PSEG Early Site Permit
Advisory Committee on Reactor Safeguards

June 10, 2015

PSEG
Power LLC

PSEG – Overview

Christopher Schwarz
Vice President
Operations Support

PSEG Power LLC

PSEG Corporate Overview

PSEG

PSE&G

Traditional T&D

Electric Customers: 2.2M
Gas Customers: 1.8M

~6,300 – Employees

PSEG Power LLC

Regional Wholesale Energy

Nuclear Capacity: 3,661 MW
Total Capacity: 13,446 MW

Nuclear – ~1,500
Fossil – ~1,000
ER&T and Power Support – ~90
Power Ventures / Solar Source – ~10

Total – ~2,600

PSEG LONG ISLAND

Traditional T&D

Electric Customers: 1.1M

~2,100 – Employees

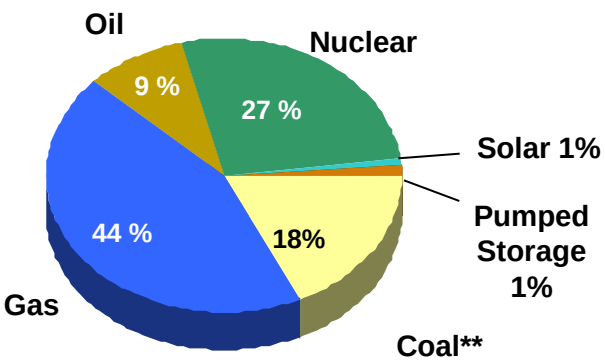
Services Company – ~1,000 Employees

Total – ~12,000

PSEG Power Portfolio – 2013

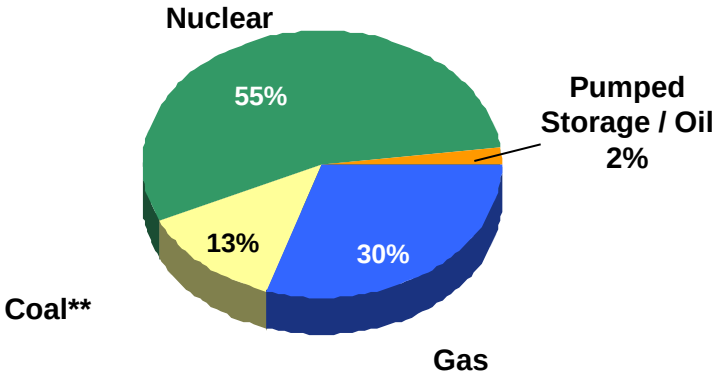
Fuel Diversity

Total MW: 13,466



Energy Produced

Total GWh: 54,264



Coal - includes NJ units that fuel switch to gas**

Solar <1%

- 4th largest generator in PJM
- Generating assets in four states – New Jersey / New York / Connecticut / Pennsylvania

PSEG Power LLC

PSEG Nuclear – Salem and Hope Creek

Second largest site in country

- Approximately 3,575 MWe
- Enough electricity for ~3 million homes

Each unit licensed for 60 years (license renewal completed)

- Salem Unit 1 (PWR, 1180* MW) – August 2036
- Salem Unit 2 (PWR, 1175* MW) – April 2040
- Hope Creek (BWR, 1219* MW) – April 2046

*Mean Annual Net Rating

Factors Influencing Our Future Fuel Diversity

Polar Vortex

- First concerns related to ‘winter’ peak vs ‘summer’ peak
- Challenges gas supply and availability

New Jersey High Electric Demand Day (HEDD)

- Peaking capacity required to shut down in 2015

Nuclear retirements

- In the next 20 years, a significant number of nuclear units reach their end of life (60 yrs)
- Fukushima changes could accelerate nuclear retirements as plants are no longer economic

Early Site Permit – Overview

Jamie Mallon
ESP Manager

PSEG Power LLC

Early Site Permit Application

PSEG Power LLC and PSEG Nuclear LLC are applicants

Reactor technology has not been selected

Application includes:

- Site Safety Analysis Report to address impacts of the environment on the plant, including hurricanes and earthquakes
- Emergency Plan – consistent with existing plants
- Environmental Report

ESPA based on a "plant parameter envelope" (PPE)

- Assumes single large unit or two smaller units
- Impacts address footprints and other parameters such as water use
- Up to 2200 MWe for the two unit plant [Westinghouse AP-1000]

Early Site Permit Application Contents

Part 1 – Administrative Information

Part 2 - Site Safety Analysis Report

- Chapter 1 – Introduction and General Description
- Chapter 2 – Site Characteristics and Site Parameters
- Chapter 3 – Aircraft Hazards
- Chapter 11 – Radioactive Waste Management
- Chapter 13 – Emergency Planning
- Chapter 15 – Transient and Accident Analysis
- Chapter 17 – Quality Assurance

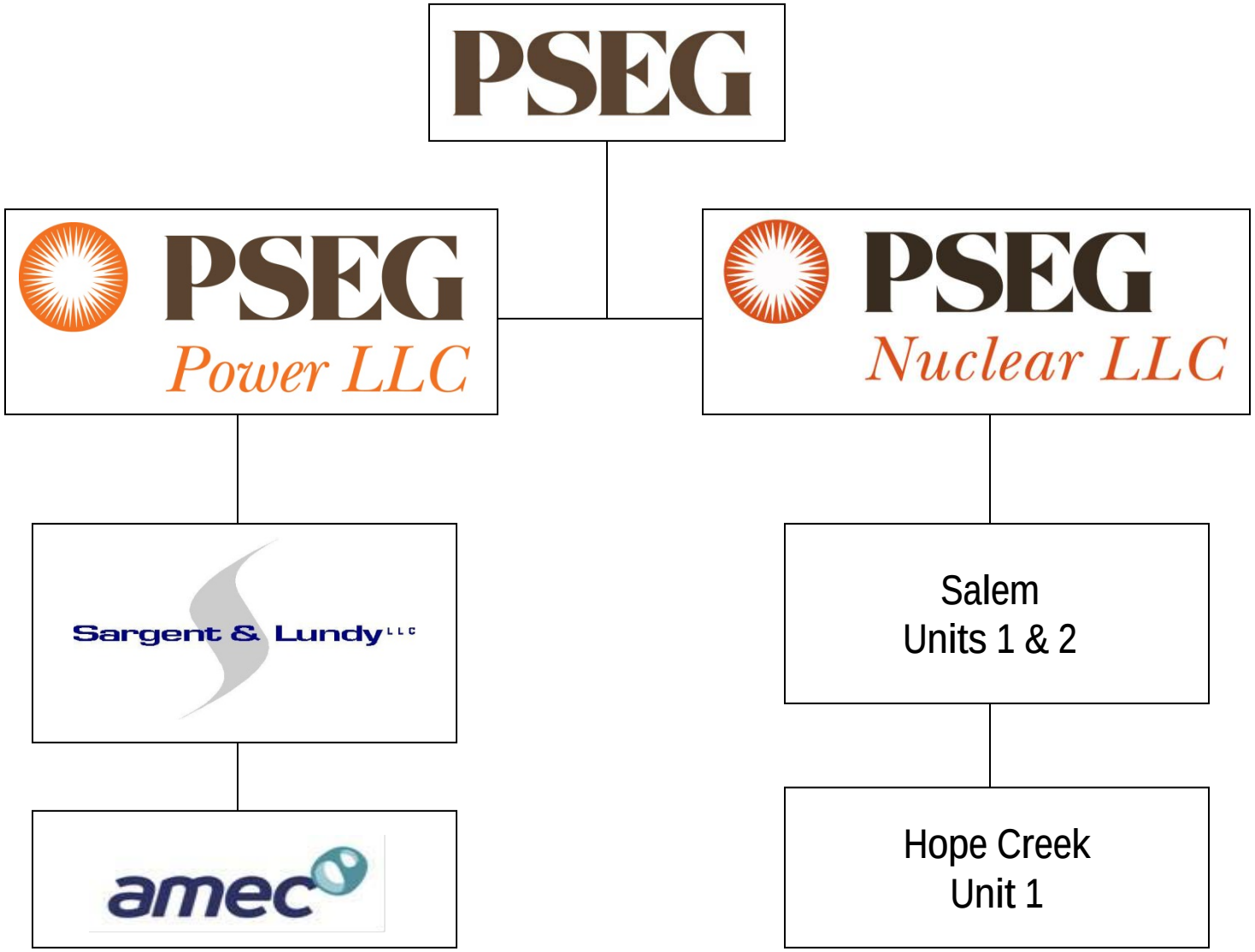
Part 3 – Environmental Report

Part 4 – LWA – Not Used

Part 5 – Emergency Plan

Part 6 – SUNSI Information – Not Used

PSEG Early Site Permit Organization



Site Location

Existing 734 acre PSEG property located on southern part of Artificial Island

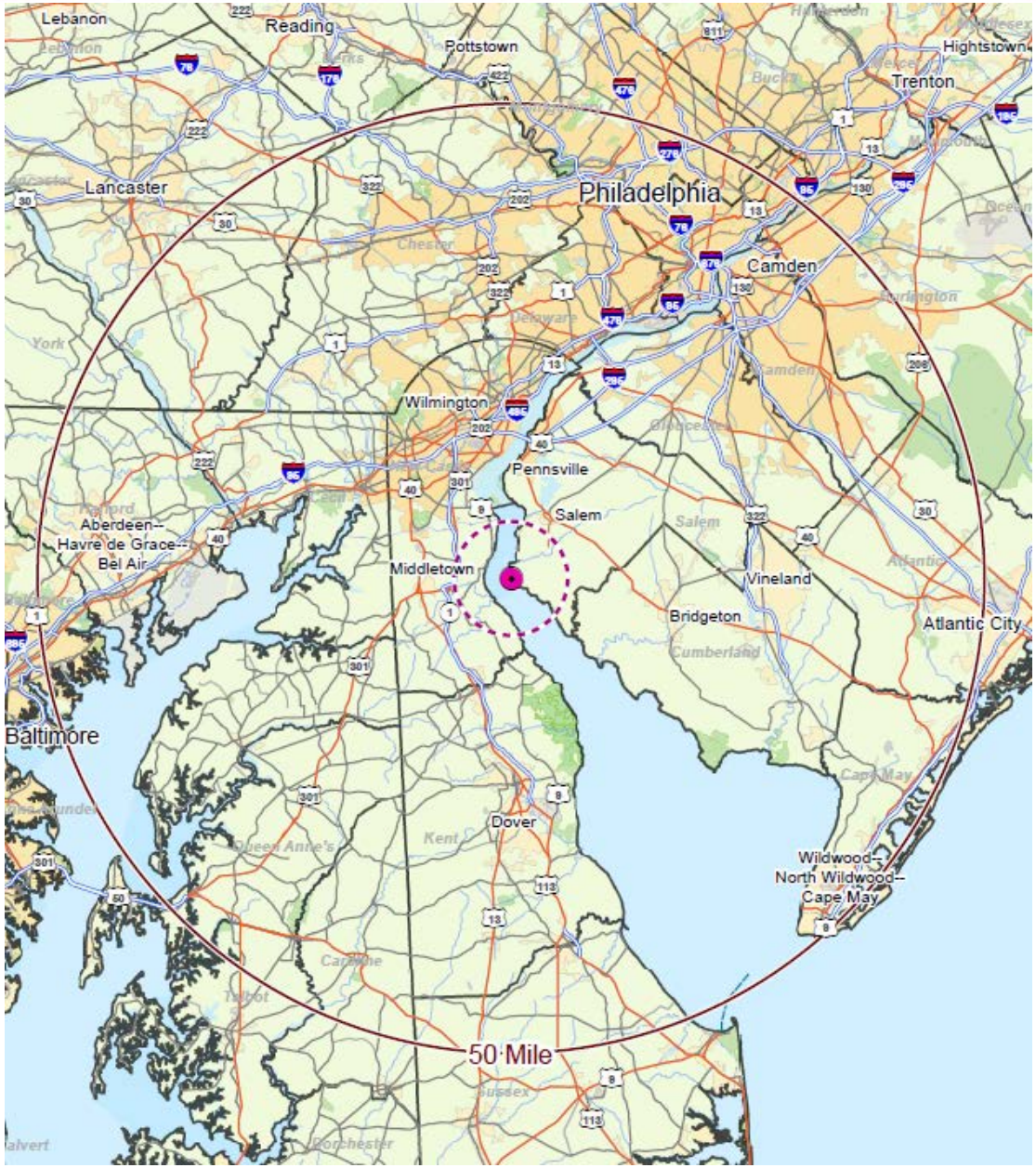
- 15 miles south of Delaware Memorial Bridge
- 18 miles south of Wilmington, Delaware
- 30 miles southwest of Philadelphia, Pennsylvania
- 7-1/2 miles southwest of Salem, New Jersey

Currently three operating nuclear reactors on Artificial Island

- Salem Units 1 and 2 - Westinghouse PWRs - 3459 MWt each
- Hope Creek Unit 1 – GE BWR - 3840 MWt

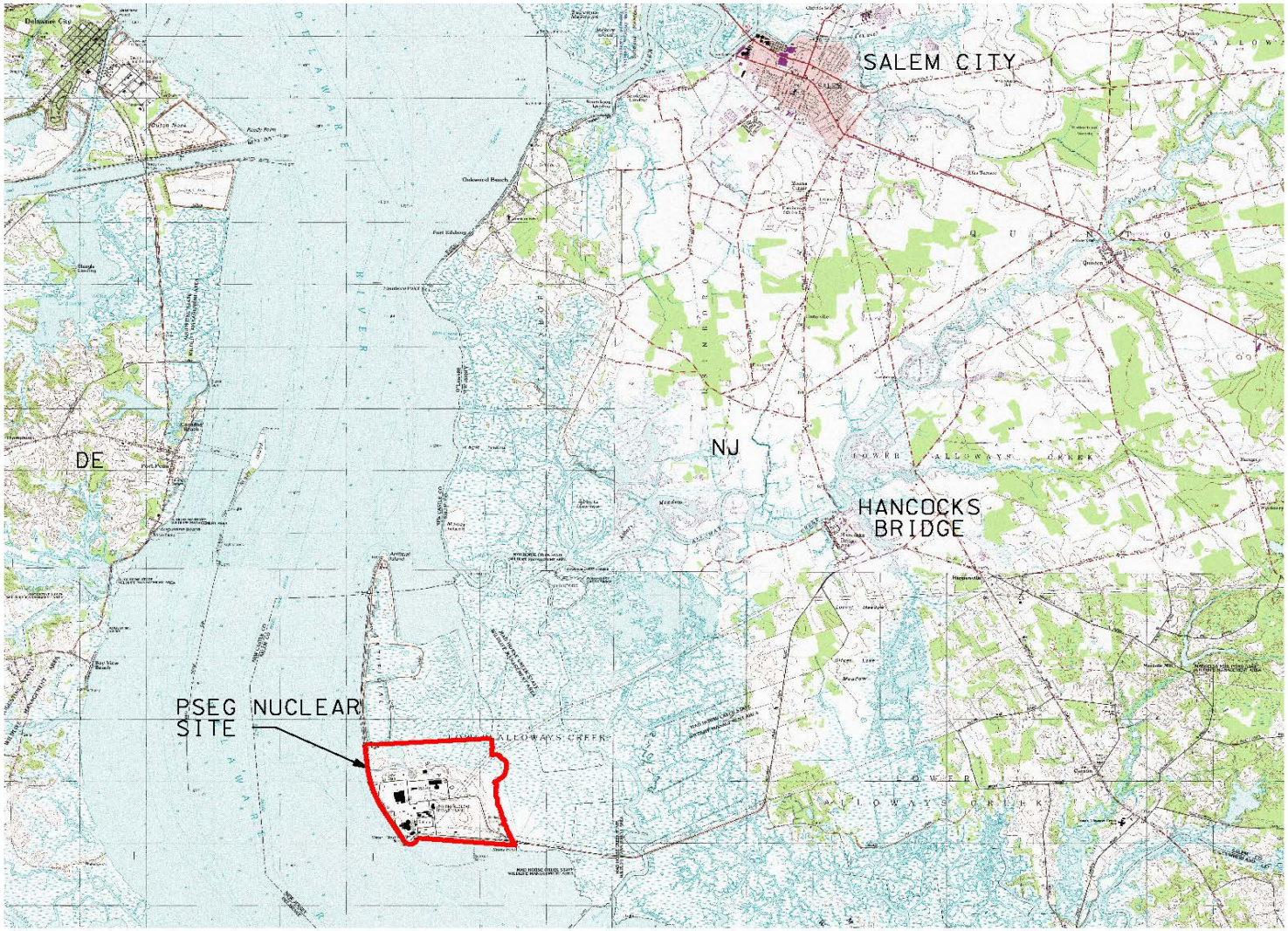
PSEG is in negotiation with U.S. Army Corps of Engineers (USACE) to acquire an additional 85 acres immediately north of Hope Creek Generating Station (HCGS)

PSEG ESP Site and Regional Vicinity (NJ, DE, PA AND MD)



PSEG Power LLC

Current PSEG Site And Local Vicinity



PSEG NUCLEAR SITE

LOCAL.sgn 5/18/2009 5:45:21 PM

PSEG Site

PSEG Power LLC

PSEG Site

PSEG Power LLC

Early Site Permit Application Development

Regulatory guidance to prepare the application

- 10 CFR Part 52 – Subpart A
- RG 1.206 - Combined License Applications for Nuclear Power Plants (LWR Edition)
- NUREG – 0800 - Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition
- RS-002 – Processing Applications for Early Site Permits

Studies and processes

- Site Studies and Investigation Programs
- Conceptual Design and Analysis
- Plant Parameter Envelope

Plant Parameter Envelope Development

Follow the Part 52 process as designed

Reactor technology designs not yet mature

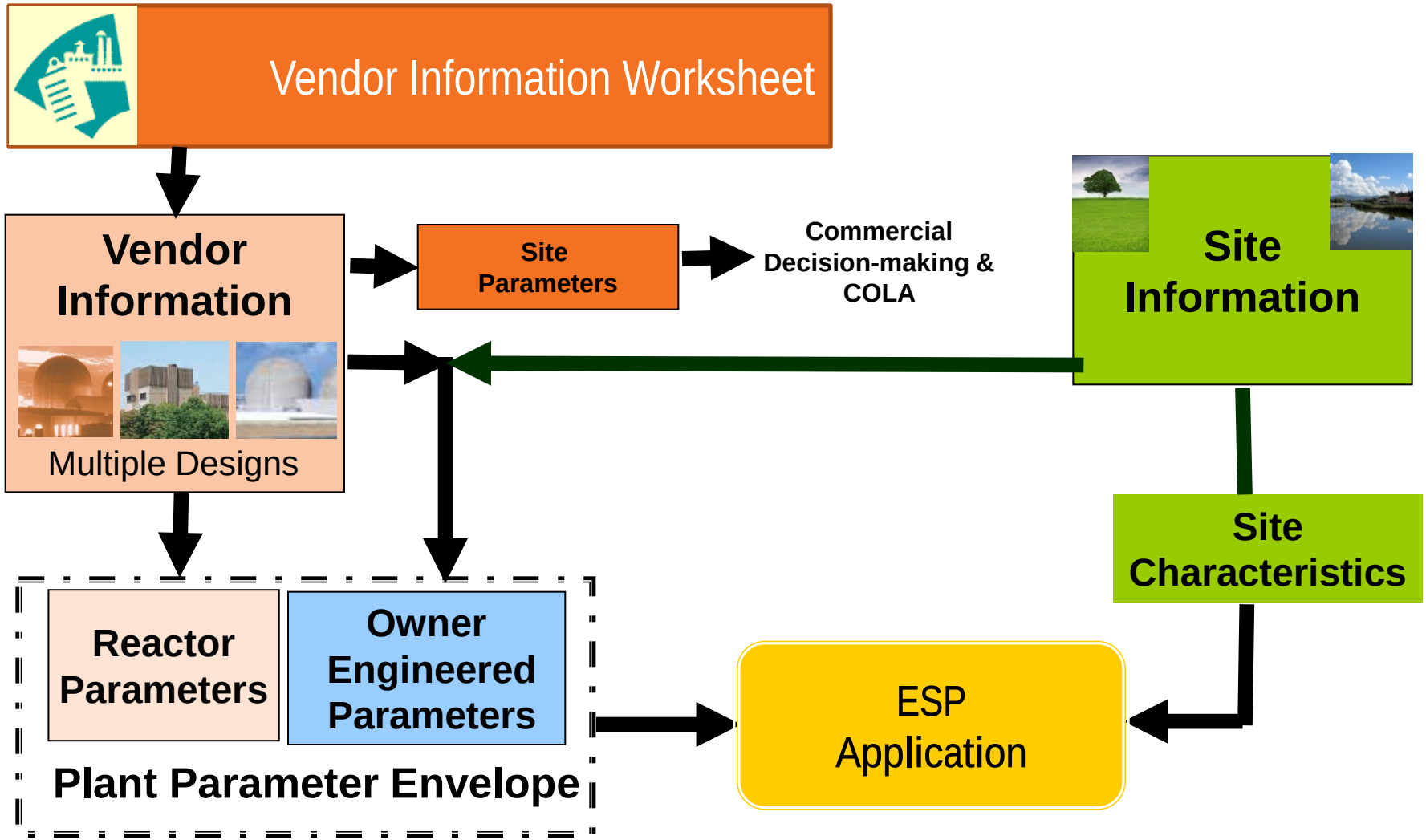
- Regulatory risk exists until Design Certification reviews are complete
- Technology and commercial risks exist until detailed designs are more complete

Bounding values for parameters that define facility's interaction with the environment

Reactor technology designs considered:

- Single Unit ABWR
- Single Unit U.S. EPR
- Single Unit US-APWR
- Dual Unit AP1000

Plant Parameter Development Approach



Plant Parameter Development Approach (Cont.)

PPE Table (SSAR Section 1.3)

- Reactor Parameters
  - Radiological Effluents
  - Chemical Emissions
- Owner Engineered Parameters
  - Site Layout Acreages
  - Normal Plant Heat Sink

Sample Format

PPE Item		Design Parameter	Definition
1	**Structure**		
1.1	**Building Characteristics**		
1.1.1	Height	234 ft.	The height from finished grade to the top of the tallest power block structure, excluding cooling towers.
1.1.2	Foundation Embedment	39 ft. to 84.3 ft.	The depth from finished grade to the bottom of the basemat for the most deeply embedded power block structure.

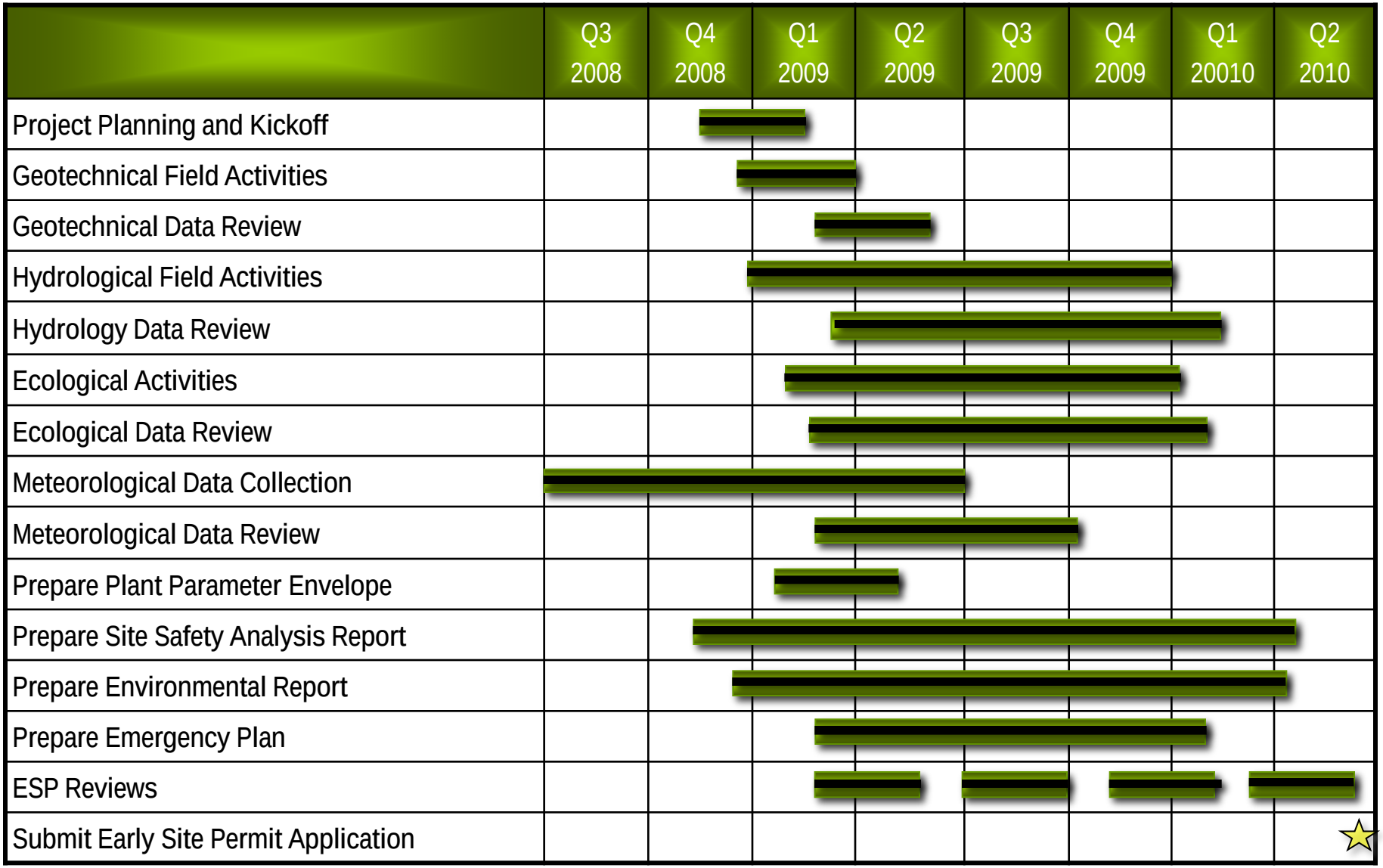
PSEG Power LLC

Plant Parameter Development Approach (Cont.)

Parameter Categories

- Structure
- Normal Plant and Ultimate Heat Sink
- Potable/Sanitary/Demineralized/Fire Protection Water System
- Miscellaneous Drain (Discharge)
- Unit Vent/Airborne Effluent Release Point
- Solid and Liquid Radwaste System
- Auxiliary Boiler System
- Onsite/Offsite Electrical Power System
- Standby Power System
- Plant Characteristics
- Construction
- Miscellaneous Parameters

Early Site Permit Application – Submitted May 25th 2010



NRC Site Safety Visits

Pre-application Subsurface Investigation	January 2009
PPE Development	March 2009
Hazards Analysis	December 2009
Post-application ESPA Overview	June 2010
Hydrology Audit	February 2011
Quality Assurance	June 2011
Geotechnical Audit	September 2011
Seismic Analysis	Sept./Dec. 2012
Flood Re-analysis	July/Sept. 2013
Hydrology Audit	February 2014

Application Timeline

ESP Application Timeline

▪ Application Submitted	May 25, 2010
▪ Application Docketed	August 4, 2010
▪ Review Schedule Issued	November 29, 2010
▪ Hydrology Audit	February 15 - 16, 2011
▪ Fukushima EQ and Tsunami	March 11, 2011
• Flooding	
– RAI #67 Issued – PMSS	September 27, 2012
– Flood re-analysis	July - September 2013
– Initial Response to RAI #67	September 27, 2013
– Hydrology Audit	February 4 - 6, 2014
– Revised Response to RAI #67	April 15, 2015
– ASER – SSAR 2.4 Issued	April 22, 2015

PSEG Power LLC

Application Timeline (Cont.)

ESP Application Timeline

- Seismic
  - Mineral VA M5.8 EQ — August 23, 2011
  - Geotechnical Audit — September 29 - 30, 2011
  - NUREG-2115, CEUS-SSC Issued — January 2012
  - RAI # 61 Issued – Vib. Ground Motion — June 7, 2012
  - Seismic Re-analysis — July - December 2012
  - ASER – SSAR 2.5 Issued — July 14, 2014

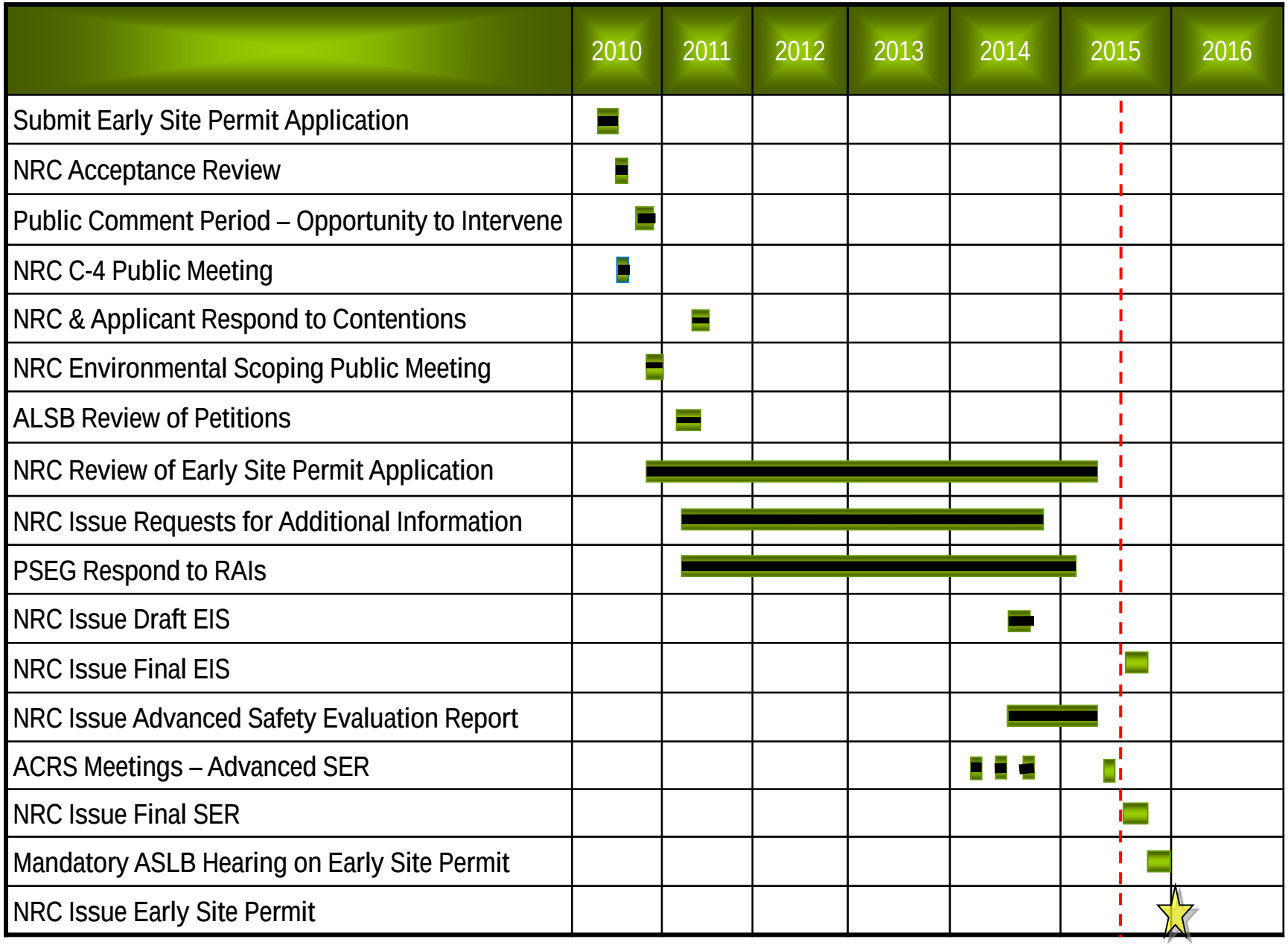
ESP Application, Revision 4, submitted June 5, 2015

- Addresses all Confirmatory Items
- Closes all open licensing commitments

ASER/ACRS Committee Timeline

- Initial ASERs Issued — October 31, 2013
- 2nd Set ASERs Issued — January 8, 2014
- 3rd Set ASERs Issued — January 15, 2014
- ACRS Subcommittee Meeting — March 19, 2014
  - SSAR Sections 3.5.1.6, 11.2/11.3 13.3, 15.0.3, 17.5
- ASER – SSAR 2.5 Issued — July 14, 2014
- ACRS Subcommittee Meeting — September 29-30, 2014
  - SSAR Sections 2.1/2.2, 2.3, 2.5
- ASER – SSAR 2.4 Issued — April 22, 2015
- ACRS Subcommittee Meeting — June 9, 2015
  - SSAR Section 4
- ACRS Full Committee Meeting — June 10, 2015

ESP Project Update - Licensing Process

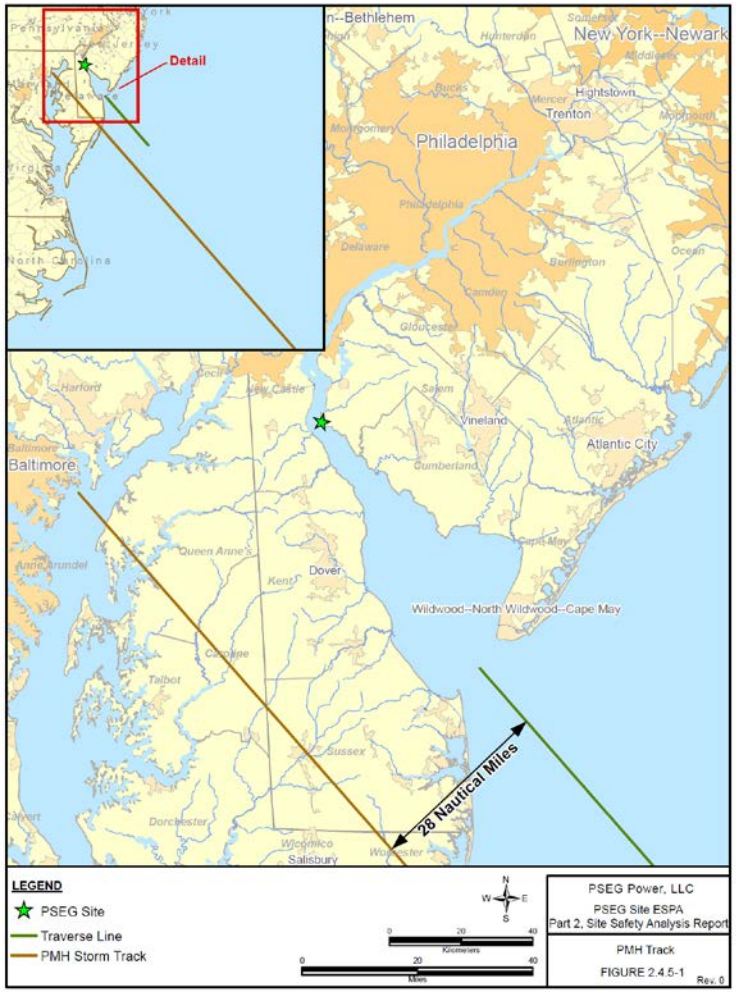


Chapter 2 – Section 2.4.5
Probable Maximum Surge
And Seiche Flooding

PSEG Power LLC

2.4.5 Probable Maximum Surge and Seiche Flooding

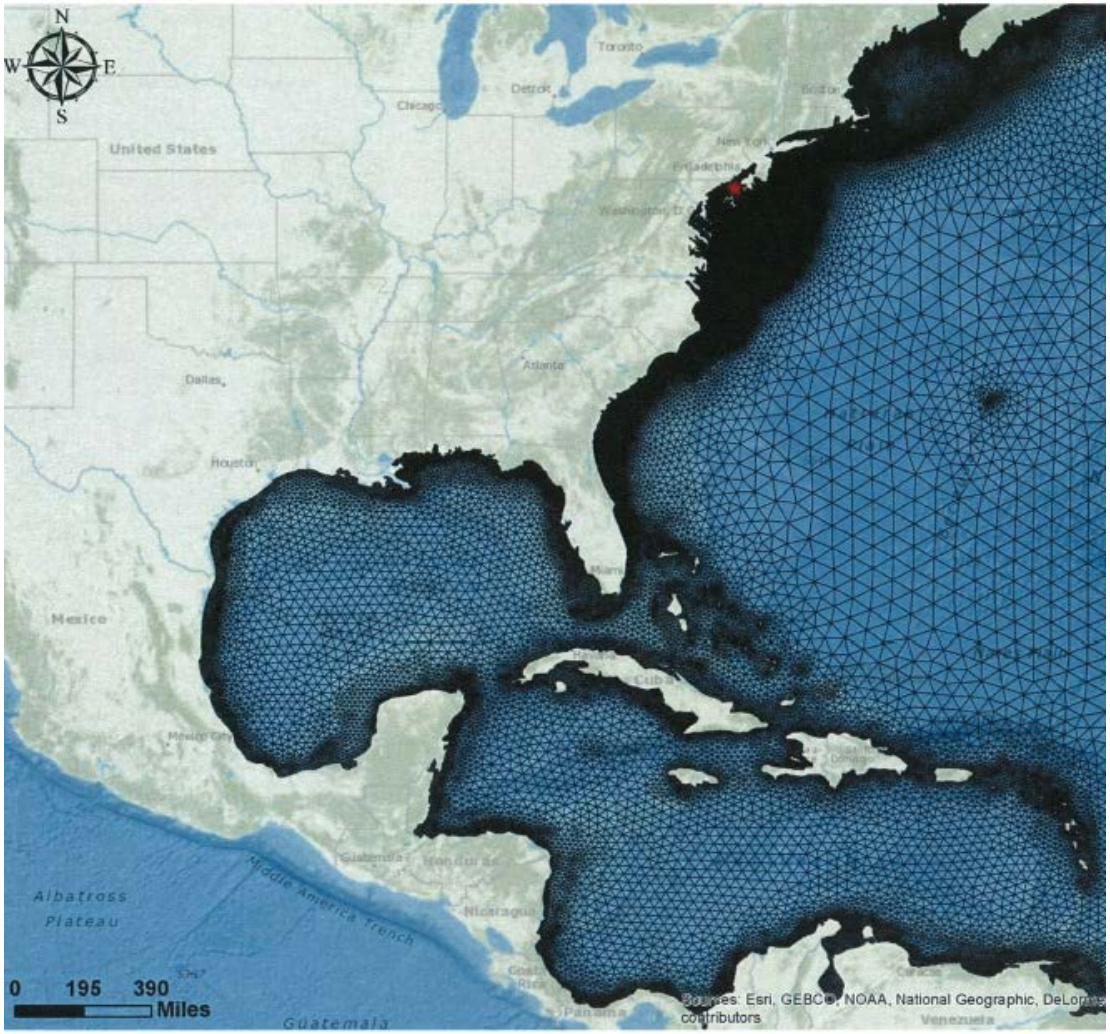
Probable Maximum Hurricane (PMH) Storm Meteorological Parameters based on NWS 23



Probable Maximum Surge and Seiche Flooding (Cont.)

PSEG developed a high resolution 2-D storm surge model (ADCIRC+SWAN) to support development of the response to RAI No. 67

- 2-D models are recognized as a more accurate storm surge modeling tool
- FEMA Region III coastal flood study



2.4.5 Probable Maximum Surge and Seiche Flooding (Cont.)

Use high resolution ADCIRC+SWAN Model to determine total design basis WSEL for the selected PMH storm

Finite element mesh refined at project site

PSEG Power LLC

2.4.5 Probable Maximum Surge and Seiche Flooding (Cont.)

PMH Maximum Total Water Surface Elevation

- 2-D ADCIRC+SWAN Model Results:
  - Antecedent Water Level 1.35 ft.
  - Maximum Still Water Level 20.2 ft. NAVD
  - Wave Runup 7.4 ft.
  - 10% Exceedance High Tide 4.5 ft.
  - Maximum Total Water Surface Elevation 32.1 ft. NAVD

Design Basis Flood Total WSEL is 32.1 ft. NAVD

PSEG Power LLC

Chapter 2 – Section 2.5.2
Vibratory Ground Motion

PSEG Power LLC

Vibratory Ground Motion

Objectives

- Characterize potential earthquake hazard in the site region (200 m radius)
- Characterize seismic hazard at the site
- Characterize the seismic response of the site to develop the Ground Motion Response Spectrum (GMRS)

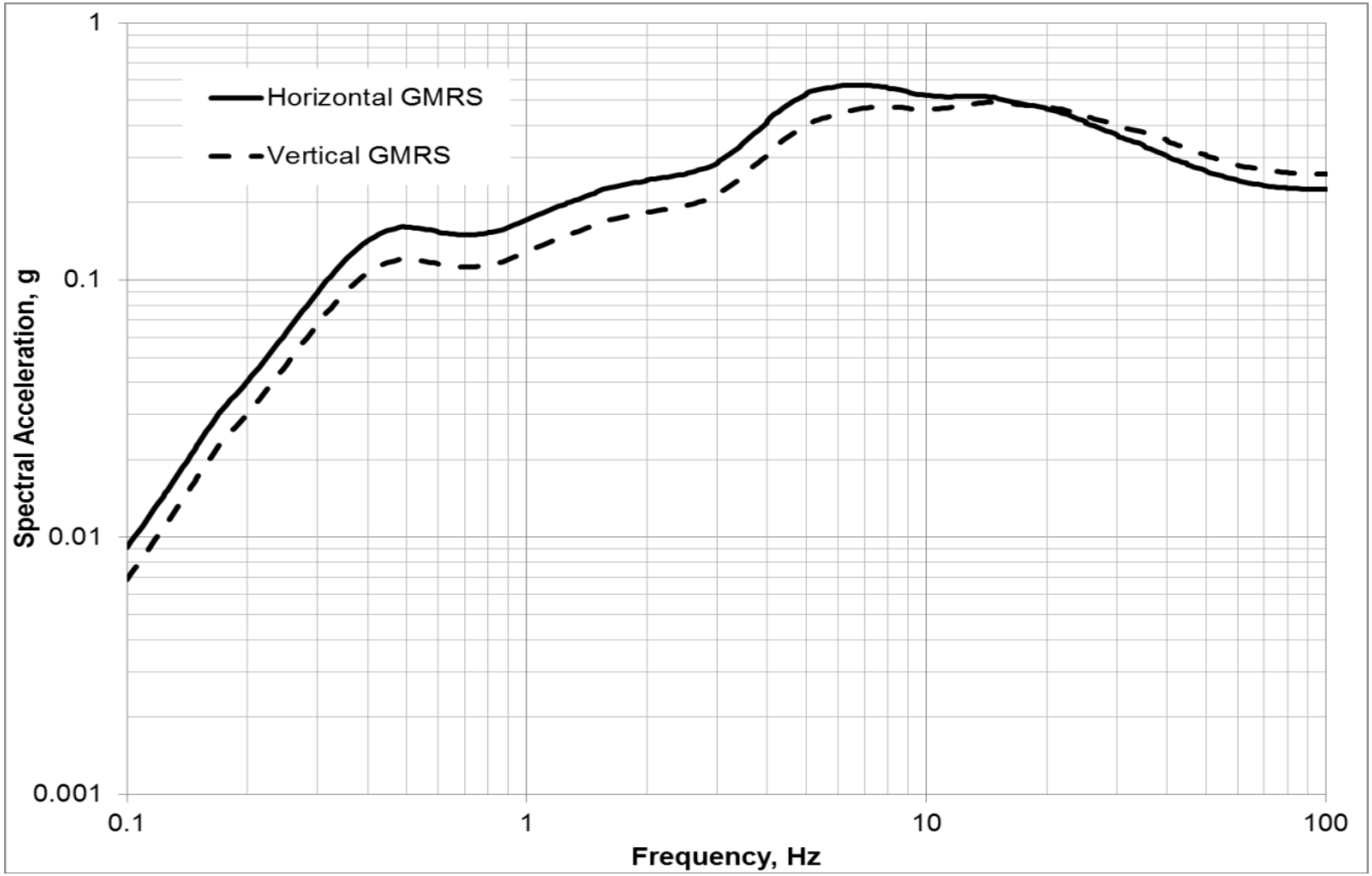
Vibratory Ground Motion (Cont.)

Methodology

- Used CEUS SSC as defined in NUREG-2115 in its entirety including all background sources and RLMEs
- Updated earthquake catalog (1/1/2009 to 12/31/2011) to characterize potential earthquake hazard in the site region (200 m radius)
- EQ recurrence rates for two RLMEs updated:
  - New Madrid Fault System (in-cluster branch)
  - Charleston (narrow source geometry branch)
- Used EPRI (2004, 2006) Ground Motion Prediction Equations
- Followed guidance in RG 1.208 to develop the horizontal and vertical GMRS

Vibratory Ground Motion (Cont.)

Soil Hazard Results



PSEG Power LLC