BELL BEND NUCLEAR POWER PLANT

PUBLIC MEETING:

Pre-Submittal Overview of Revised FSAR Section 2.5, Reflecting

-Plant Relocation on Site

-Probabilistic Seismic Hazard Analysis (PSHA) updated with the 2012 Central and Eastern United States (CEUS) Seismic Source Characterization

USNRC OFFICES, ROCKVILLE, MD

November 28, 2012

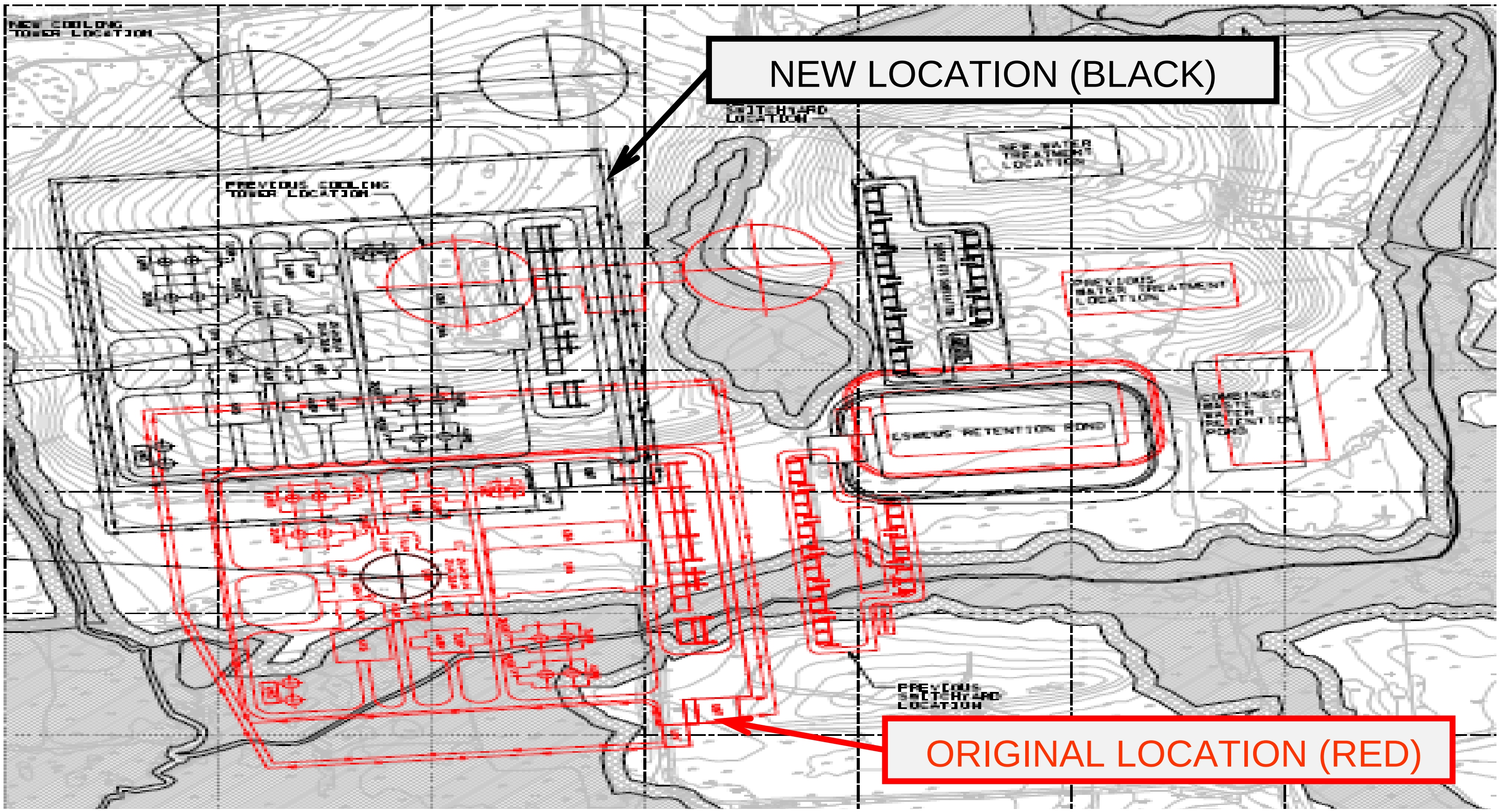
AGENDA

- Introductions, Purpose/Background
- Plot Plan Change (PPC)/Site Geotechnical Investigation Overview
- FSAR 2.5.1, Basic Geology and Seismic Information
  - Work to define site region, vicinity, and area as a result of the PPC
- FSAR 2.5.2, Vibratory Ground Motion
  - Implementation of the 2012 Central And Eastern United States (CEUS) Seismic Source Characterization (SSC) (Fukushima RAI 118 Question 2.5.2-1)
- FSAR 2.5.3, Surface Faulting
  - Additional field reconnaissance as a result of PPC
- FSAR 2.5.4, Stability of Subsurface Materials and Foundations
  - Foundation conditions, bearing capacity, settlement, lateral uniformity
- FSAR 2.5.5, Stability Of Slopes
  - Changes due to PPC
- Summary and Conclusions, Q&A

PURPOSE AND BACKGROUND

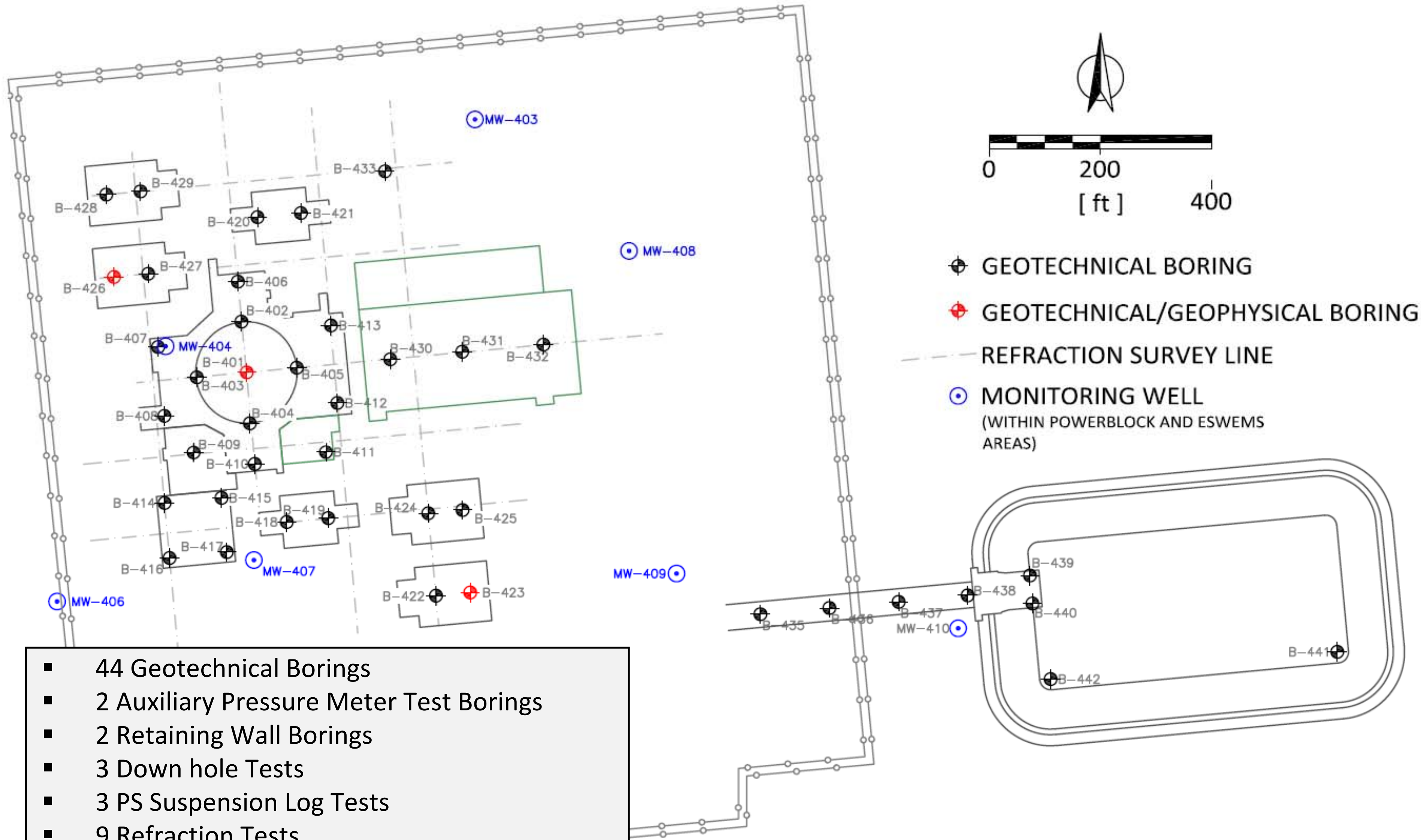
- Purpose
  - Provide NRC with the pre-submittal overview of the revised FSAR Section 2.5
    - Bell Bend plant re-location on site
    - PSHA updated with the 2012 CEUS SSC
      - Fukushima RAI 118 Q 2.5.2-1 Response
    - Schedule for submittal
- Background
  - July 11, 2012 NRC Public Meeting on Bell Bend seismic path forward
  - Respond to the Post Fukushima 2.1 NTTF Recommendations

PLOT PLAN CHANGE (PPC) OVERVIEW



NEW GEOTECHNICAL INVESTIGATION

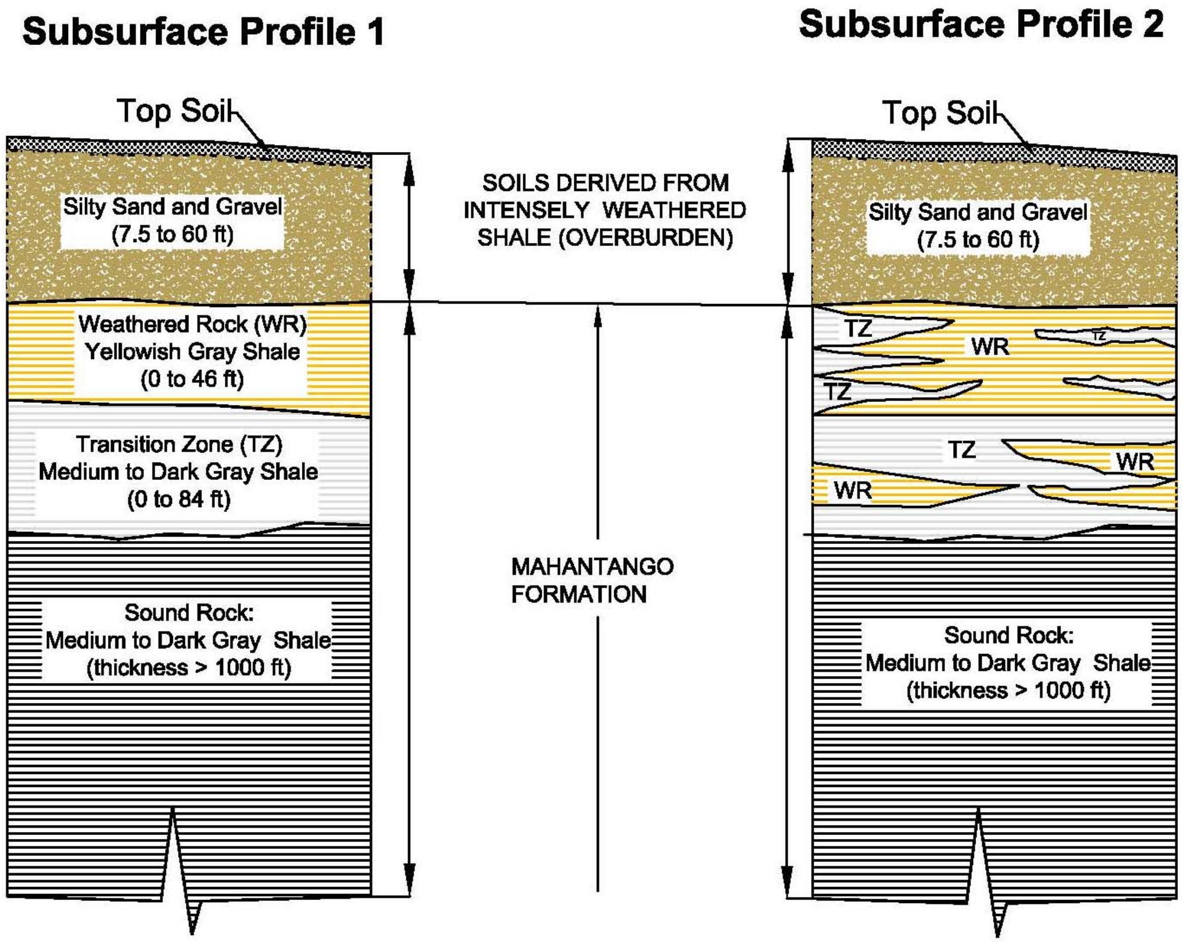
BORING LOCATION PLAN



- 44 Geotechnical Borings
- 2 Auxiliary Pressure Meter Test Borings
- 2 Retaining Wall Borings
- 3 Down hole Tests
- 3 PS Suspension Log Tests
- 9 Refraction Tests
- 10 Groundwater Wells

TYPICAL SUBSURFACE PROFILE

POWERBLOCK AREA

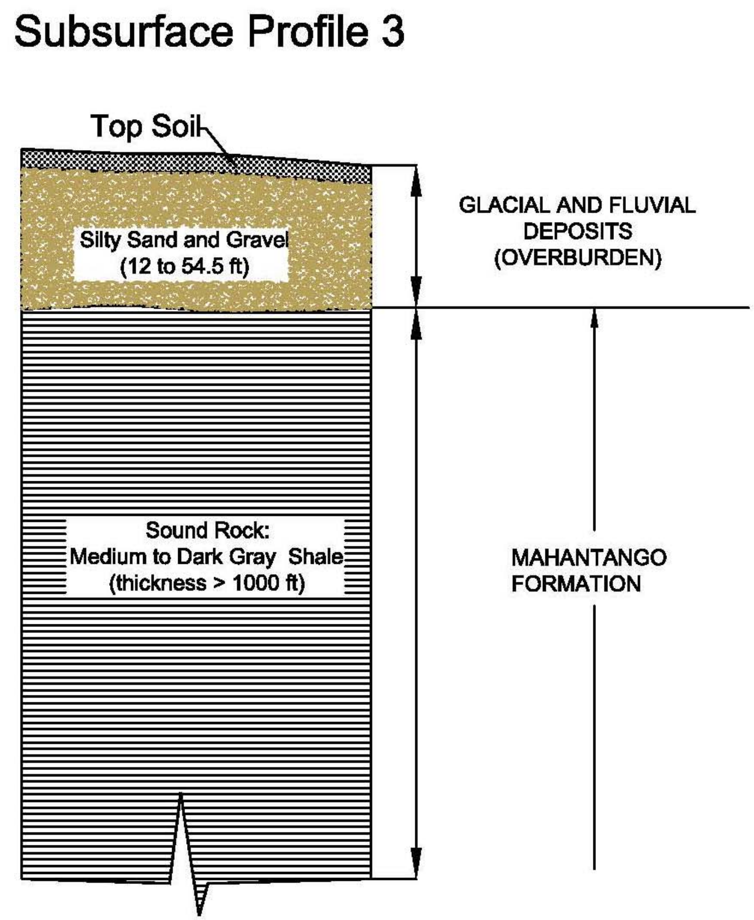


Note: Values shown on Figures represent minimum to maximum thickness

PPL NUCLEAR DEVELOPMENT

TYPICAL SUBSURFACE PROFILE

ESSENTIAL SERVICE WATER EMERGENCY MAKEUP SYSTEM (ESWEMS) AREA



Note: Values shown on Figure represent minimum to maximum thickness

PPL NUCLEAR DEVELOPMENT

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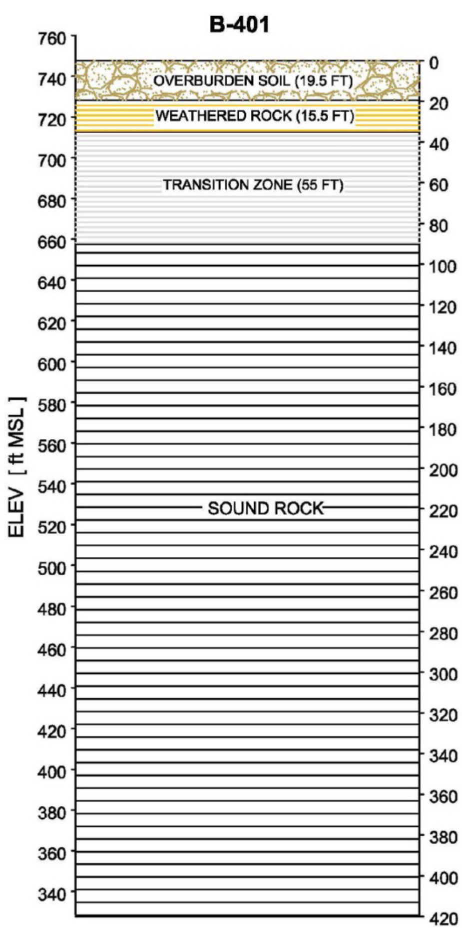
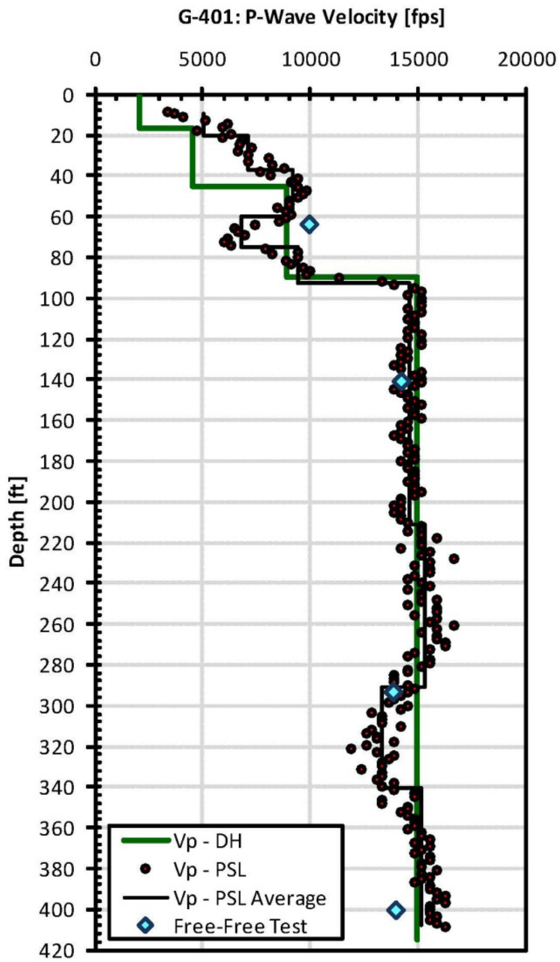
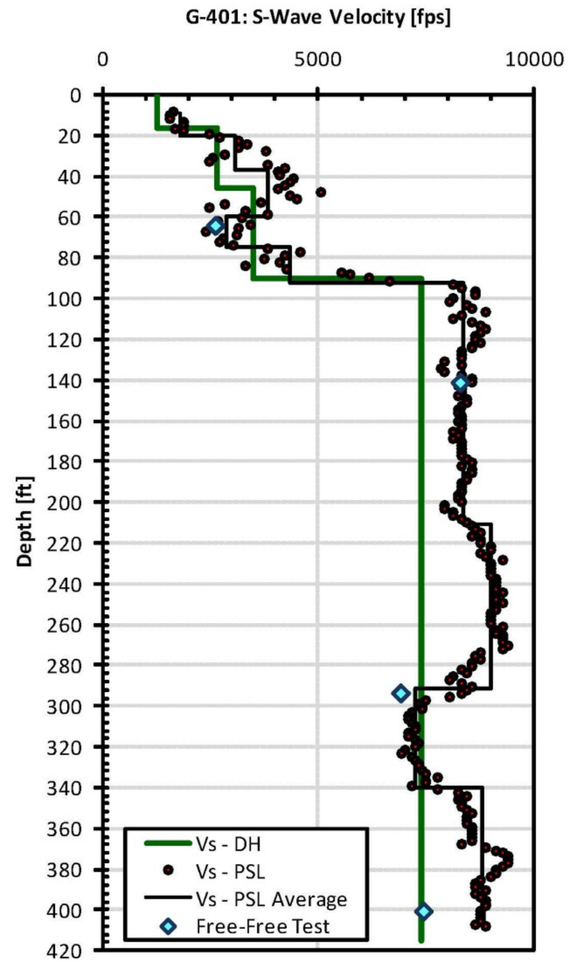
GEOPHYSICAL TESTS

DOWNHOLE AND PS SUSPENSION AT CENTER OF CONTAINMENT



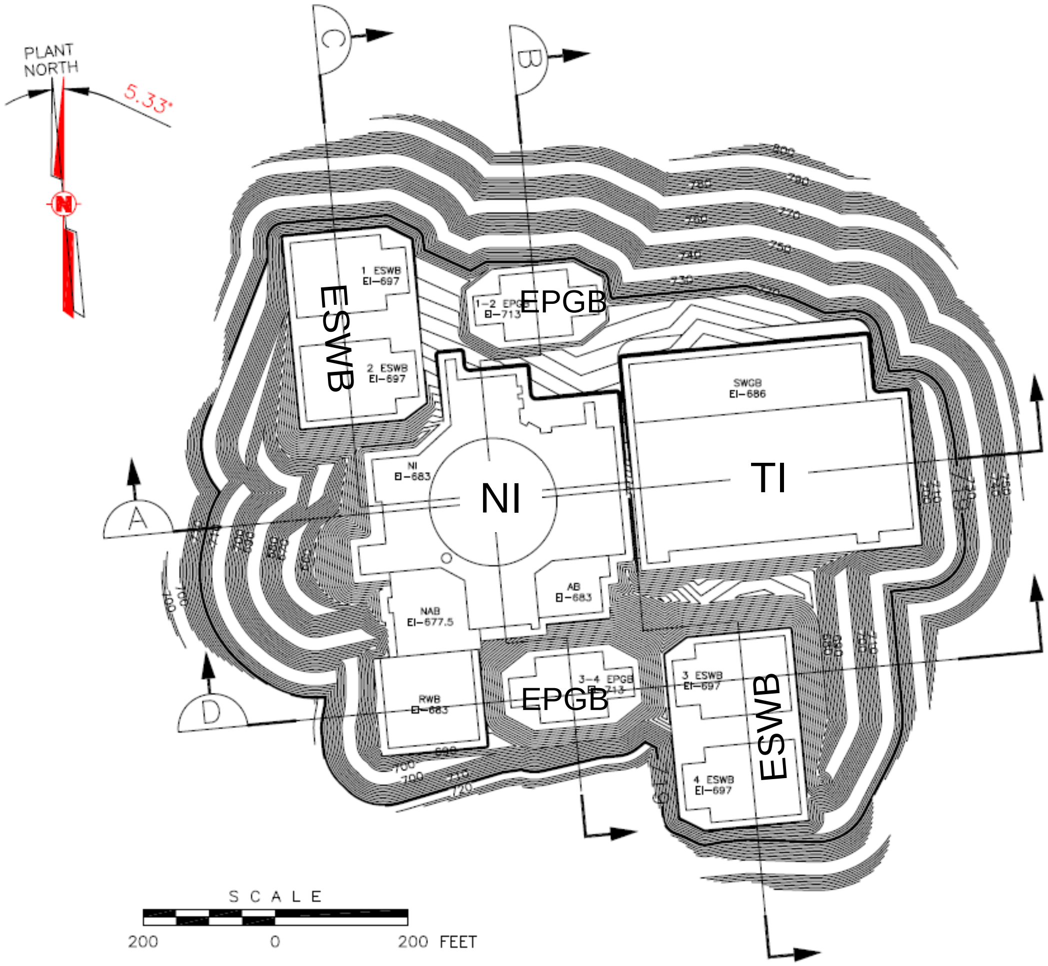




PPL NUCLEAR DEVELOPMENT

FOUNDATION CONDITIONS

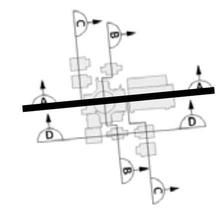
EXCAVATION PLAN

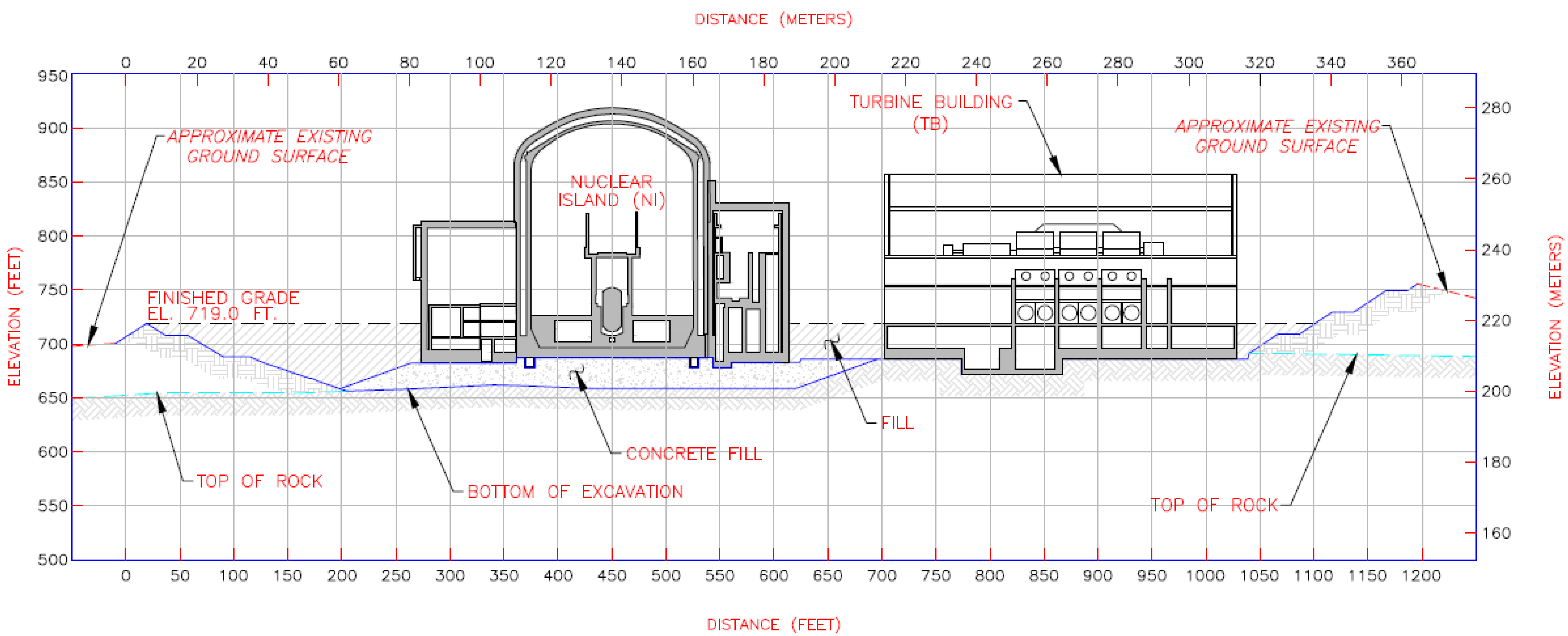


- Basemats supported by either
  - Concrete fill
  - Competent rock (Vs ≥ 6500 fps)
- Competent and uniform load bearing foundation interface

FOUNDATION INTERFACES

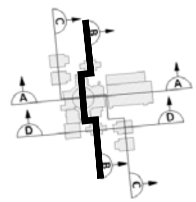
PROFILE A, EAST-WEST THROUGH NI AND TI

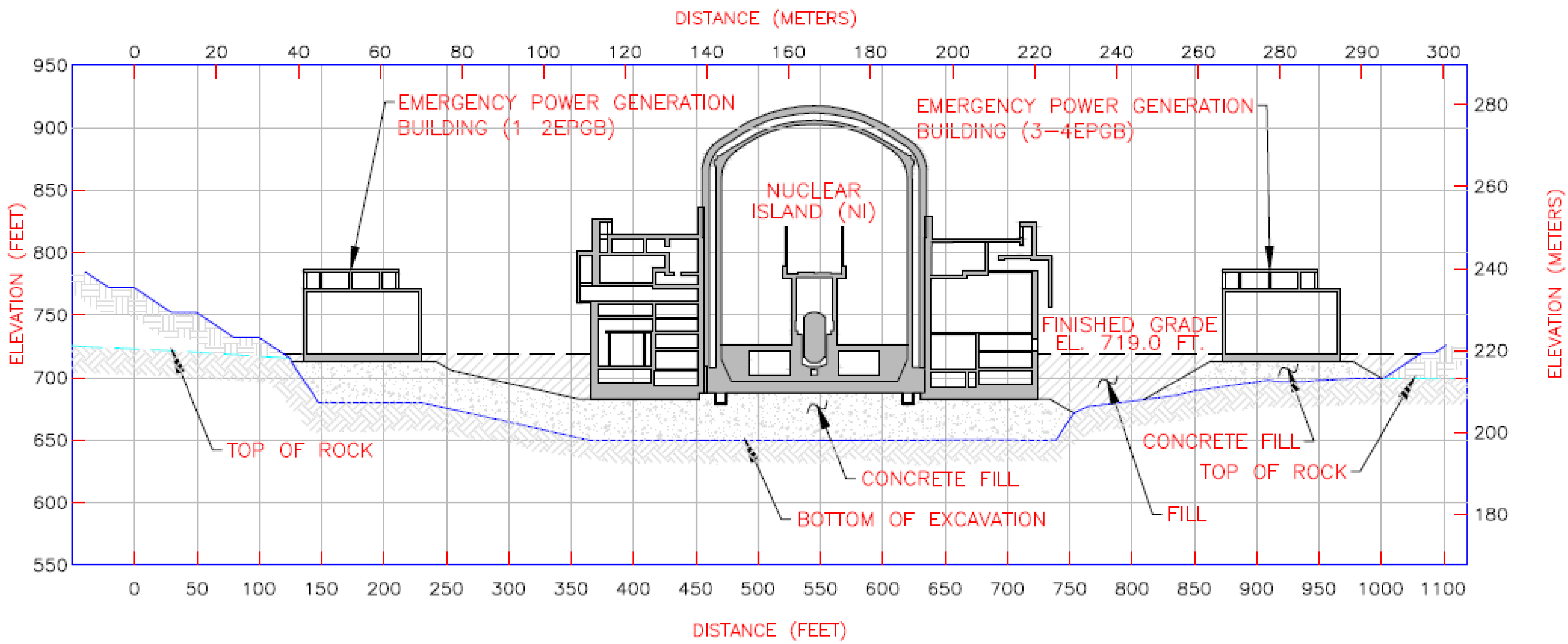




FOUNDATION INTERFACES

PROFILE B, NORTH-SOUTH, EPGB-NI-EPGB

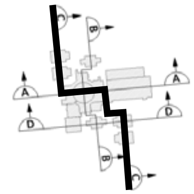


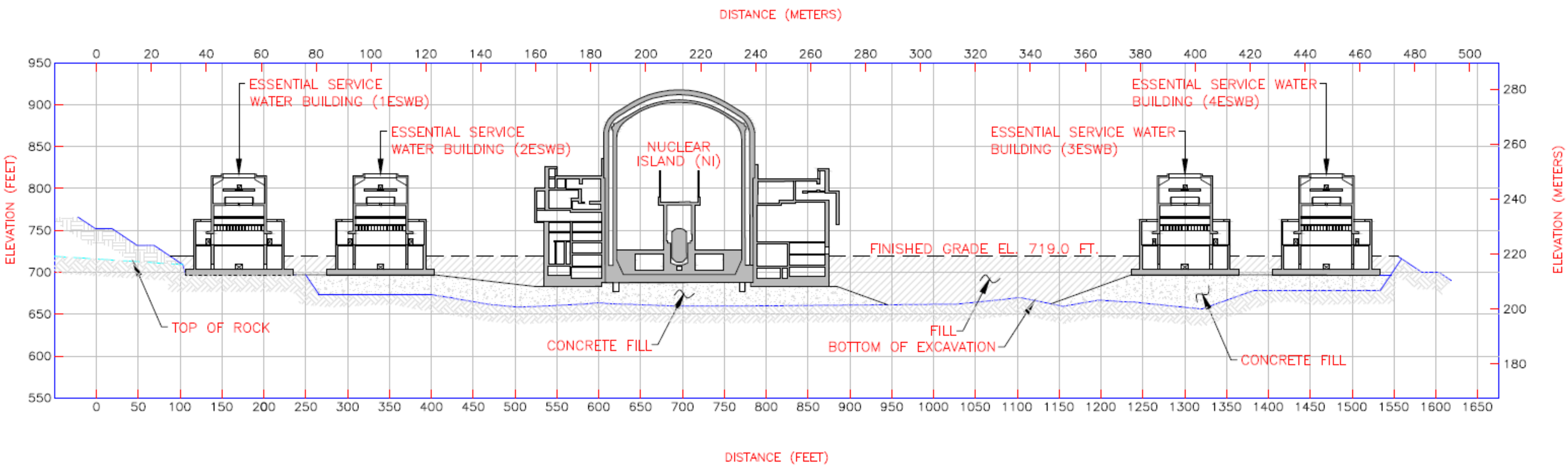


PPL NUCLEAR DEVELOPMENT

FOUNDATION INTERFACES

PROFILE C, NORTH-SOUTH, ESWB-NI-ESWB

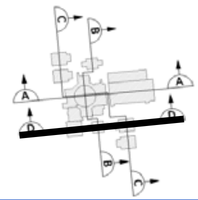


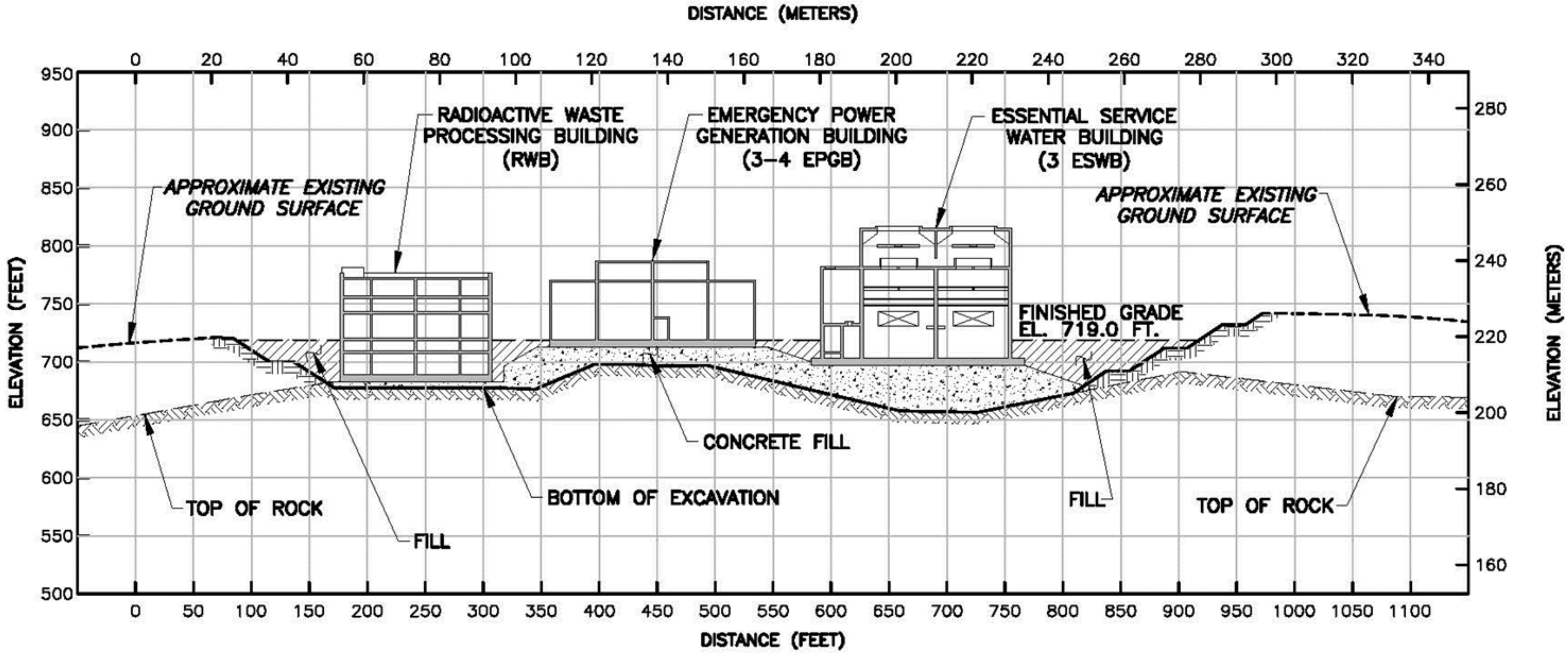


PPL NUCLEAR DEVELOPMENT

FOUNDATION INTERFACES

PROFILE D, EAST-WEST ON SOUTH SIDE, RWPB-EPGB-ESWB

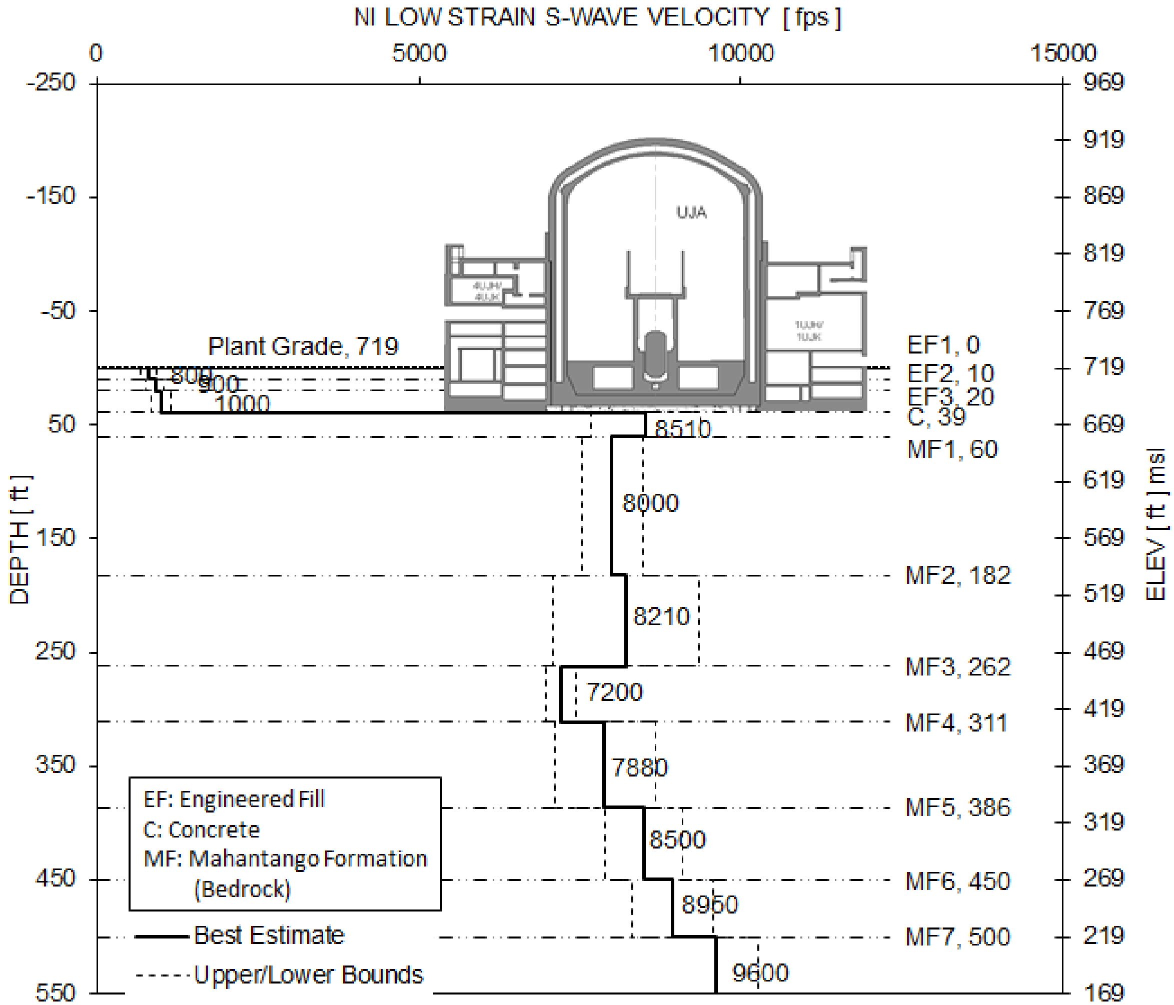




PPL NUCLEAR DEVELOPMENT

NEW GEOPHYSICAL INVESTIGATION

SHEAR WAVE VELOCITY, NI



PPL NUCLEAR DEVELOPMENT

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NEW GEOPHYSICAL INVESTIGATION

CONCLUSIONS/SUMMARY

- Full site stand alone investigation due to plot plan change
- Shear wave velocity is high, consistent with measurements from previous investigation
- Hard rock conditions throughout the full extension of the site area
  - Including ESWEMS pump house and retention pond

FSAR SECTION 2.5.1

BASIC GEOLOGIC AND SEISMIC INFORMATION

- Site area
  - Updated reconnaissance effort - results consistent with previous investigation
- Site vicinity and site region
  - Assessed and determined that no update is required (based on new site investigation)
- Section updated to remove EPRI-SOG references
- Added EPRI/DOE/NRC CEUS 2012 SSC
- Conclusion: site remains suitable from a geologic perspective

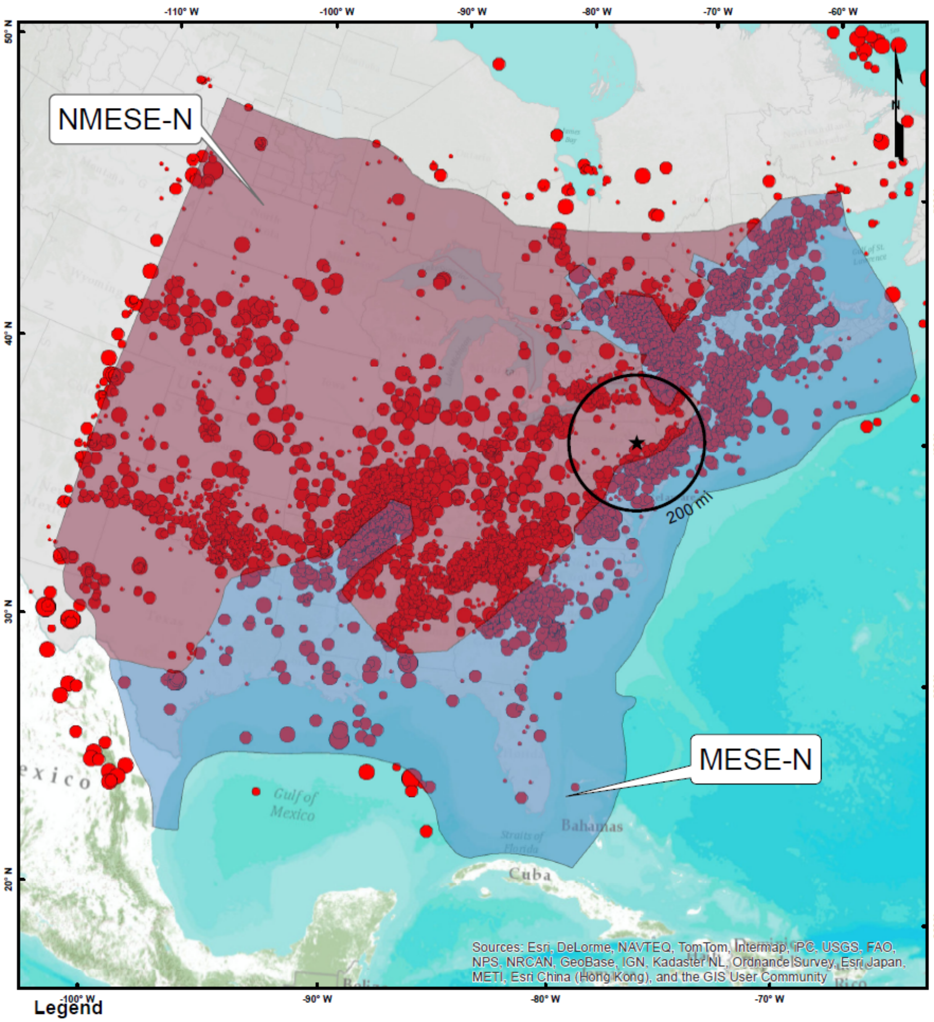
FSAR SECTION 2.5.2

VIBRATORY GROUND MOTION

- PSHA for the BBNPP site
  - 2010 PSHA for new plant location based on updated EPRI-SOG SSC
  - 2012 PSHA for new plant location based on 2012 CEUS SSC (NUREG-2115)
  - Mmax and Seismotectonic sources that encroach into the 200 Mi (320 Km) vicinity
  - RLME sources
  - Ground motion attenuation - EPRI (2004, 2006)
- Updated site response analysis

MMAX SOURCE ZONES

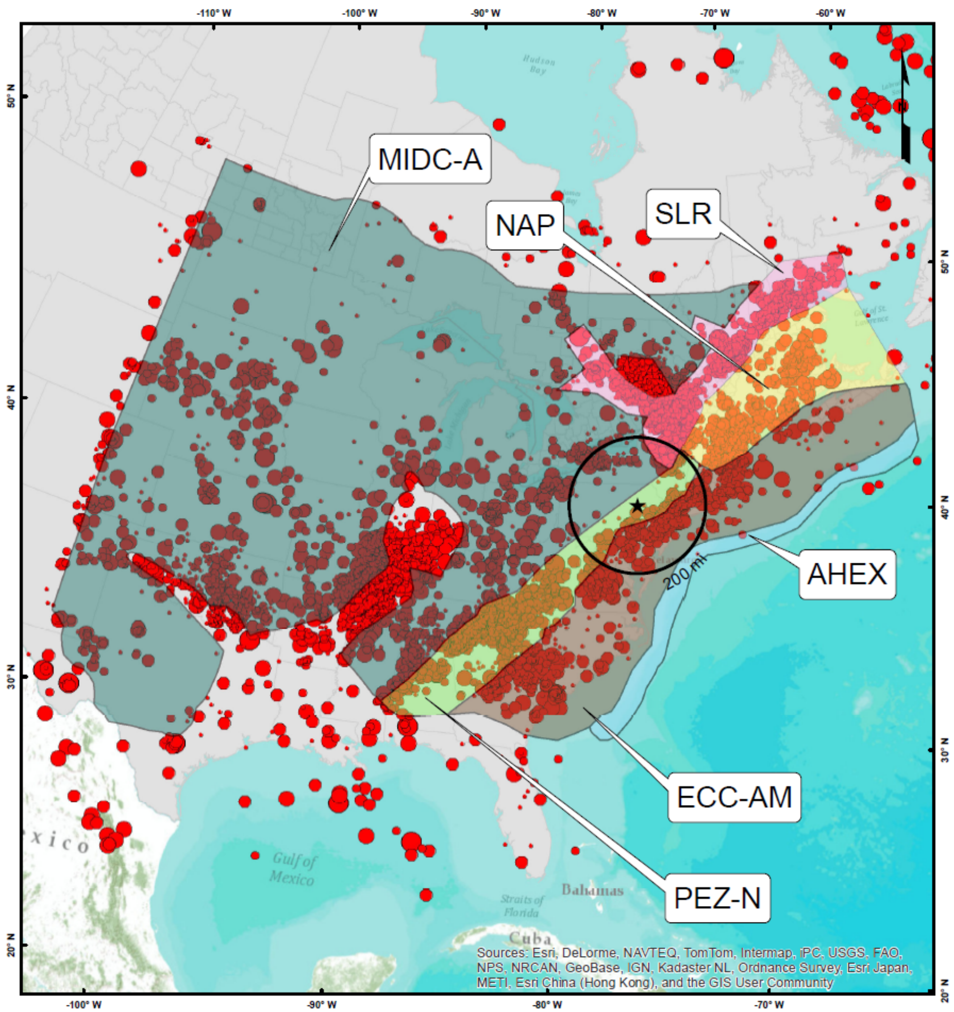
MESOZOIC AND YOUNGER EXTENDED REGION (MESE) AND NON-MESE (NMESE)



- Narrow interpretation of Mmax source zones MESE and NMESE, (MESE-N and NMESE-N, respectively)

SEISMOTECTONIC SOURCE ZONES

ROUGH CREEK GRABEN (RCG) IS NOT PART OF REELFOOT RIFT, NARROW PEZ

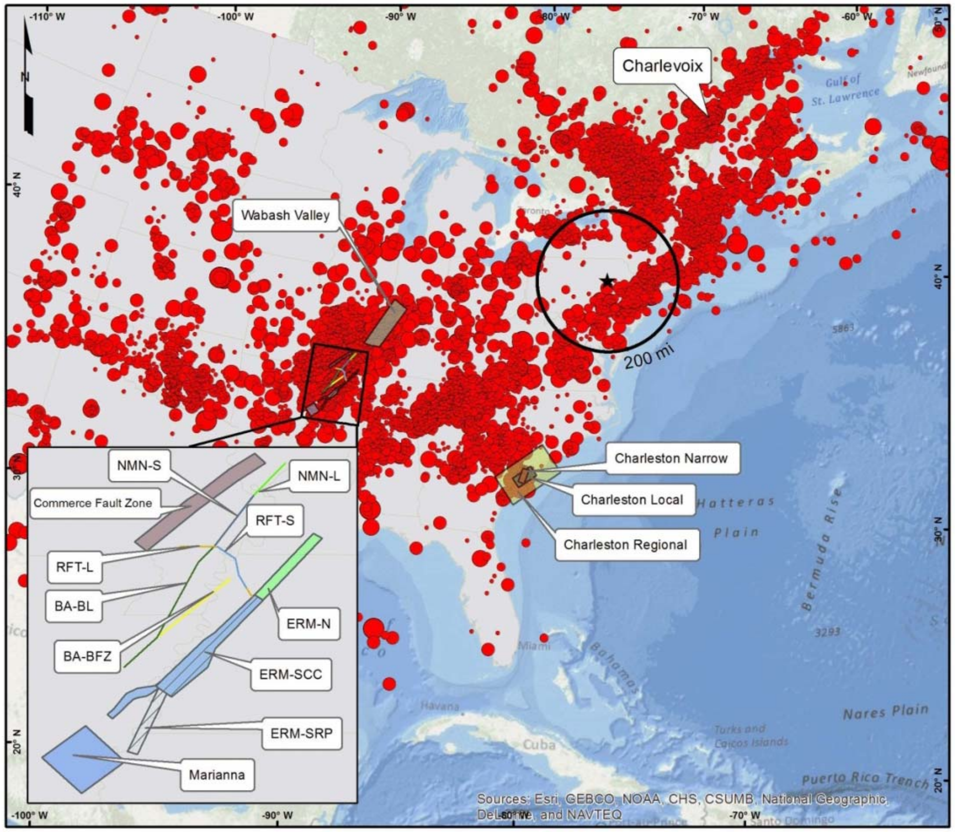


- MIDC-A: Midcontinent Craton A
- SLR: St. Lawrence Rift
- NAP: Northern Appalachians
- AHEX: Atlantic Highly Extended Crust
- ECC-AM: Extended Continental Crust Atlantic Margin
- PEZ-N Paleozoic Extended Crust (Narrow)

PPL NUCLEAR DEVELOPMENT

REPEATED LARGE MAGNITUDE EQs

RLME SOURCES USED FOR THE BBNPP PSHA



- Charlevoix
- Charleston
- Wabash Valley
- New Madrid Fault System (NMFS)
- Commerce Fault Zone (CFZ)
- Eastern Rift Margin (ERM-N, ERM-S)
- Marianna

SOURCE CONFIGURATION MODELS

SC: SOURCE CONFIGURATION USED FOR BELL BEND PSHA

SC	WEIGHT	DISTRIBUTED SEISMICITY	RLME SOURCES
M-I	0.160	Study Region	New Madrid Fault System (NMFS) Charlevoix Charleston Wabash Valley Commerce Fault Zone (CFZ) Eastern Rift Margin (ERM-N, ERM-S) Marianna
M-II	0.048	MESE-N, NMESE-N	
M-III	0.192	MESE-W, NMESE-W	
S-I	0.320	AHEX, ECC-AM, PEZ-N, NAP, SLR, MIDC-A	
S-II	0.160	AHEX, ECC-AM, PEZ-N, NAP, SLR, MIDC-B	
S-III	0.080	AHEX, ECC-AM, PEZ-W, NAP, SLR, MIDC-C	
S-IV	0.040	AHEX, ECC-AM, PEZ-N, NAP, SLR, MIDC-D	

PPL NUCLEAR DEVELOPMENT

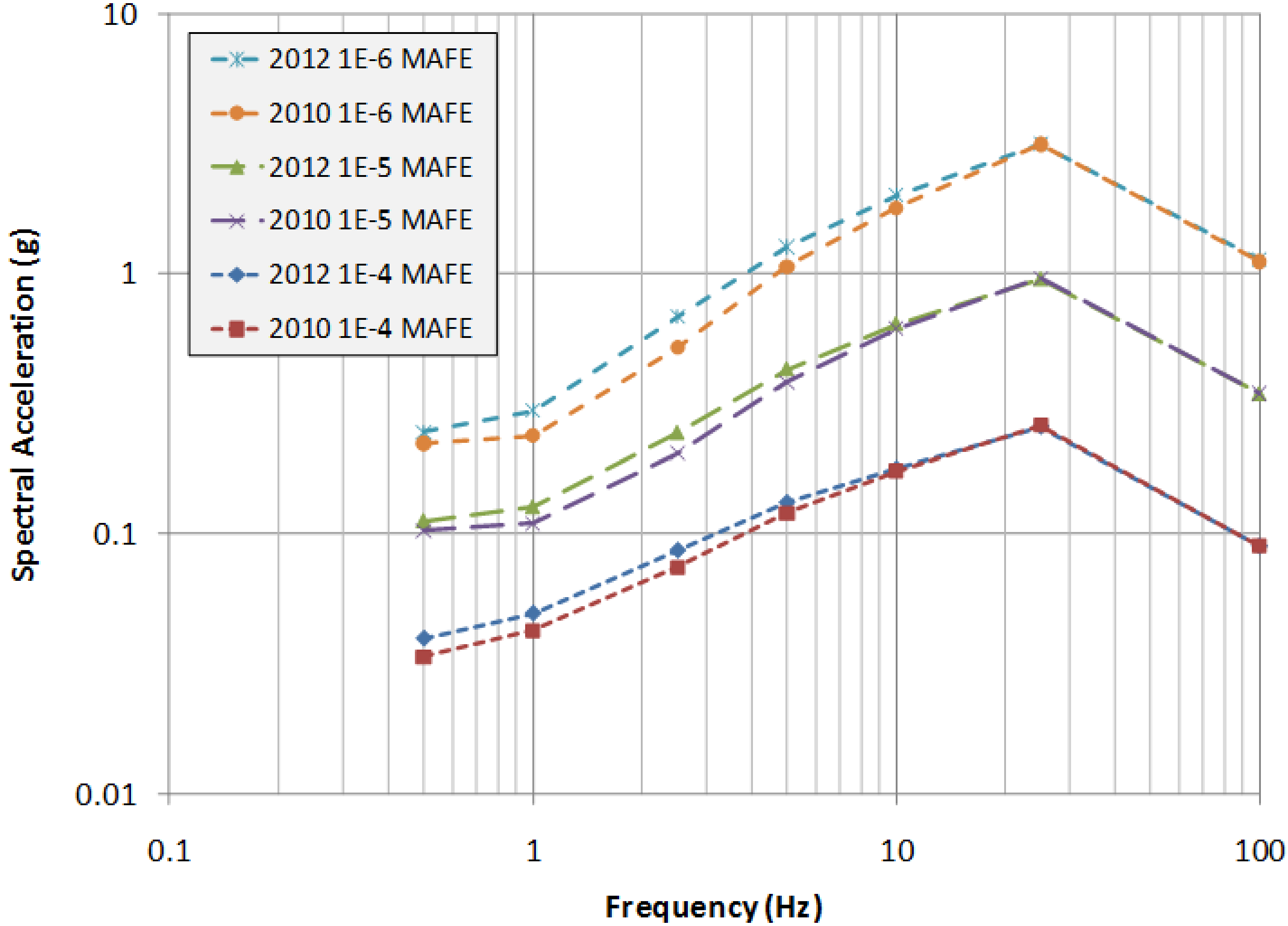
PSHA RESULTS

BELL BEND PSHA VIBRATORY GROUND MOTION

- At response frequencies of 10 Hz and above, hazard is similar to the previous PSHA performed with the use of an updated EPRI-SOG SSC
- At response frequencies less than 10 Hz, hazard is higher than the one estimated with the use of the EPRI-SOG SSC

PSHA RESULTS

UNIFORM HAZARD RESPONSE SPECTRA (UHRS) FOR HARD ROCK



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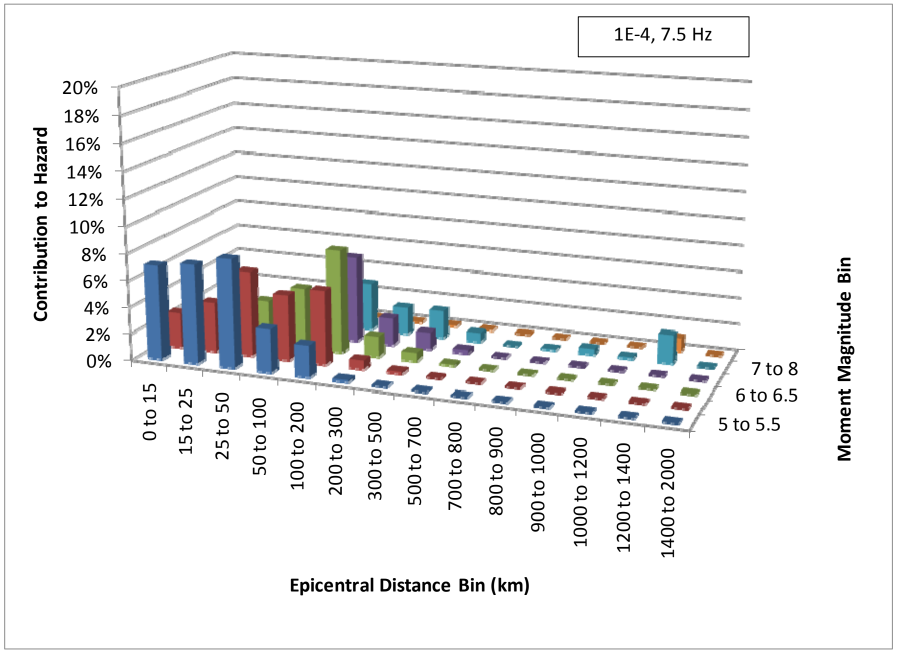
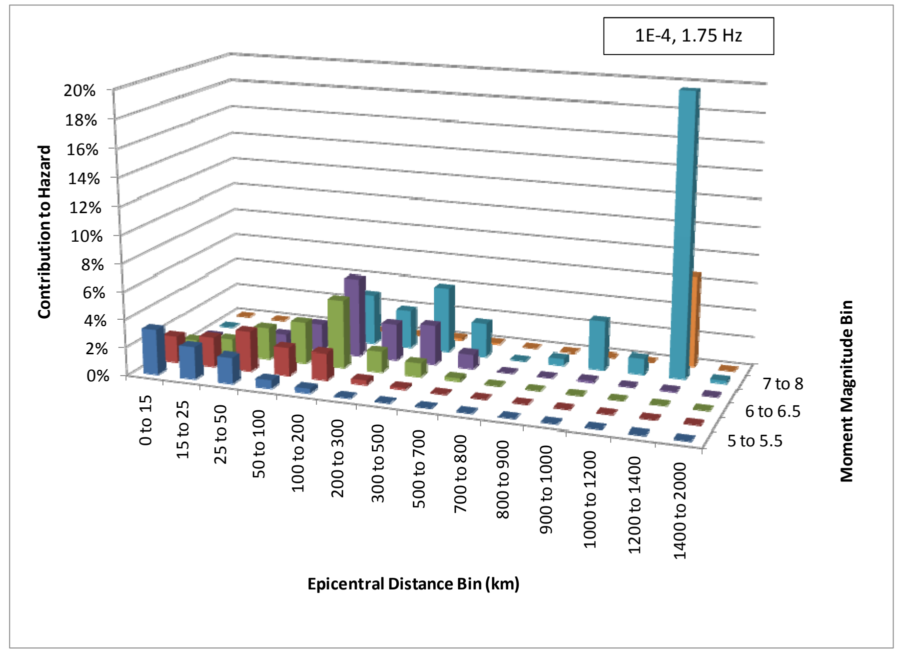
PSHA RESULTS

DEAGGREGATION 1E-4 MEAN ANNUAL FREQUENCY OF EXCEEDANCE

- High Frequency



- Low Frequency

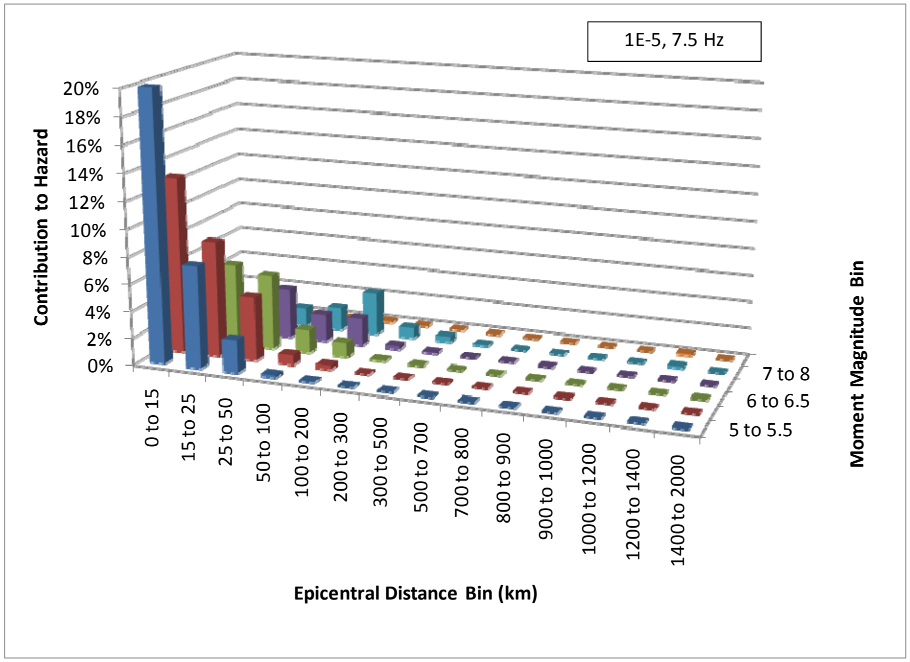


PPL NUCLEAR DEVELOPMENT

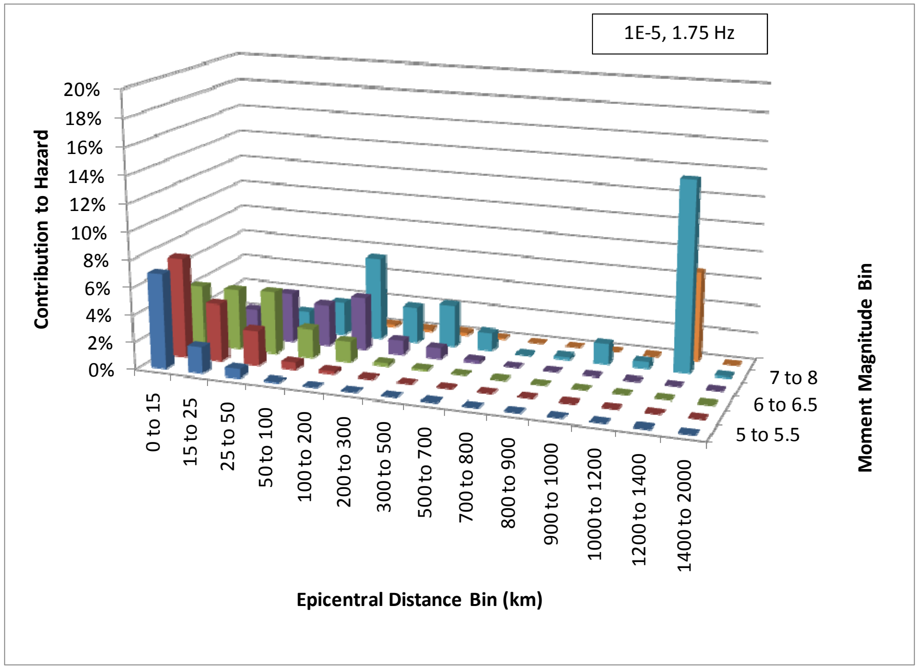
PSHA RESULTS

DEAGGREGATION 1E-5 MEAN ANNUAL FREQUENCY OF EXCEEDANCE

- High Frequency

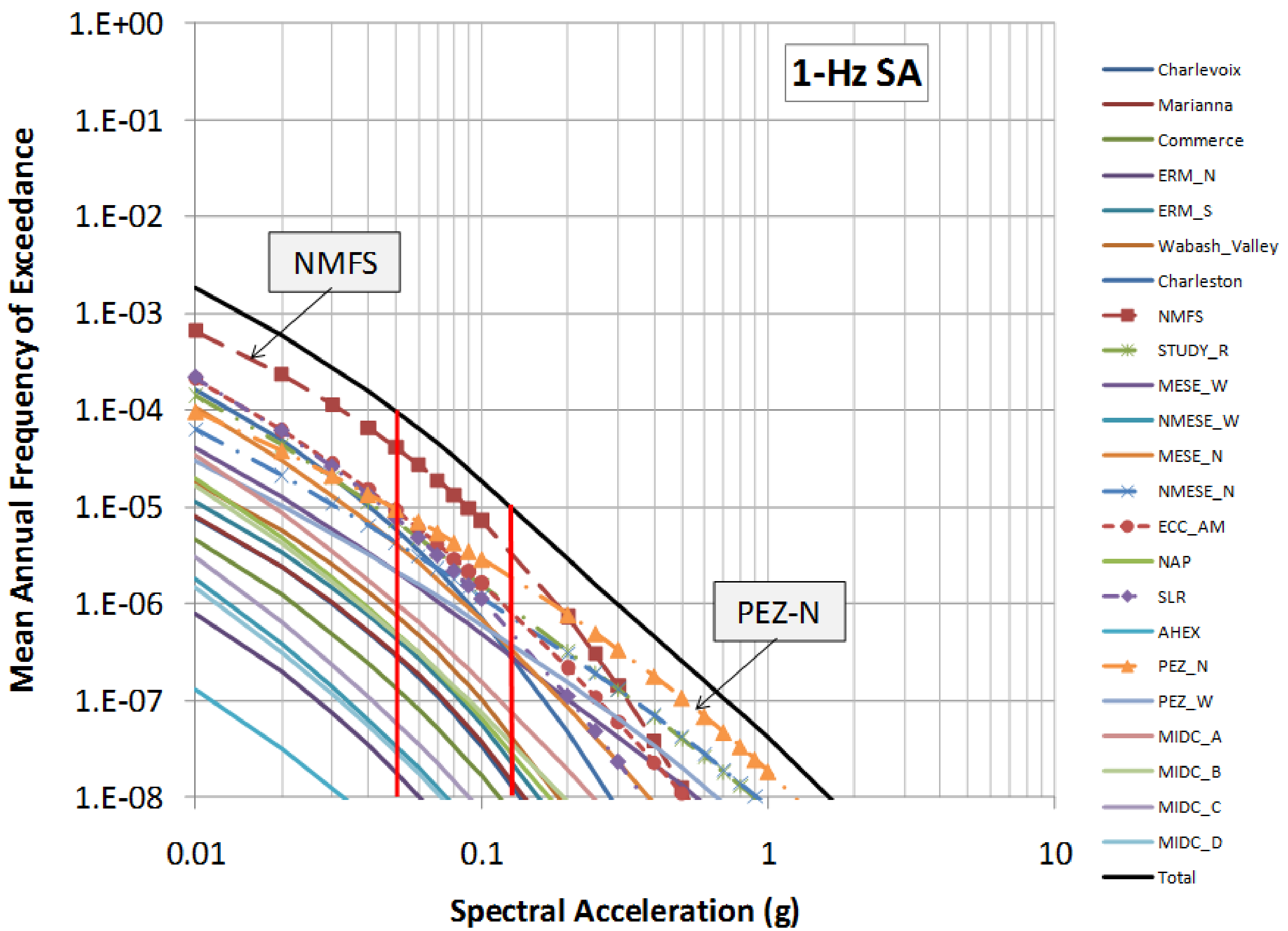


- Low Frequency



PSHA RESULTS

CONTRIBUTION PER SOURCE, 1 Hz



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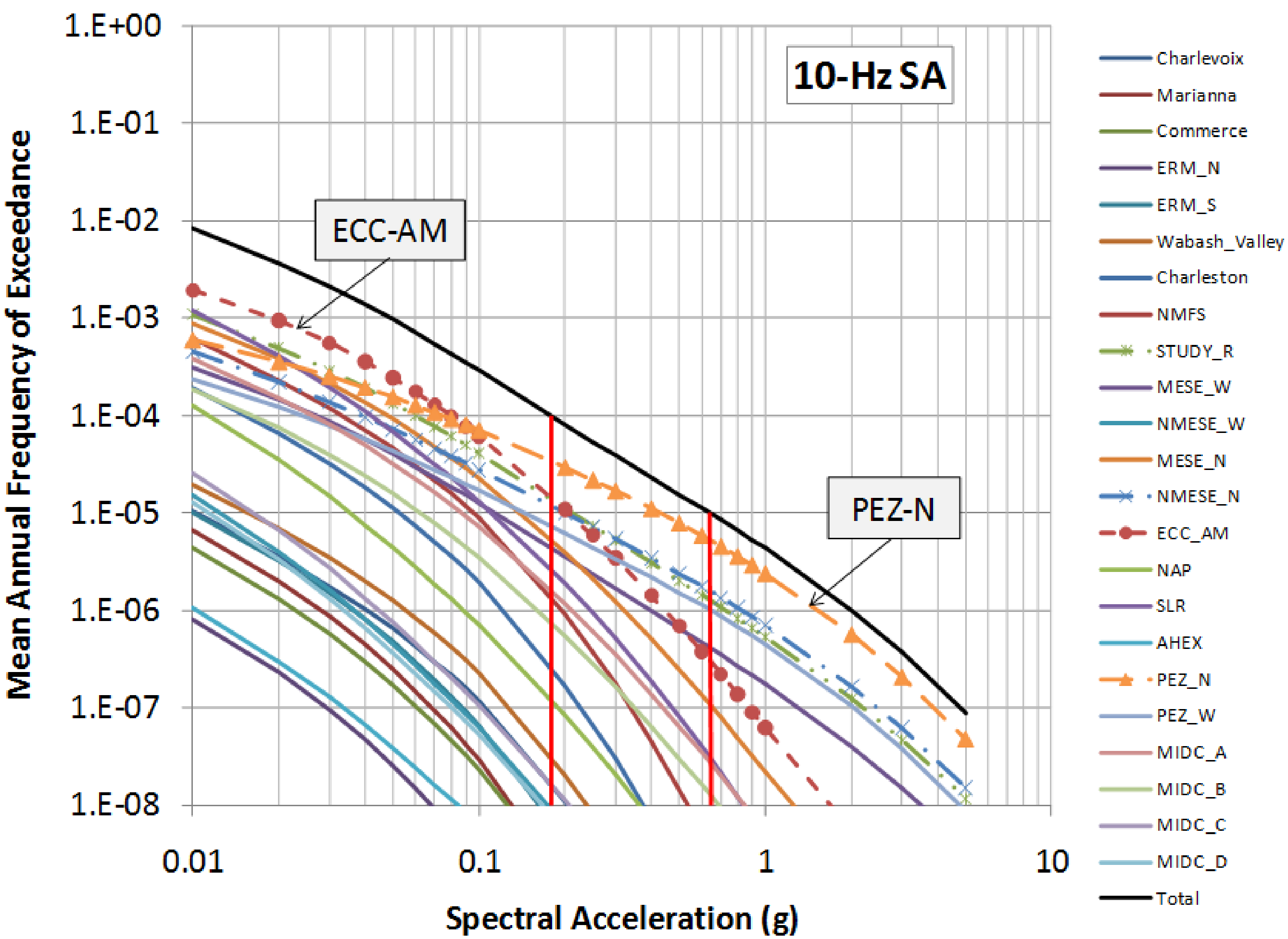
PSHA RESULTS

CONTRIBUTION PER SOURCE, 10 Hz



PPL NUCLEAR DEVELOPMENT

SITE RESPONSE ANALYSIS

GROUND MOTION RESPONSE SPECTRA (GMRS)

- Updated Ground Motion Response Spectra (GMRS)
- GMRS defined according to RG 1.208 guidance
  - Free-field outcrop at top of competent rock (sound Mahantango formation)
  - Approach 2B of NUREG/CR-6728
  - Vertical GMRS established with V/H ratios (NUREG/CR-6728)
    - V_{S30} for BBNPP site is greater than (>) 6500 fps
    - Hard Rock

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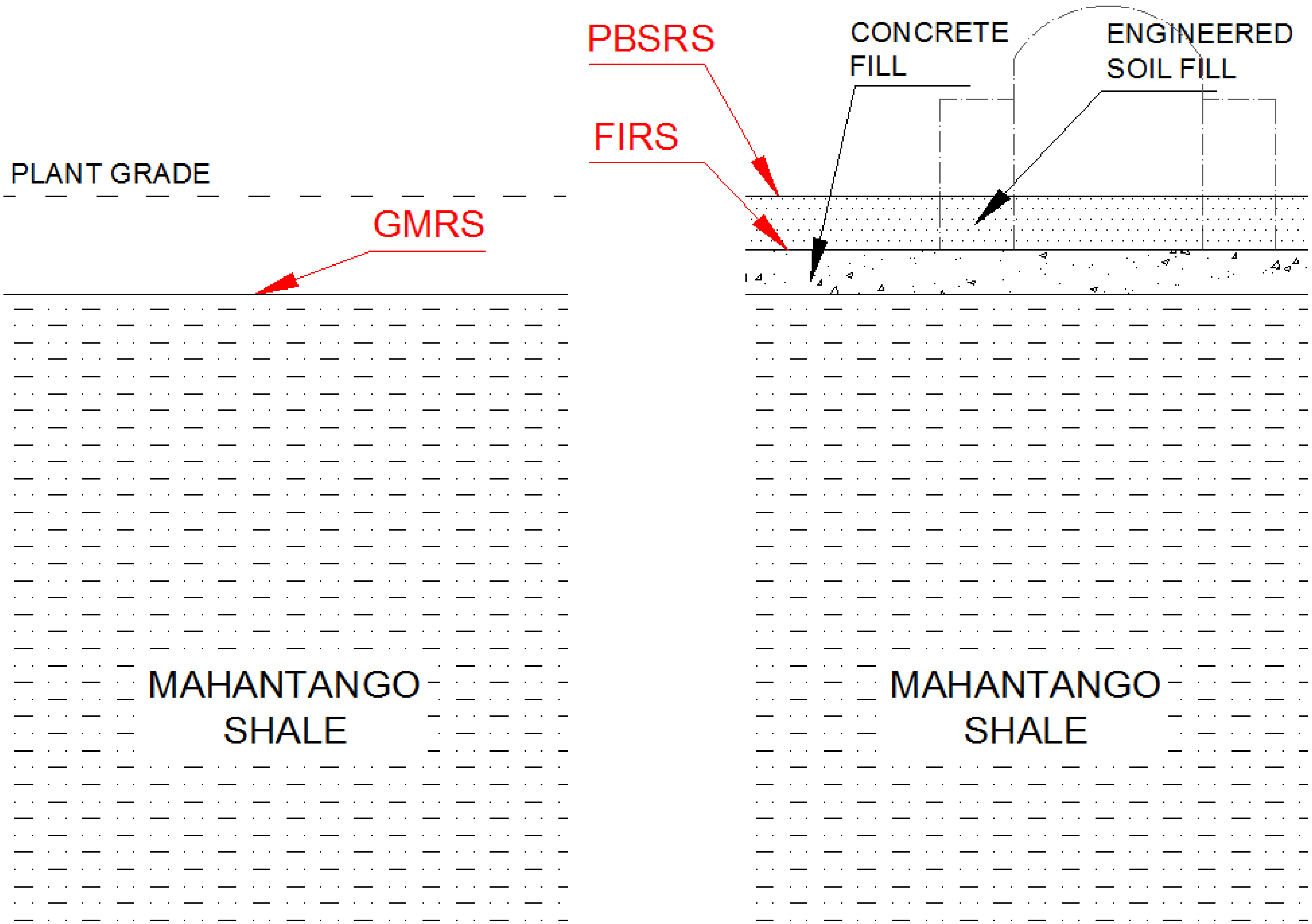
SITE RESPONSE ANALYSIS

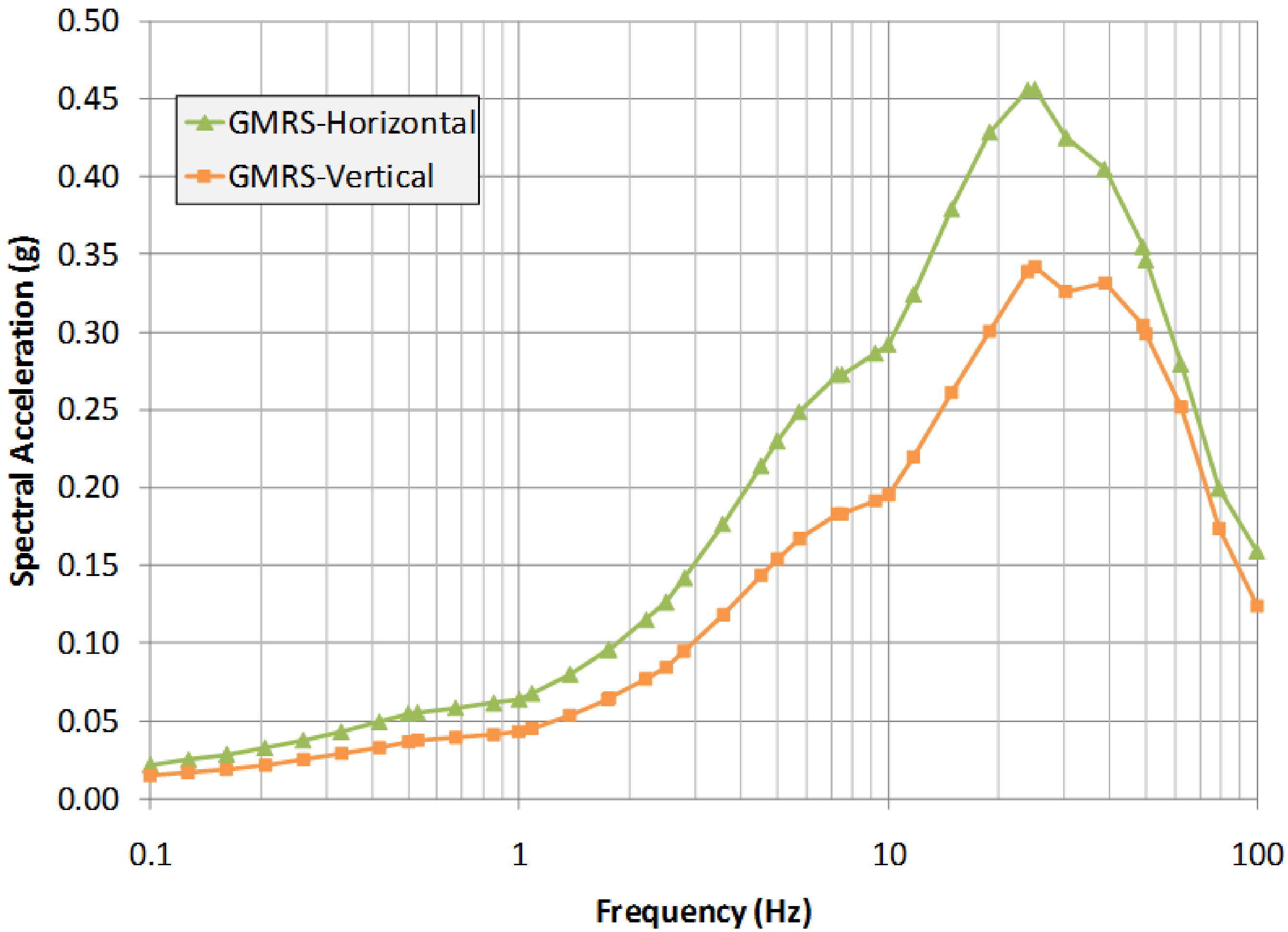
FOUNDATION INPUT RESPONSE SPECTRA (FIRS)

- The Nuclear Island (NI) Foundation Input Response Spectra (FIRS) is the basis for the comparison to the US EPR™ Certified Seismic Design Response Spectra (CSDRS)
- FIRS is defined as an In-Column outcropping motion at the elevation of the NI basemat
- The following comparisons are shown based on soil column used in 2010 (PPC, EPRI-SOG)

GMRS/FIRS/PBSRS



GROUND MOTION RESPONSE SPECTRA



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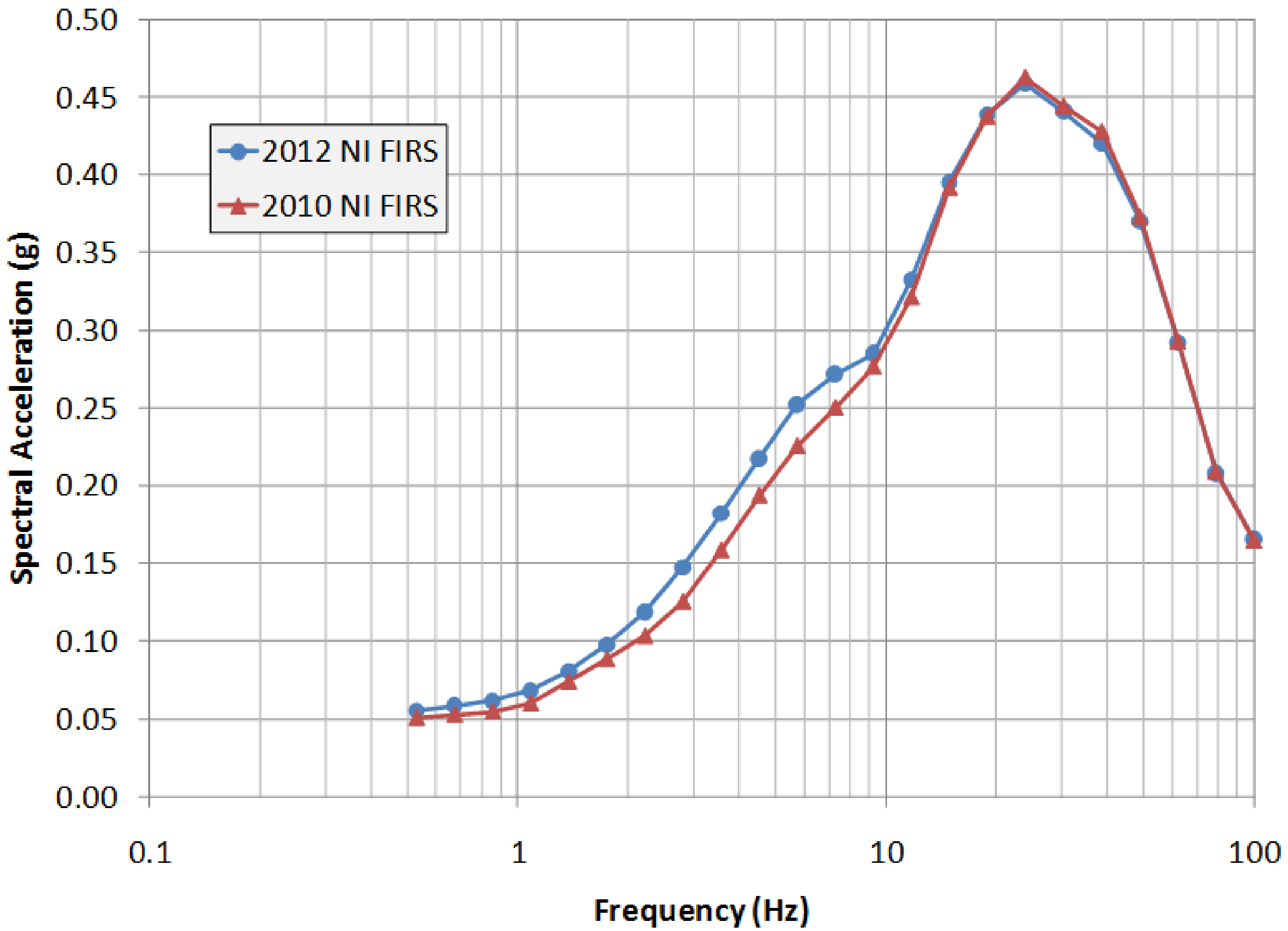
FOUNDATION INPUT RESPONSE SPECTRA (FIRS)

EPRI SOG VS. CEUS 2012 (2010 EPRI-SOG BASED ON OLD SOIL COLUMN)



PPL NUCLEAR DEVELOPMENT

RESPONSE TO RAI 118

POST FUKUSHIMA NTTF RECOMMENDATION

- Response to RAI 118 submitted to NRC on 11/15/12
- Evaluated potential impact of 2012 CEUS SSC (NUREG-2115) on the rock UHRS and GMRS/FIRS
  - 2012 CEUS SSC Included updated earthquake catalog, Source Zones/RLME Sources, and characterization of maximum magnitude and recurrence parameters
  - Model differences from updated EPRI-SOG (1986) previously used
  - Prudent to update PSHA and GMRS/FIRS using 2012 CEUS SSC

RESPONSE TO RAI 118

POST FUKUSHIMA NTTF RECOMMENDATION

- PSHA Implementation
  - Used Source Zones that extend to within 200 miles of the BBNPP Site
  - Updated geological, geophysical, and seismic data indicate no need to modify the 2012 CEUS SSC or supplement with local sources
  - Minimum M 5.0; no CAV filter
  - For Distributed Seismicity Source Zones, hazard integration carried out to a distance of 435 miles

RESPONSE TO RAI 118

POST FUKUSHIMA NTTF RECOMMENDATION

- GMRS/FIRS
  - Updated following guidance in RG 1.208
  - Impact to GMRS (Not Comparable)
    - In 2010, GMRS developed as PBSRS
    - In 2012, GMRS developed for surface outcrop of competent Material
  - Impact to NI FIRS (basis for SSE)
    - None for spectral acceleration (SA) at 10 Hz and above
    - Increase of about 10-15% for SA less than about 7 Hz

FSAR SECTION 2.5.2

SUMMARY AND CONCLUSIONS

- PSHA And GMRS/FIRS updated using 2012 CEUS SSC and following RG 1.208
- For NI FIRS
  - Negligible impact at high frequency response
  - Increase of 10-15% at low frequency response
- FSAR 2.5.2 revised to reflect updated PSHA, site response, and GMRS

FSAR SECTION 2.5.3

SURFACE FAULTING

- Additional field reconnaissance was performed due to the plot plan change
- Results of this effort were consistent with previous efforts
- There is no potential for tectonic fault rupture and there are no capable tectonic sources within a 25 mi (40 Km) radius of the BBNPP site
- Minor editorial changes made, including reference changes (removed reference to R.G. 1.165, for example)

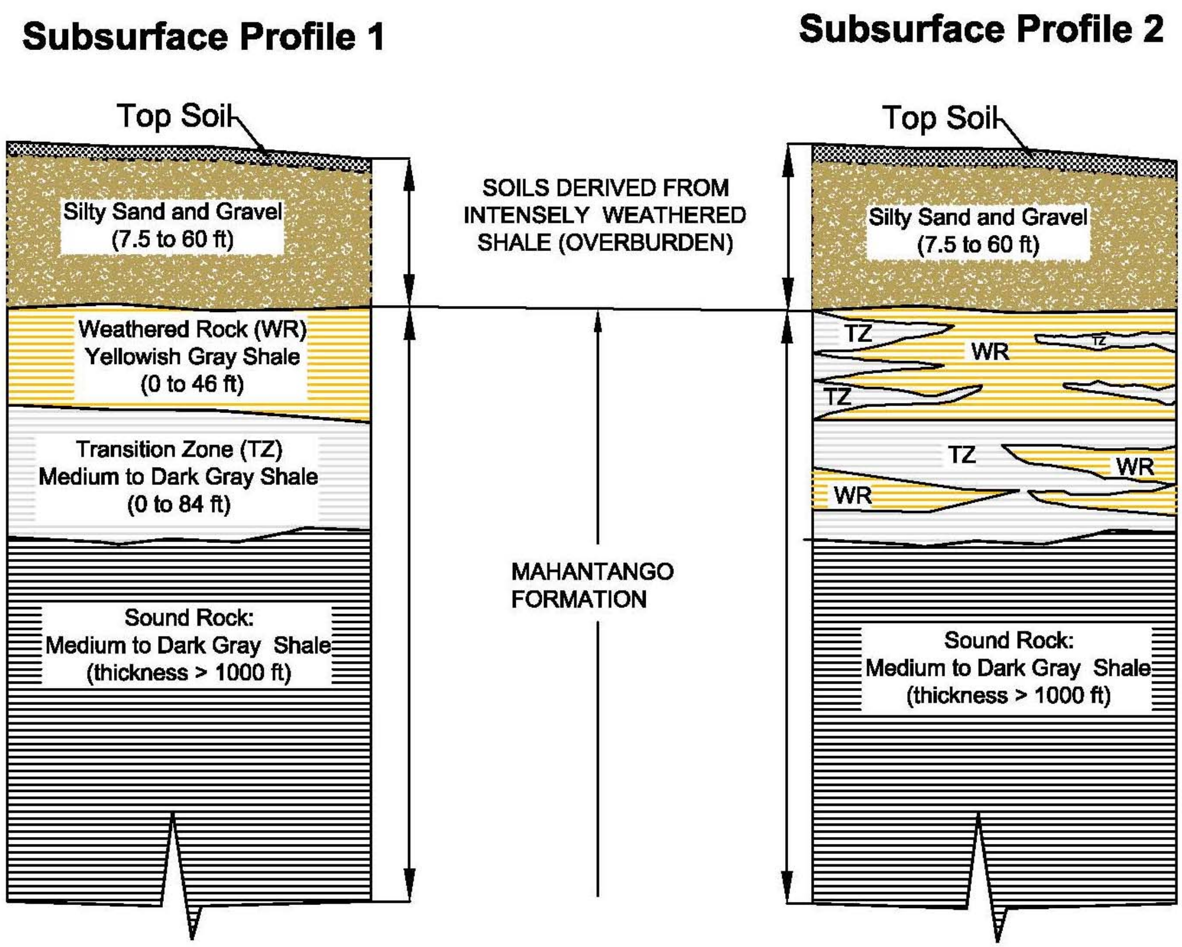
FSAR SECTION 2.5.4

STABILITY OF SUBSURFACE MATERIALS AND FOUNDATIONS

- Summary of foundation conditions
- Bearing capacity analysis
- Settlement analysis
- Lateral uniformity

TYPICAL SUBSURFACE PROFILE

POWERBLOCK AREA



Note: Values shown on Figures represent minimum to maximum thickness

FSAR SECTION 2.5.4

FOUNDATION CONDITIONS

- Basemats of safety related buildings placed on
  - Concrete fill, or
  - Competent rock (V_S > 6500 fps)
  - Competent and Uniform load bearing interface

STRUCTURE		FND DEPTH [FT]	MATERIAL
Nuclear Island	NI	39	Concrete
Essential Service Water Building	1ESWB	33	Mahantango
	2ESWB	33	Concrete
	3ESWB	33	Concrete
	4ESWB	33	Concrete
Emergency Power Generation Building	1-2EPGB	11	Concrete
	3-4EPGB	11	Concrete
Essential Service Water Emergency Makeup	ESWEMS	30	Concrete

FSAR SECTION 2.5.4

BEARING CAPACITY ANALYSIS RESULTS

- Buildings are placed on concrete or competent rock: bearing capacity is not an issue
- Rock bearing capacities are higher than concrete bearing capacity
- Overall allowable static bearing capacity is in excess of 120 ksf, while allowable dynamic bearing capacity is in excess of 180 ksf,
  - Well in excess of US EPR^{TM} requirements (22 ksf static/35 ksf dynamic bearing pressures)

FSAR SECTION 2.5.4

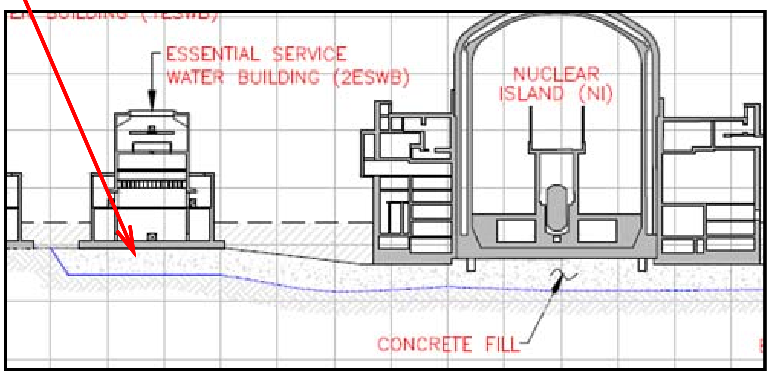
SETTLEMENT ANALYSIS, RESULTS AND CONCLUSIONS

- Overall settlements are below 0.1 inches throughout the footprint of the foundation
- Settlement is negligible for the BBNPP site
- BBNPP tilt is less than 0.06 in/50 Ft
- Settlement criteria specified in US EPR™ FSAR 2.5.4 (Tilt<0.5 in/50 Ft) is met.

FSAR SECTION 2.5.4

ASSESSMENT OF LATERAL UNIFORMITY

- Site condition
  - Non-Horizontal Rock and Concrete Interfaces and Different Buildings with Foundation Materials of Concrete or Rock (Mahantango Formation)

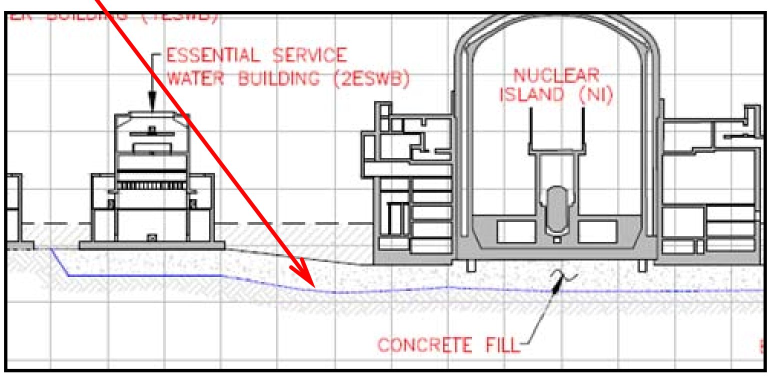


- Impact on site response
  - The Best Estimate shear wave velocities of Mahantango formation and concrete are close and therefore impedance is small.
  - Foundation materials are uniform for an area larger than the basemat of the building (no local effect).
  - Condition does not have an impact on site amplification analysis.

FSAR SECTION 2.5.4

ASSESSMENT OF LATERAL UNIFORMITY

- Site condition
  - Slightly non-horizontal rock/concrete and backfill interfaces



- Impact on GMRS
  - GMRS defined at top of competent material (Mahantango formation)
  - The GMRS is influenced by the foundation material and the underlying rock and not sensitive to backfill above foundation elevations

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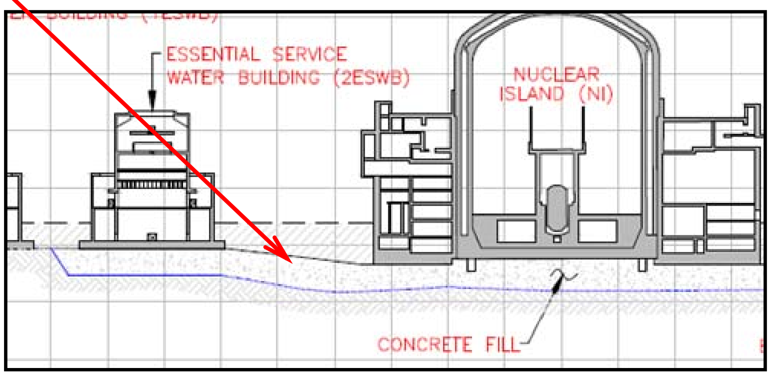
FSAR SECTION 2.5.4

ASSESSMENT OF LATERAL UNIFORMITY

- Site condition
  - Slightly non-horizontal rock/concrete and backfill interfaces



- Site condition
  - Slightly sloping topography

- Impact on FIRS/PBSRS
  - No abrupt changes between backfill and foundation line
  - No dimensional effects to FIRS
  - Impedance between concrete and rock, and the thickness of backfill at foundation Location, are accounted for in the analysis

- Impact on horizontal layer assumption
  - 8% Gradient < US EPR™ 20%

FSAR SECTION 2.5.4

CONCLUSIONS

- BBNPP safety related structures are placed on either rock or concrete layers providing competent and uniform load bearing layers
- The foundation materials provide very high allowable bearing capacities (>100 ksf)
- Settlement is negligible
- Lateral uniformity met: Horizontal site with uniform properties within foundation footprints
  - Gradient at BBNPP 8% < US EPR™ 20%

FSAR SECTION 2.5.5

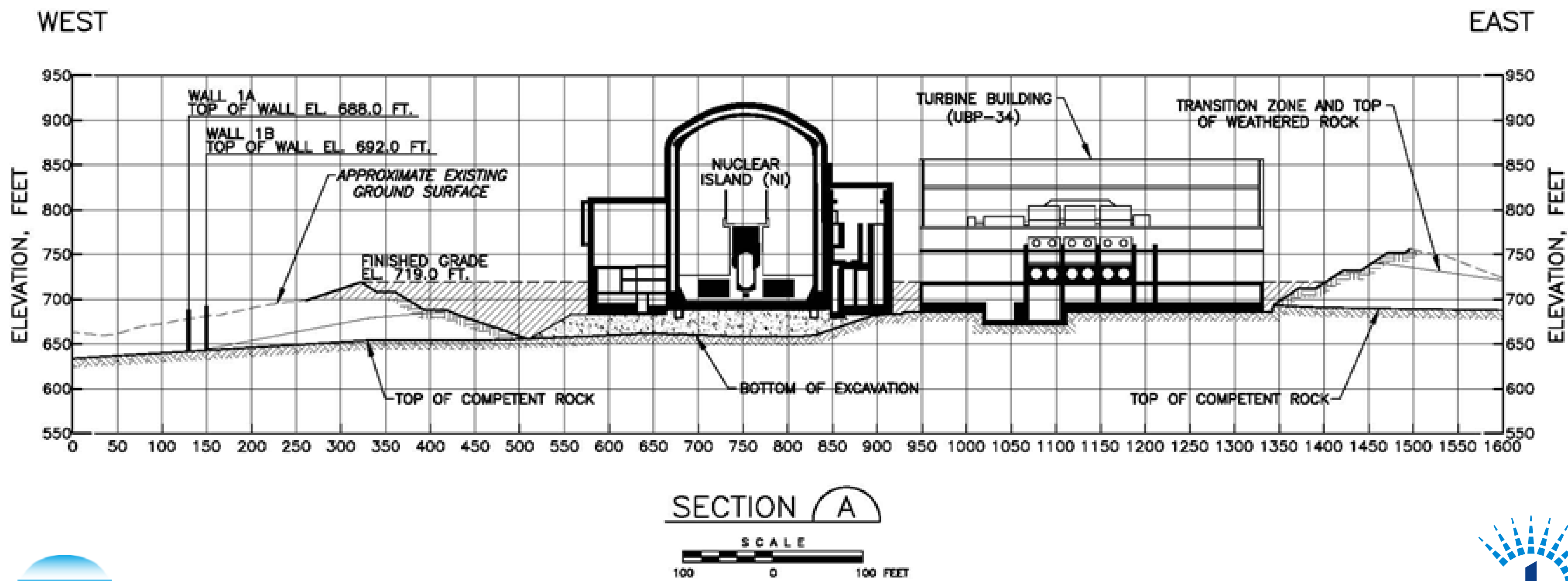
STABILITY OF SLOPES

- Section updated as a result of Plot Plan Change
- Inputs into slope stability analyses such as groundwater elevation and seismic input also updated
- Based on analyses provided in this section, it is concluded that the constructed and natural slopes at the site are stable with adequate factors of safety

FSAR SECTION 2.5.5

STABILITY OF SLOPES

- Wall 1A and 1B
  - 20ft wide road supported between the two walls
  - Closest Safety-Related Structure is 290-ft away (Rad Waste Processing Building)



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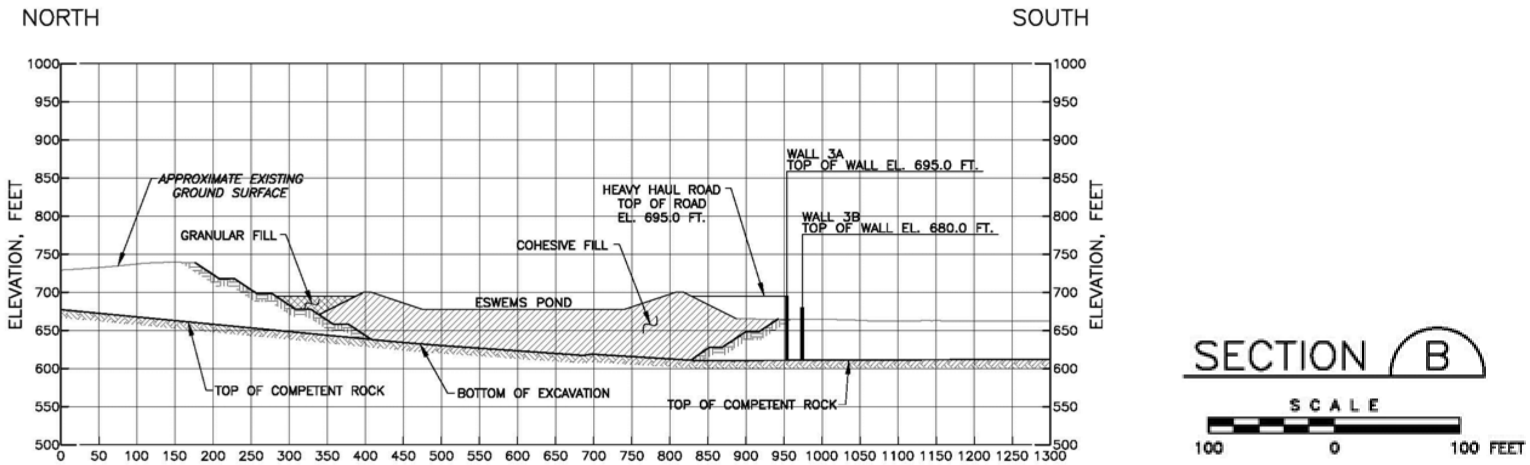
FSAR SECTION 2.5.5

STABILITY OF SLOPES

- Wall 3A and 3B
  - No critical surface circles extend into ESWEMS retention pond berm area



FSAR SECTION 2.5

SUMMARY AND CONCLUSIONS

- Bell Bend Nuclear Power Plant Site PSHA updated with the use of the 2012 CEUS SSC
  - Most "up to date" seismic source characterization
  - Fully reflects new location of plant on Site
  - Responsive to the Post Fukushima 2.1 NTTF recommendations
    - Key Input To FSAR 2.5 Revision
- Favorable geotechnical conditions

FSAR SECTION 2.5

SUMMARY AND CONCLUSIONS

- On track to provide FSAR Chapter 2.5 to NRC by 12/31/2012
  - To include revised core boring logs and seismic refraction report (Part 11F, 11G)
- PPL is now set to begin seismic reconciliation of the Bell Bend safety related structures (3.7 and 3.8)
  - Consistent with the US EPR^{TM} Design Certification
  - Responsive to the Post-Fukushima Near Term Task Force Recommendation 2.1