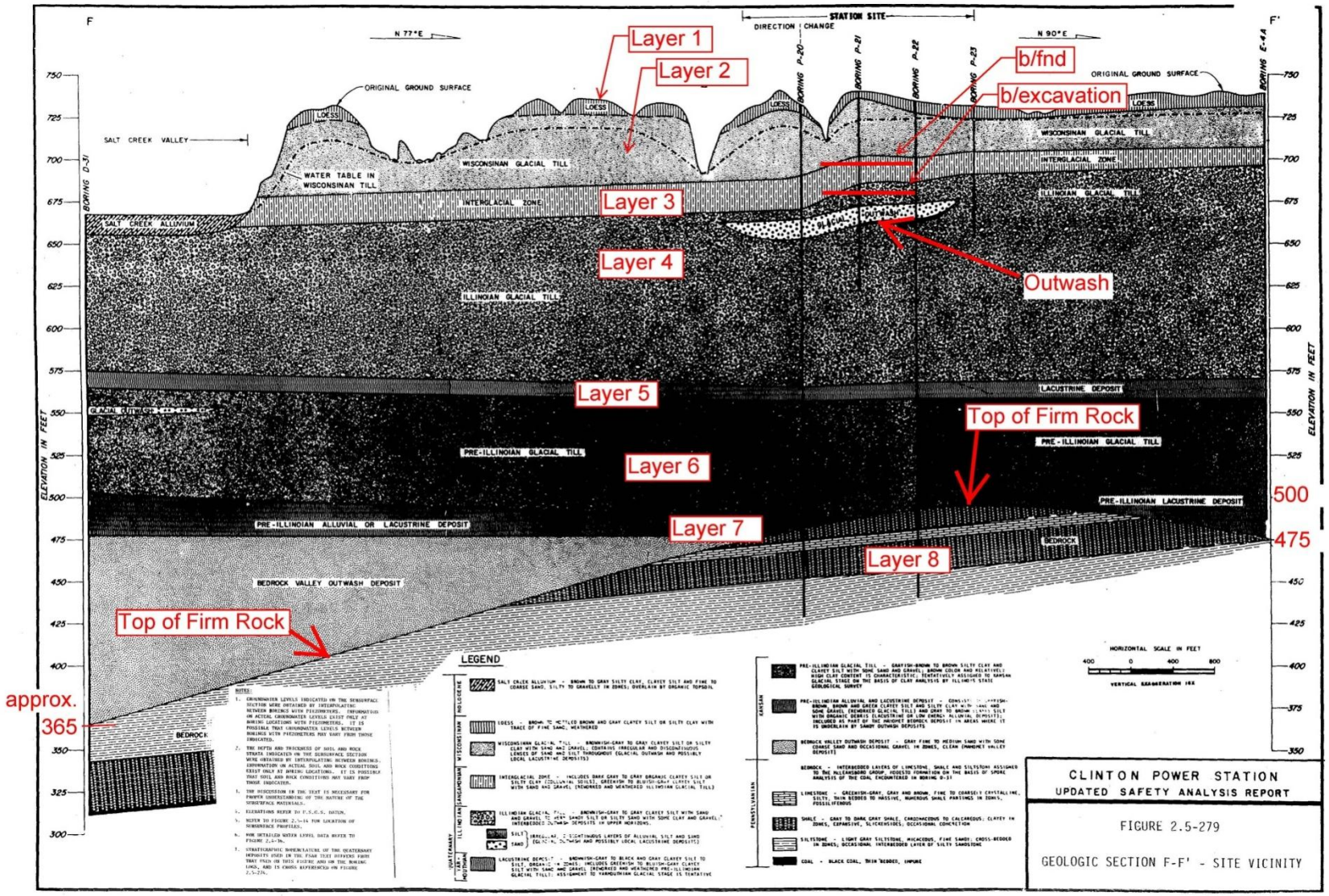
Slide is based on Figure 2.5-3 from ESSP for EGC ESP and Figure 2.5-276 from CSP USAR.



Top of Rock Contours from ESSP for EGC ESP

Site Cross-Section AA-AA'

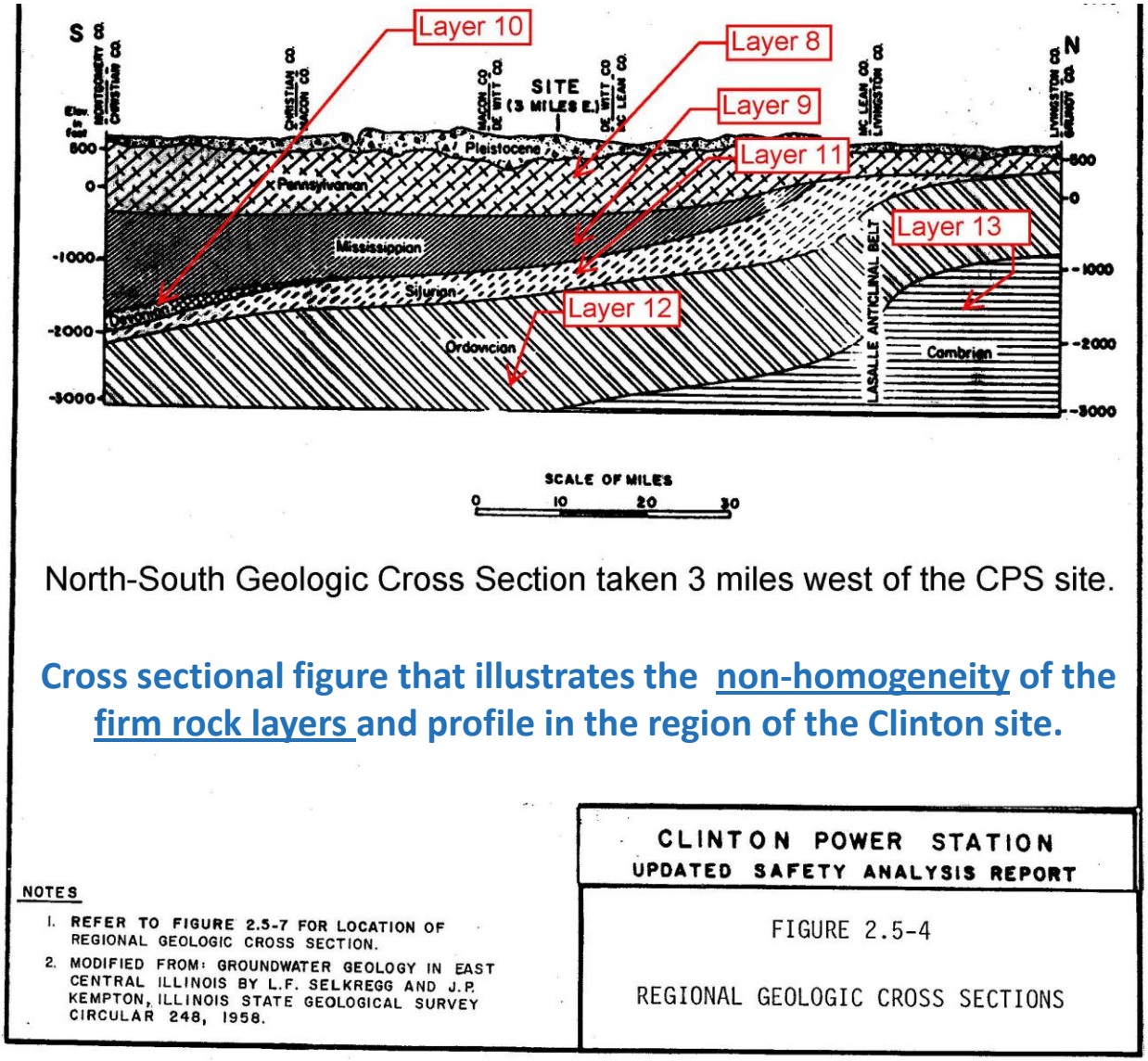
Clinton - Exelon Response



Site Cross-Section F-F'

Exelon Generation

Clinton - Exelon Response



North-South Geologic Cross Section taken 3 miles west of the CPS site.

Cross sectional figure that illustrates the non-homogeneity of the firm rock layers and profile in the region of the Clinton site.

Region Geologic Cross Section

Clinton - Exelon Response

Exelon Basis # 2 (cont'd):

- The following table shows overburden soil and rock thickness data.
  - Note the **large range in thicknesses** for layer Nos. 2, 5, 6, and 7.

Layer Number	Layer Name	Thickness of Stratigraphic Units							
		P-series Borings[1] (CPS Site)			B-2 Boring (ESP Site)	CPS USAR[3]			LCI
		ft		ft	ft	ft		ft	ft
1	Loess	3.4	to	13	13.5	N/A			4
2	Wisconsinan Till	20	to	42	30	N/A			30
3	Interglacial Zone	10	to	19	15	N/A			22
4	Illinoian Till (local zones of Glacial Outwash is present within this layer)	104	to	123	105	N/A			103
5	Lacustrine Deposit	0	to	17	27	N/A			17
6	Pre-Illinoian Till	16.5	to	70	78	N/A			50
7	Pre-Illinoian Alluvial/Lacustrine	0	to	24	23.5	N/A			10
8	Pennsylvanian Limestone, Shale, Sandstone, Coal and Shale	229.2[2]	to	252[2]	292[2]	300	to	800	500
9	Mississippian Limestone, with lesser Siltstone and Shale	Note 3				500	to	600	500
10	Devonian Shale and Limestone	Note 3				200	-	NA	200
11	Silurian Carbonates, some of which include reef structure	Note 3				450	-	NA	500
12	Ordovician Dolomite, Sandstone, Basal Sandstone, Limestone, and Shales	Note 3				1500	-	NA	1100
13	Cambrian Siltstone, Shale, Sandstone, and Dolomite	Note 3				3100	-	NA	3000
14	Precambrian Igneous Rock	Note 3				NA	-	NA	NA

1 P-series borings to rock are the only ones included in this summary (provided in CPS USAR).
2 Depth of top of rock surface reported, not thickness.
3 Actual data not obtained for these layers from the CPS or ESP subsurface exploration programs. Therefore approximate values discussed in the CPS USAR are reported in this table.

NA - Not Available
N/A - Not Applicable

Clinton - Exelon Response

Exelon Basis # 2 (cont'd):

The table on the following slide shows overburden soil and rock shear wave velocities reported in the CPS USAR and the ESP.

- The data provided for the ESP site demonstrates the variability of shear wave velocity within individual soil layers. Note the variations in shear wave velocity values for a particular soil layer range from approximately 450 ft/s to more than 2000 ft/s.
- The data obtained from in-situ testing at the CPS site (the Downhole Survey) is reported as a singular value (or small range such as 900 - 1000 ft/s) for the soil layers, however, the range of the actual test data points within a particular layer is an unknown.
- Given the uncertainty with the range of shear wave velocity values, establishing three profiles (best estimate, lower-range and upper-range) for an analysis is appropriate per SPID section B3.0.

Clinton - Exelon Response

Exelon Basis # 2 (cont'd):

- The following table shows the soil layer Vs measurements and estimates from the ESP and CPS sites
  - Green and Red values are Lower and Upper bounds of ranges reported in the Exelon submittal to NRC on 12 September 2013.
  - First eight layers shown here. Next slide describes the deeper, firm rock layers.

Layer Number	Layer Name	Shear Wave Velocities (ft/s)					
		ESP Site			CPS Site		
		Suspension Logging Borehole B-2[1]	Seismic Cone CPT-2[1]	Seismic Cone CPT-4[1]	Downhole Survey[1,2]	Tabulated Shear Wave Velocities[3,4]	Typical Geophysical Properties[3,5]
1	Loess	820 - 1340	703 - 1354	641 - 1077	900 - 1100	900 - 1100	900
2	Wisconsinan Till						900 - 1100
3	Interglacial Zone	860 - 1970	1022 - 1231	1006 - 1602	1100	-	1100
4	Illinoian Till (local zones of Glacial Outwash is present within this layer)	1100 - 3250	-	-	2100	2000 – 2100	2100
5	Lacustrine Deposit	1390 - 2670	-	-	2100	1800	
6	Pre-Illinoian Till	1560 - 2800	-	-	2100		
7	Pre-Illinoian Alluvial/Lacustrine	1190 - 3310	-	-	2100		
8	Pennsylvanian Limestone, Shale, Sandstone, Coal and Shale	3250 - 3880	-	-	5700	5300 - 5700	5700

Note 1 - In-situ measurement of shear wave velocity

Note 2 - Typical values reported in USAR

Note 3 - Estimates / recommended values used in design analyses

Note 4 - USAR Table 2.5-46

Note 5 - USAR Figure 2.5-369

Clinton - Exelon Response

Exelon Basis # 2 (cont'd):

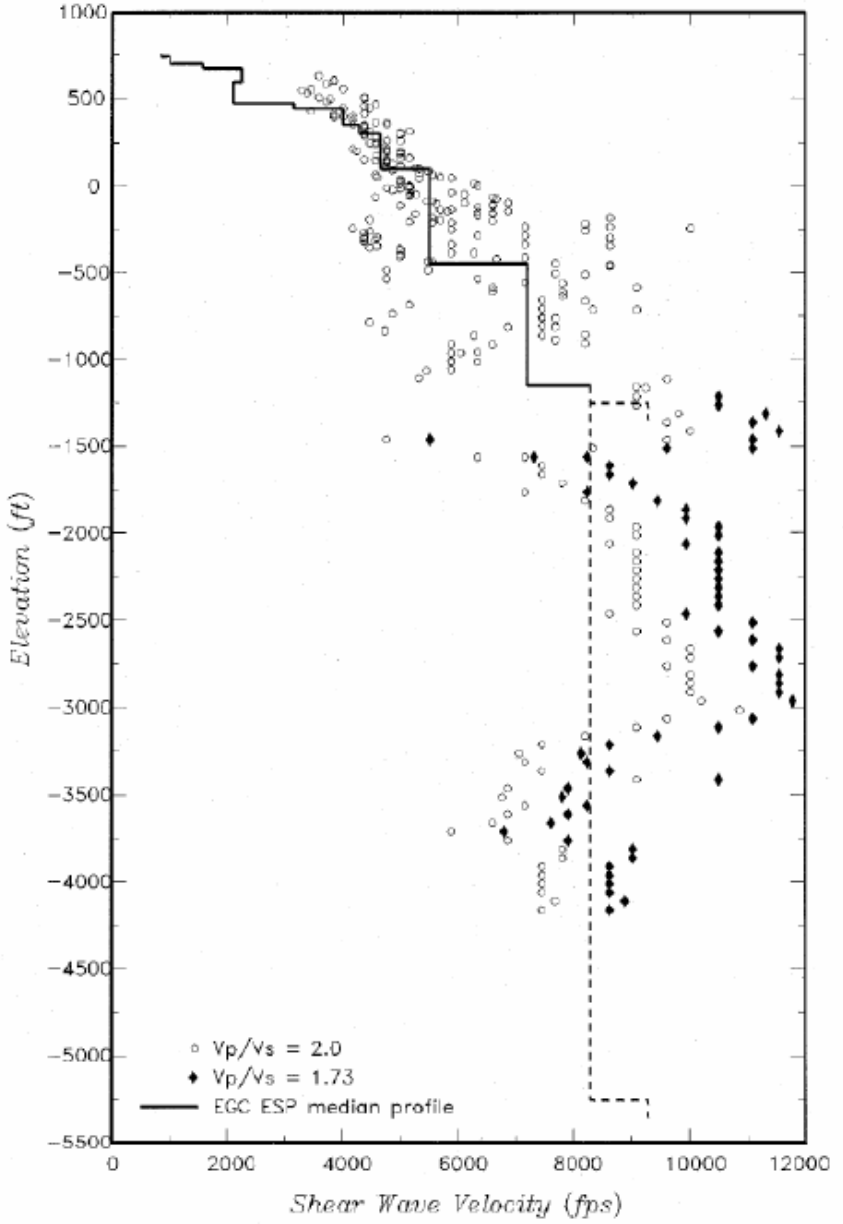
- Firm rock layer Vs is estimated from compressional wave velocity (Vp) measurements at nine (9) regional deep borings within 10 mi of ESP and CPS sites.
  - Vp / Vs = 2.0 judged appropriate for Layers 9, 10 and 11 (Poisson's ratio 0.33)
  - Vs ranges for Layers 12 and 13 comprise values computed from Vp using Vp/Vs = 1.73 and Vp/Vs = 2.0 to reflect uncertainty in Poisson's ratio
  - Green and Red values are Lower and Upper bounds of ranges reported in Exelon submittal to NRC on 12 September 2013.
- Representative ranges are estimated from regional Vp data with large dispersion shown in figure on next slide

Layer Number	Layer Name	Representative Range of Shear Wave Velocities (ft/s)
9	Mississippian Limestone, with lesser Siltstone and Shale	4500 - 6500
10	Devonian Shale and Limestone	4500 - 8500
11	Silurian Carbonates, some of which include reef structure	4500 - 8500
12	Ordovician Dolomite, Sandstone, Basal Sandstone, Limestone, and Shales	6500 - 10500
13	Cambrian Siltstone, Shale, Sandstone, and Dolomite	6500 - 10500

Clinton - Exelon Response

Exelon Basis # 2 (cont'd):

- Firm rock layer Vs representative ranges based on Vs values computed from regional Vp data and estimated Poisson's ratios
  - Considerable epistemic uncertainty in depth to hard rock due to imperfect knowledge of Poisson's ratio in deeper firm rock layers
  - Significant dispersion in compressional wave velocity data from regional deep borings
  - Epistemic uncertainty due to imperfect knowledge of site-specific firm rock wave velocities (only regional deep boring data available)



Exelon Generation

Clinton - Exelon Response

NRC Item # 3:

- Exelon used a higher kappa than the NRC.

Exelon Basis for Estimation of Total Effective Kappa:

- Profile consists of soil (240 ft) over deep firm rock (6,000 ft)
- Represents a case not directly addressed in the SPID
  - The SPID does not provide explicit guidance to calculate Total Effective Kappa for a site that has a significant(>100ft) soil layer overlying deep firm rock.
  - A hybrid approach based primarily on SPID recommendations for firm rock was used to calculate Total 'Effective' Kappa described as follows.

Clinton - Exelon Response

Exelon basis for estimation of Kappa (cont'd):

- Estimates of Total Effective Kappa based on contributions from both soil and rock
  - Top 500 ft (nonlinear zone), Low-strain damping from soil, rock curves, K=0.003s
  - Below 500 ft (linear zone), damping fixed at 1.25% (Qs=40), Effective K=0.022s
  - Hard rock contribution Effective K=0.006s
  - Total Effective Kappa for Profile 1 = 0.031s
- Uncertainty in low-strain total effective kappa addressed with three estimates
  (KP1 = 0.031s, KP2 = 0.040s(max), and KP3 = 0.026s)
- Uncertainty in total effective kappa at design loading levels addressed with multiple shear modulus and hysteretic damping curves

Clinton - Exelon Response

Exelon Conclusion / Resolution:

NRC Item # 1 - Soil Profile Considerations:

- Exelon appropriately used available data from the USAR and ESP to develop the subsurface profile(s) in accordance with the NRC endorsed SPID guidance.

NRC Item # 2 – Use of 3 Base Case Profiles:

- The earlier slides and discussions demonstrate the non-homogeneity of the soil profile at the site:
  - Variability in the location and thickness of the glacial outwash below the site
  - Variability in the top of rock and rock layer thicknesses in the site area
  - Variability in the type and thickness of the soil layers over the top of rock
  - Variability in the soil and rock shear wave velocities based on available data. Vs for rock layers are not site specific and are derived from Vp values.
- Based on soil profile uncertainties (variabilities), EPRI SPID guidance section B3.0 recommends the use of three profiles (best estimate, lower-range, and upper-range).

Clinton - Exelon Response

Exelon Conclusion / Resolution :

NRC Item # 3 – Basis for Kappa:

- Exelon has used the developed subsurface profiles to appropriately calculate kappa values (P1 = 0.031s, P2 = 0.040s, and P3 = 0.026s) in accordance with NRC endorsed SPID guidance and good technical judgment.

Clinton - Exelon Response

Exelon Conclusion / Resolution :

- The Exelon GMRS has been developed in accordance with the NRC endorsed SPID guidance and good technical judgment.
- Clinton will continue FLEX design and modification activities using the Exelon submitted GMRS in accordance with NRC Order EA-12-049.
- No ESEP will be performed for Clinton.
- Exelon concludes that the GMRS submitted in the Clinton Seismic Hazard and Screening Report (RS-14-066) is acceptable and the Clinton site screens out from further risk assessment.

Exelon Response to NRC Questions for Oyster Creek

Presented to US Nuclear Regulatory Commission

Jeff Clark – Exelon Fukushima Seismic Lead

June 17, 2014

Exelon Generation®

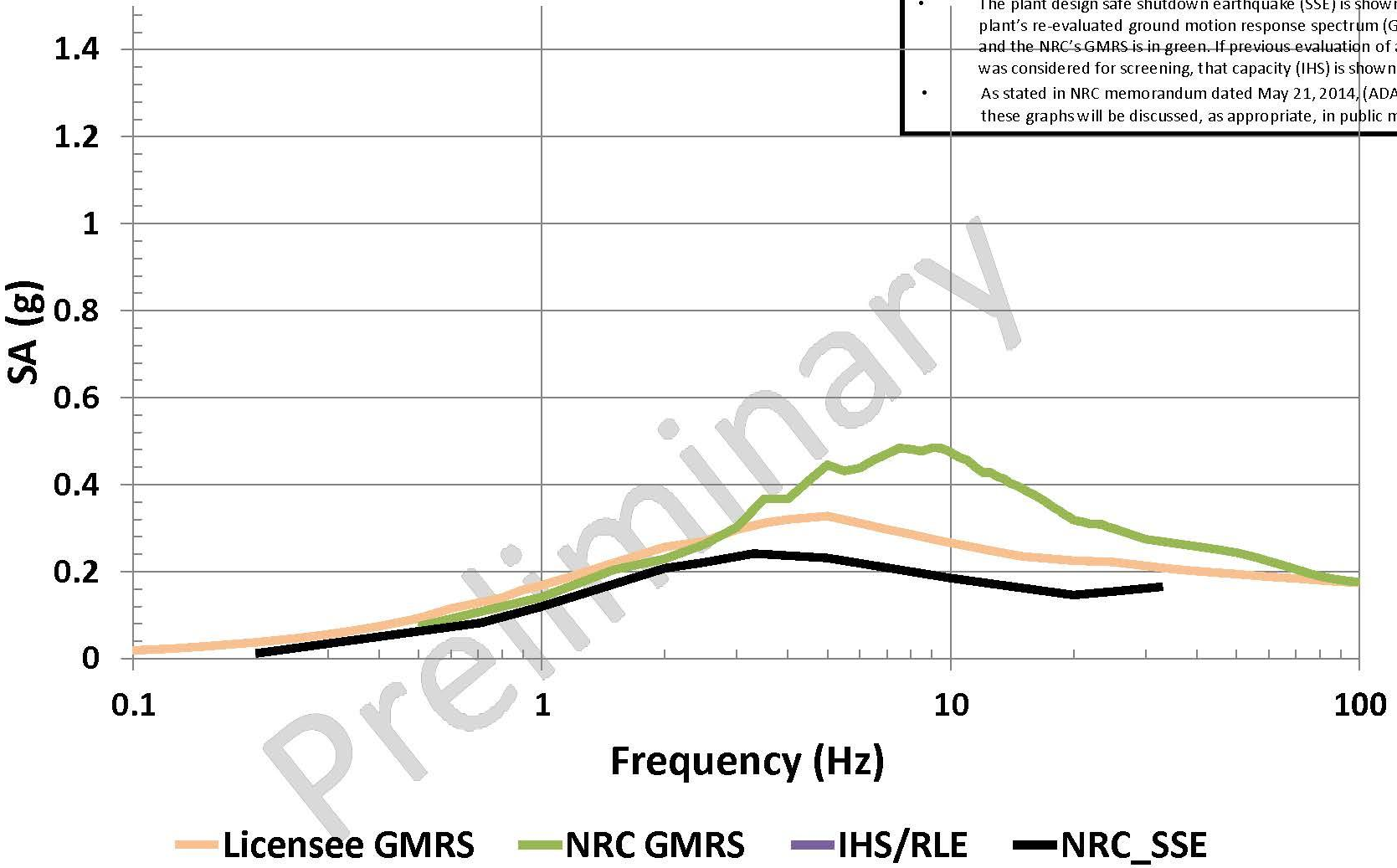
Oyster Creek - Exelon Response

The NRC identified four areas where the NRC preliminary evaluation differed from the Oyster Creek submitted report.

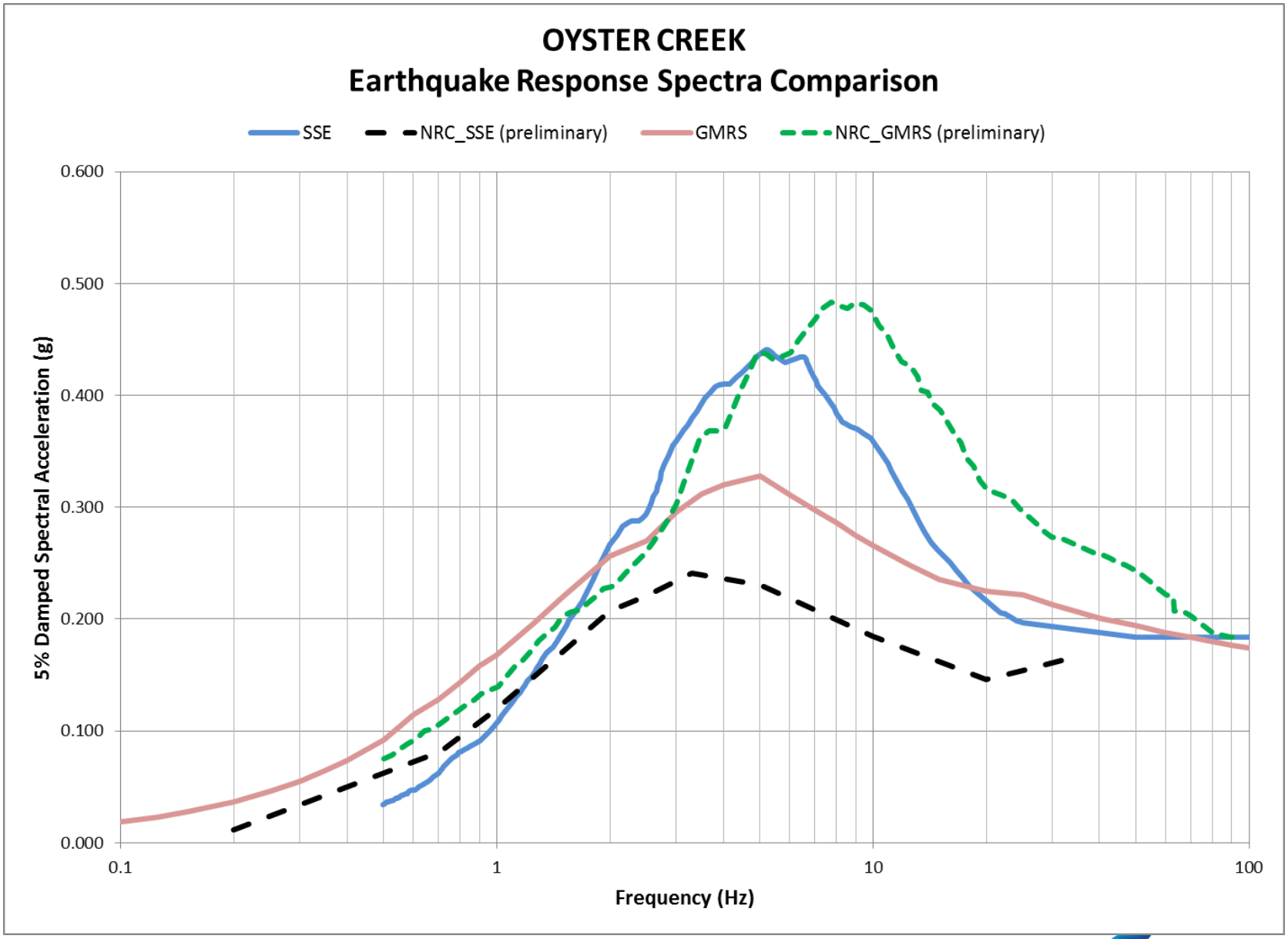
- **Item # 1:** The NRC GMRS is higher than the Exelon GMRS between 3 and 10 Hz (within screening range - 1 to 10 Hz). The difference in GMRS curves appears to be due to differences in Kappa and soil velocity profiles (See Item #2 below) below a depth of 300 feet.
- **Item # 2:** NRC velocity profile deltas exist below 300 ft depth.
- **Item # 3:** NRC states that the "NRC_SSE" published in 5/21/14 NRC letter is from the FSAR and is the appropriate SSE curve for use in screening vs. the Oyster Creek submitted 0.184g SSE (current seismic licensing basis).
- **Item # 4:** Control point was changed from September 2013 submittal to NRC.

Oyster Creek

- As discussed in the May 9, 2014, letter (ADAMS ML14111A147), the NRC considered the re-evaluated hazard and previous estimates of plant capacity to conclude that this plant is safe to continue operating while additional evaluations are conducted.
- NRC staff used this preliminary graph, focusing on the 1-10 Hertz range, and other information to determine whether this plant requires a risk evaluation over the next few years.
- The plant design safe shutdown earthquake (SSE) is shown in blue; the plant's re-evaluated ground motion response spectrum (GMRS) is in black and the NRC's GMRS is in green. If previous evaluation of a plant's capacity was considered for screening, that capacity (IHS) is shown in purple.
- As stated in NRC memorandum dated May 21, 2014, (ADAMS ML14136A126) these graphs will be discussed, as appropriate, in public meetings.



Oyster Creek – GMRS vs. SSE



Oyster Creek - Exelon Response

NRC Item #1:

- The NRC GMRS is higher than the Exelon GMRS between 3 and 10 Hz (within screening range - 1 to 10 Hz). The difference in GMRS curves appears to be due to differences in Kappa and soil velocity profiles (See Item #2 below) below 300 feet below the surface.

Exelon Basis for Estimation of Total Effective Kappa:

- Due to the depth to hard rock (3700 feet per FSAR), Oyster Creek is characterized as a deep soil site.
- Section B-5.1.3.1 of the SPID for a deep soil site with depths exceeding 3000 feet to hard rock, states that a mean base-case total effective kappa estimate of 0.04s should be used.

Oyster Creek - Exelon Response

NRC Item # 2:

- NRC velocity profile deltas exist below 300 ft depth.

Exelon Basis for Shear Wave Velocity (Vs) Profile:

- The Oyster Creek FSAR characterizes the site as a sequence of layers of unconsolidated to semi-consolidated deposits overlying the rock at 3700 feet below the surface.
- Properties of the soil from the surface to 300 feet below the surface were developed from information collected during the soil boring program performed during initial investigations of the Oyster Creek site.

Oyster Creek - Exelon Response

Exelon Basis for Shear Wave Velocity (Vs) Profile (cont'd):

- Properties of soil below 300 feet below grade were estimated based on the shear-wave velocity profile templates in the NRC endorsed SPID that match the soil profile down to 300 feet below the surface and on geological information related to soil deposits on the East coast in the vicinity of the Oyster Creek site.
- The following table and graph show the soil properties and Velocity profiles used to develop the GMRS.

Oyster Creek - Exelon Response

Soil properties obtained from soil borings and available geological information (Exelon GMRS basis)

Elevations of Layer Boundaries Under Reactor Buildings (ft., MSL)	Range in Thickness Across Site (ft.)	Soil/Rock Description and Age	Density (pcf)	Shear- Wave Velocity (fps)	Compressional Wave Velocity (fps)	Poisson's ratio
23 to 20	17-18	Late Pleistocene Cape May Formation, medium density fine sand	120	270-360	Saturated: 5000-5200	0.39
20 to 13				520-690		
13 to 5				570-760	Not saturated: 1400[c]	
5 to -3	16-17	Late Pleistocene to Late Miocene Upper Clay, alternating clay, silt, and fine sand	115	640-845	5200-5900	0.49
-3 to -11				700-930		
-11 to -20	65-66	Late Miocene Cohansey Formation, dense fine to coarse sand	125	810-1070	5200-5900	0.49
-20 to -29				860-1130		
-29 to -32				1020-1350		
-32 to -39				1100-1460		
-39 to -45				1000-1320		
-45 to -55				980-1300		
-55 to -57				1100-1450		
-57 to -63				1230-1630		
-63 to -71				1260-1670		
-71 to -77				1220-1610		

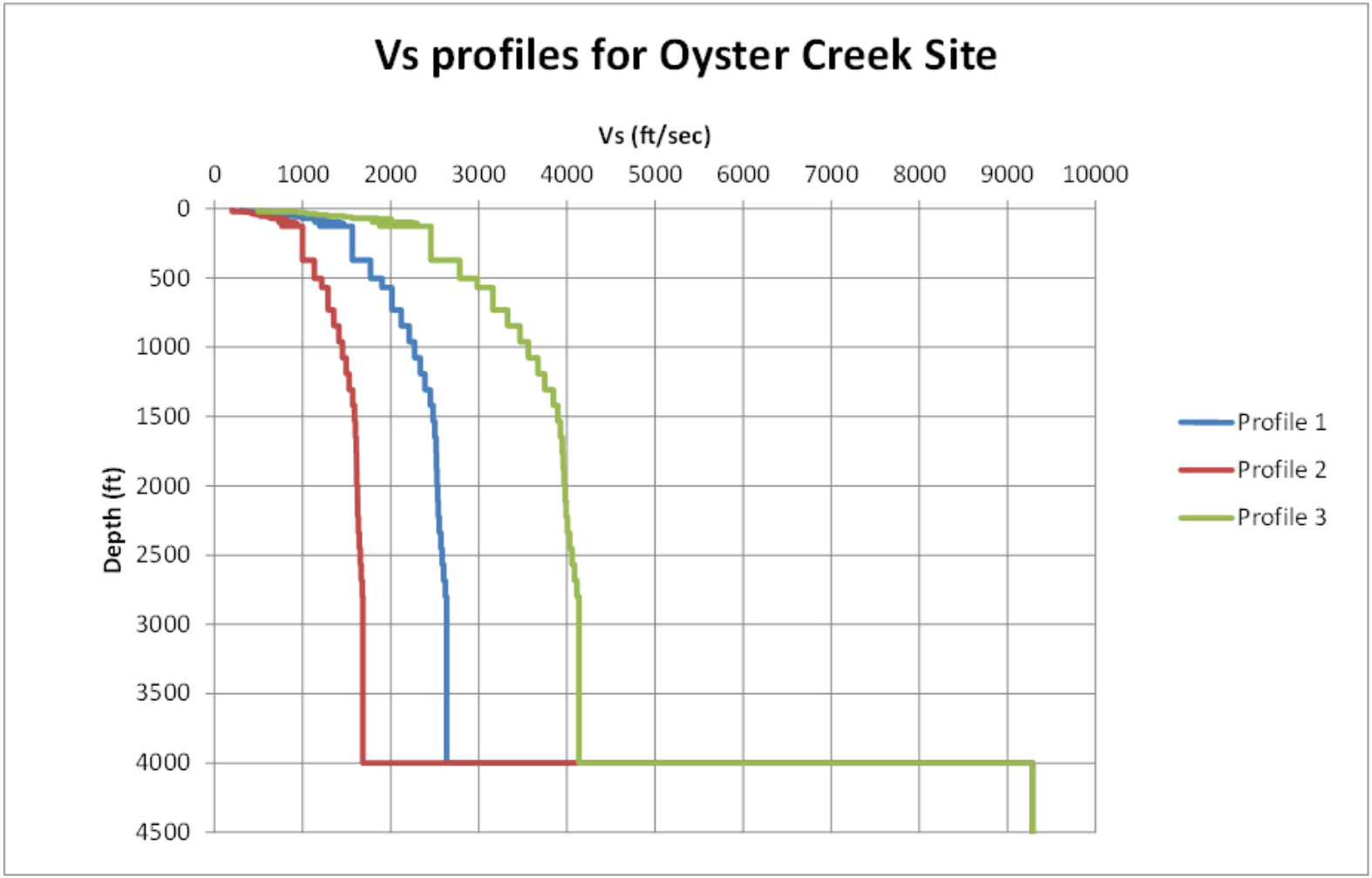
Oyster Creek - Exelon Response

Soil properties obtained from soil borings and available geological information (Exelon GMRS basis) (cont'd)

Elevations of Layer Boundaries Under Reactor Buildings (ft., MSL)	Range in Thickness Across Site (ft.)	Soil/Rock Description and Age	Density (pcf)	Shear- Wave Velocity (fps)	Compressional Wave Velocity (fps)	Poisson's ratio
-77 to -85	8	Lower Clay, alternating clay, silt, and fine sand	125	1030-1360	5200-5900	N/A
-85 to -330	245	Kirkwood Formation, dense fine to medium sand	125	1350-1780	5200-5900	N/A
-330 to N/A	3700	Quaternary, Tertiary and Cretaceous sediments	N/A	N/A	N/A	N/A
N/A	N/A	Precambrian, early Paleozoic and Triassic rocks	N/A	N/A	N/A	N/A

Oyster Creek - Exelon Response

- Shear-wave velocity profiles for Oyster Creek site



Oyster Creek - Exelon Response

NRC Item # 3:

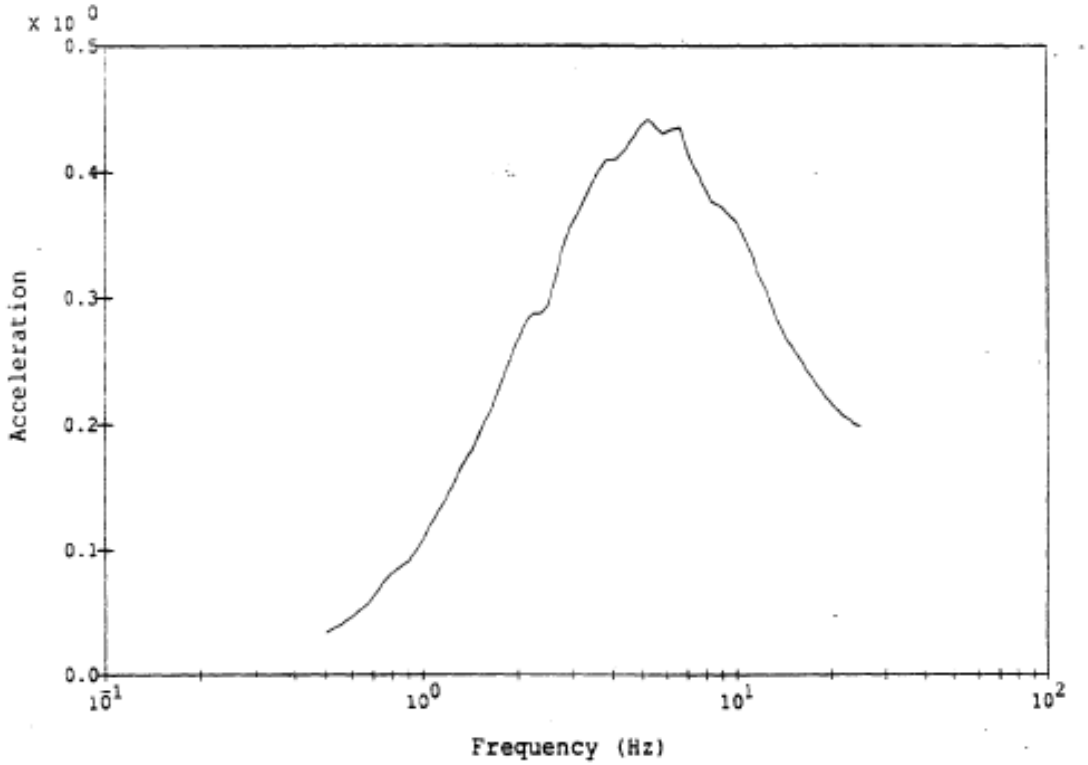
- NRC states that the “NRC_SSE” published in 5/21/14 NRC letter is from the FSAR and is the appropriate SSE curve for use in screening vs. the Oyster Creek submitted 0.184g SSE (current seismic licensing basis).

Exelon Response:

- By *Letter, A. Dromerick, NRC to J. J. Barton, GPUN, "Review and evaluation of the Soil Structure Interaction Analysis and Approach Proposed for Generation of Instructure Spectra (M69467)", Docket No. 50-219, February 23, 1995,* NRC approved the use of the in-structure response spectra developed by EQE using the site specific response spectrum (SSRS) produced by Weston Geophysical for any future designs, analyses and evaluations.
- Since this SSRS have been approved by NRC for any future evaluations in 1995, it is appropriate to be used for the Fukushima NTTF 2.1 Seismic screening. Therefore it is used as the SSE in the Screening Report.
- This SSRS is provided in Figure 3.7-18 of the UFSAR (see following slide).

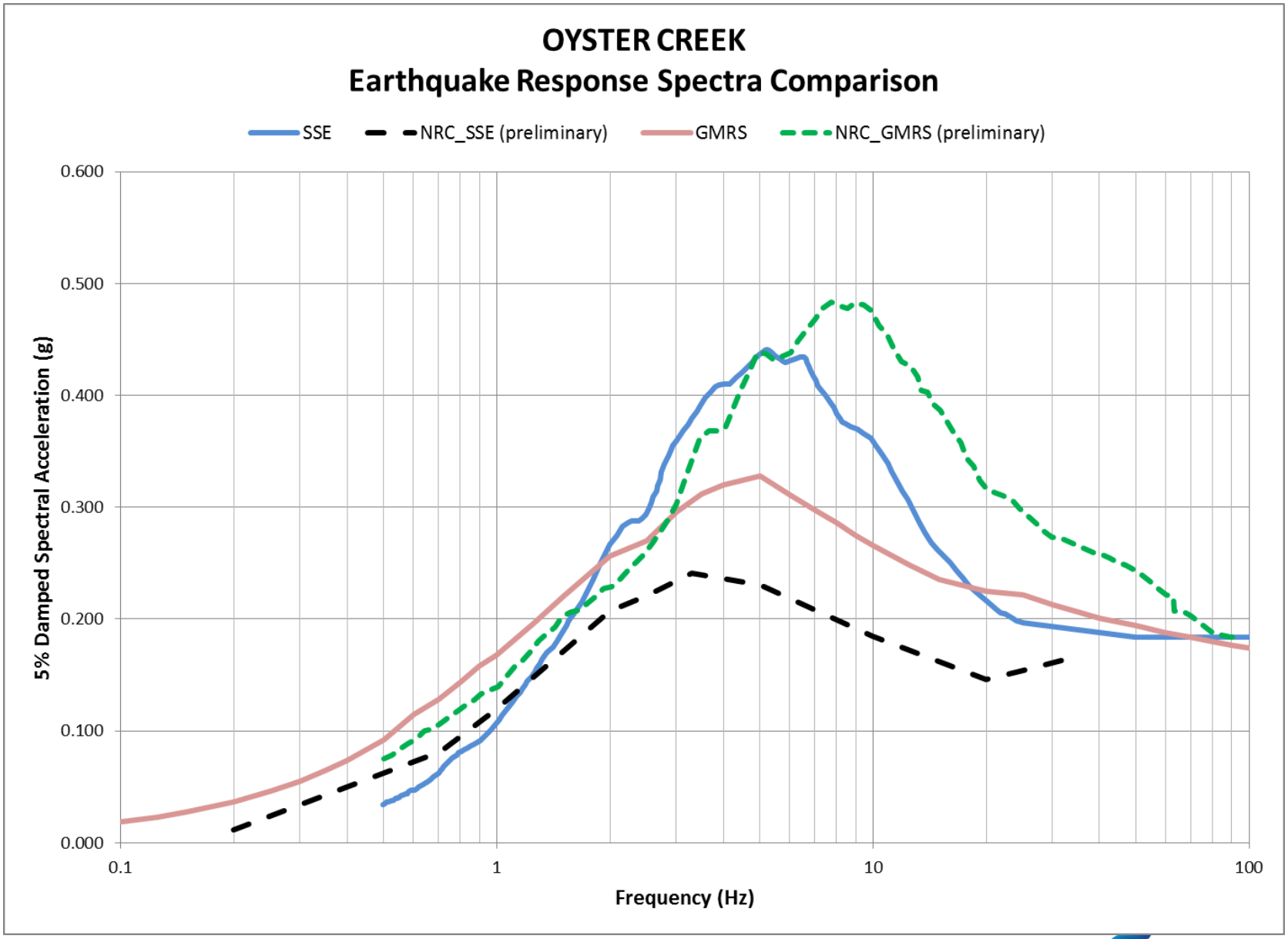
Oyster Creek - Exelon Response

Oyster Creek Site Specific Response Spectrum
from Fig. 3.7-18 of UFSAR



Notes:
Accelerations in g's
Spectral Damping 5%
PGA = 0.184g

Oyster Creek – GMRS vs. SSE



Oyster Creek - Exelon Response

NRC Item #4:

- Control point was changed from September 2013 submittal to NRC.

Exelon Basis for Control point re-location:

- The UFSAR does not explicitly describe the location of the control point. Therefore, the location of the control point provided to EPRI and submitted to NRC in September 2013 was at the base of the Reactor Building, per section 2.4.2 of the NRC endorsed SPID guidance.
- After a detailed review of EQE Report 50069-R-001 which contains the NRC approved SSRS, it was discovered later that the location of the SSRS control point is at the ground surface, as described in page 8 and 20 of the report. As a result, the location of the control point was revised and documented in the Screening Report.

Oyster Creek - Exelon Response

Exelon Conclusion / Resolution:

- The Exelon GMRS has been developed in accordance with the NRC endorsed SPID guidance.
- Inputs used to develop the GMRS are consistent with information contained in the FSAR and plant licensing basis documents.
- The SSE submitted by Exelon is the current licensing basis SSE for the plant and was accepted by the NRC in 1995.
- Oyster Creek will continue FLEX design and modification activities using the Exelon submitted GMRS in accordance with NRC Order EA-12-049.
- Oyster Creek is proceeding with ESEP for low frequency susceptible SSCs only and will complete screening and evaluation activities using the Exelon submitted GMRS and provide a report to the NRC by December 31, 2014.
- Exelon concludes that the GMRS and SSE curves submitted in the Oyster Creek Seismic Hazard and Screening Report (RS-14-070) are acceptable and the Oyster Creek site screens out from further risk assessment.

Exelon Response to NRC Questions for Limerick

Presented to US Nuclear Regulatory Commission

Jeff Clark – Exelon Fukushima Seismic Lead

June 17, 2014

Exelon Generation®

Limerick - Exelon Response

The NRC identified three areas where the NRC preliminary evaluation differed from the Limerick submitted report:

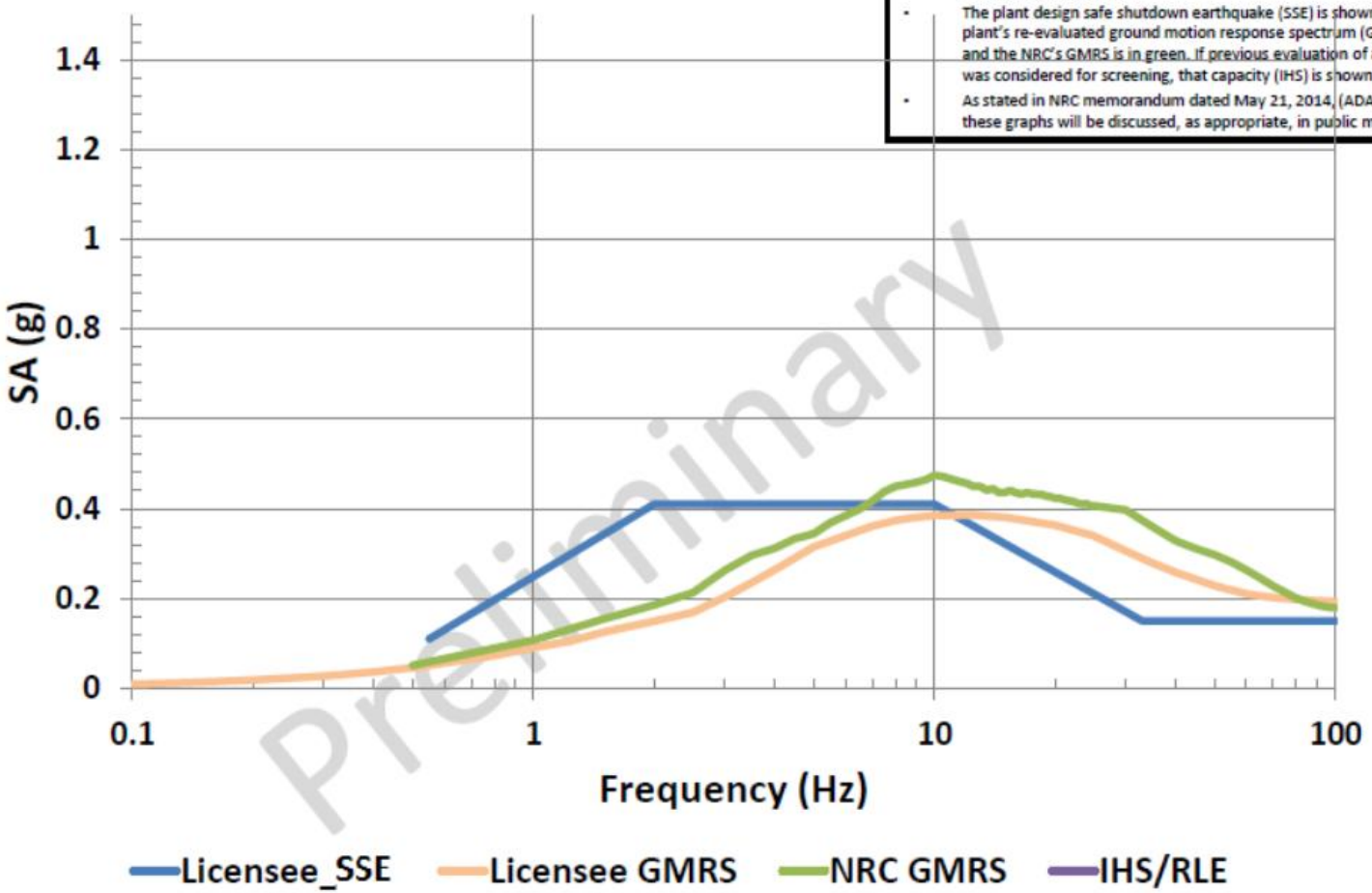
Item # 1: Minor differences in the near surface shear wave velocity profiles assumed by the NRC vs. LIM submittal values.

Item # 2: Differences in the rock properties by the NRC vs. LIM submittal properties.

Item # 3: Differences in the low strain damping values (Kappa) used for the NRC vs. Exelon GMRS development.

Limerick - Exelon Response

- As discussed in the May 9, 2014, letter (ADAMS ML14111A147), the NRC considered the re-evaluated hazard and previous estimates of plant capacity to conclude that this plant is safe to continue operating while additional evaluations are conducted.
- NRC staff used this preliminary graph, focusing on the 1-10 Hertz range, and other information to determine whether this plant requires a risk evaluation over the next few years.
- The plant design safe shutdown earthquake (SSE) is shown in blue; the plant's re-evaluated ground motion response spectrum (GMRS) is in orange and the NRC's GMRS is in green. If previous evaluation of a plant's capacity was considered for screening, that capacity (IHS) is shown in purple.
- As stated in NRC memorandum dated May 21, 2014, (ADAMS ML14136A126) these graphs will be discussed, as appropriate, in public meetings.



May 7, 2014

ML14136A126

Limerick - Exelon Response

NRC Item # 1:

- Minor differences in the near surface shear wave velocity profiles assumed by the NRC vs. LIM submittal values.

Exelon Basis for Near Surface Shear Wave Velocity (Vs) Profile:

- Both UFSAR and ISFSI geotechnical data was considered in development of shear wave velocity profiles as SPID Appendix B recommends use of “all available, applicable site geotechnical/geological information” for use in development of shear-wave velocity profiles
- ISFSI Pad and associated geotechnical exploration data are located approximately 500 feet West of the Unit 1 Reactor centerline.
- UFSAR geotechnical data was collected circa 1970, whereas newer ISFSI data was collected circa 2005.

Limerick - Exelon Response

Summary of the site geotechnical profile for Limerick

Elevations of Layer Boundaries Under Reactor Buildings (ft., MSL)	Range in Thickness Across Site (ft.)	Soil/Rock Description and Age	Density (pcf)	Shear Wave Velocity (fps)	Compressional Wave Velocity (fps)	Poisson's ratio
214 to 204	0-10	Cretaceous stiff clayey silt, sandy silt, and silty fine sand with some gravel-sized rock fragments	126-141	UFSAR: N/A ISFSI: 875-1000	UFSAR: N/A ISFSI: 1800	N/A
204 to -7800	8000	Triassic Brunswick lithofacies, hard siltstone, sandstone and shale	140-162	UFSAR: 5800-6100 ISFSI: 1900-5000	UFSAR: 7700-20000 ISFSI: 3500-8000	0.30-0.33
-7800 and below	N/A	Paleozoic and Precambrian basement rocks	N/A	N/A	N/A	N/A

Limerick - Exelon Response

Exelon Basis # 1 – Near Surface Vs:

- Base case near-surface shear wave velocities based on combination of ISFSI and UFSAR data per SPID Section B-3.1
  - Best estimate based on newer ISFSI data, mean of range (3452 fps)
  - Lower range based on best estimate divided by scale factor (2209 fps)
  - Upper range based on UFSAR data, mean of range (5952 fps)
  - Weighted 0.4, 0.3, and 0.3 respectively in site response analysis branches per SPID Table B-1.
- Uncertainties in each parameter captured in site response analysis consistent with completeness of data.

Limerick - Exelon Response

NRC Item # 2:

- Differences in the rock properties by the NRC vs. LIM submittal properties.

Exelon Basis for Rock Properties Used:

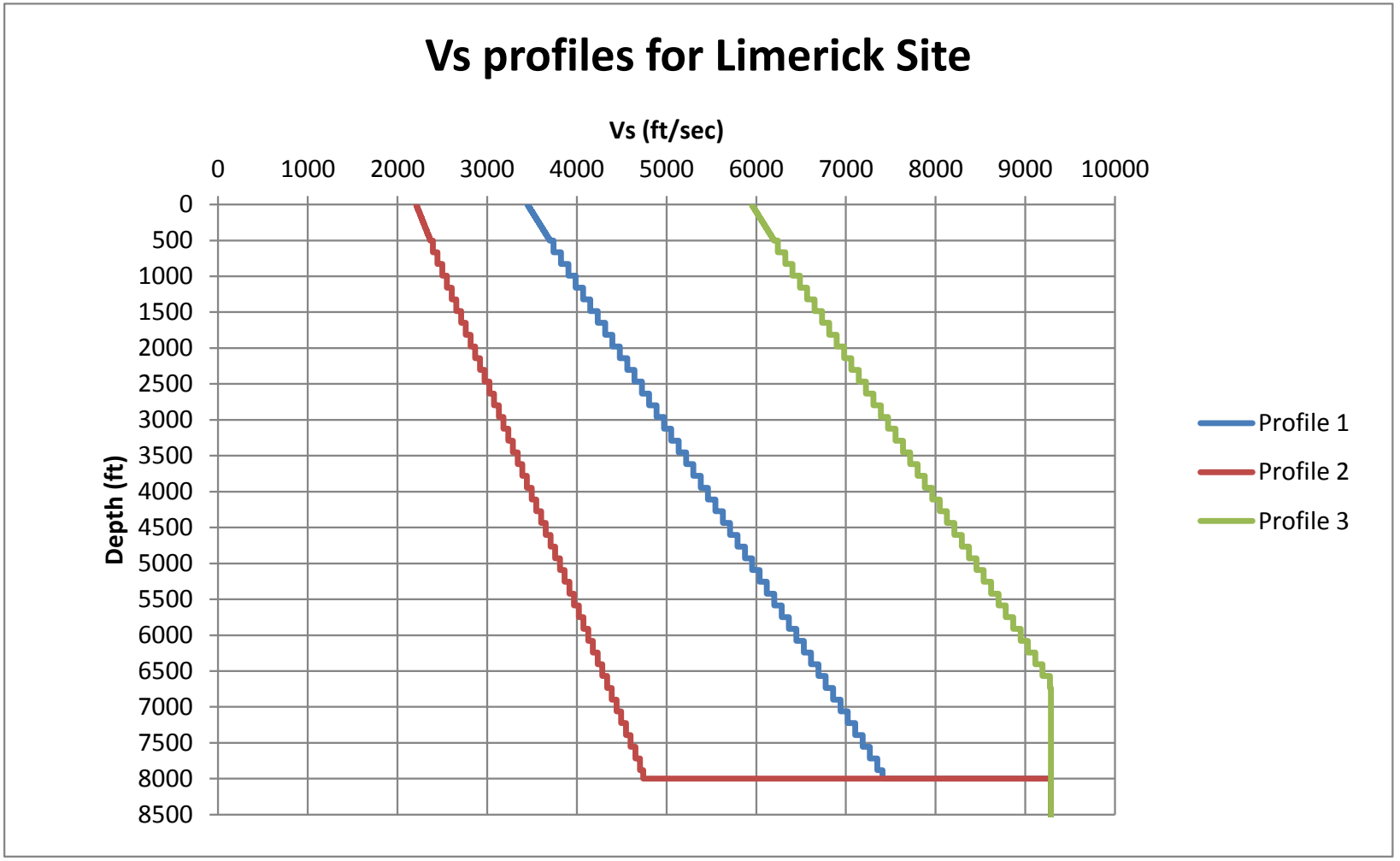
Rock Characteristics of Shear Wave Velocity Profile

- Shear wave velocities of firm rock profile below near-surface material taken based on sedimentary rock composition per SPID Section B-3.1
  - Shear wave velocity gradient for sedimentary rock taken as 0.5 m/s/m extending downward from near-surface velocity, applied to base case best estimate and upper range profiles
  - Lower range profile based on best estimate profile divided by scale factor
- Depth to basement rock nominally 8000 feet per LIM UFSAR.
  - Upper range profile limited by velocity gradient and 9285 fps shear wave velocity limit
  - Depth to reference rock randomized per NRC endorsed SPID guidance.

Limerick - Exelon Response

Exelon Basis # 2 – Rock Properties:

Shear wave velocity profiles for the Limerick site



Limerick - Exelon Response

Exelon Basis # 2 – Rock Properties:

Rock Characteristics for Shear Modulus and Damping Curves

- No site-specific nonlinear dynamic material properties were determined in the initial siting of the LIM site for sedimentary rocks.
- Dynamic response behavior of rock material over upper 500 feet was modeled two ways per SPID B-3.3:
  - Linear response
  - Non-linear EPRI “rock curves”
  - Equally weighted in site response analysis branches
  - Amplification functions relatively insensitive to rock behavior model, especially at low loading levels.

Limerick - Exelon Response

NRC Item # 3:

- Differences in the low strain damping values (Kappa) used for the NRC vs. Exelon GMRS development.

Exelon Basis for Estimation of Total Effective Kappa:

- Effective Kappa estimates were determined using Section B-5.1.3.1 of the SPID for a firm CEUS rock site.
  - With 8,000 ft of firm sedimentary rock below the SSE, kappa estimates were based on the average shear-wave velocity over the top 100 ft of the three base-case profiles P1, P2, and P3.
  - For the three profiles the corresponding average shear-wave velocities were: 3,475 fps, 2,223 fps, and 5,974 fps with corresponding kappa estimates of 0.023s, 0.036s, and 0.012s.
  - The range in kappa about the best estimate base-case value of 0.023s (profile P1) is roughly 1.6 and was considered to adequately reflect epistemic uncertainty in low strain damping (kappa) for the profile.

Limerick - Exelon Response

Exelon Conclusion / Resolution:

- GMRS differences are identified as relating to three primary areas:
  - Near-surface shear wave velocity
    - Limerick profiles reflect both UFSAR and ISFSI geotechnical data.
  - Rock properties
    - Limerick rock properties varied in accordance with NRC endorsed SPID guidance for capturing range of possible characteristics.
  - Low-strain damping (kappa)
    - Limerick kappa values follow NRC endorsed SPID guidance for deep rock sites.

Limerick - Exelon Response

Exelon Conclusion / Resolution (cont'd):

- The Exelon GMRS has been developed in accordance with the NRC endorsed SPID guidance.
- Inputs used to develop the GMRS are consistent with information contained in the UFSAR and plant licensing basis documents.
- Limerick will continue FLEX design and modification activities using the Exelon submitted GMRS in accordance with NRC Order EA-12-049.
- No ESEP will be performed for Limerick.
- Exelon concludes that the GMRS submitted for the Limerick Seismic Hazard and Screening Report (RS-14-069) is acceptable and Limerick site screens out from further risk assessment.

Exelon Response to NRC Questions for Fort Calhoun

Presented to US Nuclear Regulatory Commission

Jeff Clark – Exelon Fukushima Seismic Lead

June 17, 2014

Exelon Generation®

Fort Calhoun - Exelon Response

NRC Draft Request for Additional Information # 1:

- Prior to restart of the unit, the as found condition of Class I structural members inside containment and in the auxiliary building were determined to be outside the current licensing basis. These issues are documented in a May 14, 2014, inspection report, “Fort Calhoun – NRC Integrated Inspection Report Number 05000285/2014007” (ADAMS Accession No ML14134A410). In the FCS seismic hazard and screening report submittal of March 31, 2014, the licensee indicated that it will not perform a risk evaluation because the FCS Individual Plant Examination of External Events (IPEEE) Hazard Spectra (IHS) exceeds the calculated Ground Motion Response Spectra (GMRS). To support your conclusion, please describe how these structural elements were evaluated and found to have sufficient seismic capacity consistent with the IHS.

Fort Calhoun - Exelon Response

Exelon DRAFT RAI # 1 Response:

- NRC independently verified OPPD actions to restore containment internal structure.
- Resolution of Containment In Structure issues will be completed during the 2016 Refueling Outage. NRC Commitments noted being addressed by several proposed modifications to be performed during Refueling Outages 2015 and 2016.
- Refueling Outage 2015 modifications will close NRC commitment for restoration of beams 22A & 22B to licensing basis conditions (also meeting IPEEE plant HCLPF) as documented in ML13336A785, Enclosure 2, items 4.b, pages 2 and 3, OPPD Letter LIC-13-0164.
- NRC commitment exists to globally restore containment internal structures to FCS licensing basis levels per ML13336A785, Enclosure 2, item 4.a
- Completion of modifications will restore design basis including Individual Plant External Events Examination (IPEEE). Restoration to design basis levels will ensure plant HCLPF value is met for containment structure.
- Resolution of Auxiliary Building issues are being resolved through CAP.

Fort Calhoun - Exelon Response

NRC Draft Request for Additional Information # 2:

The FCS seismic hazard and screening report submittal indicated that a risk evaluation will not be performed because FCS's IPEEE high confidence of a low probability of failure spectrum exceeds the calculated GMRS. However, in considering the soil erosion observed during the 2011 flood at the site, please explain if the erosion and related impact could have potentially weakened the foundation supporting materials, and therefore affected the estimation of the site-specific GMRS.

Exelon DRAFT RAI # 2 Response:

- FCS performed extensive geotechnical measurements post flooding resulting in no observable differences from pre-flood data.
- As a conservative measure, further safety evaluations postulated Negatively Affected Soils under key structures, results concluded structural integrity maintained, design basis seismic unaffected.
- New GMRS calculated utilized pre and post flood soil property data.

Fort Calhoun - Exelon Response

Exelon Conclusions:

RAI # 1:

- NRC commitment exists to restore containment internal structures to FCS design basis levels per ML13336A785, Enclosure 2, item 4.a
- Resolution of Containment In Structure issues will be completed during the 2016 Refueling Outage.
- Resolution of Auxiliary Building issues are being resolved through CAP.
- NRC CAL EA-13-243, ML13351A395, dated December 17, 2013 notes OPPD commitments and NRC Closure EA-13-020 dated December 17, 2013, ML13351A423, Enclosure 1, page 9, item 2.d, notes actions in place to restore CIS in timely manner through CAP.

RAI # 2:

- FCS performed extensive geotechnical measurements post flooding resulting in no observable differences from pre-flood data and has considered all data in development of the FCS GMRS.

Fort Calhoun - Exelon Response

Exelon Recommendations:

- Fort Calhoun will continue FLEX design and modification activities using the OPPD submitted GMRS in accordance with NRC Order EA-12-049.
- Fort Calhoun is proceeding with ESEP and will complete screening and evaluation activities using the OPPD submitted GMRS and provide a report to the NRC by December 31, 2014.
- Fort Calhoun concludes that the IPEEE curve submitted in the Fort Calhoun Seismic Hazard and Screening Report (ML14097A087) is acceptable and the Fort Calhoun site screens out from further risk assessment.

Exelon Response to NRC Questions for Quad Cities

Presented to US Nuclear Regulatory Commission

Jeff Clark – Exelon Fukushima Seismic Lead

June 17, 2014

Exelon Generation®

Quad Cities - Exelon Response

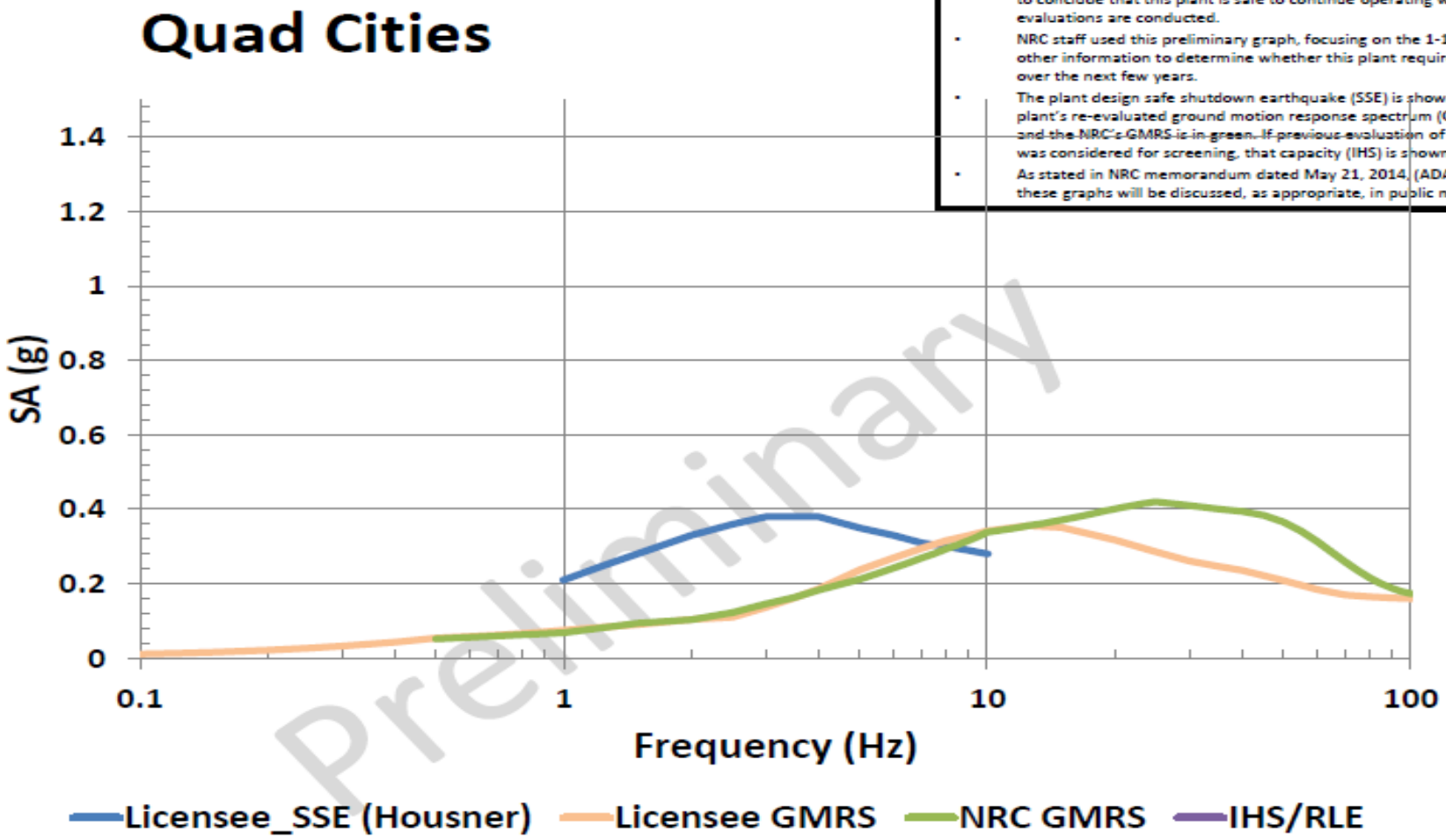
The NRC identified two areas where the NRC preliminary evaluation differed from the Quad Cities submitted report:

- **Item #1:** NRC assumes the Housner curve as the plant SSE for use in screening vs. the Exelon submitted combination of Housner and Golden Gate curves provided in the NRC Seismic Hazard and Screening report.

- **Item #2:** Differences in the low strain damping values (Kappa) used for the NRC vs. EPRI GMRS development resulting in NRC GMRS being greater than the submitted GMRS in the >10 Hz Range.

Quad Cities - Exelon Response

- As discussed in the May 9, 2014, letter (ADAMS ML14111A147), the NRC considered the re-evaluated hazard and previous estimates of plant capacity to conclude that this plant is safe to continue operating while additional evaluations are conducted.
- NRC staff used this preliminary graph, focusing on the 1-10 Hertz range, and other information to determine whether this plant requires a risk evaluation over the next few years.
- The plant design safe shutdown earthquake (SSE) is shown in blue; the plant's re-evaluated ground motion response spectrum (GMRS) is in black and the NRC's GMRS is in green. If previous evaluation of a plant's capacity was considered for screening, that capacity (IHS) is shown in purple.
- As stated in NRC memorandum dated May 21, 2014, (ADAMS ML14136A126) these graphs will be discussed, as appropriate, in public meetings.



May 7, 2014 ML14136A126

Exelon Generation

Quad Cities - Exelon Response

NRC Item # 1:

- NRC assumes the Housner curve as the plant SSE for use in screening vs. the Exelon submitted combination of Housner and Golden Gate curves provided by Exelon in the NRC Seismic Hazard and Screening report.

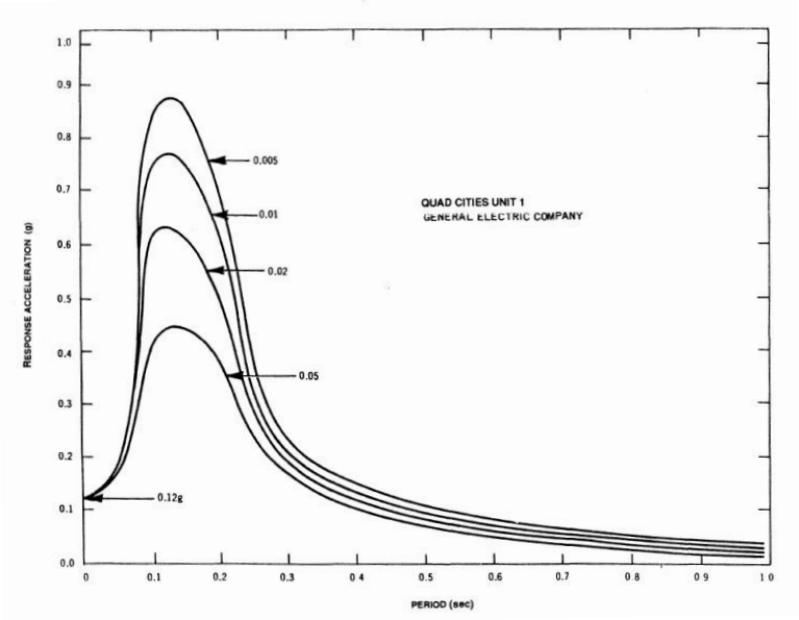
Exelon Basis for SSE:

- During the initial design and analysis of the Quad Cities Station (PDAR/FSAR), Quad Cities was designed to the Golden Gate spectra. (UFSAR Figures 3.7-1 and 3.7-2).
- In Amendment 13 of the FSAR, during initial AEC review of the plant prior to commercial operation, the Housner curve was added to the licensing basis based on AEC questions to account for low frequency accelerations, as shown in UFSAR Figure 3.7-2).
- Both curves are part of the original licensing basis as discussed and approved by the August 25, 1971 SER for initial commercial operation.
- Structures evaluated to envelope (higher loads) of Housner or Golden Gate Spectra (UFSAR Section 3.7.1)

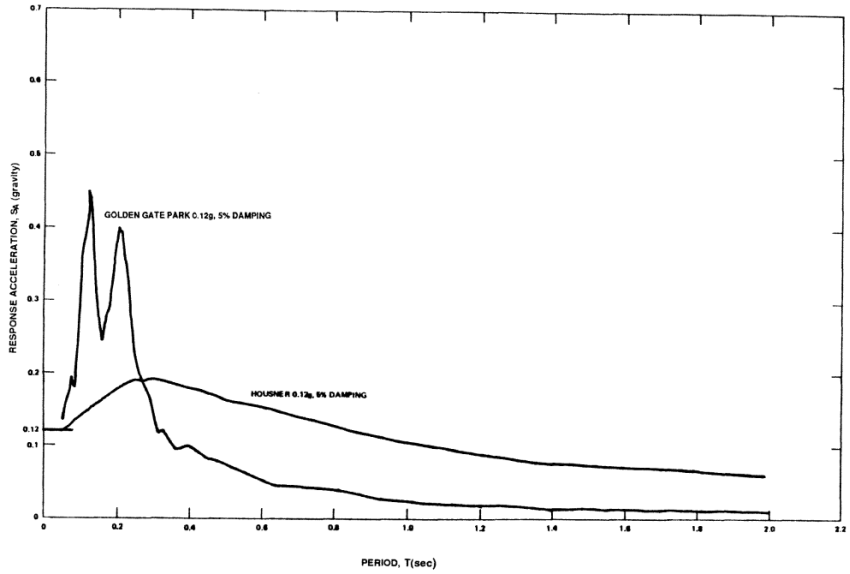
Quad Cities - Exelon Response

Exelon Item # 1 – Basis for SSE (cont'd):

UFSAR Figure 3.7-1
(Golden Gate Response Spectra)



UFSAR Figure 3.7-2
(Golden Gate Time History & Housner)



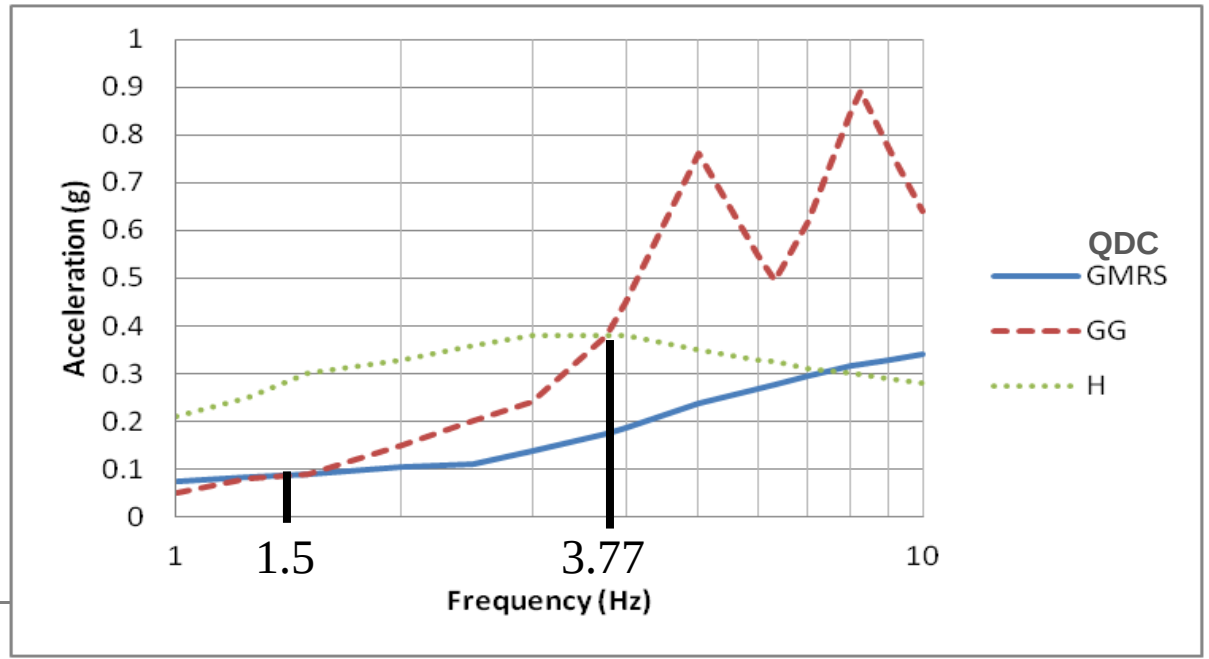
Note: These UFSAR Figures depict the OBE spectra (0.12g) and the SSE spectra is defined as twice OBE (or 0.24g) per UFSAR Section 3.7.

Quad Cities - Exelon Response

Exelon Item # 1 – Basis for SSE (cont'd):

Initial Licensing Basis (FSAR / Amendment 13 to FSAR):

- Golden Gate spectra higher at > 3.77 Hz.
- Housner spectra higher in the low-frequency range (<3.77 Hz)
- Select structures where Housner controls (<3.77 Hz) were reanalyzed
  - Reactor-Turbine Building System, Main Chimney, Feedwater and Main Steam Piping (UFSAR Section 3.7.1)
- Structures evaluated to envelope (higher loads) of Housner or Golden Gate Spectra (UFSAR Section 3.7.1)



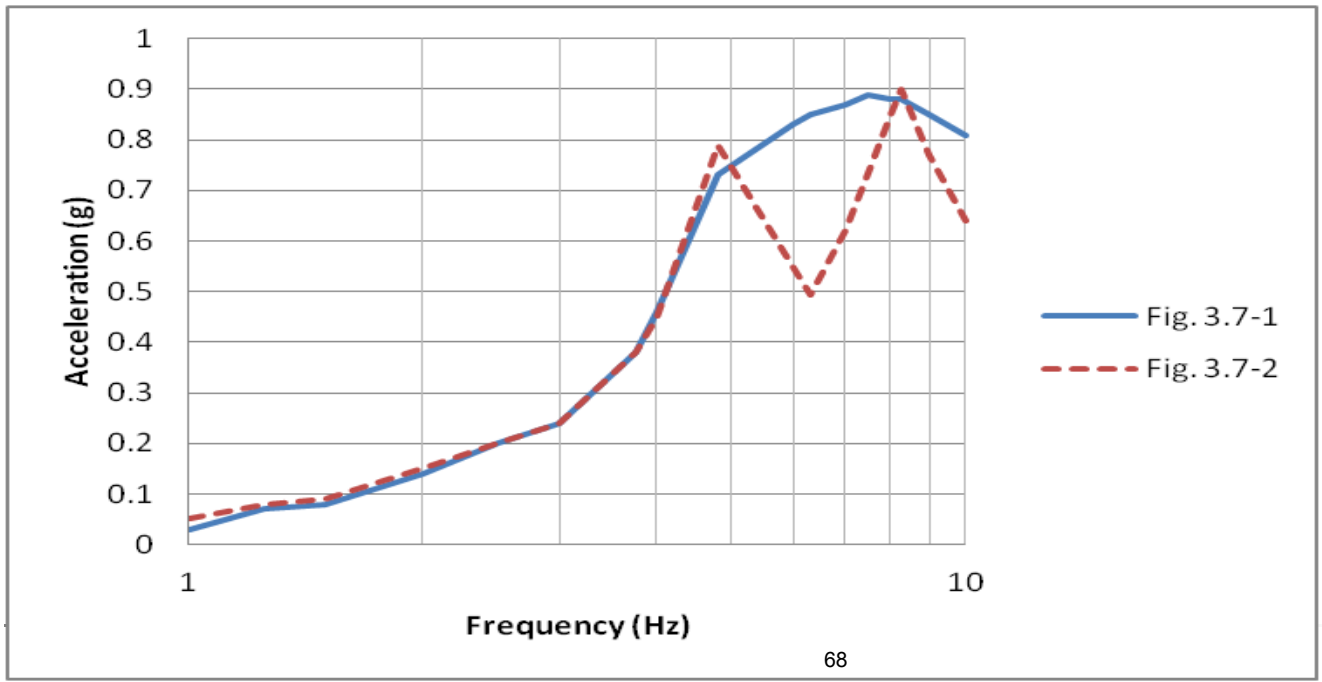
Exelon Generation

Quad Cities - Exelon Response

Exelon Item # 1 – Basis for SSE (cont'd):

Two Golden Gate Spectra discussed in UFSAR, established in original FSAR/PDAR

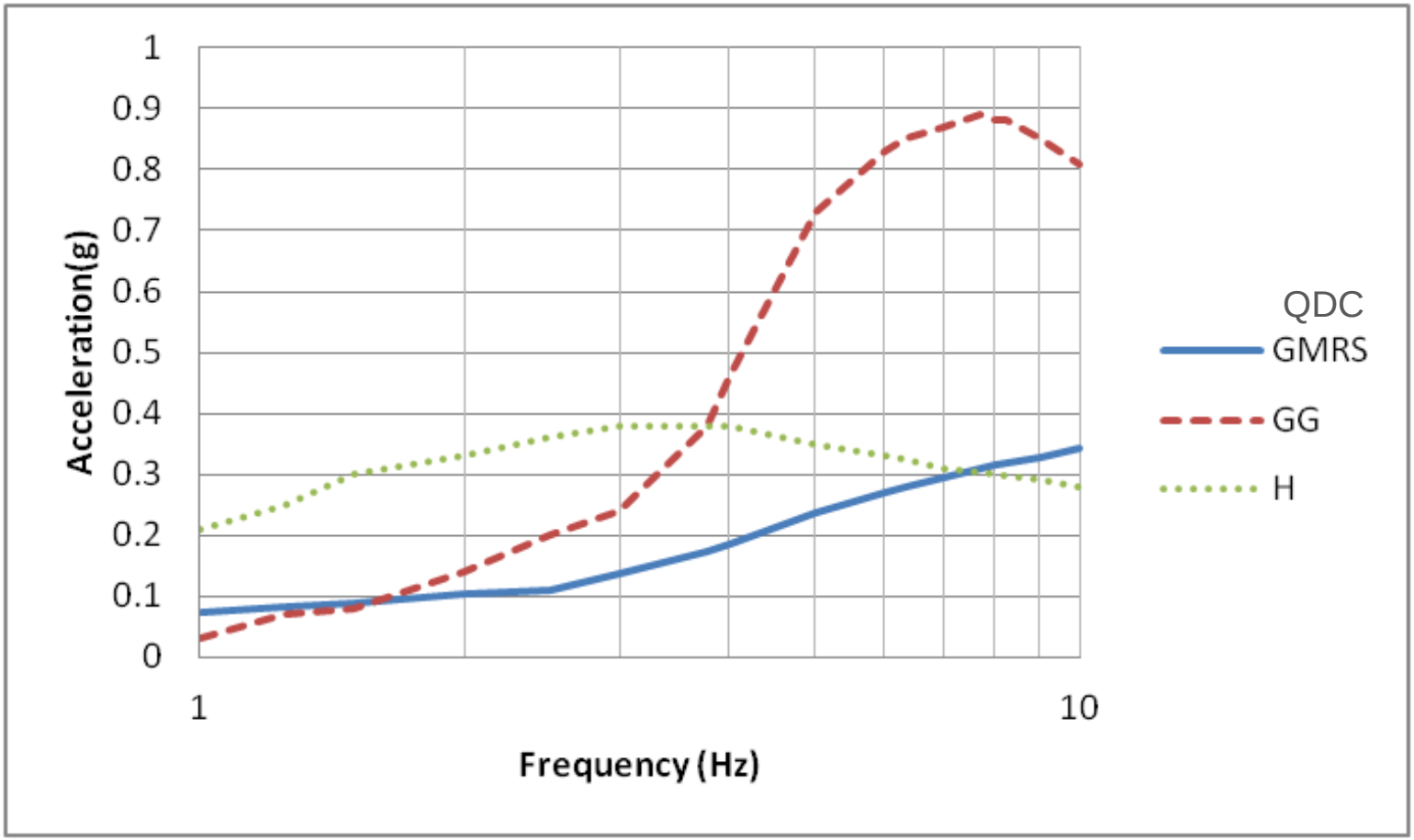
- Response Spectra Analyses performed to smoothed curve (UFSAR Fig. 3.7-1)
- Time-History Analyses performed to actual Golden Gate Record (UFSAR Fig. 3.7-2)
- Therefore, while UFSAR Fig. 3.7-1 would be the "response spectra shape" per the SPID definition, both curves are comparable. UFSAR Fig. 3.7-2 is used in submittal as representative and conservative.



Quad Cities - Exelon Response

Exelon Item # 1 – Basis for SSE (cont'd):

Conclusions unchanged if UFSAR Fig. 3.7-1 is used as Golden Gate response spectra shape for comparison to new GMRS



Quad Cities - Exelon Response

NRC Item # 2:

- Differences in the low strain damping values (Kappa) used for the NRC vs. Exelon GMRS development resulting in NRC GMRS being greater than the submitted GMRS in the >10 Hz Range.

Exelon Basis for Kappa:

- Kappa estimates were determined using Section B-5.1.3.1 of the NRC endorsed SPID for a firm CEUS rock site.

Velocity Profile	Kappa (s)	Weights
P1	0.017	0.4
P2	0.028	0.3
P3	0.007	0.3
G/G_{max} and Hysteretic Damping Curves		
M1		0.5
M2		0.5

Quad Cities - Exelon Response

Exelon Conclusion / Resolution:

- Exelon has re-confirmed that the appropriate licensing basis SSE is defined by the bounding spectral accelerations of the Golden Gate Park and Housner curves.
- Original licensing combination bounds NRC GMRS from 1-10 Hz; therefore, QDC should screen-out from performing a risk assessment.
- Exelon provided kappa values developed by EPRI using the NRC endorsed SPID, although the differences between NRC and EPRI do not impact the GMRS between 1-10 Hz.
- Quad Cities will continue FLEX design and modification activities using the Exelon submitted GMRS in accordance with NRC Order EA-12-049.
- No ESEP will be performed for Quad Cities.
- Exelon concludes that the GMRS and SSE curves submitted in the Quad Cities Seismic Hazard and Screening Report (RS-14-072) are acceptable and the Quad Cities site screens out from further risk assessment.

Exelon Response to NRC Questions for Calvert Cliffs

Presented to US Nuclear Regulatory Commission

Jeff Clark – Exelon Fukushima Seismic Lead
Rob Cavedo – Calvert PRA Engineer
June 17, 2014

Exelon Generation®

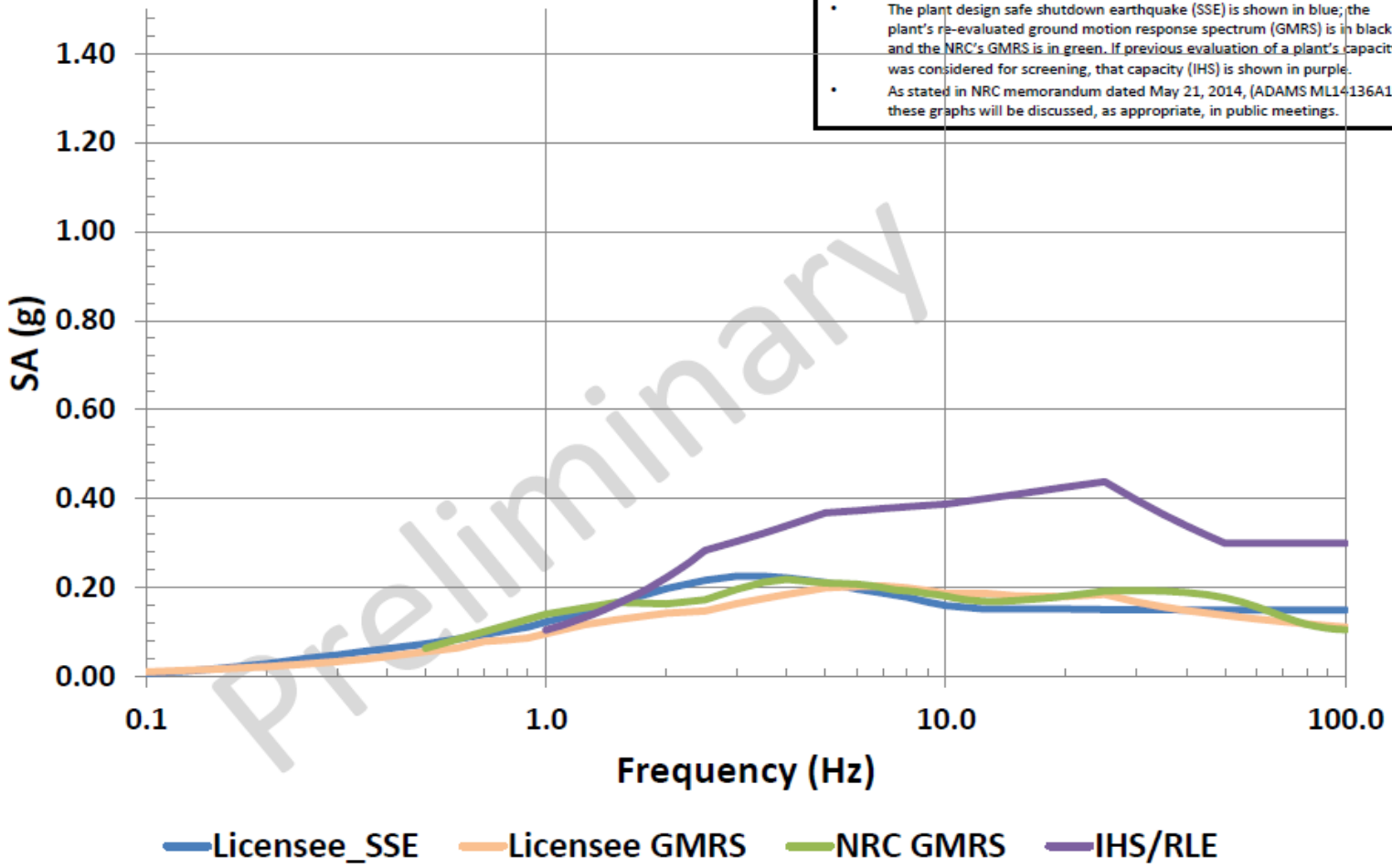
Calvert Cliffs - Exelon Response

The NRC identified four areas where the NRC preliminary evaluation differed from the Calvert Cliffs submitted report.

- **Item # 1:** IPEEE HCLPF Spectrum (IHS) curve is not anchored at the plant High Confidence of Low Probability of Failure (HCLPF) value. Submitted curve is anchored at 0.3g and NRC believes it should be anchored at 0.15g
- **Item # 2:** SPRA exhibited an "over use" of the surrogate elements in PRA model.
- **Item # 3:** Top level event "LA" used in SPRA model is problematic as it leads directly to core damage.
- **Item # 4:** Top Level event "LA" did not include loss of air compressors.

Calvert Cliffs - Exelon Response

- As discussed in the May 9, 2014, letter (ADAMS ML14111A147), the NRC considered the re-evaluated hazard and previous estimates of plant capacity to conclude that this plant is safe to continue operating while additional evaluations are conducted.
- NRC staff used this preliminary graph, focusing on the 1-10 Hertz range, and other information to determine whether this plant requires a risk evaluation over the next few years.
- The plant design safe shutdown earthquake (SSE) is shown in blue; the plant's re-evaluated ground motion response spectrum (GMRS) is in black and the NRC's GMRS is in green. If previous evaluation of a plant's capacity was considered for screening, that capacity (IHS) is shown in purple.
- As stated in NRC memorandum dated May 21, 2014, (ADAMS ML14136A126) these graphs will be discussed, as appropriate, in public meetings.



Exelon Generation

Calvert Cliffs - Exelon Response

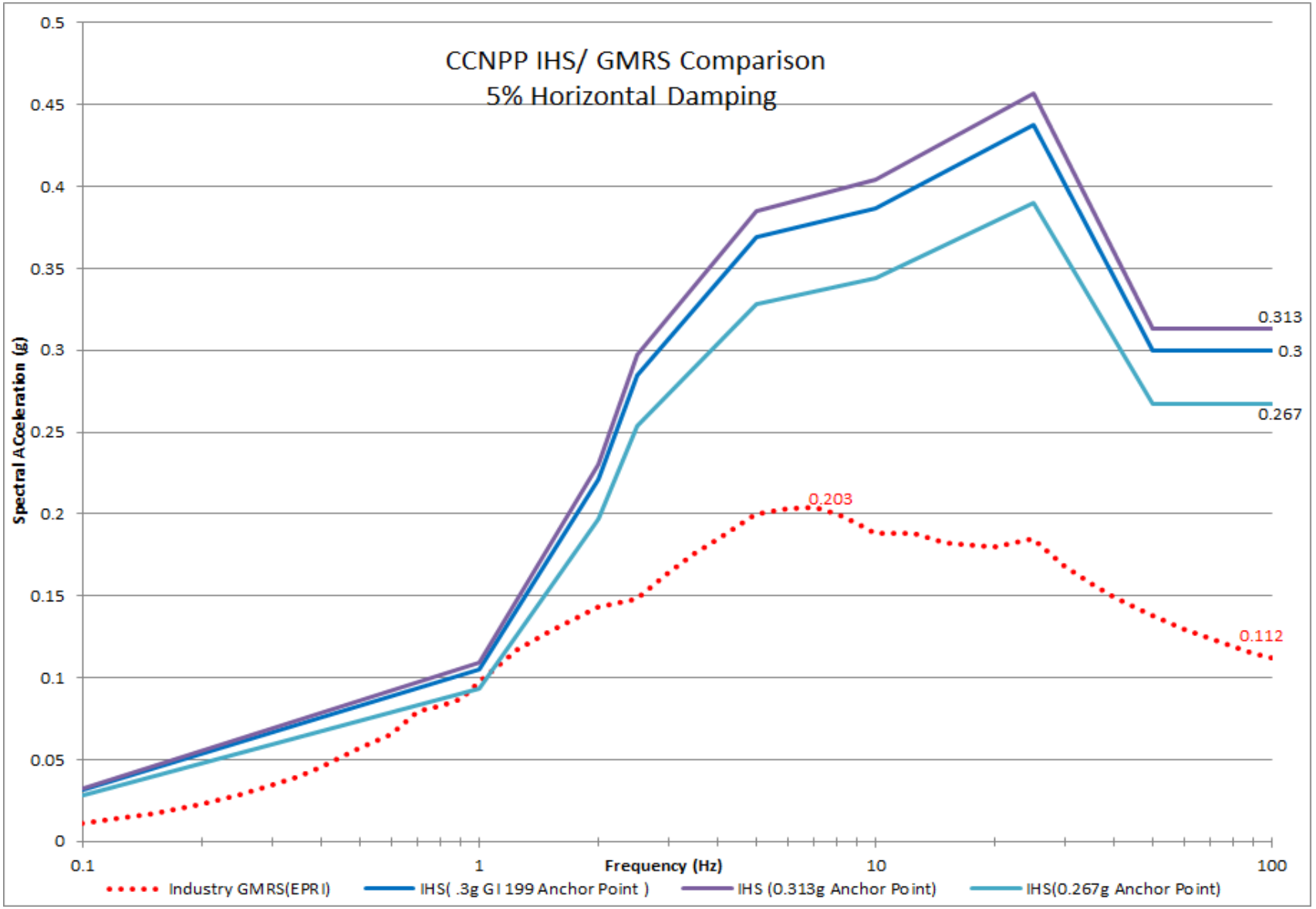
NRC Item # 1:

- IHS curve is not anchored at the plant HCLPF value. Submitted curve is anchored at 0.3g and NRC believes it should be anchored at 0.15g.

Exelon Basis for IHS curve:

- Submitted curve was anchored at 0.3g based on discussion in IPEEE and supporting vendor calculation which used this plant level HCLPF value as basis for the screening value of 0.3g. This value is also cited in GI-199.
- An upgrade to the seismic capacity of the 0C diesel to support an allowed outage time (AOT) change in 2003, resulted in a new CDF value of 9.86E-6/yr for Unit 1 and 1.21E-5/yr for Unit 2 which results in a plant level HCLPF value of 0.293g for Unit 1 and 0.267g for Unit 2. (Ref. ML031360410)
- It will be shown in the following slides a plant HCLPF value $\geq$ 0.313g can be justified with the removal of additional conservatisms in the IPEEE.
- Anchoring the IHS curve at 0.293g or 0.313g value shows on the following slide that the IHS curve bounds the GMRS curve in the 1 to 10 Hz range. Anchoring the IHS curve 0.267g demonstrates a minor delta (.0036g) between IHS and GMRS curve at 1 Hz. Other than this minor delta the IHS curve bounds the GMRS.

GMRS compared to IHS anchored at 0.267g



Exelon Generation

Calvert Cliffs - Exelon Response

NRC Item # 2:

- SPRA exhibited an “over use” of the surrogate elements in PRA model.

Exelon Basis for Surrogate use:

- There are only two surrogate top events (“LA” and “LK”) within the context of the question. All of the other top events represent individual component fragilities.
- Component fragilities were developed for all equipment that did not meet the High Confidence Low Probability of Failure (HCLPF) screening level of 0.3 g (i.e. all top events except “LA” and “LK”).
- As part of an incorporated uncertainty evaluation, all HCLPF screened systems that could directly result in core damage were assigned a surrogate representation (i.e. Top Event “LA”).
- Many IPEEE SPRAs and all margin analysis did not assign any fragility to screened equipment (i.e. HCLPF $\geq$ 0.3g) as the expected contribution of the screened items is considered minimal. (i.e. HCLPF $\geq$ 0.3g)
- It is conservative to assign a surrogate to a system where all the equipment within a system screened (i.e. greater than 0.3g HCLPF). This is true, as it is likely that the system level fragility of a screened system is more rugged than the minimum screening level fragility.

Calvert Cliffs - Exelon Response

NRC Item # 3:

- Top level event “LA” used in SPRA model is problematic as it leads directly to core damage.

Exelon Basis for Top Level Event “LA”:

- Use of Top Event “LA” as an incorporated uncertainty evaluation is conservative (i.e. bounding). In addition to being bounding from a fragility perspective, the selection and modeling of the systems causing core damage is also conservative. For example, the failure of the 125 VDC system does not lead directly to core damage. Core damage can be prevented through the manual use of the AFW system for feeding the steam generators and atmospheric dump valves for pressure control.
- The equipment within the systems considered within Top Event “LA” all met the HCLPF screening criteria. As such, the system level fragility is likely better than 0.3g HCLPF fragility. It is for this reason that many other SPRAs screened all systems where every component within the system met the HCLPF screening criteria.
- In today’s context, Top Event LA would be considered an uncertainty evaluation. In the late 1990s, it was considered a good practice to consider the impact of normally screened information. It is certainly conservative as the assumed values are 0.3g versus the actuals $\geq$ 0.3g.

Calvert Cliffs - Exelon Response

NRC Issue # 4:

- Top Level event “LA” did not include loss of air compressors.

Exelon Basis for “LA” exclusion of Air Compressors:

- Top Events “LA” and “LK” did directly fail all of the non-safety related air compressors.
- The safety related air compressors which screened at 0.3 HCLPF were modeled in the IPEEE model for random failure.
- The safety related (SR) air compressors were not included in Top Event “LA” as the loss of SR air compressors would not directly result in core damage. The plant can be safely shutdown without SR air.
- The early loss of non-safety related air is actually risk beneficial as turbine building (TB) service water (SRW) isolation valves would fail closed. This air loss would protect the SRW cooled diesel generators from overheating due to seismically induced loss of TB SRW . This beneficial failure is not credited in the IPEEE which is a substantial conservatism. The seismically induced loss of TB SRW is over a 12% risk contributor.

Calvert Cliffs - Exelon Response

Exelon Conclusion / Recommendation:

NRC Item # 1:

- The plant level HCLPF as recorded in GI-199 and submitted in 2.1 Seismic Hazard Submittal for CAL has been shown to be conservative. With the conservatism of top event “LA” removed and the 0C Diesel upgraded the resultant Unit 2 plant level HCLPF equals 0.313g.
- The conservative plant level HCLPF (0.267g) IHS anchor point demonstrates the IHS bounds the GMRS with an insignificant delta at 1Hz (.0036g). Unit 1 plant level HCLPF (0.293g) anchor point would bound the GMRS between 1 and 10 Hz.
- The NRC endorsed SPID guidance has been followed and IPEEE adequacy screening is acceptable. (pending relay chatter evaluations)

NRC Item # 2:

- The IPEEE only contains two surrogate top events which does not constitute overuse. One of these “LA” is conservative to include and results in a higher CDF than would be required by today's standards.
- All other core damage top events are based on actual component fragilities with exception of top event “LJ” Loss of Offsite Power. “LJ” assumes an early failure of the switchyard ceramic insulators which is conservative.

Calvert Cliffs - Exelon Response

NRC Item # 3:

- Top event “LA” is a conservative element of the IPEEE and results in higher CDF than is required.
- Top event “LA” contains systems and components that are rugged (>0.3g) could have been screened out, and were not required to be included in the IPEEE.

NRC Item # 4:

- The loss of air systems is adequately addressed in the IPEEE and the subsequent NRC accepted RAI response.
- The loss of air systems is not a significant contributor to CDF. Further, short term air system losses are risk beneficial. Therefore, the loss of air is not included in top event “LA”.

Calvert Cliffs - Exelon Response

Exelon Conclusion / Resolution:

- Exelon has demonstrated that resolution of the items presented is adequate to allow for the use of the IPEEE Adequacy screening as outlined in the NRC endorsed SPID guidance in Section 3.3.1.
- Exelon has complied with the Seismic 2.1, 50.54(f) request for information in accordance with the NRC endorsed SPID.
- Calvert Cliffs will continue FLEX design and modification activities using the Exelon submitted GMRS in accordance with NRC Order EA-12-049.
- Calvert Cliffs is proceeding with ESEP and will complete screening and evaluation activities using the Exelon submitted GMRS and provide a report to the NRC by December 31, 2014.
- Exelon concludes that the IPEEE curve submitted for the Calvert Cliffs Seismic Hazard and Screening Report (FLL-14-013) is acceptable and the Calvert Cliffs site screens out from further risk assessment.

ESEP Exelon Response

ESEP Impacts for Exelon:

- All Exelon plants will continue FLEX design and modification activities using the Exelon submitted GMRS in accordance with NRC Order EA-12-049.
- All Exelon plants which were screened-out using the IHS curve or screened-in requiring a risk assessment per the Exelon submittals dated March 31, 2014, are proceeding with ESEP and will complete screening and evaluation activities using the Exelon submitted GMRS and provide a report to the NRC by December 31, 2014.

Exelon Response

Exelon OVERALL FLEET Conclusion / Resolution:

- Exelon has demonstrated for all plants discussed today:
  - NRC endorsed SPID has been fully complied with in the development of the plant GMRS curves and all related screening tasks.
  - All NRC indentified items have been justified with good technical bases using the NRC endorsed guidance.
  - The Exelon Seismic Hazard and Screening reports submitted to the NRC for the fleet on March 31, 2014 are acceptable including the screening results and commitment actions identified therein.