United States Nuclear Regulatory Commission

Protecting People and the Environment

NUREG–2168, Vol. 3

Environmental Impact Statement for an Early Site Permit (ESP) at the PSEG Site

Draft Report for Comment

Appendices A to K

U.S. Nuclear Regulatory Commission
Office of New Reactors
Washington, DC 20555-0001

Regulatory Branch
Philadelphia District
U.S. Army Corps of Engineers
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ABSTRACT

This environmental impact statement (EIS) has been prepared in response to an application submitted to the U.S. Nuclear Regulatory Commission (NRC) by PSEG Power, LLC, and PSEG Nuclear, LLC (PSEG), for an early site permit (ESP). The proposed actions requested in the PSEG application are (1) the NRC issuance of an ESP for the PSEG Site located adjacent to the existing Hope Creek Generating Station and Salem Generating Station, Units 1 and 2, in Lower Alloways Creek Township, Salem County, New Jersey, and (2) U.S. Army Corps of Engineers (USACE) permit action on a Department of the Army permit application to perform certain construction activities on the site. The USACE is participating with the NRC in preparing this EIS as a cooperating agency and participates collaboratively on the review team.

This EIS includes the review team's analysis that considers and weighs the environmental impacts of building and operating a new nuclear power plant at the proposed PSEG Site and at alternative sites and mitigation measures available for reducing or avoiding adverse impacts. The EIS also addresses Federally listed species, cultural resources, essential fish habitat issues, and plant cooling system design alternatives.

The EIS includes the evaluation of the proposed action's impacts on waters of the United States pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Appropriation Act of 1899. The USACE will conduct a public interest review in accordance with the guidelines promulgated by the U.S. Environmental Protection Agency under authority of Section 404(b) of the Clean Water Act. The public interest review, which will be addressed in the USACE permit decision document, will include an alternatives analysis to determine the least environmentally damaging practicable alternative.

After considering the environmental aspects of the proposed NRC action, the NRC staff's preliminary recommendation to the Commission is that the ESP be issued as requested. This recommendation is based on (1) the application submitted by PSEG, including Revision 3 of the Environmental Report (ER), and the PSEG responses to requests for additional information from the NRC and USACE staffs; (2) consultation with Federal, State, Tribal, and local agencies; (3) the staff's independent review; (4) the staff's consideration of comments related to the environmental review that were received during the public scoping process; and (5) the assessments summarized in this EIS, including the potential mitigation measures identified in the ER and this EIS. The USACE permit decision will be made following issuance of the final EIS.

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CONTENTS

Page

ABSTRACT iii
FIGURES xi
TABLES xiii
EXECUTIVE SUMMARY xix
ACRONYMS AND ABBREVIATIONS xxxi
1.0 INTRODUCTION 1-1
1.1 Background 1-1
1.1.1 Plant Parameter Envelope 1-2
1.1.2 Site Preparation and Preliminary Construction Activities 1-3
1.1.3 NRC ESP Application Review 1-3
1.1.4 USACE Permit Application Review 1-6
1.1.5 Preconstruction Activities 1-7
1.1.6 Cooperating Agencies 1-8
1.1.7 Concurrent NRC Reviews 1-9
1.2 The Proposed Federal Actions 1-10
1.3 The Purpose and Need for the Proposed Actions 1-11
1.3.1 NRC Proposed Action 1-11
1.3.2 The USACE Permit Action 1-11
1.4 Alternatives to the Proposed Actions 1-12
1.5 Compliance and Consultations 1-13
1.6 Report Contents 1-14
2.0 AFFECTED ENVIRONMENT 2-1
2.1 Site Location 2-1
2.2 Land Use 2-5
2.2.1 The Site and Vicinity 2-5
2.2.2 Offsite Areas 2-18
2.2.3 The Region 2-21
2.3 Water 2-24
2.3.1 Hydrology 2-24
2.3.2 Water Use 2-43
2.3.3 Water Quality 2-45
2.3.4 Water Monitoring 2-51
2.4 Ecology 2-51
2.4.1 Terrestrial and Wetland Ecology 2-51
2.4.2 Aquatic Ecology 2-83
2.5 Socioeconomics 2-118
2.5.1 Demographics 2-119
2.5.2 Community Characteristics 2-126
2.6 Environmental Justice 2-147
2.6.1 Methodology 2-148
2.6.2 Scoping and Outreach 2-157
2.6.3 Special Circumstances of the Minority and Low-Income Populations 2-157
2.6.4 Migrant Populations 2-158
2.6.5 Environmental Justice Summary 2-158
2.7 Historic and Cultural Resources 2-159
2.7.1 Cultural Background 2-161

2.7.2 Historic and Cultural Resources at the PSEG Site and Offsite Areas.. 2-163
2.7.3 Consultation.... 2-168
2.8 Geology.... 2-169
2.9 Meteorology and Air Quality.... 2-172
2.9.1 Climate.... 2-172
2.9.2 Air Quality.... 2-176
2.9.3 Atmospheric Dispersion.... 2-177
2.9.4 Meteorological Monitoring.... 2-180
2.10 Nonradiological Health.... 2-185
2.10.1 Public and Occupational Health.... 2-185
2.10.2 Noise.... 2-187
2.10.3 Transportation.... 2-188
2.10.4 Electromagnetic Fields.... 2-188
2.11 Radiological Environment.... 2-189
2.12 Related Federal Projects and Consultation.... 2-191
3.0 SITE LAYOUT AND PLANT PARAMETER ENVELOPE....3-1
3.1 External Appearance and Site Layout.... 3-1
3.2 Plant Parameter Envelope.... 3-4
3.2.1 Plant Water Use.... 3-7
3.2.2 Proposed Plant Structures.... 3-12
3.3 Construction and Preconstruction Activities.... 3-19
3.3.1 Site Preparation.... 3-20
3.3.2 Power Block Construction.... 3-22
3.3.3 Construction Workforce.... 3-25
3.3.4 Summary of Resource Commitments During Construction and Preconstruction.... 3-25
3.4 Operational Activities.... 3-26
3.4.1 Description of Cooling System Operational Modes.... 3-26
3.4.2 Plant-Environmental Interfaces During Operation.... 3-27
3.4.3 Radioactive Waste Management Systems.... 3-29
3.4.4 Nonradioactive Waste Management Systems.... 3-29
4.0 CONSTRUCTION IMPACTS AT THE PROPOSED SITE....4-1
4.1 Land-Use Impacts.... 4-4
4.1.1 The Site and Vicinity.... 4-4
4.1.2 Offsite Areas.... 4-8
4.2 Water-Related Impacts.... 4-12
4.2.1 Hydrological Alterations.... 4-13
4.2.2 Water-Use Impacts.... 4-18
4.2.3 Water-Quality Impacts.... 4-21
4.2.4 Hydrological Monitoring.... 4-24
4.3 Ecological Impacts.... 4-25
4.3.1 Terrestrial and Wetland Impacts.... 4-25
4.3.2 Summary of Impacts to Important Habitats.... 4-40
4.3.3 Aquatic Impacts.... 4-44
4.4 Socioeconomic Impacts.... 4-50
4.4.1 Physical Impacts.... 4-51
4.4.2 Demography.... 4-56
4.4.3 Economic Impacts to the Community.... 4-60
4.4.4 Infrastructure and Community Service Impacts.... 4-66
4.4.5 Summary of Socioeconomic Impacts.... 4-76
4.5 Environmental Justice Impacts.... 4-77

4.5.1 Health Impacts 4-77
4.5.2 Physical and Environmental Impacts 4-77
4.5.3 Socioeconomic Impacts 4-79
4.5.4 Subsistence and Special Conditions 4-79
4.5.5 Migrant Labor 4-80
4.5.6 Summary of Environmental Justice Impacts 4-80
4.6 Historic and Cultural Resources 4-80
4.7 Meteorological and Air-Quality Impacts 4-82
4.7.1 Construction and Preconstruction Activities 4-83
4.7.2 Traffic (Emissions) 4-85
4.7.3 Summary 4-86
4.8 Nonradiological Health Impacts 4-86
4.8.1 Public and Occupational Health 4-86
4.8.2 Noise Impacts 4-91
4.8.3 Impacts of Transporting Construction Materials and Construction Personnel to the PSEG Site 4-92
4.8.4 Summary of Nonradiological Health Impacts 4-93
4.9 Radiation Health Impacts 4-94
4.9.1 Direct Radiation Exposures 4-94
4.9.2 Radiation Exposures from Gaseous Effluents 4-95
4.9.3 Radiation Exposures from Liquid Effluents 4-96
4.9.4 Total Dose to Site Preparation Workers 4-96
4.9.5 Summary of Radiological Health Impacts 4-96
4.10 Nonradioactive Waste Impacts 4-97
4.10.1 Impacts to Land 4-97
4.10.2 Impacts to Water 4-97
4.10.3 Impacts to Air 4-98
4.10.4 Summary of Impacts 4-99
4.11 Measures and Controls to Limit Adverse Impacts During Construction Activities 4-99
4.12 Summary of Preconstruction and Construction Impacts 4-104
5.0 OPERATIONAL IMPACTS AT THE PROPOSED SITE 5-1
5.1 Land-Use Impacts 5-1
5.1.1 The Site and Vicinity 5-1
5.1.2 Offsite Areas 5-3
5.2 Water-Related Impacts 5-4
5.2.1 Hydrological Alterations 5-5
5.2.2 Water-Use Impacts 5-6
5.2.3 Water-Quality Impacts 5-10
5.2.4 Water Monitoring 5-16
5.3 Ecological Impacts 5-17
5.3.1 Terrestrial and Wetland Impacts Related to Operations 5-17
5.3.2 Aquatic Impacts Related to Operation 5-30
5.4 Socioeconomic Impacts 5-42
5.4.1 Physical Impacts 5-43
5.4.2 Demography 5-48
5.4.3 Economic Impacts to the Community 5-50
5.4.4 Infrastructure and Community Service Impacts 5-56
5.4.5 Summary of Socioeconomics 5-62
5.5 Environmental Justice 5-62
5.5.1 Health Impacts 5-63

5.5.2 Physical and Environmental Impacts 5-63
5.5.3 Socioeconomic Impacts 5-65
5.5.4 Subsistence and Special Conditions 5-65
5.5.5 Migrant Labor 5-66
5.5.6 Summary of Environmental Justice Impacts 5-66
5.6 Historic and Cultural Resources 5-66
5.7 Meteorology and Air Quality Impacts 5-67
5.7.1 Air Quality Impacts 5-67
5.7.2 Cooling System Impacts 5-71
5.7.3 Transmission Line Impacts 5-75
5.7.4 Summary 5-76
5.8 Nonradiological Health Impacts 5-76
5.8.1 Etiological Agents 5-76
5.8.2 Noise 5-78
5.8.3 Acute Effects of Electromagnetic Fields 5-79
5.8.4 Chronic Effects of Electromagnetic Fields 5-79
5.8.5 Occupational Health 5-80
5.8.6 Impacts of Transporting Operations Personnel to the PSEG Site 5-81
5.8.7 Summary of Nonradiological Health Impacts 5-82
5.9 Radiological Impacts of Normal Operations 5-82
5.9.1 Exposure Pathways 5-82
5.9.2 Radiation Doses to Members of the Public 5-86
5.9.3 Impacts to Members of the Public 5-88
5.9.4 Occupational Doses to Workers 5-91
5.9.5 Impacts to Biota Other than Humans 5-91
5.9.6 Radiological Monitoring 5-93
5.10 Nonradiological Waste Impacts 5-94
5.10.1 Impacts to Land 5-95
5.10.2 Impacts to Water 5-95
5.10.3 Impacts to Air 5-96
5.10.4 Mixed Waste Impacts 5-96
5.10.5 Summary of Waste Impacts 5-96
5.11 Environmental Impacts of Postulated Accidents 5-97
5.11.1 Design-Basis Accidents 5-101
5.11.2 Severe Accidents 5-107
5.11.3 Severe Accident Mitigation Alternatives 5-119
5.11.4 Summary of Postulated Accident Impacts 5-119
5.12 Measures and Controls to Limit Adverse Impacts During Operation 5-119
5.13 Summary of Operational Impacts 5-124
6.0 FUEL CYCLE, TRANSPORTATION, AND DECOMMISSIONING 6-1
6.1 Fuel Cycle Impacts and Solid Waste Management 6-1
6.1.1 Land Use 6-8
6.1.2 Water Use 6-9
6.1.3 Fossil Fuel Impacts 6-9
6.1.4 Chemical Effluents 6-10
6.1.5 Radiological Effluents 6-11
6.1.6 Radiological Wastes 6-13
6.1.7 Occupational Dose 6-17
6.1.8 Transportation 6-17
6.1.9 Summary 6-17
6.2 Transportation Impacts 6-17

6.2.1 Transportation of Unirradiated Fuel 6-20
6.2.2 Transportation of Spent Fuel 6-29
6.2.3 Transportation of Radioactive Waste 6-41
6.2.4 Conclusions for Transportation 6-44
6.3 Decommissioning Impacts 6-45
7.0 CUMULATIVE IMPACTS 7-1
7.1 Land Use 7-6
7.2 Water Use and Quality 7-10
7.2.1 Water Use Impacts 7-10
7.2.2 Water Quality Impacts 7-14
7.3 Ecology 7-18
7.3.1 Terrestrial and Wetlands Resources 7-18
7.3.2 Aquatic Ecosystem 7-25
7.4 Socioeconomics and Environmental Justice 7-30
7.4.1 Socioeconomics 7-30
7.4.2 Environmental Justice 7-33
7.5 Historic and Cultural Resources 7-34
7.6 Air Quality 7-35
7.6.1 Criteria Pollutants 7-35
7.6.2 Greenhouse Gas Emissions 7-37
7.6.3 Summary 7-39
7.7 Nonradiological Health 7-39
7.8 Radiological Impacts of Normal Operation 7-42
7.9 Nonradiological Waste Systems 7-43
7.10 Postulated Accidents 7-44
7.11 Fuel Cycle, Transportation, and Decommissioning 7-45
7.11.1 Fuel Cycle 7-46
7.11.2 Transportation of Radioactive Material 7-46
7.11.3 Decommissioning 7-47
7.11.4 Summary of Cumulative Fuel Cycle, Transportation, and Decommissioning Impacts 7-48
7.12 Conclusions and Recommendations 7-48
8.0 NEED FOR POWER 8-1
8.1 Description of Power System 8-2
8.1.1 Rationale for Choosing New Jersey as the Market Area 8-3
8.1.2 Structure of Power Markets Serving New Jersey 8-4
8.1.3 Electric System Reliability in New Jersey 8-7
8.1.4 Forecasting Model Methodology and Sufficiency Attributes 8-10
8.2 Power Demand 8-12
8.2.1 Factors Affecting Power Growth and Demand 8-12
8.2.2 Historic and Forecast Electricity Demand 8-15
8.3 Power Supply 8-17
8.4 Assessment of Need for Power 8-21
8.5 Conclusion 8-22
9.0 ENVIRONMENTAL IMPACTS OF ALTERNATIVES 9-1
9.1 No-Action Alternative 9-3
9.2 Energy Alternatives 9-3
9.2.1 Alternatives Not Requiring New Generation Capacity 9-4
9.2.2 Alternatives Requiring New Generation Capacity 9-8
9.2.3 Feasible Discrete New Generating Alternatives 9-20
9.2.4 Combination of Alternatives 9-35

9.2.5 Summary Comparison of Alternatives 9-41
9.3 Alternative Sites 9-44
9.3.1 Alternative Site Selection Process 9-44
9.3.2 Site 4-1 9-56
9.3.3 Site 7-1 9-107
9.3.4 Site 7-2 9-148
9.3.5 Site 7-3 9-188
9.3.6 Comparison of the Impacts of the Proposed Action and Alternative Sites 9-229
9.4 System Design Alternatives 9-235
9.4.1 Heat Dissipation Systems 9-235
9.4.2 Circulating Water System Alternatives 9-237
9.4.3 Summary 9-243
10.0 CONCLUSIONS AND RECOMMENDATIONS 10-1
10.1 Impacts of the Proposed Action 10-4
10.2 Unavoidable Adverse Environmental Impacts 10-4
10.2.1 Unavoidable Adverse Impacts during Construction and Preconstruction 10-4
10.2.2 Unavoidable Adverse Impacts during Operation 10-12
10.3 Relationship Between Short-Term Uses and Long-Term Productivity of the Human Environment 10-19
10.4 Irreversible and Irretrievable Commitments of Resources 10-19
10.4.1 Irreversible Commitments of Resources 10-20
10.4.2 Irretrievable Commitments of Resources 10-21
10.5 Alternatives to the Proposed Action 10-22
10.6 Benefit-Cost Balance 10-23
10.6.1 Benefits 10-24
10.6.2 Costs 10-28
10.6.3 Summary of Benefits and Costs 10-34
10.7 Staff Conclusions and Recommendations 10-35
11.0 REFERENCES 11-1
APPENDIX A CONTRIBUTORS TO THE ENVIRONMENTAL IMPACT STATEMENT A-1
APPENDIX B ORGANIZATIONS CONTACTED B-1
APPENDIX C CHRONOLOGY OF NRC AND USACE STAFF ENVIRONMENTAL REVIEW CORRESPONDENCE RELATED TO THE PSEG APPLICATION FOR AN EARLY SITE PERMIT (ESP) AT THE PSEG SITE C-1
APPENDIX D SCOPING COMMENTS AND RESPONSES D-1
APPENDIX E DRAFT ENVIRONMENTAL IMPACT STATEMENT COMMENTS AND RESPONSES E-1
APPENDIX F KEY CONSULTATION CORRESPONDENCE F-1
APPENDIX G SUPPORTING INFORMATION AND DATA: POPULATION PROJECTIONS AND RADIOLOGICAL DOSE ASSESSMENT G-1
APPENDIX H LIST OF AUTHORIZATIONS, PERMITS, AND CERTIFICATIONS H-1
APPENDIX I PSEG SITE CHARACTERISTICS AND PLANT PARAMETER ENVELOPE VALUES I-1
APPENDIX J PSEG REPRESENTATIONS AND ASSUMPTIONS J-1
APPENDIX K GREENHOUSE GAS FOOTPRINT ESTIMATES FOR A REFERENCE 1,000-MW(E) LIGHT WATER REACTOR (LWR) K-1

FIGURES

Figure		Page
ES-1	PSEG Site Location and Vicinity.	xxiii
ES-2	Map Showing the Locations of Alternative Sites.	xxix
2-1	PSEG Site Location Vicinity (6-mi boundary) and Region (50-mi ring).	2-2
2-2	PSEG Site Utilization Plan.	2-3
2-3	Aerial View of the Existing PSEG Property.	2-4
2-4	PSEG Site and Near Offsite Land Use.	2-7
2-5	NJDEP 2002 Land Use/Land Cover Within the PSEG Site.	2-8
2-6	USACE Jurisdictional Determination Block 26, Lots 2, 4, 4.01, 5, and 5.01, Lower Alloways Creek Township.	2-11
2-7	Land Use Within the Vicinity of the PSEG Site.	2-14
2-8	Farmland Resources in the Vicinity of the PSEG Site.	2-16
2-9	Major Transportation Features in the PSEG Site Region.	2-17
2-10	Existing PSEG Transmission Corridors.	2-19
2-11	Land Management Areas along the Proposed Causeway Route.	2-22
2-12	Land Use in the PSEG Site Region.	2-23
2-13	The Delaware River Watershed.	2-26
2-14	Streams on and near the PSEG Site Identified Using the High-Resolution USGS National Hydrography Dataset (NHD).	2-28
2-15	Annual Discharge at the Trenton USGS Streamflow Gage.	2-33
2-16	Characteristics of the Monthly Discharge During Water Years 1913–2011 at the Trenton USGS Streamflow Gage.	2-34
2-17	Cross-Section Through the Southern New Jersey Coastal Plain Aquifer System.	2-38
2-18	Hydrogeologic Units at the PSEG Site.	2-40
2-19	Surface Water Quality Sampling Locations on and Near the PSEG Site.	2-46
2-20	Chloride Data for the HCGS and SGS Groundwater Production Wells for the Period 2003–2013.	2-50
2-21	Surface Waters and Ponds On and Near the PSEG Site Providing Habitat for Aquatic Resources.	2-84
2-22	Delaware Bay and River Sampling Zones: Zones 1, 2, and 3 lower bay; Zones 4, 5, and 6 middle bay; Zones 7 and 8 upper bay; Zones 9 through 14 Delaware River.	2-95
2-23	Local Road Network in the Vicinity of the PSEG Site.	2-135
2-24	Aggregate of Minorities Block Groups Within 50 Mi of the PSEG Site.	2-152
2-25	Hispanic Ethnicity Block Groups Within 50 Mi of the PSEG Site.	2-153
2-26	Black Minority Block Groups Within 50 Mi of the PSEG Site.	2-155
2-27	Low-Income Household Block Groups Within 50 Mi of the PSEG Site.	2-156
2-28	The USACE Permit Area and NRC Area of Potential Effect for Section 106 review.	2-160
2-29	Underwater Portion of the USACE Permit Area.	2-161
2-30	Stratigraphic Section of the PSEG Site.	2-170
2-31	View of SGS and HCGS Looking West-Northwest from the Existing PSEG Meteorological Tower Unit.	2-181
2-32	Existing PSEG Meteorological Tower and Meteorological Building with Backup Meteorological Tower in Foreground.	2-182

2-33 Close-up View of 33-ft Instrument Boom (dew-point sensor can be seen near top left corner of image; dry-bulb temperature, wind speed, wind direction, and delta-temperature instruments are at the end of the boom on the right side of the image). 2-183
3-1 Existing Salem Generating Station and Hope Creek Generating Station Site. 3-2
3-2 Plant Water Use. 3-10
3-3 Photo Simulation Showing the Existing Hope Creek Generating Station Cooling Tower (Left), the Existing Hope Creek-Red Lion Transmission Line (Left), the Two Potential New Cooling Towers (Right), a Potential New Transmission Line (Right), and the Potential New Causeway as Viewed from the Money Island Estuary Platform. 3-18
4-1 Land Use/Land Cover Impacted by Preconstruction and Construction at the PSEG Site and in the Vicinity. 4-6
5-1 Theis analytical solution (left) compared with model results from Figure 44 of Dames and Moore (Dames and Moore 1988-TN3311) (20 years of pumping 493 gpm from the middle PRM aquifer). 5-9
5-2 Predicted PSEG Thermal Plume in Relation to the Approximate Locations of the HCGS HDA and the SGS Plume Boundary Under Flood Tide Conditions. 5-13
5-3 LMDCT Salt Deposition Rates. 5-19
5-4 Simulations of the appearance of new nuclear power plant facilities at the PSEG Site from Augustine Beach access and Collins Beach Road, New Castle County, Delaware. 5-46
5-5 Simulations of the appearance of new nuclear power plant facilities at the PSEG Site and the proposed causeway from the Hancocks Bridge community and the Money Island Estuary Platform in Salem County, New Jersey. 5-47
5-6 Exposure Pathways to Humans. 5-84
5-7 Exposure Pathways to Biota Other than Humans. 5-85
6-1 The Uranium Fuel Cycle: No-Recycle Option. 6-6
6-2 Illustration of Truck Stop Model. 6-33
8-1 PJM Interconnection, LLC, Service Area. 8-5
8-2 New Jersey Electric Utility Service Areas. 8-6
8-3 Map of the ReliabilityFirst Region. 8-8
8-4 DOE-Designated Critical Congestion Area and Congestion Area of Concern in the Eastern Interconnection. 8-9
8-5 Actual and Forecast Summer Peak Demand in the PJM RTO 2006–2012. 8-11
8-6 Historic and Projected Electricity Demand in New Jersey (MW) 1998–2023. 8-16
8-7 Generation Resources by Fuel Type, 2007–2012. 8-19
9-1 Map Showing the Locations of PSEG Alternative Sites. 9-48
9-2 County Preserved Farmland at Alternative Site 4-1. 9-61
9-3 Deed of Conservation Restriction Parcel at Alternative Site 4-1. 9-62
9-4 Wildlife Sanctuaries, Refuges, and Preserves Within the 6-mi Vicinity of Alternative Site 4-1. 9-76
9-5 Aggregate of Minorities Block Groups Within 50 Mi of Site 4-1. 9-97
9-6 Low-Income Block Groups Within 50 Mi of Site 4-1. 9-98
9-7 County Preserved Farmland at Alternative Site 7-1. 9-112
9-8 Wildlife Sanctuaries, Refuges, and Preserves Within the 6-mi Vicinity of Alternative Site 7-1. 9-125
9-9 Wildlife Sanctuaries, Refuges, and Preserves Within the 6-mi Vicinity of Alternative Site 7-2. 9-165
9-10 Deed of Conservation Restriction Parcels at Site 7-3. 9-193
9-11 Wildlife Sanctuaries, Refuges, and Preserves Within the 6-mi Vicinity of Site 7-3. 9-205

TABLES

Table		Page
ES-1	Cumulative Impacts on Environmental Resources, Including the Impacts of a New Nuclear Power Plant at the PSEG Site	xxv
ES-2	Comparison of Environmental Impacts of Energy Alternatives	xxvii
ES-3	Comparison of Environmental Impacts at Alternative Sites	xxx
2-1	NJDEP 2002 Land Use/Land Cover (LULC) Within the Proposed PSEG Site	2-9
2-2	Land Use in the Vicinity (6-mi radius) and Region (50-mi radius) of the PSEG Site	2-15
2-3	Land Use in the Existing PSEG Transmission Line Corridors and in the Existing PSEG Access Road Right-of-Way (ROW)	2-20
2-4	Parameters Measured Daily at U.S. Geological Survey (USGS) Stream Gages in the Delaware River near the PSEG Site	2-29
2-5	Annual Discharge in the Delaware River at Trenton, New Jersey	2-31
2-6	Reservoirs in the Delaware River Basin with Storages Exceeding 10,000 ac-ft	2-34
2-7	Approximate Top Elevation and Thickness for Hydrogeologic Units at the PSEG Site (summary of ER Section 2.6.2)	2-41
2-8	Threatened (T), Endangered (E), and Special Concern (SC) Species Potentially Occurring in the Vicinity of the PSEG Site	2-63
2-9	Fish Species Sampled in Ponds and Marsh Creeks in the Vicinity of the PSEG Site in 2009 and Between 2003 and 2010	2-87
2-10	Macroinvertebrates Sampled in Ponds, Onsite Marsh Creeks, Offsite Large Marsh Creeks, and Nearshore Delaware River Estuary in the Vicinity of the PSEG Site in 2009 (PSEG 2013-TN2586)	2-90
2-11	Fish Species and Blue Crab Abundance from Bottom and Pelagic Trawl and Seining Sampling in the Delaware River Estuary and Near the PSEG Site Between 2003 and 2010	2-92
2-12	Federally and State-Listed Species in the Vicinity of the PSEG Site and Existing Transmission Corridors	2-113
2-13	Recent Population and Growth Rates of Counties in the Economic Impact Area	2-120
2-14	Population of Counties, Townships and Municipalities Within 10 mi of PSEG	2-120
2-15	Historical and Projected Populations in the Economic Impact Area and the States of Delaware and New Jersey, 1970–2040	2-122
2-16	Percentage Age and Gender Distribution in the Economic Impact Area	2-123
2-17	Household Income Distribution (Percent of Households) Within the Economic Impact Area in 2011 Inflation-Adjusted Dollars	2-123
2-18	Racial and Ethnic Distribution Within the Economic Impact Area	2-124
2-19	Estimates of the Transient and Migrant Worker Populations in the Economic Impact Area	2-125
2-20	2011 Annual Average Labor Force, Employment, and Unemployment in Counties of the Impact Area and in the States of New Jersey and Delaware	2-127
2-21	Annual Unemployment Rates (percent) for Counties of the Economic Impact Area and the States of New Jersey and Delaware, 2002 to 2011	2-127
2-22	Total Employment by Industry Type in the Economic Impact Area (2012)	2-129
2-23	HCGS and SGS Employee Distribution by State and County as of 2008	2-130
2-24	Residential Locations of Outage Workers for the Largest Recent Outage at the HCGS/SGS Site	2-131

2-25 Per Capita Income for Counties of the Impact Area and the States of New Jersey and Delaware, 2002 to 2011 2-131
2-26 Tax Rates for Counties in Economic Impact Area and States 2-132
2-27 Operation-Related Payroll and Purchases for Materials and Services (2005 to 2008) for HCGS and SGS 2-133
2-28 Annual Average Daily Traffic Counts on Selected Roads Near the PSEG Site 2-136
2-29 Business and General Aviation Airports Serving the Economic Impact Area 2-137
2-30 Housing Data for Counties in the Economic Impact Area (2012) 2-139
2-31 Major Water Supply Systems (Serving 5,000 or More People) in New Jersey Counties of the Economic Impact Area 2-141
2-32 Public Wastewater Treatment Systems in the Economic Impact Area (2008) 2-143
2-33 Local Law Enforcement Personnel in Counties of the Economic Impact Area 2-145
2-34 Public School Enrollment, Teachers, and Student-to-Teacher Ratios in the Economic Impact Area and State 2-147
2-35 Statewide Percent Minority Populations and Associated 20 Percentage Point Threshold Criteria for the 50-mi Region 2-151
2-36 Distribution of Census Block Groups Exceeding Environmental Justice Thresholds in the Economic Impact Area 2-154
2-37 Historic Properties within the 4.9-mi Area of Potential Effect that are Visible from the PSEG Site 2-167
2-38 Mean Seasonal and Annual Morning and Afternoon Mixing Heights and Wind Speeds at the PSEG Site 2-178
2-39 Atmospheric Dispersion Factors for Proposed Units 1 and 2 Design Basis Accident Calculations 2-179
2-40 Maximum Annual Average Atmospheric Dispersion (χ/Q) and Deposition Factors (D/Q) for Evaluation of Normal Effluents for Receptors of Interest 2-179
2-41 Existing PSEG Meteorological Instrumentation Performance Specifications 2-184
3-1 Plant Water Use 3-9
3-2 Anticipated Schedule for Preconstruction and Construction at the PSEG Site 3-20
3-3 Summary of Resource Commitments Associated with Preconstruction and Construction at the PSEG Site 3-25
3-4 Annual Estimated Pollutant Emissions from Cooling Towers, Auxiliary Boilers, and Stationary Fuel-Burning Emergency Power Equipment at a New Nuclear Power Plant at the PSEG Site 3-28
3-5 Blowdown Constituents and Concentrations in Liquid Effluent Discharge 3-30
4-1 Land-Use Changes from Preconstruction and Construction Activities on the PSEG Site 4-5
4-2 Offsite Land-Use Changes from Building the Proposed Causeway 4-9
4-3 Estimated Construction Workforce Requirements by Construction Month 4-57
4-4 Projected Construction Labor Availability and Onsite Labor Requirement 4-59
4-5 Estimated Population Increase in the Economic Impact Area During the Peak Building Period 4-60
4-6 Estimated Annual Purchases of Services and Materials During the Building Period 4-62
4-7 Expected Distribution of Newly Created Workers in the Economic Impact Area at Peak Employment 4-63
4-8 Estimated Increase in Income Tax Revenue Associated with Workforce 4-64
4-9 Estimated Sales Tax Revenue on Purchases During Building Period 4-65
4-10 Level of Service (LOS) Ranges 4-67
4-11 Traffic Impact Analysis Assumptions 4-67
4-12 Impacts on Roadways around PSEG Site during Peak Building 4-68

4-13 Estimated Housing Impacts in the Economic Impact Area 4-71
4-14 Estimated Water Supply Impacts in the Economic Impact Area....4-73
4-15 Estimated Wastewater Supply Impacts in the Economic Impact Area 4-73
4-16 Estimated Number of School-Aged Children Associated with In-Migrating Workforce Associated with Building at the PSEG Site 4-75
4-17 Typical Noise and Emissions from Construction Equipment and Light Vehicles Used in Major Construction Projects....4-88
4-18 Projected Total Nonfatal Occupational Illnesses and Injuries to Construction Force Using 2009 Rates for Various Groups 4-90
4-19 Nonradiological Impacts of Transporting Construction Workers to and from the PSEG Site 4-93
4-20 Measures and Controls to Limit Adverse Impacts when Building a New Nuclear Power Plant at the PSEG Site 4-100
4-21 Summary of Impacts from Building a New Nuclear Power Plant at the PSEG Site 4-105
5-1 Maximum Predicted Salt Deposition Rate....5-18
5-2 Ambient Noise Levels at HCGS and SGS in February 2009....5-20
5-3 Impingement Rate for Important Most Abundant and Total Finfish Species and Blue Crab Impinged at SGS and HCGS 5-32
5-4 Estimated Population Increase in the Economic Impact Area During Operations 5-49
5-5 Estimated Annual Purchases of Services and Materials During Operations 5-51
5-6 Expected Distribution of Newly Created Workers in the Economic Impact Area During Operations 5-52
5-7 Estimated Increase in Income Tax Revenue Associated with Workforce....5-53
5-8 Estimated Sales Tax Revenue on Purchases During Operations 5-54
5-9 Estimated Housing Impacts in the Economic Impact Area....5-57
5-10 Estimated Water Supply Impacts in the Economic Impact Area....5-59
5-11 Estimated Wastewater Supply Impacts in the Economic Impact Area 5-59
5-12 Estimated Number of School-aged Children Associated with In-migrating Workforce Associated with Operations at the PSEG Site 5-61
5-13 Annual Estimated Emissions from Cooling Towers, Auxiliary Boilers, and Emergency Power Supply System Diesel Generators at the PSEG Site....5-69
5-14 Nonradiological Impacts of Transporting Operations Personnel to and from the PSEG Site 5-82
5-15 Doses to the MEI for Liquid Effluent Releases from PSEG....5-86
5-16 Doses to the MEI from the Gaseous Effluent Pathway for a New Nuclear Power Plant....5-87
5-17 Comparison of MEI Dose Estimates from Liquid and Gaseous Effluents of the PSEG Site to Design Objectives....5-89
5-18 Comparison of Doses for the PSEG Site to 40 CFR 190 5-90
5-19 Biota Other Than Human Doses from Liquid and Gaseous Effluents (per new unit)....5-92
5-20 Comparison of Biota Dose Rate from a New Nuclear Power Plant at the PSEG Site to IAEA Guidelines for Biota Protection 5-93
5-21 Atmospheric Dispersion Factors for PSEG Site DBA Calculations....5-103
5-22 Design Basis Accident Doses for US-APWR 5-103
5-23 Design Basis Accident Doses for U.S. EPR....5-104
5-24 Design Basis Accident Doses for AP1000 Reactor....5-105
5-25 Design Basis Accident Doses for ABWR 5-105
5-26 Environmental Risks from a US-APWR Severe Accident at the PSEG Site 5-109

5-27 Environmental Risks from AP1000 Reactor Severe Accident at the PSEG Site 5-110
5-28 Environmental Risks from a U.S. EPR Severe Accident at the PSEG Site 5-111
5-29 Environmental Risks from an ABWR Severe Accident at the PSEG Site 5-112
5-30 Comparison of Environmental Risks for a New Nuclear Power Plant at the PSEG Site with Risks for Current-Generation Reactors at Five Sites Evaluated in NUREG–1150 5-114
5-31 Comparison of Environmental Risks from Severe Accidents for a US-APWR, an AP1000, a U.S. EPR, and an ABWR at the PSEG Site with Risks for Current Plants from Operating License Renewal Reviews 5-116
5-32 Measures and Controls to Limit Adverse Impacts During Operation of a New Nuclear Power Plant at the PSEG Site 5-120
5-33 Summary of Operational Impacts for a New Nuclear Power Plant at the PSEG Site 5-125
6-1 Uranium Fuel Cycle Environmental Data as Provided in Table S–3 of 10 CFR 51.51(b) 6-2
6-2 Comparison of Annual Average Dose Received by an Individual from All Sources 6-13
6-3 Number of Truck Shipments of Unirradiated Fuel for the Reference LWR and ABWR, AP1000, U.S. EPR, and US-APWR Reactors at the PSEG Site, Normalized to the Reference LWR [880 MW(e) (net)] 6-21
6-4 RADTRAN 5.6 Input Parameters for Reference LWR Fresh Fuel Shipments 6-23
6-5 Radiological Impacts Under Normal Conditions of Transporting Unirradiated Fuel to the PSEG Site or Alternative Sites for a Single Reactor, Normalized to Reference LWR [880 MW(e) (net)] 6-24
6-6 Nonradiological Impacts of Transporting Unirradiated Fuel to the PSEG Site and Alternative Sites with a Single Reactor, Normalized to Reference LWR [880 MW(e) (net)] 6-28
6-7 Transportation Route Information for Shipments from the PSEG Site and Alternative Sites to the Yucca Mountain Spent Fuel Disposal Facility 6-31
6-8 RADTRAN 5.6 Normal (Incident-Free) Exposure Parameters 6-32
6-9 Normal (Incident-Free) Radiation Doses to Transport Workers and the Public from Shipping Spent Fuel from the PSEG Site and Alternative Sites to the Proposed High-Level Waste Repository at Yucca Mountain, Normalized to Reference LWR [880 MW(e) (net)] 6-34
6-10 Radionuclide Inventories Used in Transportation Accident Risk Calculations for the US-APWR, U.S. EPR, ABWR, and AP1000 Reactors 6-37
6-11 Annual Spent Fuel Transportation Accident Impacts for a Single Reactor at the PSEG Site and Alternative Sites, Normalized to Reference LWR Reactor [880 MW(e) (net)] 6-39
6-12 Nonradiological Impacts of Transporting Spent Fuel from the PSEG Site and Alternative Sites to Yucca Mountain for a Single Reactor, Normalized to Reference LWR [880 MW(e) (net)] 6-40
6-13 Summary of Radioactive Waste Shipments from the PSEG Site and Alternative Sites for a Single Reactor, Normalized to Reference LWR [880 MW(e) (net)] 6-42
6-14 Nonradiological Impacts of Radioactive Waste Shipments from the PSEG Site and Alternative Sites with a Single Reactor, Normalized to Reference LWR [880 MW(e) (net)] 6-43
7-1 Projects and Other Actions Considered in the Cumulative Impacts Analysis for the PSEG Site 7-2
7-2 PSEG Estimates of Land Use Impacts Associated with a Potential Offsite Transmission Line Right-of-Way 7-9

7-3 Comparison of Annual Carbon Dioxide (CO_2) Emissions 7-38
7-4 Cumulative Impacts on Environmental Resources, Including the Impacts of a New Nuclear Power Plant at the Site 7-49
8-1 Historical and Forecast Annual Growth Rate of New Jersey's Population, 1995 to 2025 8-13
8-2 Energy Consumption by Customer Class, New Jersey, 2013 8-13
8-3 Electricity Demand in New Jersey for 2014–2023 (MW) 8-16
8-4 Total Electricity Needed in New Jersey in 2023 8-17
8-5 New Jersey Electricity Supply by Fuel (MW) 8-18
8-6 New Jersey Summer Peak Load (MW) by Region 8-20
8-7 Need for Power in New Jersey in 2023 8-22
9-1 Summary of Environmental Impacts of Coal-Fired Power Generation at the PSEG Site 9-28
9-2 Summary of Environmental Impacts of Natural-Gas-Fired Power Generation 9-34
9-3 Summary of Environmental Impacts of a Combination of Power Sources 9-38
9-4 Summary of Environmental Impacts (Impact Category Level) of Constructing and Operating New Nuclear, Coal-Fired, and Natural-Gas-Fired Power Generating Units and a Combination of Alternatives 9-41
9-5 Comparison of Carbon Dioxide Emissions for Energy Alternatives 9-42
9-6 Rankings of the Candidate Sites Based on Total Numerical Scores 9-50
9-7 Weighted Numerical Scores for the Candidate Sites Based on Three Categories of Site Characteristics 9-50
9-8 Projects and Other Actions Considered in the Cumulative Impacts Analysis for Site 4-1 9-57
9-9 Delaware River Reduction in Flow and Assessed Impact Levels 9-67
9-10 State and Federal Threatened, Endangered, and Rare Species Recorded in the Site 4-1 Area 9-75
9-11 Federally and State-Listed Aquatic Species in Hunterdon County, New Jersey, Near the Proposed Location of Water Intake and Discharge Structures 9-83
9-12 Estimated Population Increase in the Alternative 4-1 Site Economic Impact Area 9-88
9-13 Housing Units at the Alternative 4-1 Site in Hunterdon and Bucks Counties 9-93
9-14 Estimated Number of School-Aged Children Associated with the In-migrating Workforce Associated with Building and Operations at Site 4-1 9-94
9-15 Projects and Other Actions Considered in the Cumulative Impacts Analysis for Site 7-1 9-108
9-16 State and Federal Threatened, Endangered, and Rare Species Recorded in the Site 7-1 Area 9-123
9-17 Federally and State-Listed Aquatic Species in the Delaware River Estuary Near Site 7-1 9-131
9-18 Projects and Other Actions Considered in the Cumulative Impacts Analysis for Site 7-2 9-150
9-19 State and Federal Threatened, Endangered, and Rare Species Recorded in the Site 7-2 Area 9-164
9-20 Federally and State-Listed Aquatic Species in the Delaware River Estuary Near Site 7-2 9-171
9-21 Projects and Other Actions Considered in the Cumulative Impacts Analysis for Site 7-3 9-189
9-22 State and Federal Threatened, Endangered, and Rare Species Recorded in the Site 7-3 Area 9-204
9-23 Federally and State-Listed Aquatic Species in the Delaware River Estuary Near Site 7-3 9-212

9-24 Comparison of Cumulative Impacts at the Proposed PSEG Site and Four Alternative Sites 9-232
10-1 Unavoidable Adverse Environmental Impacts During Construction and Preconstruction 10-5
10-2 Unavoidable Adverse Environmental Impacts from Operations 10-13
10-3 Benefits of Building and Operating a New Nuclear Power Plant at the PSEG Site (in 2013 U.S. dollars)....10-25
10-4 Internal and External Costs of Building and Operations at the PSEG Site (in 2013 U.S. dollars)....10-28

EXECUTIVE SUMMARY

This environmental impact statement (EIS) presents the results of a U.S. Nuclear Regulatory Commission (NRC) environmental review of an application for an early site permit (ESP) at a proposed site in Salem County, New Jersey. The U.S. Army Corps of Engineers (USACE) participated in the preparation of the EIS as a cooperating agency and as a collaborative member of the review team, which consisted of the NRC staff, its contractor staff, and the USACE staff.

Background

On May 25, 2010, PSEG Power, LLC, and PSEG Nuclear, LLC (PSEG) submitted an application to the NRC for an ESP at the PSEG Site located adjacent to the existing Hope Creek Generating Station (HCGS) and Salem Generating Station (SGS) in Lower Alloways Creek Township, Salem County, New Jersey. On March 31, 2014, PSEG submitted a third revised version of its application, which also included an Environmental Report (ER).

Upon acceptance of PSEG's initial application, the NRC review team began the environmental review process as described in Title 10 of the *Code of Federal Regulations* (CFR) Part 52 by publishing in the *Federal Register* on October 15, 2010, a Notice of Intent to prepare an EIS and conduct scoping. As part of the environmental review, the review team

- considered comments received during the 60-day scoping process that began on October 15, 2010, and conducted related public scoping meetings on November 4, 2010, in Carneys Point, New Jersey;
- conducted site audits from April 17, 2012, through April 19, 2012, and from May 7, 2012, through May 11, 2012;
- reviewed PSEG's ER and developed requests for additional information using guidance from NUREG–1555, *Standard Review Plans for Environmental Reviews for Nuclear Power Plants: Environmental Standard Review Plan*; and
- consulted with Native American tribes and Federal and State agencies such as the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, the Advisory Council on Historic Preservation, the New Jersey Department of Environmental Protection, the New Jersey State Historic Preservation Office, and the State of Delaware Office of Historical and Cultural Affairs.

Proposed Action

The proposed actions related to the PSEG application are (1) the NRC issuance of an ESP for the PSEG Site and (2) the USACE issuance of a permit pursuant to Section 404 of the Federal Water Pollution Control Act [Clean Water Act (CWA)] and Section 10 of the Rivers and Harbors Appropriation Act of 1899, as amended, to perform certain dredge and fill activities on the site.

Purpose and Need for Action

The purpose and need for the NRC proposed action—issuance of the ESP—is to provide for early resolution of site safety and environmental issues, which provides stability in the licensing process. Although no reactor will be built at the PSEG Site under this action (the ESP), to resolve environmental issues the staff assumed in this EIS that one or two reactors with the parameters specified in the plant parameter envelope (PPE) would be built and operated. Any new nuclear plant would provide for additional electrical generating capacity to meet the need for baseload power of at least 2,200 MW(e) in the State of New Jersey by 2021.

The objective of the PSEG-requested USACE action is to obtain a Department of the Army individual permit to perform regulated dredge and fill activities that would affect wetlands and other waters of the United States. The basic purpose of obtaining the Army individual permit is for PSEG to conduct work associated with building a power plant to generate electricity for additional baseload capacity.

Public Involvement

A 60-day scoping period was held from October 15, 2010, through December 14, 2010. On November 4, 2010, the NRC held public scoping meetings in Carneys Point, New Jersey. The review team received many oral comments during the public meetings and a total of 12 written statements, 7 letters, and 1 e-mail during the scoping period on topics such as surface-water hydrology, ecology, socioeconomics, historic and cultural resources, air quality, uranium fuel cycle, energy alternatives, and benefit-cost balance.

Affected Environment

The PSEG Site is located on the southern part of Artificial Island adjacent to the existing HCGS and SGS, Units 1 and 2, in Lower Alloways Creek Township, Salem County, New Jersey. The PSEG Site is on the eastern bank of the Delaware River about 18 mi south of Wilmington, Delaware, and 30 mi southwest of Philadelphia, Pennsylvania. The site is about 7 mi east of Middletown, Delaware; 7.5 mi southwest of Salem, New Jersey; and 9 mi south of Pennsville, New Jersey. Figure ES-1 depicts the location of the PSEG Site in relation to nearby counties and cities within the context of the 50-mi region and the 6-mi vicinity.

Cooling water for any new nuclear units constructed at the PSEG Site would be obtained from the Delaware River. These units would use either mechanical or natural draft cooling towers to transfer waste heat to the atmosphere. A portion of the water obtained from the Delaware River would be returned to the environment via a discharge structure located in the Delaware River on the western side of Artificial Island. The remaining portion of the water would be released to the atmosphere via evaporative cooling.

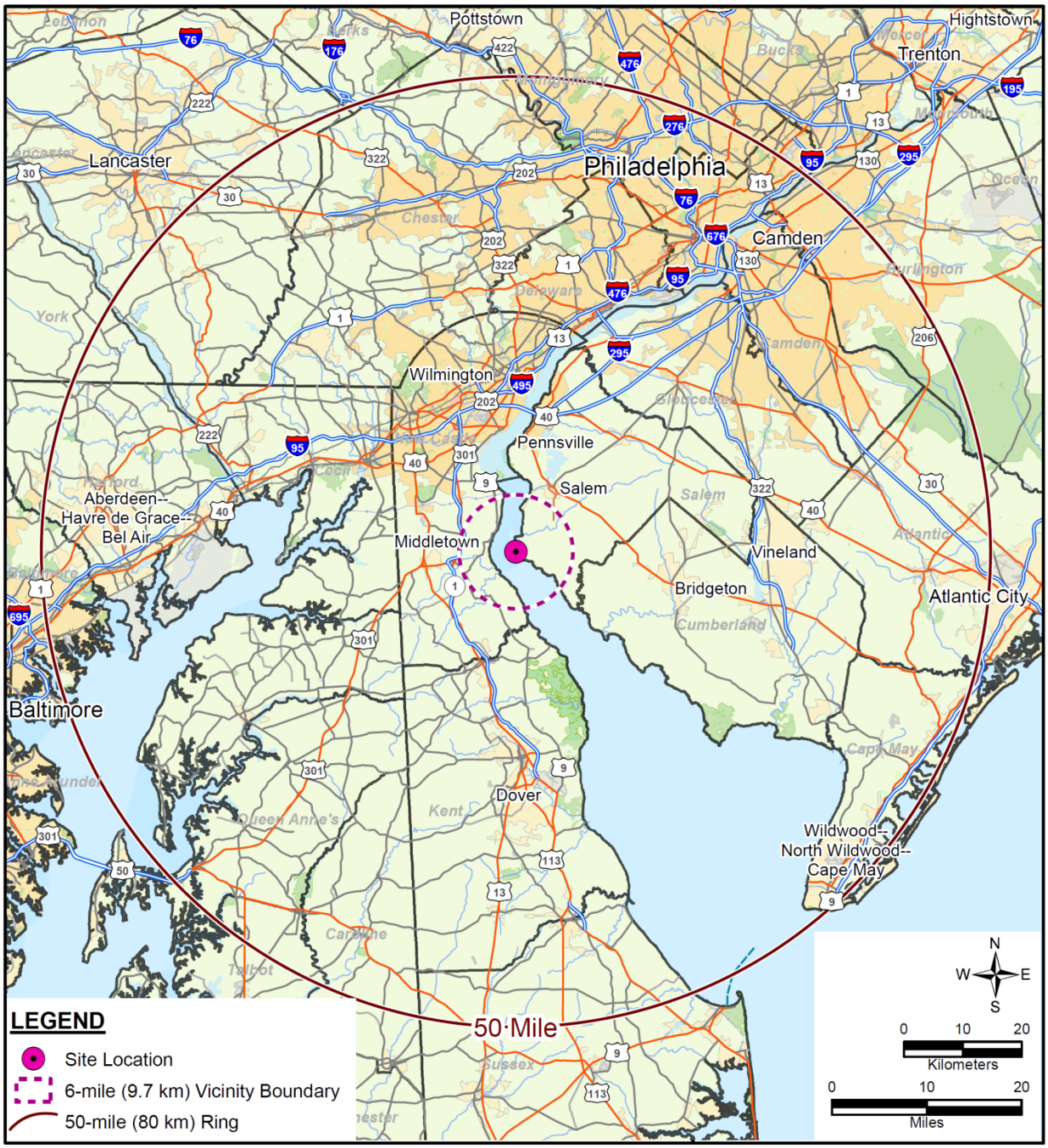

Figure ES-1. PSEG Site Location and Vicinity.

Evaluation of Environmental Impacts

When evaluating the environmental impacts associated with nuclear power plant construction and operations, the NRC's authority is limited to construction activities related to radiological health and safety or common defense and security; that is, under 10 CFR 51.4, the NRC-authorized activities are related to safety-related structures, systems, or components and may include pile driving; subsurface preparation; placement of backfill, concrete, or permanent retaining walls within an excavation; installation of foundations; or in-place assembly, erection, fabrication, or testing. In this EIS, the NRC review team evaluates the potential environmental impacts of the construction and operation of a new nuclear power plant at the PSEG Site for the following resource areas:

- land use,
- air quality,
- aquatic ecology,
- terrestrial ecology,
- surface and groundwater,
- waste (radiological and nonradiological),
- human health (radiological and nonradiological),
- socioeconomics,
- environmental justice, and
- cultural resources.

This EIS also evaluates impacts associated with accidents, the fuel cycle, decommissioning, and transportation of radioactive materials.

The impacts are designated as SMALL, MODERATE, or LARGE. The incremental impacts related to the construction and operations activities requiring the NRC authorization are described and characterized, as are the cumulative impacts resulting from the proposed action when the effects are added to, or interact with, other past, present, and reasonably foreseeable future effects on the same resources.

SMALL: Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.

MODERATE: Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.

LARGE: Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

Table ES-1 provides a summary of the cumulative impacts for the PSEG Site. The review team found that the cumulative environmental impacts would be SMALL for several resource categories, including demography, nonradiological health, radiological health, severe accidents, waste, fuel cycle, decommissioning, and transportation.

Table ES-1. Cumulative Impacts on Environmental Resources, Including the Impacts of a New Nuclear Power Plant at the PSEG Site

Resource Category	Impact Level
Land Use	MODERATE
Water-Related	
—Surface-Water Use	MODERATE
—Groundwater Use	MODERATE
—Surface-Water Quality	MODERATE
—Groundwater Quality	MODERATE
Ecology	
—Terrestrial Ecosystems	MODERATE
—Aquatic Ecosystems	MODERATE to LARGE
Socioeconomic	
—Physical Impacts	SMALL to MODERATE
—Demography	SMALL
—Taxes and Economic Impacts	SMALL (beneficial for the region) to LARGE (beneficial for Salem County)
—Infrastructure and Community Services	SMALL to MODERATE
Environmental Justice	None
Historic and Cultural Resources	MODERATE
Air Quality	SMALL to MODERATE
Nonradiological Health	SMALL
Radiological Health	SMALL
Waste Management	SMALL
Severe Accidents	SMALL
Fuel Cycle, Transportation, and Decommissioning	SMALL

The cumulative impacts for physical impacts, infrastructure and community services, and air quality would be SMALL to MODERATE. The review team found that the cumulative environmental impacts on land use, surface-water use and quality, groundwater use and quality, terrestrial and wetland ecosystems, and historic and cultural resources would be MODERATE. However, the contributions of impacts from the NRC-authorized activities would be SMALL for all of the above-listed resource areas, except for physical impacts and infrastructure and community services impacts. The new cooling towers would contribute to MODERATE cumulative physical impacts associated with aesthetics in certain locations, and traffic impacts

during the peak periods for building a new nuclear plant would contribute to MODERATE cumulative impacts for infrastructure and community services.

The incremental impacts associated with the development of the causeway and the transmission lines would be the principal contributors to the MODERATE cumulative impacts for land use and also to the MODERATE impacts for historic and cultural resources. Extensive past and present use of surface water from the Delaware River would be the primary driver for the MODERATE impacts for surface-water use and quality. Similarly, extensive past and present groundwater withdrawals from the local aquifer system would contribute to the MODERATE cumulative impacts to groundwater resources.

Cumulative terrestrial and wetland ecosystem impacts would be MODERATE because of the loss of habitat from development of the causeway and the transmission line corridors. The significant history of the degradation of the Delaware Bay and Delaware River Estuary has had a noticeable and sometimes destabilizing effect on many aquatic species and communities. Building and operating any new nuclear plant at the PSEG Site, in conjunction with the operations of the existing HCGS and SGS nuclear units, would contribute to MODERATE to LARGE cumulative impacts to aquatic ecosystems.

The cumulative impacts to taxes and the economy would be beneficial and would range from SMALL for the region to LARGE for Salem County. There are few minority populations and/or low-income populations near the PSEG Site. Furthermore, there are no pathways for disproportionately high and adverse impacts on minority or low-income populations.

The SMALL to MODERATE cumulative impact on air quality would result from the existing concentration of greenhouse gases in the atmosphere.

Alternatives

The review team considered the environmental impacts associated with alternatives to issuing an ESP for the PSEG Site. These alternatives included a no-action alternative (i.e., not issuing the ESP), as well as alternative energy sources, siting locations, or system designs.

The **no-action alternative** would result in the ESP not being granted or the USACE not issuing its permit. Upon such a denial, construction and operation of a new nuclear plant at the PSEG Site would not occur, and the predicted environmental impacts would not take place. If no other facility were to be built and no strategy implemented to take its place, the benefits of the additional electrical capacity and electricity generation to be provided would also not occur and the need for baseload power would not be met.

Based on the review team's review of **energy alternatives**, the review team eliminated several energy sources (i.e., wind, solar, and biomass) from full consideration because they are not currently capable of meeting the baseload electricity need. The review team concluded that, from an environmental perspective, none of the viable baseload alternatives (natural gas, coal, or a combination of alternatives) is clearly environmentally preferable to building new baseload nuclear power generating units at the PSEG Site. Table ES-2 provides a comparative summary of the environmental impacts of the viable energy alternatives.

Table ES-2. Comparison of Environmental Impacts of Energy Alternatives

Resource Areas	PSEG Site (Nuclear)	Energy Alternatives[(a)]		
		Coal	Natural Gas	Combination
Land Use	SMALL to MODERATE	MODERATE	MODERATE	MODERATE
Surface Water	SMALL	SMALL	SMALL	SMALL
Groundwater	SMALL	SMALL	SMALL	SMALL
Terrestrial Ecosystems	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE
Aquatic Ecosystems	SMALL	SMALL	SMALL	SMALL
Socioeconomics	LARGE (beneficial) to MODERATE (adverse)	LARGE (beneficial) to MODERATE (adverse)	MODERATE (beneficial) to SMALL (adverse)	MODERATE (beneficial) to MODERATE (adverse)
Environmental Justice	None	None	None	None
Historic and Cultural	SMALL	SMALL	SMALL	SMALL
Air Quality	SMALL	MODERATE	SMALL to MODERATE	SMALL to MODERATE
Human Health	SMALL	SMALL	SMALL	SMALL
Waste Management	SMALL	MODERATE	SMALL	SMALL

(a) Impacts taken from Table 9-4 (see Section 9.2.5) in the environmental impact statement. The conclusions for the energy alternatives are compared to those for the NRC-authorized activities at the PSEG Site as reflected in Chapters 4 and 5, as well as in Section 6.1. Note that cumulative impacts are not included in the comparison of energy alternatives.

The review team compared the cumulative effects of the PSEG Site against those of the **alternative sites**. The following four alternatives sites were selected for review (see Figure ES-2).

- Site 4-1 in Hunterdon County, New Jersey
- Site 7-1 in Salem County, New Jersey
- Site 7-2 in Salem County, New Jersey
- Site 7-3 in Cumberland County, New Jersey

Table ES-3 provides a comparative summary of the cumulative impacts for the alternative sites. Although there are differences and distinctions between the cumulative environmental impacts of building and operating a new nuclear power plant at the PSEG Site or at one of the alternative sites, the review team concludes that these differences are not sufficient to determine that any of the alternative sites would be environmentally preferable to the PSEG Site for building and operating a new nuclear power plant. In such a case, the PSEG Site prevails because none of the alternative sites are clearly environmentally preferable.

The review team considered various alternative systems designs, including alternative heat-dissipation systems and multiple alternative intake, discharge, and water-supply systems. The review team identified no alternatives for the PSEG Site that would be environmentally preferable to the systems designs used as the basis for analysis in this EIS. However, if at some time in the future PSEG requests authorization from the NRC (e.g., a combined license) to build and operate a new nuclear power plant, the review team will need to compare the specific heat dissipation design chosen to the other designs that were included in the PPE (Section 9.4.1. provides more detail on this matter).

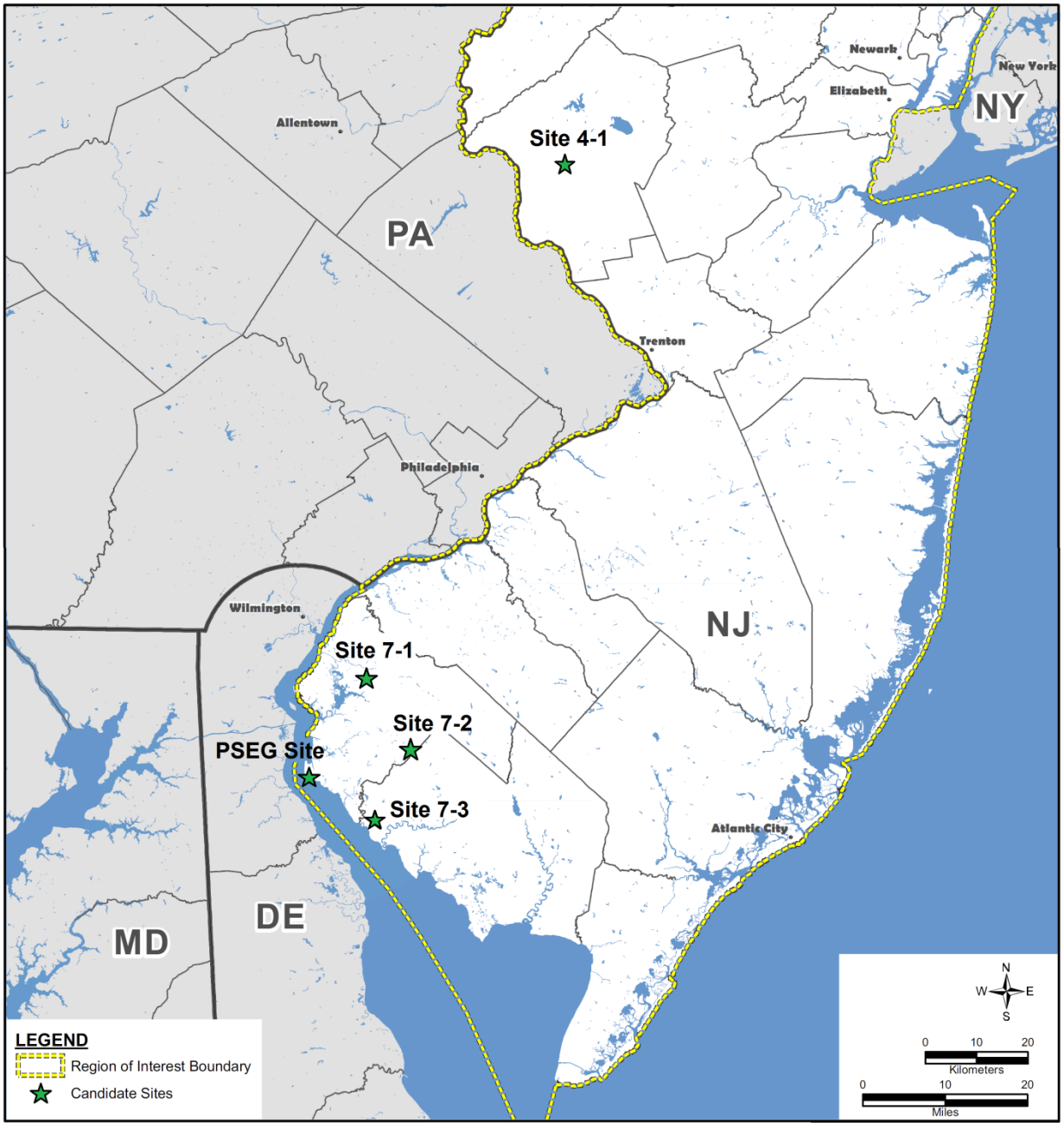

Figure ES-2. Map Showing the Locations of Alternative Sites.
(Note: Site 7-4 is the PSEG Site.)

Table ES-3. Comparison of Environmental Impacts at Alternative Sites

Resource Areas	PSEG Site[a] (Site 7-4)	Alternative Sites[b]			
		Site 4-1	Site 7-1	Site 7-2	Site 7-3
Land Use	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE
Surface Water	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE
Groundwater	MODERATE	SMALL	MODERATE	MODERATE	MODERATE
Terrestrial Ecosystems	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE
Aquatic Ecosystems	MODERATE to LARGE	MODERATE	MODERATE to LARGE	MODERATE to LARGE	MODERATE to LARGE
Socioeconomics	LARGE (beneficial) to MODERATE (adverse)	LARGE (beneficial) to LARGE (adverse)	LARGE (beneficial) to LARGE (adverse)	LARGE (beneficial) to LARGE (adverse)	LARGE (beneficial) to LARGE (adverse)
Environmental Justice	None	None	Potential	None	None
Historic and Cultural	MODERATE	LARGE	MODERATE	MODERATE	MODERATE
Air Quality	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE
Human Health	SMALL	SMALL	SMALL	SMALL	SMALL
Waste Management	SMALL	SMALL	SMALL	SMALL	SMALL

(a) Cumulative impact determinations taken from Table 7-4 in the environmental impact statement (EIS) (see Section 7.12).
(b) Cumulative impact determinations taken from Table 9-24 in the EIS (see Section 9.3.6).

Benefits and Costs

The review team compiled and compared the pertinent analytical conclusions reached in this EIS. All of the expected impacts from building and operating a new nuclear power plant at the PSEG Site were gathered and aggregated into two final categories: (1) the expected environmental costs and (2) the expected benefits to be derived from approval of the proposed action. Although the analysis in Section 10.6 of this EIS is conceptually similar to a purely economic benefit-cost analysis, which determines the net present dollar value of a given project, the intent of that section is to identify potential societal benefits of the proposed activities and compare them to the potential internal (i.e., private) and external (i.e., societal) costs of the proposed activities. In general, the purpose is to inform the ESP process by gathering and reviewing information that demonstrates the likelihood that the benefits of the proposed activities outweigh the aggregate costs.

On the basis of the assessments in this EIS, the building and operation of a new nuclear power plant at the PSEG Site, with mitigation measures identified by the review team, would accrue benefits that most likely would outweigh the economic, environmental, and social costs. For the NRC-proposed action (i.e., the NRC-authorized construction and operation), the accrued benefits would also outweigh the costs of preconstruction, construction, and operation of a new nuclear power plant at the PSEG Site.

Recommendation

The NRC staff's preliminary recommendation to the Commission related to the environmental aspects of the proposed action is that the ESP should be issued as proposed.

This preliminary recommendation is based on the following:

- the application, including the ER and its revisions, submitted by PSEG;
- consultation with Federal, State, Tribal, and local agencies;
- consideration of public comments received during scoping; and
- the review team's independent review and assessment as detailed in this EIS.

In making its recommendation, the NRC staff determined that none of the alternative sites is environmentally preferable (and therefore, also not obviously superior) to the PSEG Site. The NRC staff also determined that none of the energy or cooling-system alternatives assessed is environmentally preferable to the proposed action.

The NRC staff's determination is independent of the USACE's determination of whether the PSEG Site is the least environmentally damaging practicable alternative pursuant to CWA Section 404(b)(1) Guidelines. The USACE will conclude its analysis of both offsite and onsite alternatives in its Record of Decision.

ACRONYMS AND ABBREVIATIONS

°C	degree(s) Celsius
°F	degree(s) Fahrenheit
µg	micrograms
µS/cm	microsievert(s) per centimeter
χ/Q	atmospheric dispersion factor(s)
7Q10	7-day, 10-year low flow (i.e., the lowest flow for 7 consecutive days, expected to occur once per decade)
AADT	annual average daily traffic
ABWR	Advanced Boiling Water Reactor
ac	acre(s)
ac-ft	acre-feet
acfm	actual cubic feet per minute
ACHP	Advisory Council on Historic Preservation
ACS	American Community Survey
ACW	Alloway Creek Watershed Wetland Restoration
AD	Anno Domini
ADAMS	Agencywide Documents Access and Management System
AE	Atlantic City Electric
ALARA	as low as reasonably achievable
ANL	Argonne National Laboratory
ANS	American Nuclear Society
AP1000	Advanced Passive 1000 (pressurized water) reactor
APE	area of potential effect
AQCR	Air Quality Control Region
ARRA	American Recovery and Reinvestment Act
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute
ASMFC	Atlantic States Marine Fisheries Commission
ASSRT	Atlantic Sturgeon Status Review Team
ATWS	anticipated transient without scram
BA	biological assessment
BACT	Best Available Control Technology
bbl	barrel(s)
BBS	North American Breeding Bird Survey
BC	Before Christ
BEA	Bureau of Economic Analysis
BEIR	Biological Effects of Ionizing Radiation
BGEPA	Bald and Golden Eagle Protection Act
BGS	basic generation service
BLS	Bureau of Labor Statistics (U.S. Department of Labor)

BMP	best management practice
BNL	Brookhaven National Laboratory
BRAC	Base Realignment and Closure
BTS	Bureau of Technical Services
Btu	British thermal unit(s)
BUD	beneficial use determination
BWA	Bureau of Water Allocation
BWR	boiling water reactor
CAA	Clean Air Act
CAES	compressed air energy storage
CAFRA	Coastal Area Facility Review Act
CAIR	Clean Air Interstate Rule
CCS	carbon capture and sequestration
CCW	component cooling water
CDC	Centers for Disease Control and Prevention
CDF	confined disposal facility
CEDE	committed effective dose equivalent
CEQ	Council on Environmental Quality
CFR	*Code of Federal Regulations*
cfs	cubic feet per second
CH_4	methane
Ci	curie(s)
cm	centimeter(s)
CMP	Coastal Management Program
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	CO_2 equivalent
COL	combined construction permit and operating license or combined license
COLA	combined license application
CORMIX	Cornell Mixing Zone Expert System
CP	construction permit
CR	County Route
CSAPR	Cross-State Air Pollution Rule
CSP	concentrating solar power
CWA	Clean Water Act (aka Federal Water Pollution Control Act)
CWIS	circulating water intake structure
CWS	circulating water system
CZM	coastal zone management
CZMA	Coastal Zone Management Act
d	day
D/Q	deposition factor(s)
DA	Department of the Army

DAM	Day-Ahead Market
dB	decibel(s)
dBA	decibel(s) on the A-weighted scale
DBA	design basis accident
DBF	design basis flood
DC	direct current
DBT	dry-bulb temperature
DCD	Design Certification/Control Document
DCR	Deed of Conservation Restriction
DDT	Dichlorodiphenyltrichloroethane
DE	Delaware
DEIS	draft environmental impact statement
DFW	Division of Fish & Wildlife
DNL	day-night average sound levels
DNREC	Delaware Department of Natural Resources and Environmental Control
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DPCC	Discharge Prevention, Containment, and Countermeasure
DPS	distinct population segment
DR	demand response
DRBC	Delaware River Basin Commission
DRN	Delaware Riverkeeper Network
DSM	demand-side management
DWDS	demineralized water distribution system
EA	environmental assessment
EAB	exclusion area boundary
ECOS	Environmental Conservation Online System (FWS)
EDC	electric delivery company
EDG	emergency diesel generator
EE	energy efficiency
EEP	Estuary Enhancement Program
EFH	essential fish habitat
EFORd	equivalent demand forced outage rate
EIA	Energy Information Administration
EIF	equivalent impact factor
EIS	environmental impact statement
ELF	extremely low frequency
EMAAC	Eastern Mid-Atlantic Area Council
EMF	electromagnetic field
EMS	emergency medical services
EO	Executive Order
EPA	U.S. Environmental Protection Agency

EPR	Evolutionary Power Reactor
ER	Environmental Report
ESA	Endangered Species Act of 1973, as amended
ESF	engineered safety feature
ESMP	Environmental Surveillance and Monitoring Program
ESP	early site permit
ESPA	early site permit application
ESRP	Environmental Standard Review Plan (NUREG–1555)
ESWS	essential service water system
FEMA	U.S. Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FHWA	Federal Highway Administration
FMP	fishery management plan
FP	fission product
fpm	feet per minute
fps	feet per second
FPS	fire protection system
FR	*Federal Register*
FRN	*Federal Register* Notice
FSAR	Final Safety Analysis Report
ft	foot or feet
ft^2	square foot or feet
ft^3	cubic foot or feet
FWCA	Fish and Wildlife Coordination Act
FWS	U.S. Fish and Wildlife Service
g	gram(s)
gal	gallon(s)
GBq	gigabecquerel
GCRP	U.S. Global Change Research Program
GDP	gross domestic product
GEIS	*Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (NUREG–1437)
GEIS-DECOM	GEIS-Decommissioning of Nuclear Facilities (NUREG–0586)
GHG	greenhouse gas
GI-LLI	gastrointestinal lining of lower intestine
GIS	geographic information system
GMP	gross metropolitan product
gpd	gallon(s) per day
gpm	gallon(s) per minute
GSR	geologic survey report
GWh	gigawatt-hour(s)
GWPP	groundwater protection program

Gy	Gray(s)
H1H	high-first-high
H2H	high-second-high
ha	hectare(s)
HAP	hazardous air pollutant
HAPC	Habitat Area of Particular Concern
HCGS	Hope Creek Generating Station
HDA	heat dissipation area
HLW	high-level waste
HPO	historic preservation office
hr	hour(s)
Hz	hertz
I	U.S. Interstate (highway)
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiological Protection
IGCC	integrated gasification combined cycle
in.	inch(es)
IPCC	Intergovernmental Panel on Climate Change
IRM	installed reserve margin
ISFSI	independent spent fuel storage installation
JCPL	Jersey Central Power & Light
kg	kilogram(s)
kHz	kilohertz
km	kilometer(s)
km/hr	kilometer(s) per hour
km^2	square kilometer(s)
kV	kilovolt(s)
kW(e)	kilowatt(s) (electrical)
kWh	kilowatt-hour(s)
L	liter(s)
lb	pound(s)
Ldn	day-night average sound level
LEDPA	least environmentally damaging practicable alternative
Leq	equivalent continuous sound level
LFG	landfill gas
LLC	Limited Liability Company
LLW	low-level waste
LMDCT	linear mechanical draft cooling tower
LMP	locational marginal price

LOCA	loss of coolant accident
LOI	letter of interpretation
LOLE	loss of load expectation
LOS	level of service
LPZ	low population zone
LST	local standard time
LULC	land use and land cover
LWA	Limited Work Authorization
LWCF	Land and Water Conservation Fund
LWR	light water reactor
m	meter(s)
m/s	meter(s) per second
m^2	square meter(s)
m^3	cubic meter(s)
m^3/s	cubic meter(s) per second
MACCS2	Melcor Accident Consequence Code System Version 1.12
MAPP	Mid-Atlantic Power Pathway
MCCI	molten corium-to-concrete interaction
MCWB	mean coincident wet-bulb temperature
MDCT	mechanical draft cooling tower
MEI	maximally exposed individual
MERP	Marsh Ecology Research Program
mg	milligram(s)
Mgd	million gallon(s) per day
mGy	milligray(s)
mi	mile(s)
mi^2	square mile(s)
min	minute(s)
mL	milliliter(s)
MM	million
mm	millimeter(s)
mo	month(s)
MOU	Memorandum of Understanding
MOX	mixed oxides
mph	mile(s) per hour
mrad	millirad(s)
mrem	millirem(s)
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSA	Metropolitan Statistical Area
MSDS	material safety data sheets
MSL	mean sea level
mSv	millisievert(s)
MSW	municipal solid waste

MT	metric ton(nes)
MTU	metric ton(nes) uranium
MUA	municipal utilities authority
MW	megawatt(s)
MW(e)	megawatt(s) (electrical)
MW(t)	megawatt(s) (thermal)
MWd	megawatt-day(s)
MWd/MTU	megawatt-day(s) per metric ton of uranium
MWh	megawatt-hour(s)
N/A	not applicable
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standards
NAVD	North American Vertical Datum (sea level reference point used in surveying)
NAVD88	North American Vertical Datum of 1988
NCA	Noise Control Act
NCI	National Cancer Institute
NCP	non-coincident peak
NCRP	National Council on Radiation Protection and Measurements
NDCT	natural draft cooling tower
NEFMC	New England Fishery Management Council
NEI	Nuclear Electric Institute
NEPA	National Environmental Policy Act of 1969, as amended
NEPT	Neptune Regional Transmission System
NERC	North American Electric Reliability Corporation
NESC	National Electric Safety Code
NGCC	natural gas combined cycle
NGVD29	National Geodetic Vertical Datum of 1929
NHD	National Hydrology Dataset
NHL	National Historic Landmark
NHPA	National Historic Preservation Act
NIEHS	National Institute of Environmental Health Sciences
NJ	New Jersey
NJAC	New Jersey Administrative Code
NJBNE	New Jersey Bureau of Nuclear Engineering
NJBPU	New Jersey Board of Public Utilities
NJDEP	New Jersey Department of Environmental Protection
NJDOT	New Jersey Department of Transportation
NJEMP	New Jersey Energy Master Plan
NJGS	New Jersey Geological Survey
NJLWD	New Jersey Department of Labor and Workforce Development
NJPDES	New Jersey Pollutant Discharge Elimination System
NJSA	New Jersey Statutes Annotated
NJSM	New Jersey State Museum

NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NO_x	oxides of nitrogen
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NRCS	Natural Resource Conservation Service
NREL	National Renewable Energy Laboratory
NRHP	National Register of Historic Places
NSF	National Science Foundation
NSLP	Northeast Supply Link Project
NSPS	new source performance standard
NTU	nephelometric turbidity unit
NUREG	U.S. Nuclear Regulatory Commission technical document
NWI	National Wetland Inventory
NWR	National Wildlife Refuge
NWS	National Weather Service
NY-NJ-CT	New York–Northern New Jersey–Long Island (nonattainment area)
NYB	New York Bight
O_3	ozone
ODCM	Offsite Dose Calculation Manual
ODST	Office of Dredging and Sediment Technology
OL	operating license
OPA	Office of Planning Advocacy
OPSI	Organization of PJM States, Inc.
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
PA-NJ-DE	Philadelphia–Wilmington (nonattainment area)
PA-NJ-MD-DE	Philadelphia–Wilmington–Atlantic City (nonattainment area)
PAM	primary amoebic meningoencephalitis
para.	paragraph
Pb	lead
PCB	polychlorinated biphenyl
PECO	PECO Energy
pH	measure of acidity or basicity in solution
PHI	Pepco Holdings Inc.
PIR	public interest review
PIRF	public interest review factor
PJM	PJM Interconnection, LLC
PM	particulate matter
PM_{10}	particulate matter with a mean aerodynamic diameter of 10 μm or less
$PM_{2.5}$	particulate matter with a mean aerodynamic diameter of 2.5 μm or less

PNNL	Pacific Northwest National Laboratory
ppb	part(s) per billion
PPE	plant parameter envelope
ppm	part(s) per million
ppt	part(s) per thousand
PRA	probabilistic risk assessment
PRM	Potomac-Raritan-Magothy (aquifer)
PSD	Prevention of Significant Deterioration
PSE&G	Public Service Electric and Gas Company
PSEG	PSEG Power, LLC, and PSEG Nuclear, LLC
psi	pounds per square inch
psu	practical salinity unit
PSWS	potable and sanitary water system
PTE	potential to emit
PV	photovoltaic
PWR	pressurized water reactor
rad	radiation absorbed dose
RAI	Request for Additional Information
RCRA	Resource Conservation and Recovery Act of 1976, as amended
REC	renewable energy credit(s)
RECO	Rockland Electric Company
rem	Roentgen equivalent man (a unit of radiation dose)
REMP	radiological environmental monitoring program
RERR	Radioactive Effluent Release Report
RFC	Reliability*First* Corporation
RFI	request for information
RG	Regulatory Guide
RGPP	Radiological Groundwater Protection Program
RKM	River Kilometer
RM	River Mile
ROD	Record of Decision
ROI	region of interest
ROW	right-of-way
RPM	reliability pricing model
RPS	Renewable Portfolio Standard
RSA	relevant service area
RSICC	Radiation Safety Information Computational Center
RTEP	Regional Transmission Expansion Plan
RTM	real-time market
RTO	regional transmission organization
RTP	rated thermal power
RV	recreational vehicle
RWS	raw water service

Ryr	reactor-year(s)
s	second(s)
SA	sanitation authority or sewerage authority
SACTI	Seasonal and Annual Cooling Tower Impact (prediction code)
SAFSTOR	Safe Storage
SAMA	severe accident mitigation alternative
SAV	submerged aquatic vegetation
SBO	station blackout (in reference to a diesel generator)
scf	standard cubic feet
SCR	selective catalytic reduction
SE	southeast
SECA	Solid State Energy Conversion Alliance
SEIA	Socioeconomic Impact Area
SEIS	Supplemental Environmental Impact Statement
SER	safety evaluation report
SESC Act	Soil Erosion and Sediment Control Act
SGS	Salem Generating Station, Units 1 and 2
SGTR	steam generator tube rupture
SHPO	State Historic Preservation Office
SIL	significant impact level
SIP	State Implementation Plan
SMC	South Macro-Corridor
SO_2	sulfur dioxide
SO_x	oxides of sulfur
SOARCA	State-of-the-Art Reactor Consequence Analysis
SPCC	spill prevention, control, and countermeasures
SPCCP	spill prevention, control, and countermeasure plan
SRERP	Susquehanna-Roseland Electric Reliability Project
SSAR	Site Safety Analysis Report
SSC	structure, system, or component
STP	sewage treatment plant
Sv	sievert
SWIS	service water intake system
SWPPP	stormwater pollution prevention plan
SWS	service water system
T	ton(s)
T&E	threatened and endangered
TDS	total dissolved solids
TEDE	total effective dose equivalent
THPO	Tribal Historic Preservation Office
TIA	traffic impact analysis
TLD	thermoluminescent dosimeter

TPS	third party supplier
tpy	ton(s) per year
TRAGIS	Transportation Routing Analysis Geographic Information System
^{235}U	uranium-235
UA	utilities authority
UHS	ultimate heat sink
UMTRI	University of Michigan Transportation Research Institute
U.S.	United States
U.S. EPR	U.S. Evolutionary Power Reactor
US-APWR	U.S. Advanced Pressurized Water Reactor
USACE	U.S. Army Corps of Engineers
USC	United States Code
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
V	volt
VOC	volatile organic compound
WBT	wet-bulb temperature
WHO	World Health Organization
WMA	Wildlife Management Area
WMC	West Macro-Corridor
WRA	Water Resources Association of Delaware River Basin
yd	yard(s)
yd^3	cubic yard(s)
yr	year(s)
yr^{-1}	per year

APPENDIX A

CONTRIBUTORS TO THE ENVIRONMENTAL IMPACT STATEMENT

APPENDIX A

CONTRIBUTORS TO THE ENVIRONMENTAL IMPACT STATEMENT

The overall responsibility for the preparation of this environmental impact statement was assigned to the Office of New Reactors, U.S. Nuclear Regulatory Commission (NRC). The U.S. Army Corps of Engineers (USACE) is participating as a cooperating agency. The statement was prepared by members of the Office of New Reactors with assistance from other NRC organizations, the USACE, Oak Ridge National Laboratory, Argonne National Laboratory, Brookhaven National Laboratory, and Pacific Northwest National Laboratory.

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	Brookhaven National Laboratory[(c)]	
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Ann Miracle		Aquatic Ecology
Rajiv Prasad		Surface Water Hydrology
Lance Vail		Surface Water and Groundwater Hydrology

(a) Oak Ridge National Laboratory is managed for the U.S. Department of Energy by UT-Battelle LLC.
(b) Argonne National Laboratory is managed for the U.S. Department of Energy by UChicago Argonne LLC.
(c) Brookhaven National Laboratory is managed for the U.S. Department of Energy by Brookhaven Science Associates LLC.
(d) Pacific Northwest National Laboratory is managed for the U.S. Department of Energy by Battelle Memorial Institute.

APPENDIX B

ORGANIZATIONS CONTACTED

APPENDIX B

ORGANIZATIONS CONTACTED

The following Federal, State, Tribal, regional, and local organizations were contacted during the course of the U.S. Nuclear Regulatory Commission staff's review of potential environmental impacts from the building and operation of a new nuclear power plant (within the plant parameter envelope described in this EIS) at the PSEG Site in Salem County, New Jersey:

Advisory Council on Historic Preservation, Office of Federal Agency Programs, Washington, D.C.

Borough of Penns Grove, Salem County, New Jersey

Cherokee Nation of New Jersey, Newark, New Jersey

City of Salem, Salem County, New Jersey

Cumberland County, New Jersey

Delaware Department of Natural Resources and Environmental Control, Dover, Delaware

Delaware River Basin Commission, Trenton, New Jersey

Delaware State Historic Preservation Office, Dover, Delaware

Delaware Tribe of Indians, Bartlesville, Oklahoma

Eastern Delaware Nation, Troy, Pennsylvania

Eastern Lenape Nation of Pennsylvania, Easton, Pennsylvania

Federal Emergency Management Agency, Region II, New York, New York

Gloucester County, New Jersey

Nanticoke Lenni-Lenape Indians of New Jersey, Bridgeton, New Jersey

Nanticoke Tribe Association, Millsboro, Delaware

National Marine Fisheries Service, Northeast Regional Office, Gloucester, Massachusetts

New Castle County, Delaware

New Jersey Department of Environmental Protection, Trenton, New Jersey

New Jersey Historic Preservation Office, Trenton, New Jersey

1 Powhatan Renape Nation, Rankokous, New Jersey

2 Ramapough Mountain Indians, Mahwah, New Jersey

3 Salem County, New Jersey

4 South Jersey Transportation Planning Organization, Vineland, New Jersey

5 Taino Tribal Council of Jatibonicu, Vineland, New Jersey

6 The Delaware Nation–Delaware Tribe of Western Oklahoma, Anadarko, Oklahoma

7 Township of Carneys Point, Salem County, New Jersey

8 Township of Elsinboro, Salem County, New Jersey

9 Township of Lower Alloways Creek, Salem County, New Jersey

10 Township of Pennsville, New Jersey

11 U.S. Army Corps of Engineers, Philadelphia District, Philadelphia, Pennsylvania

12 U.S. Environmental Protection Agency, Region 2, New York, New York

13 U.S. Fish and Wildlife Service, Northeast Regional Office, Hadley, Massachusetts

APPENDIX C

CHRONOLOGY OF NRC AND USACE STAFF ENVIRONMENTAL REVIEW CORRESPONDENCE RELATED TO THE PSEG APPLICATION FOR AN EARLY SITE PERMIT (ESP) AT THE PSEG SITE

APPENDIX C

CHRONOLOGY OF NRC AND USACE STAFF ENVIRONMENTAL REVIEW CORRESPONDENCE RELATED TO THE PSEG APPLICATION FOR AN EARLY SITE PERMIT (ESP) AT THE PSEG SITE

This appendix contains a chronological listing of correspondence between the U.S. Nuclear Regulatory Commission (NRC) and PSEG Power, LLC, and PSEG Nuclear, LLC (PSEG), and other correspondence related to the NRC staff's environmental review, under 10 CFR Part 51, for PSEG's application for an early site permit at the PSEG Site. All documents, with the exception of those containing proprietary information, have been placed in the Commission's Public Document Room, at One White Flint North, 11555 Rockville Pike (first floor), Rockville, Maryland, and are available electronically from the Public Electronic Reading Room found on the Internet at the following web address: http://www.nrc.gov/reading-rm.html. From this site, the public can gain access to the NRC's Agencywide Document Access and Management Systems (ADAMS), which provides text and image files of the NRC's public documents in the Publicly Available Records component of ADAMS. The ADAMS accession numbers for each document are included below.

July 6, 2009	NRC trip report—May 27–29, 2009, readiness assessment (C-1) visit for a future early site permit application at the PSEG Site (Accession No. ML091800033).
November 23, 2009	NRC trip report—October 20–22, 2009, readiness assessment (C-2) visit for a future early site permit application at the PSEG Site (Accession No. ML093220183).
March 25, 2010	Letter from D. P. Lewis, Nuclear Development Director, PSEG Power, LLC, regarding early site permit application for the PSEG Site (Accession No. ML101480484).
April 30, 2010	Trip report—April 12–15, 2010, readiness assessment (C-3) visit for a future early site permit application at the PSEG Site (Accession No. ML101180344).
June 4, 2010	Letter and information from PSEG in support of early site permit application for the PSEG Site—Alternative Site Evaluation Study (Accession No. ML101600086).
June 9, 2010	Letter and information from PSEG in support of early site permit application for the PSEG Site—cultural and historic resource reports (Accession No. ML101660395).

July 13, 2010	Letter from the New Jersey Department of Environmental Protection to PSEG approving the Coastal Zone Management Certification for the PSEG early site permit application (Accession No. ML1204A109).
August 23, 2010	Letter from the NRC to D. P. Lewis, Nuclear Development Director, PSEG Power, LLC, regarding PSEG early site permit application online reference portal (Accession No. ML102240060).
September 8, 2010	Letter from Gary S. Janosko, Nuclear Development Regulatory Director, PSEG Power, LLC, regarding federal consistency determination by State of New Jersey Department of Environmental Protection (Accession No. ML102530617).
September 10, 2010	Letter from Gary S. Janosko, Nuclear Development Regulatory Director, PSEG Power, LLC, regarding PSEG early site permit application online reference portal (Accession No. ML102570065).
September 24, 2010	Letter to Jeff Dilks, Director, Salem Free Public Library, regarding maintenance of reference materials at the Salem Free Public Library related to PSEG Power, LLC, early site permit application for the PSEG Site near Hancocks Bridge, New Jersey (Accession No. ML102630546).
September 24, 2010	Letter to Barbara Hunt, Manager, Penns Grove–Carneys Point Public Library, regarding maintenance of reference materials at the Penns Grove–Carneys Point Public Library related to PSEG Power, LLC, early site permit application for the PSEG Site near Hancocks Bridge, New Jersey (Accession No. ML102630552).
September 24, 2010	Letter to Deborah Ecret, Library Assistant Supervisor, Pennsville Public Library, regarding maintenance of reference materials at the Pennsville Public Library related to PSEG Power, LLC, early site permit application for the PSEG Site near Hancocks Bridge, New Jersey (Accession No. ML102630558).
October 8, 2010	Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping: Letter to PSEG, and *Federal Register* Notice (published in the *Federal Register* on 10/15/10) (Accession No. ML102710517).
October 8, 2010	*Federal Register* Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process for PSEG early site permit application (Accession No. ML102670686).
October 8, 2010	Letter from the NRC to D. P. Lewis, Nuclear Development Director, PSEG Power, LLC, regarding Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping related to an early site permit application for the PSEG Site (Accession No. ML102710582).

October 22, 2010	Notice of Public Meeting to Discuss Environmental Review Process and Receive Scoping Comments on the PSEG Site Early Site Permit Application (Accession No. ML102920542).
October 26, 2010	Letter to Doris Pieschel, Secretary, Eastern Lenape Nation of Pennsylvania, regarding Notification and Request for Consultation and Participation in the Scoping Process for the Environmental Review of the PSEG Early Site Permit Application (Accession No. ML102990155).
October 26, 2010	Letter to C. W. Longbow, Principal Chief, Cherokee Nation of New Jersey, regarding Notification and Request for Consultation and Participation in the Scoping Process for the Environmental Review of the PSEG Early Site Permit Application (Accession No. ML102850579).
October 26, 2010	Letter to Larry Jackson, Chief, Nanticoke Tribe Association, regarding Notification and Request for Consultation and Participation in the Scoping Process for the Environmental Review of the PSEG Early Site Permit Application (Accession No. ML102990090).
October 26, 2010	Letter to Taino Tribal Council of Jatibonicu, NJ–US Taino Tribal Affairs Office, regarding Notification and Request for Consultation and Participation in the Scoping Process for the Environmental Review of the PSEG Early Site Permit Application (Accession No. ML102990045).
October 26, 2010	Letter to Doreen Scott, Commissioner, Ramapough Mountain Indians, regarding Notification and Request for Consultation and Participation in the Scoping Process for the Environmental Review of the PSEG Early Site Permit Application (Accession No. ML102990059).
October 26, 2010	Letter to Jerry Douglas, Chief, Delaware Tribe of Indians, Oklahoma, regarding Notification and Request for Consultation and Participation in the Scoping Process for the Environmental Review of the PSEG Early Site Permit Application (Accession No. ML102990185).
October 26, 2010	Letter to Kerry Holton, President, the Delaware Nation–Delaware Tribe of Western Oklahoma, regarding Notification and Request for Consultation and Participation in the Scoping Process for the Environmental Review of the PSEG Early Site Permit Application (Accession No. ML102990210).
October 26, 2010	Letter to Marvin Moriarty, Regional Director, US Fish and Wildlife Service, regarding Notification and Request for Consultation and Participation in the Scoping Process for the Environmental Review of the PSEG Early Site Permit Application (Accession No. ML102860150).
October 26, 2010	Letter to Peter Colosi, Assistant Regional Administrator, National Marine Fisheries Service, regarding Notification and Request for Consultation

	and Participation in the Scoping Process for the Environmental Review of the PSEG Early Site Permit Application (Accession No. ML102860101).
October 26, 2010	Letter to Mollie Eliot, Secretary, Eastern Delaware Nation, regarding Notification and Request for Consultation and Participation in the Scoping Process for the Environmental Review of the PSEG Early Site Permit Application (Accession No. ML102990165).
October 26, 2010	Letter to Vincent Maresca, New Jersey Historic Preservation Office, regarding Notification and Request for Consultation and Participation in the Scoping Process for the Environmental Review of the PSEG Early Site Permit Application (Accession No. ML102850545).
October 26, 2010	Letter to David Chanda, Director, New Jersey Department of Environmental Protection, regarding Notification and Request for Consultation and Participation in the Scoping Process for the Environmental Review of the PSEG Early Site Permit Application (Accession No. ML102850556).
October 26, 2010	Letter to Reid Nelson, Director, Office of Federal Agency Programs, Advisory Council on Historic Preservation, regarding Notification and Request for Consultation and Participation in the Scoping Process for the Environmental Review of the PSEG Early Site Permit Application (Accession No. ML102850562).
October 26, 2010	Letter to Curtis W. Diggs, Secretary, Powhatan Renape Nation regarding Notification and Request for Consultation and Participation in the Scoping Process for the Environmental Review of the PSEG Early Site Permit Application (Accession No. ML102990071).
October 26, 2010	Letter to Mark Gould, Tribal Chairperson, Nanticoke Lenni-Lenape Indians of New Jersey regarding Notification and Request for Consultation and Participation in the Scoping Process for the Environmental Review of the PSEG Early Site Permit Application (Accession No. ML102990114).
November 1, 2010	*Federal Register* Notice—Early Site Permit Application for PSEG, Notice of Hearing, Opportunity to Petition for Leave to Intervene and Associated Order (Accession No. ML102460085).
November 4, 2010	11/04/2010 Summary of the Public Scoping Meetings conducted for the environmental review process for the PSEG early site permit application (Accession No. ML103270350).
November 5, 2010	Letter to William Jenkins, U.S. Army Corps of Engineers, regarding U.S. NRC Environmental Impact Statement for the PSEG Power, LLC, and PSEG Nuclear, LLC (PSEG), early site permit application on the building

	and operation of one or more reactors at the PSEG Site, Salem County, New Jersey (Accession No. ML102930260).
November 8, 2010	Letter from the NRC to D. P. Lewis, Nuclear Development Director, PSEG Power, LLC, regarding application for an early site permit for the PSEG Site; the Notice of Hearing, Opportunity to Petition for Leave to Intervene, and Associated Order (Accession No. ML102460154).
November 29, 2010	Summary of the Public Scoping Meetings conducted for the environmental review process for the PSEG Site early site permit application (Accession No. ML102920514).
November 29, 2010	Letter from the NRC to D. P. Lewis, Nuclear Development Director, PSEG Power, LLC, regarding PSEG Site early site permit application review schedule (Accession No. ML102780654).
December 9, 2010	Letter from Stanley Gorski, National Marine Fisheries Service, regarding consultation process for PSEG early site permit application review (Accession No. ML103570197).
January 24, 2011	Letter from Frank Cianfrani, Chief, Regulatory Branch, U.S. Army Corps of Engineers, regarding letter on cooperating on PSEG early site permit environmental impact statement (Accession No. ML110380482).
April 15, 2011	Letter from the NRC to D. P. Lewis, Nuclear Development Director, PSEG Power, LLC, regarding information needs to support the environmental review site audits for the PSEG Site early site permit application (Accession No. ML11101A017).
November 1, 2011	Scoping summary report—Environmental impact statement scoping process (Accession No. ML112150127).
December 23, 2011	Letter from the NRC to James Mallon, Early Site Permit Manager, PSEG Power, LLC, regarding change in schedule of PSEG Site early site permit application review (Accession No. ML111390147).
January 18, 2012	Letter from the NRC to James Mallon, Early Site Permit Manager, PSEG Power, LLC, regarding environmental project manager change for the early site permit application review for the PSEG Site (Accession No. ML120110021).
May 14, 2012	PSEG early site permit met trip report—May 2012, review of the pre-operational and operational onsite metrological monitoring program (ML12135A608).
May 21, 2012	Letter to the NRC from James Mallon, Early Site Permit Manager, PSEG Power, LLC, regarding submittal of Revision 1 of the early site permit application for the PSEG Site (Accession No. ML12170A637).

May 31, 2012	Letter from the NRC to James Mallon, Early Site Permit Manager, PSEG Power, LLC, regarding change in schedule of PSEG early site permit application review (Accession No. ML121070466).
June 11, 2012	Letter and information from James Mallon, Early Site Permit Manager, PSEG Power, LLC, regarding PSEG Power, LLC, documents in support of early site permit application for the PSEG Site (Accession No. ML121660484).
June 11, 2012	Letter from the NRC to James Mallon, Early Site Permit Manager, PSEG Power, LLC, regarding resubmittal of Revision 1 of the early site permit application for the PSEG Site (Accession No. ML12170A635).
July 30, 2012	Draft environmental Request for Additional Information Table for the PSEG Site early site permit application review—submitted to PSEG (Accession No. ML12202B194).
August 28, 2012	Request for Additional Information Env-01 (eRAI 6728), for general information needed for the PSEG Site early site permit application review submitted by the NRC to PSEG (Accession No. ML12241A458).
August 29, 2012	Request for Additional Information Env-02 (eRAI 6729), for land use needed for the PSEG Site early site permit application review submitted by the NRC to PSEG (Accession No. ML12242A537).
August 29, 2012	Request for Additional Information Env-03 (eRAI 6731), for water needed for the PSEG Site early site permit application review submitted by the NRC to PSEG (Accession No. ML12242A540).
August 29, 2012	Request for Additional Information Env-04 (eRAI 6732), for terrestrial and wetland ecology needed for the PSEG Site early site permit application review submitted by the NRC to PSEG (Accession No. ML12242A542).
August 29, 2012	Request for Additional Information Env-05 (eRAI 6733), for aquatic ecology needed for the PSEG Site early site permit application review submitted by the NRC to PSEG (Accession No. ML12242A544).
August 31, 2012	Request for Additional Information Env-06 (eRAI 6734), for socioeconomics needed for the PSEG Site early site permit application review submitted by the NRC to PSEG (Accession No. ML12244A153).
August 31, 2012	Request for Additional Information Env-07 (eRAI 6735), for historic and cultural resources needed for the PSEG Site early site permit application review submitted by the NRC to PSEG (Accession No. ML12244A155).
August 31, 2012	Request for Additional Information Env-08 (eRAI 6736), for meteorology and air quality needed for the PSEG Site early site permit application review submitted by the NRC to PSEG (Accession No. ML12244A262).

August 31, 2012	Request for Additional Information Env-09 (eRAI 6737), for nonradiological health impacts needed for the PSEG Site early site permit application review submitted by the NRC to PSEG (Accession No. ML12244A264).
August 31, 2012	Request for Additional Information Env-13 (eRAI 6741), for need for power needed for the PSEG Site early site permit application review submitted by the NRC to PSEG (Accession No. ML12244A268).
August 31, 2012	Request for Additional Information Env-14 (eRAI 6742), for environmental impacts of alternatives needed for the PSEG Site early site permit application review submitted by the NRC to PSEG (Accession No. ML12244A270).
August 31, 2012	Request for Additional Information Env-10 (eRAI 6738), for radiation exposure to construction workers needed for the PSEG Site early site permit application review submitted by the NRC to PSEG (Accession No. ML12244A266).
August 31, 2012	Request for Additional Information Env-15 (eRAI 6743), for nonradioactive waste impacts needed for the PSEG Site early site permit application review submitted by the NRC to PSEG (Accession No. ML12244A271).
September 20, 2012	Request for Additional Information Env-11 (eRAI 6739), for environmental impacts of postulated accidents needed for the PSEG Site early site permit application review submitted by the NRC to PSEG (Accession No. ML12264A586).
September 20, 2012	Request for Additional Information Env-12 (eRAI 6740), for fuel cycle, transportation, and decommissioning needed for the PSEG Site early site permit application review submitted by the NRC to PSEG (Accession No. ML12264A589).
September 26, 2012	Letter from James Mallon, Early Site Permit Manager, PSEG Power, LLC, to the NRC regarding response to Request for Additional Information Env-01 (eRAI 6728), for general information needed for the PSEG Site early site permit application review (Accession No. ML122830087).
September 27, 2012	Summary of the environmental site audits conducted for the PSEG Site early site permit application review (Accession No. ML12207A142)
September 28, 2012	Letter from James Mallon, Early Site Permit Manager, PSEG Power, LLC, regarding Waste Confidence Decision and temporary storage rule and PSEG's early site permit application for the PSEG Site (Accession No. ML12275A460).

September 28, 2012	Letter from James Mallon, Early Site Permit Manager, PSEG Power, LLC, to the NRC regarding response to Request for Additional Information Env-03 (eRAI 6731), for water needed for the PSEG Site early site permit application review (Accession No. ML12277A391).
September 28, 2012	Letter from James Mallon, Early Site Permit Manager, PSEG Power, LLC, to the NRC regarding response to Request for Additional Information Env-04 (eRAI 6732), for terrestrial and wetland ecology needed for the PSEG Site early site permit application review (Accession No. ML122830118).
September 28, 2012	Letter from James Mallon, Early Site Permit Manager, PSEG Power, LLC, to the NRC regarding response to Request for Additional Information Env-04 (eRAI 6732), for terrestrial and wetland ecology needed for the PSEG Site early site permit application review (Accession No. ML12283A120).
September 28, 2012	Letter from James Mallon, Early Site Permit Manager, PSEG Power, LLC, to the NRC regarding response to Request for Additional Information Env-05 (eRAI 6733), for aquatic ecology needed for the PSEG Site early site permit application review (Accession No. ML12275A455).
October 1, 2012	Letter from James Mallon, Early Site Permit Manager, PSEG Power, LLC, to the NRC regarding response to Request for Additional Information Env-02 (eRAI 6729), for land use needed for the PSEG Site early site permit application review (Accession No. ML122860214).
October 3, 2012	Letter from James Mallon, Early Site Permit Manager, PSEG Power, LLC, to the NRC regarding response to Request for Additional Information Env-13 (eRAI 6741), for need for power needed for the PSEG Site early site permit application review (Accession No. ML12279A100).
October 3, 2012	Letter from James Mallon, Early Site Permit Manager, PSEG Power, LLC, to the NRC regarding response to Request for Additional Information Env-14 (eRAI 6742), for environmental impacts of alternatives needed for the PSEG Site early site permit application review (Accession No. ML12279A099).
October 4, 2012	Letter from James Mallon, Early Site Permit Manager, PSEG Power, LLC, to the NRC regarding response to Request for Additional Information Env-06 (eRAI 6734), for socioeconomics needed for the PSEG Site early site permit application review (Accession No. ML122840593).
October 4, 2012	Letter from James Mallon, Early Site Permit Manager, PSEG Power, LLC, to the NRC regarding response to Request for Additional Information Env-06 (eRAI 6734), for socioeconomics needed for the PSEG Site early site permit application review (Accession No. ML122970371).

October 4, 2012	Letter from James Mallon, Early Site Permit Manager, PSEG Power, LLC, to the NRC regarding response to Request for Additional Information Env-07 (eRAI 6735), for historic and cultural resources needed for the PSEG Site early site permit application review (Accession No. ML122900207).
October 4, 2012	Letter from James Mallon, Early Site Permit Manager, PSEG Power, LLC, to the NRC regarding response to Request for Additional Information Env-08 (eRAI 6736), for meteorology and air quality needed for the PSEG Site early site permit application review (Accession No. ML12284A198).
October 4, 2012	Letter from James Mallon, Early Site Permit Manager, PSEG Power, LLC, to the NRC regarding response to Request for Additional Information Env-09 (eRAI 6737), for nonradiological health impacts needed for the PSEG Site early site permit application review (Accession No. ML122900140).
October 4, 2012	Letter from James Mallon, Early Site Permit Manager, PSEG Power, LLC, to the NRC regarding response to Request for Additional Information Env-10 (eRAI 6738), for radiation exposure to construction workers needed for the PSEG Site early site permit application review (Accession No. ML122860420).
October 18, 2012	Letter from James Mallon, Early Site Permit Manager, PSEG Power, LLC, to the NRC regarding response to Request for Additional Information Env-14 (eRAI 6742), for environmental impacts of alternatives needed for the PSEG Site early site permit application review (Accession No. ML12296A445).
October 18, 2012	Letter from James Mallon, Early Site Permit Manager, PSEG Power, LLC, to the NRC regarding response to Request for Additional Information Env-15 (eRAI 6743), for nonradioactive waste impacts needed for the PSEG Site early site permit application review (Accession No. ML12296A443).
October 19, 2012	Letter from James Mallon, Early Site Permit Manager, PSEG Power, LLC, to the NRC regarding response to Request for Additional Information Env-11 (eRAI 6739), for environmental impacts of postulated accidents needed for the PSEG Site early site permit application review (Accession No. ML12296A770).
October 19, 2012	Letter from James Mallon, Early Site Permit Manager, PSEG Power, LLC, to the NRC regarding response to Request for Additional Information Env-12 (eRAI 6740), for fuel cycle, transportation, and decommissioning needed for the PSEG Site early site permit application review (Accession No. ML12296A772).

November 2, 2012	Letter from James Mallon, Early Site Permit Manager, PSEG Power, LLC, to the NRC regarding response to Request for Additional Information Env-11 (eRAI 6739), for environmental impacts of postulated accidents needed for the PSEG Site early site permit application review (Accession No. ML12311A268).
December 19, 2012	Draft Supplemental Request for Additional Information Table for the PSEG Site early site permit application review—submitted to PSEG (Accession No. ML12354A589).
January 7, 2013	Revised draft Supplemental Request for Additional Information Table for the PSEG Site early site permit application review—submitted to PSEG (Accession No. ML13007A241).
February 5, 2013	Final Supplemental Request for Additional Information Env-12S (eRAI 7003), for fuel cycle, transportation, and decommissioning needed for the PSEG Site early site permit application review submitted by the NRC to PSEG (Accession No. ML13036A334).
February 11, 2013	Final Supplemental Request for Additional Information Env-09S (eRAI 7028), for environmental impacts of alternatives needed for the PSEG Site early site permit application review submitted by the NRC to PSEG (Accession No. ML13042A326).
February 14, 2013	Draft Supplemental Request for Additional Information Env-05S (eRAI 7034), for aquatic ecology needed for the PSEG Site early site permit application review submitted by the NRC to PSEG (Accession No. ML13045A470).
March 5, 2013	Final Supplemental Request for Additional Information Env-05S (eRAI 7034), for aquatic ecology needed for the PSEG Site early site permit application review submitted by the NRC to PSEG (Accession No. ML13064A653).
March 7, 2013	Letter from James Mallon, Early Site Permit Manager, PSEG Power, LLC, to the NRC regarding response to Request for Additional Information Env-12S (eRAI 7003), for fuel cycle, transportation, and decommissioning needed for the PSEG Site early site permit application review (Accession No. ML130770208).
March 11, 2013	Letter from James Mallon, Early Site Permit Manager, PSEG Power, LLC, to the NRC regarding response to Request for Additional Information Env-9S (eRAI 7028), for environmental impacts of alternatives needed for the PSEG Site early site permit application review (Accession No. ML13073A147).

March 20, 2013	E-mail from Steven Mars, Senior Biologist, U.S. Fish and Wildlife Service, New York Field Office, to the NRC regarding potential effects to Federally listed species by activities described in PSEG Site early site permit application (Accession No. ML1407A595).
March 27, 2013	Letter from James Mallon, Early Site Permit Manager, PSEG Power, LLC, regarding submittal of Revision 2 of the early site permit application for the PSEG Site (Accession No. ML13098A975).
April 4, 2013	Letter from James Mallon, Early Site Permit Manager, PSEG Power, LLC, to the NRC regarding response to Request for Additional Information Env-05S (eRAI 7034), for aquatic ecology needed for the PSEG Site early site permit application review (Accession No. ML131090575).
April 18, 2013	Letter and documents from PSEG in support of early site permit application for the PSEG Site—Nuclear Development Project Conceptual Barge Facilities and Haul Roads Report (Accession No. ML131130145).
April 24, 2013	Letter to the U.S. Army Corps of Engineers, Philadelphia District, on agency roles under Section 106 of the National Historic Preservation Act for the PSEG Site early site permit environmental impact statement (Accession No. ML13058A438).
May 10, 2013	Letter and documents from PSEG in support of early site permit application for the PSEG Site—Roadmaps for Changes to the PSEG Early Site permit Application, Revision 2 (Accession No. ML13134A473).
May 28, 2013	Draft Supplemental Request for Additional Information Env-06S (eRAI 7132), for socioeconomics needed for the PSEG Site early site permit application review submitted by the NRC to PSEG (Accession No. ML13148A450).
June 5, 2013	Draft Supplemental Request for Additional Information Env-02S (eRAI 6972), for land use (transmission lines) needed for the PSEG Site early site permit application review submitted by the NRC to PSEG (Accession No. ML13157A120).
June 17, 2013	Final Supplemental Request for Additional Information Env-02S (eRAI 6972), for land use (transmission lines) needed for the PSEG Site early site permit application review submitted by the NRC to PSEG (Accession No. ML13168A506).
June 17, 2013	Final Supplemental Request for Additional Information Env-06S (eRAI 7132), for socioeconomics needed for the PSEG Site early site permit application review submitted by the NRC to PSEG (Accession No. ML13168A506).

July 31, 2013	Draft Supplemental Request for Additional Information Env-11S (eRAI 7211), for environmental impacts of postulated accidents needed for the PSEG Site early site permit application review submitted by the NRC to PSEG (Accession No. ML13212A334).
July 31, 2013	Letter to Louis Chiarella, Assistant Regional Administrator, National Marine Fisheries Service, regarding request for updated consultation for the environmental review of the PSEG early site permit application (Accession No. ML13206A180).
August 2, 2013	Letter from James Mallon, Early Site Permit Manager, PSEG Power, LLC, to the NRC regarding response to Request for Additional Information Env-06S (eRAI 7132), for socioeconomics needed for the PSEG Site early site permit application review (Accession No. ML13214A155).
August 2, 2013	Letter from James Mallon, Early Site Permit Manager, PSEG Power, LLC, to the NRC regarding response to Request for Additional Information Env-02S (eRAI 6972), for land use needed for the PSEG Site early site permit application review (Accession No. ML13214A153).
August 15, 2013	Final Supplemental Request for Additional Information Env-11S (eRAI 7211), for environmental impacts of postulated accidents needed for the PSEG Site early site permit application review submitted by the NRC to PSEG (Accession No. ML13227A390).
August 20, 2013	Letter and documents from PSEG in support of early site permit application for the PSEG Site—Archaeological and Cultural Information (Accession No. ML13252A296).
August 27, 2013	Letter from James Mallon, Early Site Permit Manager, PSEG Power, LLC, to the NRC regarding response to Request for Additional Information Env-11S (eRAI 7211), for environmental impacts of postulated accidents needed for the PSEG Site early site permit application review (Accession No. ML13246A298).
September 12, 2013	Letter from the NRC to James Mallon, Early Site Permit Manager, PSEG Power, LLC, regarding change in schedule of PSEG Site early site permit application review (Accession No. ML12361A136).
September 24, 2013	Letter and documents from PSEG in support of early site permit application for the PSEG Site—Redacted Archaeological Information (Accession No. ML13280A457).
September 25, 2013	Letter from Timothy A. Slavin, Delaware State Historic Preservation Officer, finding of no adverse effect for the PSEG early site permit application (Accession No. ML13275A113)

September 27, 2013	Draft Supplemental Request for Additional Information Env-04S (eRAI 7268), for terrestrial and wetland ecology needed for the PSEG Site early site permit application review submitted by the NRC to PSEG (Accession No. ML13270A441).
October 4, 2013	Final Supplemental Request for Additional Information Env-04S (eRAI 7268), for terrestrial and wetland ecology needed for the PSEG Site early site permit application review submitted by the NRC to PSEG (Accession No. ML13277A438).
October 4, 2013	Letter to Larry Miller, New Jersey Department of Environmental Protection, Office of Natural Lands Management, request for rare or endangered species and natural communities information for the PSEG early site permit application (Accession No. ML13275A623).
October 24, 2013	Letter from Robert Cartica, New Jersey Department of Environmental Protection, Office of Natural Lands Management, rare or endangered species and natural communities information for the PSEG early site permit application, Alternative Site 4-1 (Accession No. ML13311A021).
October 24, 2013	Letters from Robert Cartica, New Jersey Department of Environmental Protection, Office of Natural Lands Management, rare or endangered species and natural communities information for the PSEG early site permit application, Alternative Sites 4-1, 7-1, and 7-2, Intake Locations Only (Accession No. ML14154A451).
October 24, 2013	Letters from Robert Cartica, New Jersey Department of Environmental Protection, Office of Natural Lands Management, rare or endangered species and natural communities information for the PSEG early site permit application, Alternative Sites 4-1 and 7-4, Site Locations Only (Accession No. ML1414142A004).
October 24, 2013	Letters from Robert Cartica, New Jersey Department of Environmental Protection, Office of Natural Lands Management, rare or endangered species and natural communities information for the PSEG early site permit application, Alternative Sites 7-3 and 7-4, Site and Intake Locations (Accession No. ML14154A448).
October 24, 2013	Letter from Robert Cartica, New Jersey Department of Environmental Protection, Office of Natural Lands Management, rare or endangered species and natural communities information for the PSEG early site permit application, Alternative Site 7-2, Site Location Only (Accession No. ML14154A439).

October 25, 2013	Letter from Mary Colligan, National Marine Fisheries Service, regarding updated consultation information for the PSEG early site permit application review (Accession No. ML13319A998).
October 31, 2013	Letter and documents from PSEG in support of early site permit application for the PSEG Site—Addendum to the Historic Properties Visual Impact Assessment (Accession No. ML13310A572).
November 5, 2013	Letter from James Mallon, Early Site Permit Manager, PSEG Power, LLC, to the NRC regarding response to Request for Additional Information Env-04S (eRAI 7268), for terrestrial and wetland ecology needed for the PSEG Site early site permit application review (Accession No. ML13309A826).
December 20, 2013	Draft Supplemental Request for Additional Information Env-08S (eRAI 7369), for meteorology and air quality needed for the PSEG Site early site permit application review submitted by the NRC to PSEG (Accession No. ML13354C105)
January 30, 2014	Final Supplemental Request for Additional Information Env-08S (eRAI 7369), for meteorology and air quality needed for the PSEG Site early site permit application review submitted by NRC to PSEG (Accession No. ML14030A636).
February 24, 2014	Letter and documents from PSEG in support of early site permit application for the PSEG Site—revised land cover data (Accession No. ML14058A142).
February 27, 2014	Letter from James Mallon, Early Site Permit Manager, PSEG Power, LLC, to NRC regarding response to Request for Additional Information Env-08S (eRAI 7369), for meteorology and air quality data needed for the PSEG Site early site permit application review (Accession No. ML14077A023).
February 28, 2014	Request for Electronic Reading Room documents to be submitted to the docket (hydrology) for the PSEG Site early site permit application review—submitted to PSEG (Accession No. ML14059A408)
March 10, 2014	Letter and documents from PSEG in support of early site permit application for the PSEG Site—hydrology references (Accession No. ML14077A028).
March 27, 2014	Letter to NRC from James Mallon, Early Site Permit Manager, PSEG Power, LLC, regarding information in support of of the early site permit application for the PSEG Site—Clarification of audit summary information (Accession No. ML1409A429)

March 31, 2014	Letter to NRC from James Mallon, Early Site Permit Manager, PSEG Power, LLC, regarding submittal of Revision 3 of the early site permit application for the PSEG Site (Accession No. ML14093A588).
April 10, 2014	Letter and documents from PSEG in support of early site permit application for the PSEG Site—Roadmap for Changes to the PSEG Early Site Permit Application, Revision 3 (Accession No. ML14101A384).

APPENDIX D

SCOPING COMMENTS AND RESPONSES

APPENDIX D

SCOPING COMMENTS AND RESPONSES

On October 15, 2010, the U.S. Nuclear Regulatory Commission (NRC) published a Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process in the *Federal Register* (75 FR 63521-3). The Notice of Intent notified the public of the staff's intent to prepare an environmental impact statement (EIS) and conduct scoping for an application received from PSEG Power, LLC, and PSEG Nuclear, LLC (PSEG), for an Early Site Permit (ESP) for the PSEG Site. The PSEG Site is located adjacent to the existing Salem Generating Station (SGS) and Hope Creek Generating Station (HCGS) in Lower Alloways Creek Township, Salem County, New Jersey.

This EIS has been prepared in accordance with provisions of the National Environmental Policy Act of 1969 (NEPA), Council on Environmental Quality guidelines, and Title 10 of the *Code of Federal Regulations* (CFR) Parts 51 and 52. As outlined by NEPA, the NRC initiated the scoping process with the issuance of the *Federal Register* Notice. The NRC invited the applicant; Federal, Tribal, State, and local government agencies; local organizations; and individuals to participate in the scoping process by providing oral comments at the scheduled public meeting and/or submitting written suggestions and comments no later than December 14, 2010.

D.1 Overview of the Scoping Process

The scoping process provides an opportunity for public participation to identify issues to be addressed in the EIS and to highlight public concerns and issues. The notice of intent identified the following objectives of the scoping process.

- Define the proposed action that is to be the subject of the EIS.
- Determine the scope of the EIS and identify significant issues to be analyzed in depth.
- Identify and eliminate from detailed study those issues that are peripheral or that are not significant.
- Identify any environmental assessments and other EISs that are being prepared or will be prepared that are related to, but not part of, the scope of the EIS being considered.
- Identify other environmental review and consultation requirements related to the proposed action.
- Identify parties consulting with the NRC under the National Historic Preservation Act (NHPA), as set forth in 36 CFR 800.8(c)(1)(i).

- Indicate the relationship between the timing of the preparation of the environmental analyses and the NRC's tentative planning and decision-making schedule.

- Identify any cooperating agencies and, as appropriate, allocate assignments for preparation and schedules for completing the EIS to the NRC and any cooperating agencies. By letter dated January 24, 2011, the U.S. Army Corps of Engineers (USACE) accepted the NRC's invitation to participate as a cooperating agency in the environmental review of the PSEG ESP application.

- Describe how the EIS will be prepared and identify any contractor assistance to be used.

Two public scoping meetings were held at the Performing Arts Theater (Davidow Hall) on the campus of Salem Community College in Carneys Point, New Jersey, on November 4, 2010; meetings took place at 1:00 p.m. and 7:00 p.m. The NRC announced the meetings in local and regional newspapers (*Today's Sunbeam*, *News of Cumberland County*, *Gloucester County Times*, and *The News-Journal* of Wilmington, Delaware) and issued press releases locally. Each scoping meeting began with prepared statements from NRC staff members providing a brief overview of the ESP application review process and the NEPA process. After the NRC's prepared statements, the meetings were opened for public comments.

Twenty-three afternoon scoping meeting attendees and eight evening scoping meeting attendees provided oral comments that were recorded and transcribed by a certified court reporter. Twelve written statements were received during the meeting. In addition to the oral and written statements provided at the public scoping meeting, seven letters and one e-mail message were received during the scoping period.

Transcripts for both afternoon and evening scoping meetings can be found in ADAMS under accession numbers ML103270568 and ML103270579, respectively. A scoping meeting summary memorandum (ML103270350) was issued November 29, 2010.

At the conclusion of the scoping period, the NRC staff and its contractor, Oak Ridge National Laboratory, reviewed the scoping meeting transcripts, as well as all written material received, and identified individual comments. These comments were organized according to topic within the proposed EIS or according to the general topic if outside the scope of the EIS. After comments were grouped according to subject area, the staff prepared responses to the comments, identifying which were within the scope of the EIS.

Table D-1 identifies in alphabetical order the individuals providing comments during the scoping period, their affiliation (if given), and the ADAMS accession number that can be used to locate the correspondence. Table D-2 lists the comment categories in alphabetical order and the commenter names and numbers for comments for each category. The balance of this appendix presents the comments with NRC staff responses organized by topic category.

Table D-1. Individuals Providing Comments During the Comment Period

Commenter	Affiliation (If Stated)	Comment Source and ADAMS Accession #	Correspondence ID Number
Applegate, Jim	Self	Letter (ML103270230)	0010
Applegate, Jim	Self	Meeting Transcript (ML103270568)	0001-10
Bailey, David	Ranch Hope	Meeting Transcript (ML103270568)	0001-21
Batty, Sandy	Association of NJ Environmental Commissions	Letter (ML103260561)	0003
Birdwell, Margaret (Sally) Sooy	The Swedish Colonial Society	Email (ML103370191)	0015
Blake, Matt	American Littoral Society	Meeting Transcript (ML103270568)	0001-19
Bobbitt, Bruce	Self	Meeting Transcript (ML103270579)	0002-2
Braun, Bob	PSEG	Meeting Transcript (ML103270579)	0002-3
Brown, Elizabeth	Delaware Riverkeeper Network	Letter (ML103500259)	0018
Brubaker, Scott	New Jersey Department of Environmental Protection	Letter (ML103540101)	0019
Brubaker, Scott	New Jersey Department of Environmental Protection	Letter (ML103540101)	0021
Brubaker, Scott	New Jersey Department of Environmental Protection	Letter (ML103540101)	0020
Burger, Joanna	Rutgers, the State University of New Jersey	Letter (ML103370042)	0013
Campbell, Keith	Self	Meeting Transcript (ML103270579)	0002-8
Davis, Robert	Salem City	Meeting Transcript (ML103270568)	0001-1
DeLuca, Mike	Self	Meeting Transcript (ML103270579)	0002-4
Dillingham, Tim	American Littoral Society	Letter (ML103260561)	0003
Duffy, Brian	Salem County Chamber of Commerce	Meeting Transcript (ML103270568)	0001-18
Duvall, Brian	New Jersey Academy for Aquatic Sciences	Meeting Transcript (ML103270579)	0002-5
Eastman, Ajax	Self	Letter (ML103270664)	0012
Eastman, Ajax	Self	Meeting Transcript (ML103270568)	0001-7

Table D-1 (continued)

Commenter	Affiliation (If Stated)	Comment Source and ADAMS Accession #	Correspondence ID Number
Elk, John	Elsinboro Township	Letter (ML103470078)	0016
Galetto, Jane Morton	Citizens United to Protect the Maurice River and Its Tributaries, Inc.	Letter (ML103260561)	0003
Gaye, Earl	Salem County Administrator	Meeting Transcript (ML103270568)	0001-15
Goldsmith, Amy	New Jersey Environmental Federation	Letter (ML103260561)	0003
Gorski, Stanley	National Marine Fisheries Service	Letter (ML103571097)	0022
Hassler, Charles	Self	Letter (ML103260587)	0005
Hassler, Charles	Self	Meeting Transcript (ML103270568)	0001-17
Joyce, Tom	PSEG Nuclear	Meeting Transcript (ML103270568)	0001-3
Kehoe, Jim	Building Trades in Southern New Jersey	Meeting Transcript (ML103270568)	0001-22
Kugler, John	Salem County Improvement Authority	Letter (ML103260561)	0009
Kugler, John	Salem County Improvement Authority	Meeting Transcript (ML103270568)	0001-12
Lacandro, Roger	Rutgers, the State University of New Jersey	Letter (ML103270170)	0008
Lacandro, Roger	Rutgers, the State University of New Jersey	Meeting Transcript (ML103270568)	0001-9
Lewis, Kenneth	Maryland Conservation Council	Letter (ML103270162)	0007
Lewis, Kenneth	Maryland Conservation Council	Meeting Transcript (ML103270568)	0001-6
McConaghie, Jennifer	U.S. Department of the Interior	Letter (ML103481202)	0017
McNutt, Richard	Tidewaters Gateway Partnership, Inc.	Letter (ML103260561)	0003
Meadow, Norman	Maryland Conservation Council	Meeting Transcript (ML103270568)	0001-5
Molzahn, Robert	Self	Letter (ML103270654)	0011
Molzahn, Robert	Water Resources Association of Delaware River Basin	Meeting Transcript (ML103270568)	0001-8
Nedd, Sheranee	Self	Meeting Transcript (ML103270579)	0002-7

Table D-1 (continued)

Commenter	Affiliation (If Stated)	Comment Source and ADAMS Accession #	Correspondence ID Number
Nolan, Christine	South Jersey Land and Water Trust	Letter (ML103260561)	0003
O'Gorman, Margaret	Conserve Wildlife Foundation of New Jersey	Letter (ML103260561)	0003
Patouhas, Maria	Chamber of Commerce Southern New Jersey	Letter (ML103260611)	0006
Patouhas, Maria	Chamber of Commerce Southern New Jersey	Meeting Transcript (ML103270568)	0001-23
Pompper, Ellen	Lower Alloways Creek	Meeting Transcript (ML103270568)	0001-2
Richardson, T.J.	Self	Meeting Transcript (ML103270568)	0001-11
Salmon, Edward	New Jersey Energy Coalition	Letter (ML103260578)	0004
Salmon, Edward	New Jersey Energy Coalition	Meeting Transcript (ML103270568)	0001-13
Schneider, Richard	Coalition to Protect Fisheries	Meeting Transcript (ML103270579)	0002-6
Schulte, James	Preservation Salem County	Letter (ML103260561)	0003
Sweeney, Steve	New Jersey State Senate	Meeting Transcript (ML103270579)	0002-1
Thomas, Loren	Salem County Vocational Technical Schools	Meeting Transcript (ML103270568)	0001-20
van Rossum, Maya	The Delaware Riverkeeper	Letter (ML103260561)	0003
Velinsky, David	Academy of Natural Sciences	Letter (ML103350644)	0014
Velinsky, David	Academy of Natural Sciences	Meeting Transcript (ML103270568)	0001-4
Verinoham, Brian	New Jersey State Police	Meeting Transcript (ML103270568)	0001-16
Weinstein, Michael	PSEG Institute for Sustainability Studies	Meeting Transcript (ML103270568)	0001-14

Table D-2. Comment Categories with Associated Commenters and Comment IDs

Comment Category	Commenter (Comment ID)
Alternatives—Energy	• Applegate, Jim (0001-10-1) (0001-10-2) (0001-10-4) (0010-1) • Campbell, Keith (0002-8-3) • DeLuca, Mike (0002-4-7) • Duvall, Brian (0002-5-3) • Eastman, Ajax (0001-7-3) (0001-7-5) (0001-7-6) (0001-7-7) (0001-7-10) (0001-7-14) (0012-3) (0012-6) (0012-7) (0012-10) (0012-12) • Hassler, Charles (0001-17-4) • Kugler, John (0001-12-4) (0009-5) • Lewis, Kenneth (0001-6-2) (0001-6-4) (0001-6-5) (0001-6-6) (0007-3) (0007-4) (0007-5) • Molzahn, Robert (0001-8-4) (0001-8-5) (0011-3) (0011-5) • Nedd, Sheranee (0002-7-1) • Salmon, Edward (0001-13-1) (0001-13-6) (0001-13-7) (0001-13-14) (0004-1) (0004-2) (0004-5) • Schneider, Richard (0002-6-2) (0002-6-22) • Velinsky, David (0001-4-10) (0014-15)
Alternatives—System Design	• Batty, Sandy (0003-6) • Blake, Matt (0001-19-7) • Brown, Elizabeth (0018-5) (0018-8) (0018-10) (0018-14) (0018-18) • Dillingham, Tim (0003-6) • Galetto, Jane Morton (0003-6) • Goldsmith, Amy (0003-6) • Lacandro, Roger (0001-9-4) (0008-5) • McNutt, Richard (0003-6) • Molzahn, Robert (0001-8-6) (0011-8) • Nolan, Christine (0003-6) • O'Gorman, Margaret (0003-6) • Schneider, Richard (0002-6-15) • Schulte, James (0003-6) • van Rossum, Maya (0003-6) • Velinsky, David (0014-17)
Benefit-Cost Balance	• Kehoe, Jim (0001-22-6) • Kugler, John (0009-8) • Salmon, Edward (0001-13-11) (0004-3)

Table D-2 (continued)

Comment Category	Commenter (Comment ID)
Cumulative Impacts	• Eastman, Ajax (0001-7-4) (0012-5) • Lewis, Kenneth (0001-6-7) (0007-6) • Schneider, Richard (0002-6-1) (0002-6-11)
Ecology—Aquatic	• Applegate, Jim (0001-10-5) (0001-10-7) (0001-10-9) (0010-5) (0010-7) • Batty, Sandy (0003-4) • Blake, Matt (0001-19-4) • Brown, Elizabeth (0018-4) (0018-13) (0018-17) (0018-21) • Brubaker, Scott (0019-5) (0019-23) (0019-25) (0020-3) (0020-9) (0020-12) (0020-14) (0020-17) (0020-19) (0020-21) (0020-23) (0020-26) • DeLuca, Mike (0002-4-3) (0002-4-5) (0002-4-6) • Dillingham, Tim (0003-4) • Duvall, Brian (0002-5-2) • Eastman, Ajax (0001-7-8) (0001-7-12) (0012-2) (0012-11) (0012-14) • Galetto, Jane Morton (0003-4) • Goldsmith, Amy (0003-4) • Gorski, Stanley (0022-2) (0022-4) (0022-6) (0022-10) (0022-12) (0022-14) (0022-15) • Lacandro, Roger (0001-9-3) (0001-9-5) (0008-6) • McNutt, Richard (0003-4) • Molzahn, Robert (0001-8-7) (0011-6) (0011-9) (0011-12) • Nolan, Christine (0003-4) • O'Gorman, Margaret (0003-4) • Schneider, Richard (0002-6-10) (0002-6-13) (0002-6-18) (0002-6-20) • Schulte, James (0003-4) • van Rossum, Maya (0003-4) • Velinsky, David (0001-4-2) (0001-4-4) (0001-4-6) (0014-2) (0014-4) (0014-6) (0014-8) (0014-10) (0014-12) • Weinstein, Michael (0001-14-2) (0001-14-4) (0001-14-5) (0001-14-8) (0001-14-10)
Ecology—Terrestrial	• Applegate, Jim (0001-10-4) (0001-10-6) (0001-10-8) (0010-4) (0010-6) • Batty, Sandy (0003-3) (0003-7) • Blake, Matt (0001-19-3) • Brown, Elizabeth (0018-3) (0018-11) • Brubaker, Scott (0019-22) • Burger, Joanna (0013-2) (0013-3) (0013-4) (0013-5) (0013-6)

Table D-2 (continued)

Comment Category	Commenter (Comment ID)
	• Campbell, Keith (0002-8-5) • DeLuca, Mike (0002-4-2) • Dillingham, Tim (0003-3) (0003-7) • Duvall, Brian (0002-5-1) • Eastman, Ajax (0001-7-8) (0001-7-9) (0001-7-11) (0001-7-13) (0012-4) (0012-8) (0012-9) (0012-13) • Galetto, Jane Morton (0003-3) (0003-7) • Goldsmith, Amy (0003-3) (0003-7) • Gorski, Stanley (0022-5) (0022-8) (0022-9) (0022-11) (0022-13) • Lacandro, Roger (0001-9-3) (0008-4) • Lewis, Kenneth (0007-7) • McNutt, Richard (0003-3) (0003-7) • Meadow, Norman (0001-5-5) • Molzahn, Robert (0001-8-10) (0001-8-11) (0011-11) (0011-13) • Nolan, Christine (0003-3) (0003-7) • O'Gorman, Margaret (0003-3) (0003-7) • Schulte, James (0003-3) (0003-7) • van Rossum, Maya (0003-3) (0003-7) • Velinsky, David (0001-4-1) (0001-4-3) (0001-4-5) (0014-3) (0014-5) (0014-7) (0014-9) • Weinstein, Michael (0001-14-1) (0001-14-3) (0001-14-6) (0001-14-7) (0001-14-9)
Geology	• Lacandro, Roger (0008-3) • Schneider, Richard (0002-6-7)
Health—Radiological	• Brubaker, Scott (0019-6) (0019-8) • Meadow, Norman (0001-5-2) (0001-5-4) (0001-5-8)
Historic and Cultural Resources	• Batty, Sandy (0003-7) • Birdwell, Margaret (Sally) Sooy (0015-1) • Blake, Matt (0001-19-6) • Brubaker, Scott (0019-27) (0021-3) (0021-4) (0021-5) (0021-6) • Dillingham, Tim (0003-7) • Galetto, Jane Morton (0003-7) • Goldsmith, Amy (0003-7) • McNutt, Richard (0003-7) • Nolan, Christine (0003-7) • O'Gorman, Margaret (0003-7) • Schulte, James (0003-7) • van Rossum, Maya (0003-7)

Table D-2 (continued)

Comment Category	Commenter (Comment ID)
Hydrology—Groundwater	• Brubaker, Scott (0019-1) (0019-7) (0021-2)
Hydrology—Surface Water	• Batty, Sandy (0003-2) • Blake, Matt (0001-19-2) • Brown, Elizabeth (0018-2) (0018-9) (0018-12) (0018-15) (0018-16) • Brubaker, Scott (0019-2) (0019-3) (0019-24) (0019-26) (0020-10) (0020-13) (0020-15) (0020-18) (0020-20) (0020-22) (0020-24) (0020-27) • DeLuca, Mike (0002-4-4) • Dillingham, Tim (0003-2) • Galetto, Jane Morton (0003-2) • Goldsmith, Amy (0003-2) • Gorski, Stanley (0022-1) (0022-3) • Lacandro, Roger (0001-9-7) (0008-8) • McNutt, Richard (0003-2) • Molzahn, Robert (0001-8-1) (0001-8-8) (0001-8-9) (0001-8-13) (0011-1) (0011-10) (0011-14) • Nolan, Christine (0003-2) • O'Gorman, Margaret (0003-2) • Schneider, Richard (0002-6-9) • Schulte, James (0003-2) • van Rossum, Maya (0003-2) • Velinsky, David (0001-4-7) (0001-4-9) (0014-11) (0014-13)
Land Use—Site and Vicinity	• Batty, Sandy (0003-9) (0003-10) • Blake, Matt (0001-19-9) • Brown, Elizabeth (0018-7) • Brubaker, Scott (0019-13) (0019-14) (0019-15) (0019-17) (0019-21) (0020-2) (0020-4) (0020-5) (0020-6) (0020-7) (0020-8) (0020-11) (0020-16) (0020-25) • Dillingham, Tim (0003-9) (0003-10) • Galetto, Jane Morton (0003-9) (0003-10) • Goldsmith, Amy (0003-9) (0003-10) • McNutt, Richard (0003-9) (0003-10) • Molzahn, Robert (0001-8-12) • Nolan, Christine (0003-9) (0003-10) • O'Gorman, Margaret (0003-9) (0003-10) • Schulte, James (0003-9) (0003-10) • van Rossum, Maya (0003-9) (0003-10)

Table D-2 (continued)

Comment Category	Commenter (Comment ID)
Land Use—Transmission Lines	• Brubaker, Scott (0019-31) • McConaghie, Jennifer (0017-1)
Meteorology and Air Quality	• Brubaker, Scott (0019-4) (0019-9) (0019-10) (0019-11) (0019-12) (0019-16) (0019-18) (0019-19) (0019-20)
Need for Power	• Campbell, Keith (0002-8-2) • DeLuca, Mike (0002-4-8) • Duvall, Brian (0002-5-4) • Hassler, Charles (0001-17-9) (0005-3) (0005-5) • Kehoe, Jim (0001-22-4) • Lacandro, Roger (0008-2) • Molzahn, Robert (0001-8-3) (0011-4) • Patouhas, Maria (0006-4) • Salmon, Edward (0001-13-13) (0004-6) • Schneider, Richard (0002-6-21) • Sweeney, Steve (0002-1-2)
Process—ESP	• Brubaker, Scott (0020-1) • Schneider, Richard (0002-6-17) (0002-6-19)
Process—NEPA	• Batty, Sandy (0003-1) (0003-8) • Blake, Matt (0001-19-1) (0001-19-8) • Brown, Elizabeth (0018-1) (0018-6) (0018-19) (0018-20) • Brubaker, Scott (0019-30) • Dillingham, Tim (0003-1) (0003-8) • Galetto, Jane Morton (0003-1) (0003-8) • Goldsmith, Amy (0003-1) (0003-8) • McNutt, Richard (0003-1) (0003-8) • Nolan, Christine (0003-1) (0003-8) • O'Gorman, Margaret (0003-1) (0003-8) • Salmon, Edward (0001-13-5) • Schulte, James (0003-1) (0003-8) • van Rossum, Maya (0003-1) (0003-8)
Socioeconomics	• Batty, Sandy (0003-6) • Blake, Matt (0001-19-5) • Bobbitt, Bruce (0002-2-2) • Braun, Bob (0002-3-1) (0002-3-2) • Campbell, Keith (0002-8-4) • Davis, Robert (0001-1-1) • Dillingham, Tim (0003-6)

Table D-2 (continued)

Comment Category	Commenter (Comment ID)
	• Duffy, Brian (0001-18-3) (0001-18-5) • Elk, John (0016-4) (0016-5) • Galetto, Jane Morton (0003-6) • Gaye, Earl (0001-15-2) • Goldsmith, Amy (0003-6) • Hassler, Charles (0001-17-6) (0005-7) • Joyce, Tom (0001-3-1) (0001-3-2) • Kehoe, Jim (0001-22-3) • Kugler, John (0001-12-2) (0001-12-3) (0009-3) (0009-4) • Lacandro, Roger (0001-9-8) (0008-9) • McNutt, Richard (0003-6) • Molzahn, Robert (0001-8-2) (0011-2) • Nolan, Christine (0003-6) • O'Gorman, Margaret (0003-6) • Patouhas, Maria (0001-23-2) (0006-2) (0006-3) • Salmon, Edward (0001-13-12) (0004-4) • Schneider, Richard (0002-6-12) (0002-6-14) (0002-6-16) • Schulte, James (0003-6) • Sweeney, Steve (0002-1-4) • van Rossum, Maya (0003-6)
Uranium Fuel Cycle	• Applegate, Jim (0001-10-3) (0010-3) • Brubaker, Scott (0021-1) • Meadow, Norman (0001-5-6) • Salmon, Edward (0001-13-3) • Schneider, Richard (0002-6-5)

D.2 In-Scope Comments and Responses

The in-scope comment categories are listed alphabetically in Table D-3 in the order that they are presented in this EIS. In-scope comments and responses are included below the table. Parenthetical numbers shown after each comment refer to the Comment Identification (ID) number (document number-comment number) and the commenter name.

Table D-3. Comment Categories in Order as Presented in this Report

D.2.1 Comments Concerning Process—ESP
D.2.2 Comments Concerning Process—NEPA
D.2.4 Comments Concerning Land Use—Site and Vicinity
D.2.5 Comments Concerning Land Use—Transmission Lines
D.2.6 Comments Concerning Geology
D.2.7 Comments Concerning Hydrology—Surface Water
D.2.8 Comments Concerning Hydrology—Groundwater
D.2.9 Comments Concerning Ecology—Terrestrial
D.2.10 Comments Concerning Ecology—Aquatic
D.2.11 Comments Concerning Socioeconomics
D.2.13 Comments Concerning Historic and Cultural Resources
D.2.14 Comments Concerning Meteorology and Air Quality
D.2.16 Comments Concerning Health—Radiological
D.2.20 Comments Concerning the Uranium Fuel Cycle
D.2.25 Comments Concerning Cumulative Impacts
D.2.26 Comments Concerning the Need for Power
D.2.28 Comments Concerning Alternatives—Energy
D.2.29 Comments Concerning Alternatives—System Design
D.2.31 Comments Concerning Benefit-Cost Balance

D.2.1 Comments Concerning Process—ESP

Comment: The Office of Dredging and Sediment Technology's (ODST) primary overall concern is that the final product of the early site permit application (ESPA) process could be a conclusion that the PSEG Salem site is suitable for the construction and operation of a new nuclear power facility, with the resulting future inability of the NJDEP (or anyone else) to raise any concerns about potential environmental impacts of the proposed project. This is because all environmental impacts concerns are supposed to be addressed in the ESPA process - but they have not (at least in the application documents developed to date).

Further, this is problematic because many of the detailed analyses needed to evaluate the potential impacts of the proposed project are to be conducted as part of future State and federal permit review processes. Likewise, the development of potential measures to mitigate identified impacts are also relegated to future State and Federal permitting processes. Thus, it is not clear if approval of the construction and operation of a new nuclear power facility at the Salem site via the ESPA process would preclude the ability of NJDEP (and other regulatory agencies) to deny issuance of any required permits based on environmental impact concerns.

In part, this is due to a lack of specifics concerning the proposed project (reactor design, the need for an off-site transmission line, etc.). However, more detailed, site-specific analyses could be conducted as part of the ESPA process at a level sufficient for a preliminary determination that the site is suitable for use. Issuance of a CZM Consistency Determination by the NJDEP for the project would essentially constitute such a determination. However, as highlighted below in Comment A, although PSEG is seeking a CZM Consistency Determination from NJDEP as part of the ESPA process, the information in the ESPA documents submitted to date is incomplete and not at level sufficient to issue such a determination. (**0020-1** [Brubaker, Scott])

***Response**: With respect to environmental matters, the NRC's ESP process is as follows: The NRC regulations governing an ESP application require that an applicant for an ESP must provide the NRC with an ER that meets the requirements of 10 CFR 51.45 and 51.50. As described in 10 CFR 52.17, the contents of an application must focus on the environmental effects of construction and operation of a reactor or reactors that might be built at the proposed site, even though an ESP does not authorize such construction and operation. In addition, Section 52.18 requires that the staff prepare an EIS based on the application that focuses on the same matters. Both the ER and the EIS must include an evaluation of alternative sites to determine whether there is any obviously superior site to the site proposed. Certain issues, however, such as the benefits of the action and alternative energy sources, may be deferred until such time as the applicant submits a COL or CP application. For the ESP, the NRC prepares an EIS that resolves numerous issues on the basis of existing environmental site characteristics, as well as values of power plant design parameters set forth in the application. These issues are candidates for issue preclusion in a proceeding on an application referencing the ESP (i.e., such an issue would not be subject to litigation in a later licensing proceeding). If an applicant chooses the plant parameter envelope (PPE) approach, as PSEG has done here, the application postulates bounding values for these plant design parameters. NRC regulations allow an ESP applicant to defer an issue (e.g., the benefits assessment), as PSEG elected here, but also require that a COL applicant referencing such an ESP address the issue in its COL application. An application for a CP or COL referencing an ESP includes: a) demonstrate*

that the design of the proposed facility falls within the parameters specified in the ESP; b) indicate whether the site is suitable for construction and operation of one or more nuclear power plants; and c) identify whether there is new and significant information related to any issue resolved in the ESP proceeding. The Supplemental EIS (SEIS) prepared for the COL will build upon the ESP EIS, should one be issued. If there is no new and significant information on an issue, the COL SEIS will bring forward the conclusion reached in the ESP EIS. If there is new and significant information, then a conclusion will be reached in the COL SEIS on the basis of the analysis of the new and significant information.

D.2.2 Comments Concerning Process—NEPA

Comment: And it does amaze me how long the process takes. If you watched the slides today, you saw that we don't get to the final of this first step, until the spring of 2013. So the process is a long period of time, and I think at some time we have to face, how do we speed that up, so we can make it less expensive, but still do an excellent job of siting nuclear. (**0001-13-5** [Salmon, Edward])

Response: *These comments provide general information on the NEPA process. They do not provide any specific information related to the environmental effects of the proposed action and will not be evaluated in the EIS.*

Comment: The undersigned groups of the South Jersey Bay Shore Coalition are writing with a concern about a potential land swap in Lower Alloways Creek of New Jersey. PSEG is seeking to secure title to 84 acres on Artificial Island, from the Army Corps of Engineers, for the purposes of constructing a new nuclear power plant, Salem 4. PSEG has submitted application materials to the Nuclear Regulatory Commission demonstrating their intent to build a fourth power plant at Salem and Hope Creek. In exchange of these 84 acres the Corps is asking PSEG to identify and transfer ownership, to the Army Corps of Engineers of another 84 acres, yet to be determined, that the Corps would use as a dredge spoils disposal site for its projects.

It is clear the land swap is intended to result in the construction of Salem 4 on Artificial Island. The Corps affirmative action to remove the impediment of federal ownership of the lands that PSEG desires for this purpose, to decide and negotiate a land swap, and to take actions to accomplish this negotiation, all for the purposes of constructing Salem 4 on this location, is a major federal action that will affect the human environment and, therefore, is subject to NEPA.

I think coming in late I was catching the tail end that some of these things are, indeed, happening, which would have us pleased greatly.

Additionally, pursuing the land swap is for the purposes of identifying, securing, and utilizing a new location for a federal confined disposal facility that will receive dredge spoils from the Delaware River, and/or other Army Corps of Engineers projects. This, too, is a major federal action that will affect the human environment and, therefore, is subject to NEPA.

Therefore it was required that before engaging in negotiation and implementation of this action, the Corps must prepare an Environmental Impact Statement. And we would suggest,

considering the use to be made of this land, it is most probable that NEPA would require and should require completion of a full Environmental Impact Statement. (**0001-19-1** [Blake, Matt])

Comment: The Army Corps needs to examine these and other issues, including allowing for public comment, and going through the EA and EIS process, before the Corps makes the decision, and takes the action that supports, assists, regulates, approves, and encourages to construct Salem 4 in Artificial Island and create a new confined disposal facility for accommodating dredge spoil sites from federal projects. (**0001-19-8** [Blake, Matt])

Comment: The undersigned groups of the South Jersey Bayshore Coalition are writing with concerns about a potential land swap in the Lower Alloways Creek area of New Jersey. It appears that the Philadelphia District of the US Army Corps of Engineers is in negotiations with PSEG regarding a land swap of 84 acres. PSEG is seeking to secure title to 84 acres on Artificial Island from the Army Corps for the purposes of constructing a new nuclear power plant, (Salem 4). PSEG has submitted application materials to the Nuclear Regulatory Commission (NRC) demonstrating their intent to build a 4th nuclear plant at the Salem-Hope Creek site. In exchange for these 84 acres, the Army Corps is asking that PSEG identify and transfer ownership to the Army Corps of another 84 acres, yet to be determined, that the Army Corps would use as a dredge spoil disposal site for its projects.

We believe that negotiating and undertaking the land swap for the purposes of allowing the construction of Salem 4 by PSEG on this location and identifying a new location to be used for Army Corps spoils disposal, is the undertaking of a new activity(ies) and project(s) that are being assisted, regulated; and/or approved by the Army Corps, a federal agency.

In this process, it is likely that the Army Corps is and/or will be preparing and adopting plans and documents that would encourage, support and guide the selection of the Artificial Island location as the preferred alternative for construction of a new nuclear facility in the region, i.e. Salem 4. We understand that through this process the Army Corps will necessarily also be identifying, pursuing, planning and/or using (including adopting plans and documents) a new location for a federal confined disposal facility for dredge spoils.

It is clear the land swap is intended to result in the construction of Salem 4 on Artificial Island. The Army Corps' affirmative action to remove the impediment of federal ownership of the lands PSEG desires for this purpose, to decide to negotiate a land swap, and to take actions to accomplish this negotiation, all for the purposes of constructing Salem 4 in this location, is a major federal action that will affect the human environment and therefore is subject to NEPA.

Additionally, pursuing the land swap is for the purposes of identifying, securing and utilizing a new location for a federal confined disposal facility that will receive dredge spoils from the Delaware River and/or other Army Corps projects. This too is a major federal action that will affect the human environment and therefore is subject to NEPA.

In our view, the Army Corps is undertaking a series of systematic and connected agency steps in order to accomplish the goals of allowing construction of Salem 4 on Artificial Island and utilizing a new location for purposes of dredge spoil disposal for Army Corps projects. Therefore, it is required that before engaging in the negotiation and implementation of this action

the Army Corps must prepare an Environmental Assessment (EA). And we would suggest, considering the use to be made of this land, it is most probable that an EA will and should require completion of a full Environmental Impact Study Statement. (EIS). (**0003-1** [Batty, Sandy] [Dillingham, Tim] [Galetto, Jane Morton] [Goldsmith, Amy] [McNutt, Richard] [Nolan, Christine] [O'Gorman, Margaret] [Schulte, James] [van Rossum, Maya])

Comment: The Army Corps needs to examine these and other issues, including allowing for public comment, and going through an EA and an EIS process, before the Army Corps makes the decision and takes the action that supports, assists, regulates, approves, encourages, and acquiesces to construction of Salem 4 on Artificial Island and creates a new confined disposal facility for accommodating dredge spoils from federal projects. (**0003-8** [Batty, Sandy] [Dillingham, Tim] [Galetto, Jane Morton] [Goldsmith, Amy] [McNutt, Richard] [Nolan, Christine] [O'Gorman, Margaret] [Schulte, James] [van Rossum, Maya])

Comment: The EIS should require clearer evaluation of PSEG's use of the Army Corps confined disposal facility, the agreement to do so, and any cumulative impacts resulting from use of the site. According to the ER 4.1-9, there will be construction laydown and related activities located in the Corps CDF site. It is unclear what long-term or permanent impacts may result, despite the site use for temporary activity. The NRC should consider these potential impacts and the full range of alternatives in its EIS. Moreover, the EIS should consider the chain reaction of environmental impacts if the CDF is used for another purpose. The NRC should also examine the mechanism by which the Army Corps is providing the use of this land and any impacts this may have on Army Corps permit reviews or regulatory processes for the Project. (**0018-6** [Brown, Elizabeth])

Response: *The U.S. Army Corps of Engineers-Philadelphia District (Corps) is a Cooperating Agency on the EIS for PSEG's ESP application. As such, the environmental impacts of any actions proposed by the Corps to facilitate PSEG's ESP application, including the land exchange described in these comments will be evaluated in the EIS.*

Comment: PSEG submitted an Environmental Report (ER) to NRC in May 2010 which contains the project proponent's assessment of environmental issues related to site construction and operation. The ER uses the NRC criteria established in 10 CFR 51, Subpart A, Appendix B, Table B-1, Footnote 3 to assess whether environmental effects will be "small", "moderate" or "large" (Footnote #2). Delaware Riverkeeper Network is concerned that the characterizations of environmental effects by PSEG will be accepted whole-cloth in an EIS for the Project, in effect outsourcing the burden of drafting the EIS to the project proponent. This would constitute an inappropriate use of the NEPA process. Therefore, DRN urges NRC to review certain issues in more detail, including: clearer evaluation of PSEG's use of the Army Corps confined disposal facility, and cumulative impacts resulting from use of that site; water impacts including dredging and construction impacts; filling of wetlands; floodplain impacts; habitat impacts and impacts to species, especially Atlantic sturgeon; and impacts and evaluation of alternatives for cooling systems.

(Footnote #2): Small effects are defined as "Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the Commission has concluded

that those impacts that do not exceed permissible levels in the Commission's regulations are considered small. Moderate effects are defined as "Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource." Large effects are defined as, "Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource." (**0018-1** [Brown, Elizabeth])

Response: *The NRC and U.S. Army Corps of Engineers-Philadelphia District, which is a Cooperating Agency on the EIS for PSEG's ESP application, will use information provided in PSEG's Environmental Report, as well as other publicly-available information, to prepare the EIS. NRC and the Corps will verify the information provided by PSEG, and will conduct a thorough, independent assessment of the environmental impacts of the proposed actions (including actions proposed by the Corps) in the EIS. The EIS will assess potential impacts to all relevant environmental resources, and will address the specific issues raised in this comment: PSEG's use of the Corps' confined disposal facility and cumulative impacts resulting from use of that site; water impacts including dredging and construction impacts; filling of wetlands; floodplain impacts; habitat impacts and impacts to species, especially Atlantic sturgeon; and impacts and evaluation of alternatives for cooling systems.*

Comment: One final note is that in considering impacts in the EIS, construction-phase impacts should not be discounted as temporary. According to the ER, construction--and therefore construction-related impacts--will occur over an approximately five year time period and will include site excavation and the construction of safety-related structures. (**0018-19** [Brown, Elizabeth])

Response: *The EIS will evaluate all reasonably foreseeable direct, indirect, and cumulative impacts of building and operating new facility, regardless of whether an impact is temporary.*

Comment: DRN also stresses the importance of public transparency concerning the Army Corps' role in this Project, including transparency regarding the Corps' prior and anticipated commitments to PSEG that may impact its permit review function. (**0018-20** [Brown, Elizabeth])

Response: *The U.S. Army Corps of Engineers-Philadelphia District is a Cooperating Agency on the EIS for PSEG's ESP application. As such, the environmental impacts of any actions proposed by the Corps to facilitate PSEG's ESP application will be evaluated in the EIS.*

Comment: 9) Environmental Report, Chapter 4, Page 4.6-2,

4.6.2 Adverse Environmental Impacts

The ESP states, "Upon receipt of an ESP permit, PSEG may choose to obtain a Limited Work Authorization (LWA) to carry out site preparation and preconstruction activities. Additionally, site preparation activities, some excavation work, and construction of support buildings, roads, fences, parking lots, potable water systems, and other nonsafety-related facilities may be initiated prior to receipt of a combined license (COL). These preconstruction activities can be carried out prior to issuance of a COL and are separated from NRC-regulated construction activities."

Comment

Comment 1 (above) also applies to this portion of the project.

10) Environmental Report, Chapter 4, Page 4.6-4

4.6.3 Measures and Controls to Limit Adverse Impacts

The ESP states, "In addition to the general measures discussed above, the following specific factors limit potential adverse environmental impacts related to construction activities at the PSEG Site: compliance with federal, state, and local laws, ordinances, and regulations intended to prevent or minimize adverse environmental effects (for example, solid waste management, erosion and sediment control, air emissions ...)

Comment

Please see comment 1 for a description of one of the Federal regulations that is applicable to this project. (**0019-30** [Brubaker, Scott])

Response: *The EIS assessment of impacts from construction and operations activities will include a discussion of applicable Federal, State, and local laws and regulations.*

D.2.4 Comments Concerning Land Use—Site and Vicinity

Comment: 2) Environmental Report, Chapter 2, Page, 2.2-7

2.2.3.4 Proposed Access Road

The ESP states, "Additional access road capacity is necessary to address future transportation needs for the PSEG Site. This access road is conceptually designed as a three-lane causeway to be constructed on elevated structures for its entire length through the coastal wetlands."

Comment

Comment 1 (above) also applies to this portion of the project. (**0019-13** [Brubaker, Scott])

Comment: 3) Environmental Report, Chapter 4, Page 4.2-3

4.2.1.1.2 Land Construction

The ESP states, "Site preparation and construction activities will be conducted in accordance with federal, state, and local regulations, as appropriate. Necessary permits and authorizations will be obtained and appropriate environmental controls implemented (e.g. stormwater management systems, groundwater monitoring wells, and spill containment controls) prior to commencement of earth disturbing activities."

Comment

Please see comment 1 for a description of one of the Federal regulations that is applicable to this project. (**0019-14** [Brubaker, Scott])

Comment: 4) Environmental Report, Chapter 4, Page 4.4-2,

4.4.1.1.1.1 On-site Construction Activities

The ESP states, "An increase in daily traffic (up to 3150 construction worker vehicles and 50 trucks) is expected during peak construction along roads passing through Elsinboro and Lower Alloways Creek Township and Salem City. The composition of this traffic includes passenger cars and light-duty trucks of the construction workforce, as well as truck traffic for delivery of construction materials and heavy equipment used to support facility construction (e.g. excavators, bulldozers, heavy haul trucks, cranes, etc.). Potential effects of this daily traffic are considered as indirect impacts associated with on-site construction activities."

Comment

Comment 1 (above) also applies to this portion of the project.

5) Environmental Report, Chapter 4, Page 4.4-2,

4.4.1.1.1.2 Off-Site Construction Activities

The ESP states, "The proposed causeway and potential new transmission line are the major off-site new plant elements."

Comment

Comment 1 (above) also applies to this portion of the project. (**0019-15** [Brubaker, Scott])

Comment:

7) Environmental Report, Chapter 4, Page 4.4-4,

4.4.1.1.2 Borrow Pits

The ESP states, "To the extent possible, this fill material comes from within the PSEG site boundaries. If additional off-site fill material is required, it is expected to come from existing permitted borrow areas such as those used in the construction of HCGS."

Comment

Comment 1 (above) also applies to this portion of the project. (**0019-17** [Brubaker, Scott])

Response: *These comments refer to the NJDEQ's assertion that the proposed action must comply with the Federal General Conformity Act (40 CFR 93.150), which addresses air pollution emissions. The NRC will conduct a conformity determination under 40 CFR Part 93, Subpart B,*

outside of the NEPA process to determine whether additional mitigation is warranted. If an ESP is issued, the PSEG would be required to comply with all Federal, State, and local laws and regulations regarding air quality.

Comment: The Division of Land Use Regulation has received the PSEG Early Site Permit (ESP) application and has determined that the project will require permits.

As proposed, the project will require a CAFRA Individual Permit, Coastal Wetlands Permit, Waterfront Development Permit and Freshwater Wetlands Individual Permit from the Division. These permits must be obtained prior to any construction activities on the site related to the project described above. The Division has issued a consistency determination for the project that was sent to PSE&G representatives on July 19, 2010. (**0019-21** [Brubaker, Scott])

Response: *If an ESP is issued, PSEG would be required to obtain all necessary Federal, State, and local permits, and to comply with all Federal, State, and local laws and regulations.*

Comment: PSEG is seeking a Coastal Zone Consistency Determination from NJ as part of the ESPA process (Environmental Report, Section 1.3, page, 1.3-1). The Department's CZM review must consider the potential impacts resulting from dredging and dredged material management activities associated with the proposed project. (**0020-2** [Brubaker, Scott])

Response: *Potential impacts from dredging and dredged material management will be evaluated in EIS Chapter 4, 5, and 7.*

Comment: The EIS should require clearer evaluation of PSEG's use of the Army Corps confined disposal facility, the agreement to do so, and any cumulative impacts resulting from use of the site. According to the ER 4.1-9, there will be construction laydown and related activities located in the Corps CDF site. It is unclear what long-term or permanent impacts may result, despite the site use for temporary activity. The NRC should consider these potential impacts and the full range of alternatives in its EIS. Moreover, the EIS should consider the chain reaction of environmental impacts if the CDF is used for another purpose. The NRC should also examine the mechanism by which the Army Corps is providing the use of this land and any impacts this may have on Army Corps permit reviews or regulatory processes for the Project. (**0018-7** [Brown, Elizabeth])

Response: *Impacts to onsite and off-site land use will be evaluated in EIS Sections 4.1, 5.1, and 7.1.*

Comment: (1) SSAR, Section 1.2.1, page 1.2-1, para. #1 and para. #2: states that PSEG is planning to acquire 85 acres of land, located immediately north of the Hope Creek Generating Station, from the United States Army Corp of Engineers (USACE). This land is part of the Artificial Island Upland Confined Disposal Facility (CDF) used by the USACE for the disposal of sediments dredged from the Delaware River. The document also notes that the specific timing of this acquisition is not known. Paragraph #2 states that PSEG will obtain a lease on the remaining portion (~ 45 acres - see Section 1.2.2) of the upland CDF for temporary (duration unspecified) construction purposes. [Note: also see ER Sections 2.1.1, 2.2.1.1, and 2.8.1.2.]

The potential impacts of these acquisition and lease activities on the future dredged material disposal capacity available to the USACE for deepening and maintenance dredging activities needs to be evaluated. If acquisition of/leasing this land by PSEG will result in the need for the USACE to develop additional upland CDFs to meet its dredged material disposal needs, this indirect/cumulative impact of the proposed PSEG project must be evaluated. (**0020-4** [Brubaker, Scott])

Response: *The U.S. Army Corps of Engineers-Philadelphia District is a Cooperating Agency on the EIS for PSEG's ESP application. As such, the environmental impacts of any actions proposed by the Corps to facilitate PSEG's ESP application, including the land exchange described in these comments will be evaluated in the EIS.*

Comment: (2) SSAR, Section 2.1.2.1, page 2.1-2, para. #2: indicates that the use of 146 acres of land currently owned by USACE may ultimately be controlled by PSEG. See Comment #1 - potential impacts of such PSEG use control of this land on the USACE's dredged material disposal capacity should be addressed.

(3) SSAR, Section 2.1.2.2, page 2.1-3, paras. #2 and #3: see Comments #1 and #2. (4) Environmental Report [ER], Section 1.2.2, page 1.2-1, para. #2: see Comments #1 and #2. (**0020-5** [Brubaker, Scott])

Response: *The U.S. Army Corps of Engineers-Philadelphia District is a Cooperating Agency on the EIS for PSEG's ESP application. As such, the environmental impacts of any actions proposed by the Corps to facilitate PSEG's ESP application, including the land exchange described in these comments will be evaluated in the EIS.*

Comment: (5) ER, Table 1.3-1, page 1.3-4: use of the USACE Artificial Island CDF, and any other dredging or dredged material management activities, associated with the proposed project must be evaluated as part of the CZM Consistency, Clean Water Act Section 401, and NJ Waterfront Development Permit review processes. The NJDEP Office of Dredging and Sediment Technology (Site Remediation Program) will be the NJDEP lead on such evaluations. (**0020-6** [Brubaker, Scott])

Response: *Issues related to land use, including the proposed action's consistency with New Jersey's Coastal Zone Management and Waterfront Development Permit programs, will be addressed in EIS Sections 2.2, 4.1, 5.1, and 7.1.*

Comment: (7) ER, Section, 4.1.1.1, page 4.1-4, para. #2: states that PSEG use of 45 acres of the USACE Artificial Island Upland CDF will not impact the use of the remaining portion of the facility. Additional evaluation is needed to verify this statement. (**0020-7** [Brubaker, Scott])

Response: *The U.S. Army Corps of Engineers-Philadelphia District is a Cooperating Agency on the EIS for PSEG's ESP application. As such, the environmental impacts of any actions proposed by the Corps to facilitate PSEG's ESP application will be evaluated in the EIS.*

Comment: (9) ER, Section 4.2.1.1.4, page 4.2-5: briefly describes construction and dredging activities along the Delaware River shoreline. A total area of 92 acres - approximately 590,000 CY of sediment - is proposed to be dredged. The document concludes that impacts associated

with dredging are small. However, much more work is needed to comprehensively evaluate the potential impacts resulting from dredging and dredged material management activities - see Comment #8. (**0020-11** [Brubaker, Scott])

Comment: (11) ER, Section 4.3.1, page 4.3-1, para. #5: references a permitted disposal facility on the PSEG site [that] is used for disposal of materials dredged from the intake structures ... Is this referring to an existing dredged material upland CDF on the PSEG property? If so, this facility should be identified in an appropriate figure and described in more detail. [Note: also see Sections 2.3.1.1,2.4.1.3.4, and 2.4.2.1.1] (**0020-16** [Brubaker, Scott])

Comment: (12) ER, Section 4.3.2.3, page 4.3-19, para. #3: see Comment #9. The ~590,000 CY of sediments to be dredged have not been tested/evaluated, nor has a disposal site been selected. (**0020-18** [Brubaker, Scott])

Comment: (8) ER Section 4.1.2.2, page 4.1-7: indicates that dredged material from the USACE Artificial Island CDF and from dredging activities associated with the intake and barge facility areas would be used as fill material on-site.

At a May 9, 2010 meeting with the NJDEP, PSEG representatives indicated that dredging of ~975,000 cubic yards of sediments from the Delaware River would be needed to support the project - this has apparently been reduced to ~ 590,000 CY (see Comment #9). All dredging and dredged material management activities associated with the construction of the proposed project must be described and comprehensively evaluated. This would include testing of dredged material consistent with the requirements of the 1997 NJDEP Dredging Technical Manual. The documents submitted in support of the ESPA barely discuss dredging and dredged material aspects of the proposed project. Section 2.3.1 of the Environmental Report only briefly summarizes some Delaware River sediment samples collected in the vicinity of the project site and subjected only to grain size analyses.

Dredging and dredged material management activities will also require a variety of permits from the NJDEP, including a CZM Consistency Determination. The use of any dredged material as on-site fill - including material excavated from the USACE Artificial Island Upland CDF - will require an Acceptable Use Determination from the Department.

At the May 9, 2010 meeting, it was also stated that construction of a new dredged material upland CDF on the PSEG property may be needed. If still needed, the potential impacts of the construction and use of such a facility must also be comprehensively evaluated and approved by the Department, consistent with the requirements specified in the 1997 NJDEP Dredging Technical Manual. (**0020-8** [Brubaker, Scott])

Response: *Impacts to land use associated with dredging and the management of dredged material will be evaluated in EIS Sections 4.1, 5.1, and 7.1. In addition, the EIS (Chapter 2 and 3) will provide figures of the proposed PSEG ESP site layout and supporting structures.*

Comment: (16) ER, Section 2.8.1.2, page 2.8-3, para. #2: delegates the evaluation of the potential environmental impacts of the transfer of a portion of the USACE Artificial Island Upland CDF to PSEG to a future federal review process. As noted in this paragraph, this transfer is

expected to be a relevant factor to the overall nature and composition of impacts associated with the construction and operation of the new plant. Therefore, the impacts of this proposed land transfer should be evaluated as part of the ESPA process. Also see Comment B and Comments #1, #2, and #7. (**0020-25** [Brubaker, Scott])

Response: *The U.S. Army Corps of Engineers-Philadelphia District is a Cooperating Agency on the EIS for PSEG's ESP application. As such, the environmental impacts of any actions proposed by the Corps to facilitate PSEG's ESP application, including the land exchange described in these comments will be evaluated in the EIS.*

Comment: The Army Corps of Engineers and PSEG must consider an alternative to the land swap, such as using the existing road to Artificial Island, instead of creating a second road if, and when, a nuclear facility is permitted. In our view the existing access road should be sufficient. Issues associated with new spoil disposal site are, as yet, unknown, as the sites under consideration are unknown. But there are likely to be issues, considering the Army Corps of Engineers for riverfront lands. (**0001-19-9** [Blake, Matt])

Response: *Impacts to land use associated with the proposed causeway and the management of dredged material will be evaluated in EIS Sections 4.1, 5.1, and 7.1.*

Comment: Although the existing PSEG nuclear complex is an ideal location for an additional unit, because all of the important conveyance systems are in place, and those will not have to be developed, such as they would if it was a greenfield site. New improvements, such as roadways, should be carefully placed and designed to minimize their impact on marshlands. An elevated road system would be a design that would help minimize these impacts. We encourage PSEG to pursue such a design, and develop a comprehensive wetlands mitigation and compensation plan for these impacts. (**0001-8-12** [Molzahn, Robert])

Response: *Impacts to land use associated with the proposed causeway will be evaluated in EIS Sections 4.1, 5.1, and 7.1.*

Comment: The undersigned groups of the South Jersey Bayshore Coalition are writing with concerns about a potential land swap in the Lower Alloways Creek area of New Jersey. It appears that the Philadelphia District of the US Army Corps of Engineers is in negotiations with PSEG regarding a land swap of 84 acres. PSEG is seeking to secure title to 84 acres on Artificial Island from the Army Corps for the purposes of constructing a new nuclear power plant, (Salem 4). PSEG has submitted application materials to the Nuclear Regulatory Commission (NRC) demonstrating their intent to build a 4th nuclear plant at the Salem-Hope Creek site. In exchange for these 84 acres, the Army Corps is asking that PSEG identify and transfer ownership to the Army Corps of another 84 acres, yet to be determined, that the Army Corps would use as a dredge spoil disposal site for its projects.

We believe that negotiating and undertaking the land swap for the purposes of allowing the construction of Salem 4 by PSEG on this location and identifying a new location to be used for Army Corps spoils disposal, is the undertaking of a new activity(ies) and project(s) that are being assisted, regulated; and/or approved by the Army Corps, a federal agency.

In this process, it is likely that the Army Corps is and/or will be preparing and adopting plans and documents that would encourage, support and guide the selection of the Artificial Island location as the preferred alternative for construction of a new nuclear facility in the region, i.e. Salem 4. We understand that through this process the Army Corps will necessarily also be identifying, pursuing, planning and/or using (including adopting plans and documents) a new location for a federal confined disposal facility for dredge spoils.

It is clear the land swap is intended to result in the construction of Salem 4 on Artificial Island. The Army Corps' affirmative action to remove the impediment of federal ownership of the lands PSEG desires for this purpose, to decide to negotiate a land swap, and to take actions to accomplish this negotiation, all for the purposes of constructing Salem 4 in this location, is a major federal action that will affect the human environment and therefore is subject to NEPA.

Additionally, pursuing the land swap is for the purposes of identifying, securing and utilizing a new location for a federal confined disposal facility that will receive dredge spoils from the Delaware River and/or other Army Corps projects. This too is a major federal action that will affect the human environment and therefore is subject to NEPA.

In our view, the Army Corps is undertaking a series of systematic and connected agency steps in order to accomplish the goals of allowing construction of Salem 4 on Artificial Island and utilizing a new location for purposes of dredge spoil disposal for Army Corps projects. Therefore, it is required that before engaging in the negotiation and implementation of this action the Army Corps must prepare an Environmental Assessment (EA). And we would suggest, considering the use to be made of this land, it is most probable that an EA will and should require completion of a full Environmental Impact Study Statement. (EIS). (**0003-9** [Batty, Sandy] [Dillingham, Tim] [Galetto, Jane Morton] [Goldsmith, Amy] [McNutt, Richard] [Nolan, Christine] [O'Gorman, Margaret] [Schulte, James] [van Rossum, Maya])

Response: *Potential impacts to land use associated with the proposed land exchange and the management of dredged material will be evaluated in EIS Sections 4.1, 5.1, and 7.1.*

Comment: The Army Corps and PSEG must consider an alternative to the land swap, such as using the existing access road to Artificial Island instead of creating a second road, if and when a new nuclear facility is permitted. This would avoid destruction of wetlands and obviate the need for a new dredge disposal site. In our view, the existing access road should be sufficient and no additional destruction of wetlands should be permitted at the site. Issues associated with a new spoil disposal site are as yet unknown as the sites under consideration are unknown. But there are likely to be issues, considering the Anny [Army] Corps' preference for riverfront lands. (**0003-10** [Batty, Sandy] [Dillingham, Tim] [Galetto, Jane Morton] [Goldsmith, Amy] [McNutt, Richard] [Nolan, Christine] [O'Gorman, Margaret] [Schulte, James] [van Rossum, Maya])

Response: *Impacts to land use associated with the proposed causeway and the management of dredged material will be evaluated in EIS Sections 4.1, 5.1, and 7.1. In addition, the U.S. Army Corps of Engineers-Philadelphia District will consider impacts associated with the land swapping action as part of a separate environmental review.*

D.2.5 Comments Concerning Land Use—Transmission Lines

Comment: There are two Land and Water Conservation Fund (LWCF) sites within a 6-mile radius of the proposed project located in Delaware. It does not appear that the project will directly affect the Delaware LWCF sites. However, if new transmission lines were to cross the river, they could potentially impact these LWCF sites, depending upon placement. See the attached map for locations of the LWCF properties within the 6-mile radius of the proposal. (**0017-1** [McConaghie, Jennifer])

Response: *Potential impacts to off-site land use, including impacts from transmission lines, will be evaluated in EIS Sections 4.1, 5.1, and 7.1.*

Comment: 13) Environmental Report, Chapter 5, Page 5.6-1

5.6.1 Terrestrial Ecosystems

The ESP states, "Transmission needs for the new plant include two or three new on-site transmissions lines crossing between two proposed switchyards on the PSEG Site and a potential off-site transmission line."

Comment

Comment 1 (above) also applies to this portion of the project.

14) Environmental Report, Chapter 10, Page 10.1-5 Table 10.1-1 Construction-Related Unavoidable Adverse Environmental Impacts

Table 10.1-1 of the ESP indicates that the adverse land use impacts include construction of the new plant and causeway which will impact 500 acres of predominantly disturbed or otherwise degraded land. The mitigation measures in Table 10.1-1 states that construction activities will comply with all relevant federal, state, and local regulatory requirements, including BMPs and stormwater management plans to control erosion and runoff.

Comment

Comment 1 (above) also applies to this portion of the project. Please see comment 1 for a description of one of the Federal regulations that is applicable to this project. (**0019-31** [Brubaker, Scott])

Response: *Impacts to land use associated with the proposed action will be evaluated in EIS Sections 4.1, 5.1, and 7.1.*

D.2.6 Comments Concerning Geology

Comment: Much of the needed science for the ESP should be at hand since the new station is being sited adjacent to Hope Creek and Salem Creek generation stations; their track record appears to be good, the new site will share the same geology, use of in place dredge spoils constituting all soils of the area-thus, artificial Island. (**0008-3** [Lacandro, Roger])

Response: *The geology of the site will be discussed in EIS Section 2.1-Site Location and described in detail in EIS Section 2.8-Geology.*

Comment: And, you know, that is also why it is a very bad location. Plus the facility is built on mud. It is river mud that the facility is built on. The three existing facilities have pylons that go down, like, 70 feet. But they still don't hit bedrock. So the new facility will probably be built the same, on mud. Mud has a tendency to sink. It is not a stable foundation. The bedrock is much further below. They just stopped trying to reach bedrock. Will the new facility be based in bedrock, to make it more stable? That is a question that I think the Commission should make part of their review. And then, also, the problem with mud, and building a facility on it, is problem with earthquakes. And what happens is if you have buildings on a soft ground, like mud, you get liquefaction - that is the term that is used. You get the vibration from the earthquake. The earthquake shaking is magnified, by the mud, which shakes. A classic example is the earthquake in Mexico City, about 10 or 15 years ago. It was a mild level, Richter scale event. But because it was located in a valley, which was previously marshland, located on mud, the whole area beneath Mexico City vibrated. So the effect of damage was amplified, even greater. You have this same situation, there, on the mud at Salem Nuclear Facility. You know, who knows when an earthquake is coming. But that, also, needs to be evaluated. So I feel it is, you know, one of the worst locations for an existing facility, as well as adding a new one. (**0002-6-7** [Schneider, Richard])

Response: *The geology of the site will be discussed in the EIS Section 2.8-Geology and Section 3.2.2-Structures with a Major Environmental Interface. Safety related issues such as foundational stability and the impact of earthquakes on the plant will be evaluated as part of the Safety Evaluation Report.*

D.2.7 Comments Concerning Hydrology—Surface Water

Comment: (8) ER Section 4.1.2.2, page 4.1-7: indicates that dredged material from the USACE Artificial Island CDF and from dredging activities associated with the intake and barge facility areas would be used as fill material on-site.

At a May 9, 2010 meeting with the NJDEP, PSEG representatives indicated that dredging of ~975,000 cubic yards of sediments from the Delaware River would be needed to support the project - this has apparently been reduced to ~ 590,000 CY (see Comment #9). All dredging and dredged material management activities associated with the construction of the proposed project must be described and comprehensively evaluated. This would include testing of dredged material consistent with the requirements of the 1997 NJDEP Dredging Technical Manual. The documents submitted in support of the ESPA barely discuss dredging and dredged material aspects of the proposed project. Section 2.3.1 of the Environmental Report only briefly summarizes some Delaware River sediment samples collected in the vicinity of the project site and subjected only to grain size analyses.

Dredging and dredged material management activities will also require a variety of permits from the NJDEP, including a CZM Consistency Determination. The use of any dredged material as on-site fill - including material excavated from the USACE Artificial Island Upland CDF - will require an Acceptable Use Determination from the Department.

At the May 9, 2010 meeting, it was also stated that construction of a new dredged material upland CDF on the PSEG property may be needed. If still needed, the potential impacts of the construction and use of such a facility must also be comprehensively evaluated and approved by the Department, consistent with the requirements specified in the 1997 NJDEP Dredging Technical Manual. (**0020-10** [Brubaker, Scott])

Response: *Potential impacts to surface water and groundwater quality as a result of construction, including dredging, will be discussed in EIS Sections 4.2.3.1 Surface Water Quality Impacts and 4.2.3.2 Groundwater Quality Impacts.*

Comment: General Comments

The permittee included various estimates of projected impingement and entrainment values for the proposed system. Impingement and entrainment can be assessed by a wide variety of tools and it is not possible to comment on the accuracy of these estimates without understanding more regarding the underlying assumptions. However, as noted above, the Department supports the use of closed cycle cooling as best technology available to minimize water withdrawal rates.

The Department recognizes that the proposed closed cycle cooling system using cooling towers and a low intake velocity of less than 0.5 feet per second constitutes the best technology available for minimizing impingement and entrainment impacts under Section 3l6(b) of the Clean Water Act.

Specific Comments

The Department takes issue with the following statement on page 5.2-7:

"'NJDEP has issued a discharge permit for the SGS (reference 5.2-7) and determined that the SGSs thermal plume, including the maximum temperature, does not impact the balanced indigenous community ...."

Rather, the Department stated the following in its June 29, 2001 NJPDES permit for PSEG-Salem:

"Therefore, based on a review of the current data and modeling pertaining to the thermal plume as well as the biothermal assessment, the Department has determined that a variance under Section 316(a) is warranted. A thermal discharge at the Station, which does not exceed a maximum of 1150 F (46.10 C) is expected to assure the protection and propagation of the balanced indigenous population. These effluent limitations for temperature are set forth in Part III-B/C as described previously. In addition, effluent limitations are also retained for heat in this proposed renewal permit (applied to Units 1 and 2)."

Specifically, the Department did not include a statement in said permit that PSEG does not impact the balanced indigenous community. (**0019-26** [Brubaker, Scott])

Response: *Water quality and aquatic ecology impacts as a result of plant operations at the proposed units will be discussed in Section 3.4.2.1 - Intakes, Discharges, Cooling Towers; 5.2.2 - Water Use Impacts; Section 5.2.2.1 - Surface Water Impacts; and Section 5.3.2 - Aquatic Impacts Related to Operation.*

Comment: The Bureau of Water Allocation (BW A) has reviewed the Environmental Report (ER) submitted with PSE&G Early Site Permit (ESP) application for a proposed nuclear electric generating plant located adjacent to the existing Hope Creek Generating Station (HCGS) and Salem Generating Station, Units 1 and 2 (SGS) in Lower Alloways Creek Township, Salem County, New Jersey (NJ).

A specific reactor technology has not yet been selected. However, the design characteristics of four reactor technologies under consideration were used to establish a plant parameter envelope (PPE) (Site Safety Analysis Report [SSAR] Section 1.3). While issuance of the ESP does not authorize construction and operation of any new nuclear power units, this ER analyzes the environmental impacts that could result from the construction and operation of one or two new nuclear power units at the PSEG site. These impacts are analyzed to determine if the site is suitable for the addition of the new nuclear plant, and whether there is an alternative site that is environmentally preferable to the proposed site.

PSEG has not yet selected a specific reactor(s) technology. Four different technologies are under consideration including:

- Advanced Passive 1000 (AP1000)
- U.S. Evolutionary Power Reactor (U.S. EPR)
- Advanced Boiling Water Reactor (ABWR)
- U.S. Advanced Pressurized Water Reactor (US-APWR)

This ESP application uses a PPE approach that encompasses all four reactor technologies (SSAR Section 1.3). The ESP analyzes the environmental impacts of the four reactor technologies using either one unit (U.S. EPR, ABWR, or U.S. APWR) or two units (AP 1000) at the PSEG site. Since a specific reactor technology has not been selected, the environmental impact analyses are based on reactor bounding conditions derived from detailed reactor information supplied by the vendors. The total bounding PPE value for the new plant is 6830 gross megawatts thermal (MWt) (SSAR Table 1.3-1 Item 17.3) and 2200 MWe net. Section 3.2, Reactor Power Conversion System, provides additional information on these reactor technologies.

The new plant uses a recirculating (closed-cycle) cooling water system that includes natural draft, mechanical, or fan-assisted natural draft cooling towers. A new shoreline intake structure supplies makeup water from the Delaware River to the new plant. A new discharge structure conveys cooling tower blowdown to the Delaware River in conformance with New Jersey Pollutant Discharge Elimination System (NJPDES) permit requirements.

Section 3.4, Cooling System, provides additional detail on the intake, discharge, and cooling tower components of the plant cooling system.

In accordance with Water Supply Management Act, N.J.S.A. 58:1A-l et seq. and its supporting regulations N.J.A.C. 7:19-1 et seq. the following will be required from BWA:

A Water Allocation Temporary Dewatering Permit will be required for construction dewatering where the dewatering rate is 100,000 gallons per day for more than 30 days in a consecutive 365day period. If the dewatering period is 30 days or less, a Permit by Rule will suffice. A Dewatering Permit by Rule may be applicable if the dewatering occurs from within a coffer dam.

The current Water Allocation Permit, No. 2216P requires modification to allow additional ground water use for the new plant. Included with such a request for major modification of the Water Allocation Permit will be a Hydrogeologic Report prepared in accordance with GSR-29 Guidelines pursuant to N.J.A.C. 7:19-22(c).

The site is located in the Salem/Gloucester County USGS Study Area south of Critical Area No.2. Increases in withdrawals from the PRM Aquifer are being reviewed by BWA due to concerns with safe yield and salt water intrusion. The results of t (**0019-24** [Brubaker, Scott])

Response: *The EIS will identify and in some instances discuss all the appropriate Federal, state, and local authorizations and consultations an applicant must obtain before construction and operation can take place. These permits and approvals will be will be discuss in Chapter 1 and Appendix H of the EIS.*

Comment: Increases in turbidity through the resuspension of sediments into the water column from dredging and port operations will degrade water quality, lower dissolved oxygen levels, and potentially release chemical contaminants bound to the fine-grained estuarine/marine sediments. Sedimentation and wave patterns in the area may be altered as a result of vessels entering and exiting the proposed mooring area also resulting in increased turbidity. Suspended sediments mask pheromones used by migratory fishes, and can smother immobile benthic organisms and demersal newly- settle juvenile fish (Auld and Schubel 1978; Breitburg 1988; Newcombe and MacDonald 1991; Burton 1993; Nelson and Wheeler 1997). As supported above, the project area provides important habitat for striped bass including valuable spawning grounds and nursery habitat. Increases in turbidity will adversely affect striped bass larvae's ability to capture prey (Fay et al. 1983 in Able and Fahay 1998). The decrease in water circulation can also adversely affect striped bass survival as strong current is needed to keep the eggs suspended in the water column and prevent them from being smothered by silt (Bigelow and Schroeder 1953). (**0022-3** [Gorski, Stanley])

Response: *Potential construction impacts as a result of dredging including lowered dissolved oxygen levels, potential releases of chemical contaminants bound to fine- grained sediment, and suspended sediments will be discussed in Sections 4.2, 4.2.3.1, and 4.2.4 of the EIS. Impacts to aquatic fauna will be discussed in Section 4.3.2*

Comment: Impacts to the quality of surface waters and the alteration of river bottom sediments within the Delaware River and adjacent marsh creeks are expected as a result of the construction and operation of the proposed facility, and will include those associated with the development of shoreline features (intake structure, barge facility, heavy haul road), dredging of sediments from the near-shore area of the Delaware River to provide for water intake and

discharge and to provide adequate draft for barge access during construction, and the filling of 9.5 acres of coastal tidal wetlands and shallow open water areas. (**0022-1** [Gorski, Stanley])

Response: *Potential impacts to surface water quality as a result of construction and operation, including dredging, will be discussed in EIS Sections 4.2.3.1 and 5.2.3.1, respectively. In addition, cumulative impacts to surface water quality will be discussed in Section 7.2.1.*

Comment: (17) Section 5.1.1.1, page 5.1-1, para. #2: briefly discusses dredging activities that may be needed during operation of the proposed facility, and concludes that - since the dredged material will be disposed of in approved upland areas - any resulting impacts will be small. See Comments #8 and #9. [Also see Sections 5.2.1.2 and 10.5.2.1] (**0020-27** [Brubaker, Scott])

Response: *Potential impacts to surface water quality as a result of construction and operation, including dredging, will be discussed in EIS Sections 4.2.3.1 and 5.2.3.1, respectively. In addition, cumulative impacts to surface water quality will be discussed in Section 7.2.1.*

Comment: (15) ER, Table 4.6-1: regarding potential measures to mitigate potential water quality and aquatic ecosystem impacts resulting from dredging and dredged material management activities - see Comments #9 and #14. (**0020-24** [Brubaker, Scott])

Response: *Mitigation of water quality impacts, proposed by the applicant, as a result of construction and operation, will be discussed in Sections 4.2.5 and 5.2.5 of the EIS.*

Comment: ER Page 24 of 136-Hydrological Alterations:

"Development of these areas resulting in the loss of the artificial ponds will result in localized runoff that is collected in engineered detention basins, and conveyed to the Delaware River."

Comment: The NJBNE is requesting split samples of surface water from any new engineered basin as part of the pre-operational stage. Initial sampling provides a baseline history prior to plant operation.

In addition, the licensee should investigate whether the retention basins (being added as monitoring locations for non-radiological measurements such as Total Suspended Solids, Total Organic Compounds, pH, etc) need to be added to the Department's NJPDES Permit for Discharge to Surface Water. (**0019-2** [Brubaker, Scott])

Response: *Potential impacts to surface water quality as a result of construction and operation, including hydrological alterations, will be discussed in EIS Sections 4.2.4, 4.3.1, 5.2.1, and 5.2.1. In addition, the EIS will identify and in some instances discuss all the appropriate Federal, state, and local authorizations and consultations an applicant must obtain before construction and operation can take place. These permits and approvals will be will be discuss in Chapter 1 and Appendix H of the EIS.*

Comment: The impact of the Project, standing alone, as well as that of the cumulative land-use and development patterns in Salem County and the surrounding area, upon stormwater pollution should also be considered in depth in the EIS. The ER does not adequately address this issue. (**0018-12** [Brown, Elizabeth])

Response: *The potential impacts of stormwater pollution resulting from construction (Section 4.2.3) and operation (Section 5.2.3) will be addressed in the EIS. Cumulative impacts of the plant on surface water will be addressed in Section 7.2.2.1 of the EIS.*

Comment: (13) ER, Section 4.3.2.3, page 4.3-19, para. #3: concludes that impacts associated with dredging activities are small; see Comment #9. (**0020-20** [Brubaker, Scott])

Comment: (10) ER, Section 4.2.3.1, page 4.2-13, para #2: states that "Based on the findings of the USACE's Delaware River main channel deepening project Environmental Assessment, dredging is not expected to result in degradation of water quality." The evaluation of potential impacts presented in the referenced Environmental Assessment are of little relevance to the evaluation of the potential impacts of dredging and dredged material management activities associated with the proposed PSEG project. (**0020-15** [Brubaker, Scott])

Comment: (9) ER, Section 4.2.1.1.4, page 4.2-5: briefly describes construction and dredging activities along the Delaware River shoreline. A total area of 92 acres - approximately 590,000 CY of sediment - is proposed to be dredged. The document concludes that impacts associated with dredging are small. However, much more work is needed to comprehensively evaluate the potential impacts resulting from dredging and dredged material management activities - see Comment #8. (**0020-13** [Brubaker, Scott])

Response: *Potential impacts to surface water quality as a result of construction and operation, including dredging, will be discussed in EIS Sections 4.2.4, 4.3.1, 5.2.1, and 5.2.1. In addition, cumulative impacts to surface water use will be discussed in Section 7.2.1.1.*

Comment: The ER acknowledges that hydrogeological impacts will result from dredging near-shore areas of the Delaware River for water intake, water discharge, and barge access areas (modifying the existing HCGS barge slip.) DRN has long advocated for comprehensive environmental review of dredging projects that will result in significant harm to the Delaware River's environmental values through dredging and filling, blasting, and degraded water quality. Section 4.2.1.1.4 of PSEG's ER describes the proposed dredging as follows:

"Alteration of surface waters within the Delaware River include those associated with the development of shoreline features (intake structure, barge facility, heavy haul road), and dredging (Figure 3.1-2). Constructed features along the Delaware River shoreline require the filling of 9.5 ac. of coastal wetlands and shallow open water areas (Subsection 4.3.2.3). Construction of these facilities includes the installation of sheet piling, bulkheads, and backfilling to create the constructed project utilization area. Shorelines will be stabilized and protected from erosion by the use of hardened bank applications (concrete, riprap, etc.). Consequently, in consideration of the small area of river to be modified relative to the size of the Delaware River, and based on the use of hardened bank treatments that minimize shoreline erosion, potential construction related impacts to the Delaware River are SMALL, but warrant mitigation in accordance with the NJDEP and USACE requirements.

Sediments from the near-shore area of the Delaware River Estuary will be dredged to provide for water intake and discharge and to provide adequate draft for barge access during construction. Construction of the new barge unloading facility and mooring area will require

lowering of the river bottom an average of 4.5 ft. over an area of 61 ac. (dredging of 440,000 cubic yards of sediment). Barge mooring caissons will be constructed. Each caisson is 20 ft. in diameter resulting in the loss of 0.05 ac. of river bottom habitat for seven caissons. Construction of the new intake structure requires lowering the river bottom an average of 4.5 ft. over an area of 31-ac. (dredging of 150,000 cubic yards of sediment).

The total area to be dredged is 92 ac., extending riverward 1700 ft. from the shoreline, or 13 percent of the 2.5-mi. river width at this location. Dredging may include both mechanical and hydraulic dredging methods. Dredged material removed as part of this construction activity will be transported to and placed in an on-site or other approved upland disposal facility. The potential impacts of the dredging activities on water quality are described in Subsection 4.2.3.1.

Potential impacts to benthic organisms are discussed in Section 4.3. BMPs for dredging implemented during this activity will comply with requirements of the USACE Section 10/404 and NJDEP permits. Hydrologic alterations associated with this activity include localized changes in flow patterns along the river bottom due to differences in bottom contours at the edges of the dredge zone. From a river flow cross section perspective, the dredged area for barge access would add a total of 7500 square feet (sq. ft.) to an existing cross section of 220,000 sq. ft. (low water) to 270,000 sq. ft. (high water), or a localized increase in flow area that is in the range of 2.5 to 3.5 percent. Accordingly, the average velocity within the dredged area is reduced in proportion to the increase in cross sectional area. However, these small scale alterations in river flow are minimal in the context of the large size of the Delaware River and regular tidal flows. In consideration of the magnitude of the tidal flow and the size of the Delaware River, potential impacts associated with dredging are SMALL."

Clearly, the EIS will need to address the impact of dredging and related shoreline disturbance and take all viable alternatives into account. (**0018-9** [Brown, Elizabeth])

Response: *Potential impacts to surface water quality as a result of construction and operation, including dredging, will be discussed in EIS Sections 4.2.4, 4.3.1, 5.2.1, and 5.2.1. In addition, cumulative impacts to surface water use will be discussed in Section7.2.1.1. The part of the comment dealing with land use and potential impacts to terrestrial resources will be discussed in Sections 4.1.1 and 4.3.1.1, respectively. Finally, potential impacts to aquatic organisms as a result of construction and operation can be in Section 4.3.2 and 5.3.2.*

Comment: Therefore, DRN urges NRC to review certain issues in more detail, including: clearer evaluation of PSEG's use of the Army Corps confined disposal facility, and cumulative impacts resulting from use of that site; water impacts including dredging and construction impacts; filling of wetlands; floodplain impacts; habitat impacts and impacts to species, especially Atlantic sturgeon; and impacts and evaluation of alternatives for cooling systems. (**0018-2** [Brown, Elizabeth])

Response: *The U.S. Army Corps of Engineers-Philadelphia District is a Cooperating Agency on the EIS for PSEG's ESP application. As such, the environmental impacts of any actions proposed by the Corps to facilitate PSEG's ESP application, including the land exchange and relocation of the confined disposal facility, will be discussed in the EIS. Impacts as a result of*

construction including potential impacts to wetlands and habitat can be found in Chapter 4. Finally, potential cumulative impacts as noted in the comment will be evaluated in Chapter 7 of the EIS.

Comment: Finally, NRC must evaluate the impacts and all viable alternatives for cooling. DRN notes that EPA's Phase I regulations for new sources require closed-cycle cooling, which the new plant will have. 68 Fed. Reg. 36749-36755 (June 19, 2003). DRN has long advocated for closed-cycle cooling at the existing Salem facility. However, that does not mean that closed-cycle cooling is without impacts, or that one size fits all when selecting the specific cooling technology. According to the ER "Compared with a once- through cooling system, a closed cycle cooling system substantially reduces the volume of water diverted for cooling but increases consumptive water use as a result of evaporation loss in the cooling tower." (**0018-15** [Brown, Elizabeth])

Response: *Consumptive water use potential operational impacts will be discussed in Sections 5.2 and 7.2 of the EIS. Ecological impacts as result of plant operation will be discussed in Section 5.3.2. Potential thermal impacts, including to water chemistry, will be discussed in Section 5.2.4. Alternative cooling system designs will be discussed in Chapter 9.*

Comment: In addition to the steps being taken to protect the wetlands impacted by construction, the aquatic impacts of the proposed facility will be limited by the use of a closed cycle cooling system. Compared to a once-through system, these cooling towers will divert much less water for cooling. Projected maximum diversion for the new facility is less than 4% of the current amount used by the Salem Generating Station and is a very small fraction the total volume of the Delaware River flow. As a result, impingement of fish populations will be a small fraction--less than 3% of the current level of the Salem station.

Because of the closed cooling system, we would also expect the thermal plume of the new plant to be localized and relatively small, with no significant impact on the local aquatic biota. The conclusion is based on past studies of the impact of thermal plumes from the existing PSEG generating plants, the expected operation of the proposed cooling structures, and our understanding of the ecology of aquatic species in the vicinity of the plant. (**0014-11** [Velinsky, David])

Response: *Consumptive water use potential operational impacts will be discussed in Sections 5.2 and 7.2 of the EIS. Ecological impacts as result of plant operation will be discussed in Section 5.3.2. Potential thermal impacts will be discussed in Section 5.2.4.*

Comment: WRA is interested in PSEG's proposed project because PSEG's proposed nuclear plant will be a major water user located in the Delaware River Basin and is an important part of the economy of New Jersey and the region at large. (**0011-1** [Molzahn, Robert])

Response: *Consumptive water use potential operational impacts will be discussed in Sections 5.2 and 7.2 of the EIS.*

Comment: Consumptive water use is an important issue on the Delaware River Basin, especially during drought periods. Although the proposed plant is located in the saline estuary,

fresh water will still be evaporated by the cooling towers and thereby consumed. During declared drought emergencies the fresh water consumed should be replaced at an appropriate ratio by using water released from the Merrill Creek Reservoir near Phillipsburg, NJ. PSEG, along with several other electric generation companies, is a co- owner of Merrill Creek. Water released from Merrill Creek helps in keeping the salt line from moving upstream to the water intakes for the City of Philadelphia. Merrill Creek was financed, built and operated by electric generating companies for just this purpose. (**0011-10** [Molzahn, Robert])

Comment: Consumptive water use is an important issue on the Delaware River basin, especially during drought periods. Although the proposed plant is located in the salient estuary, fresh water will still be evaporated by the cooling towers and, thereby, consumed. During declared drought emergency the fresh water consumed should be replaced, at an appropriate ratio, by using water release from the Merrill Creek Reservoir, near Phillipsburg, New Jersey. PSEG, along with several other electric generating companies, is a co-owner of Merrill Creek. Water release from Merril Creek helps in keeping the salt line, which is a 250 isoclore line from moving upstream to the water intakes for the City of Philadelphia. Merrill Creek was financed, built and operated by electric generating companies for just this purpose. (**0001-8-9** [Molzahn, Robert])

Comment: In reviewing the PSEG Early Site Permit application, and Environmental Report filed on May 25th, 2010, we noted that the new units intake and cooling systems will be designed to minimize the impact to the aquatic community, by utilizing cooling towers, and an intake system and design flows that conform to best available technology as required under Section 316B of the Clean Water Act. The cooling tower blow-down discharge should have little impact on the Delaware River, at this location, or significantly elevate river water temperatures. (**0001-8-8** [Molzahn, Robert])

Response: *Consumptive water use potential operational impacts will be discussed in Sections 5.2 and 7.2 of the EIS. Potential thermal impacts will be discussed in Section 5.2.4. Additionally, mitigative measures proposed by the applicant, if needed will be identified in the section titled Potential Mitigation Measures for Operation-Related Water Impacts.*

Comment: With the new facility a good thing is, if it is built, that it would have a closed loop cooling system, which would greatly reduce the amount of water needed to cool the facility. A closed loop cooling system reduces the water take, compared to an open loop system, by 90 to 95 percent. So however, an average nuclear facility draws in, an open loop system, like a billion gallons of water a day, over a billion. So even with the closed loop, you are still talking about 50 million to 100 million of gallons a day. (**0002-6-9** [Schneider, Richard])

Response: *Consumptive water use potential operational impacts will be discussed in Sections 5.2 and 7.2 of the EIS.*

Comment: In addition to the steps being taken to protect wetlands impacted by the construction, the aquatic impacts of the proposed facility will be limited by the use of a closed-cycle cooling system. Compared to the once through system, these cooling towers will divert much less water for cooling. Projected maximum diversion, for the new facility, is less than

four percent, depending on the type of facility of the current use by Salem, and is less than .05 percent of the total volume of the Delaware flow. (**0001-4-7** [Velinsky, David])

Response: *Wetland protection during construction will be discussed in Sections 4.2.1 - Hydrological Alterations, 4.2.5 - Potential Mitigation Measures for Construction-Related Water Impacts, and 4.3.1 - Terrestrial and Wetland Impacts. Consumptive water use for plant operational will be discussed in Sections 5.2 and 7.2 of the EIS.*

Comment: Finally, although this does not relate directly to the environmental impacts of the new plant, I would add these thoughts on the prospects of global climate change. As an environmental scientist, I believe it is no exaggeration to say that climate change represents the singular environmental threat of the coming century. Even for the development of the new plant, the reality of sea level rise is a factor that must be and is being taken into account. (**0014-13,** (**0001-4-9** [Velinsky, David])

Response: *Environmental impacts resulting from construction and operation of the proposed plant, including greenhouse gas emissions will be addressed in the EIS Chapters 4, 5, and 7. Greenhouse gas emissions associated with the fuel cycle will be presented in Chapter 6. Potential impacts of flooding and sea level rise will be evaluated in the safety evaluation report.*

Comment: Sea level rise and storm surge are also a concern at the proposed facility. Critical structures should be elevated or waterproofed at an appropriate elevation to ensure their protection. The NRC should review these design plans to confirm they are protective for sea level rise. (**0011-14** [Molzahn, Robert])

Comment: My questions would include: concern for extreme floods and adequate entrance and egress systems, maintaining a good, continuous dialog with the community and an insistence that only the best science be incorporated in planning and construction. (**0008-8** [Lacandro, Roger])

Comment: The proposed construction of Salem 4 on Artificial Island would have several significant environmental impacts that the Corps must consider, including, but not limited to:

- Increasing level of flooding will take place on the island in the coming 50 and 100 year time frames. The impact of sea level rise must be considered. Development of an additional nuclear plant puts the facility, the workers, and the nuclear materials to be stored on the site at risk of harm and, in the case of the nuclear materials, at risk of release into the River and environment. (**0003-2** [Batty, Sandy] [Dillingham, Tim] [Galetto, Jane Morton] [Goldsmith, Amy] [McNutt, Richard] [Nolan, Christine] [O'Gorman, Margaret] [Schulte, James] [van Rossum, Maya])

Comment: The other potential impact that has to be considered here is associated with sea level rise. This is occurring, it is not disputed. Certainly in areas of New Jersey this is expected to be greater than in other areas of the country. This is not a game stopper here. One of the things I do at Rutgers is work with coastal communities on developing adaptation strategies to sea level rise. And I'm confident that the new facility will factor into account strategies to deal with a rising sea level along the New Jersey coast. (**0002-4-4** [DeLuca, Mike])

Comment: My questions would include concern for extreme floods, which may be different now than when the original plants were put into existence, adequate entrance and egress systems, maintaining a good, continuous dialogue with the community. (**0001-9-7** [Lacandro, Roger])

Comment: Sea level rise and storm surge are also a concern of the proposed facility, critical structures should be elevated, or waterproofed, at an appropriate elevation to ensure their protection. The NRC should review these design plans to conform that they are protected for sea level rise. (**0001-8-13** [Molzahn, Robert])

Comment: The proposed construction of Salem 4 on Artificial Island would have several significant and environmental impacts that the Corps must consider including, but not limited to, increased level of flooding, that will take place on the island in the coming 50 and 100 year time frame. The impact of sea level rise must be considered. Development of an additional nuclear plant puts the facility, the workers, and the nuclear materials to be stored on this site, at risk of harm. And in the case of nuclear materials, at risk of release into the river, and environment. (**0001-19-2** [Blake, Matt])

Response: *The EIS will evaluate the construction and operational impacts of the proposed plant on the existing environment. Potential impacts of flooding and sea level rise will be evaluated in the safety evaluation report.*

D.2.8 Comments Concerning Hydrology—Groundwater

Comment: As it relates to the ESP and proposed additional unit at Hope Creek, how does the trend of declining water levels in the upper PRM affect the potential water use with the proposed new unit? Will there need to be deeper wells in the mid-levels of the PRM? (**0021-2** [Brubaker, Scott])

Response: *Water withdrawal and impacts on the aquifer will be evaluated in EIS Sections 4.2.2-Water-Use Impacts and 5.2.2.2-Groundwater-Use Impacts. The cumulative impact of site groundwater use combined with the impacts of other past, present, and reasonably foreseeable future actions affecting groundwater resources will be discussed in Section 7.2-Water Use and Quality.*

Comment: ER Page 12 of 42, Section 6 -Environmental Measurements and Monitoring Programs

6.2.2.1 Radiological Monitoring Program

"The existing PSEG REMP serves as the new plant construction/preoperational radiological monitoring program. Additional on-site thermoluminescent dosimetry (TLD) monitoring locations will be added to the north of the HCGS to support the ODCM/REMP for the construction and preoperational period. A description of the new monitoring locations and other applicable parameters will be provided in the combined license (COL) application."

Comment: The NJBNE requests that the licensee establish a Groundwater Protection Program for the proposed site at the construction/pre-operational stage rather than waiting for the operation of the facility. During the construction phase, there will be knowledge as to where all

applicable tanks and pipes are going to be located, along with buildings containing radioactive fluids and areas of further investigation for potential tritium in groundwater. (**0019-7** [Brubaker, Scott])

Response: *Potential operational impacts to groundwater quality and water monitoring will be discussed in EIS Sections 5.2.3.2-Groundwater-Quality Impacts and 5.2.4-Water Monitoring. Specific details of PSEG's radiological environmental monitoring program (REMP) will be presented in EIS Section 5.9.6-Radiological Monitoring. As required by an NRC licensing condition, the existing REMP program for the currently operating Salem and Hope Creek units will be updated by the applicant to include specific details related to monitoring of the proposed unit. Per agreement with the NRC, this program includes monitoring of groundwater, is updated once necessary facility design details are available, and must be evaluated and approved by the NRC prior to the operation of the facility. The REMP program is evaluated by NRC staff as part of the safety review process to ensure that it is adequate to monitor each onsite unit, identify potential contamination, and prevent offsite impacts.*

Comment: Environmental Report (ER) Page 13 of 136-Land Use Impacts: "All necessary permits and authorizations will be obtained and appropriate environmental controls implemented (e.g., storm-water management systems, groundwater monitoring wells, and spill containment controls) prior to commencement of earth disturbing activities. Site preparation and construction activities affecting land use include clearing, grubbing, grading, excavating, and stockpiling of soils. Soil management is an important element of construction sequencing. Materials excavated from the power block area will be stockpiled and/or disposed of on-site, or otherwise evaluated for reuse/disposal, potentially under a beneficial use determination (BUD), per NJDEP requirements as appropriate."

Comment: The NJBNE is requesting split samples from any new groundwater monitoring wells installed in association with the new facility. The sampling of these new wells should be added to the existing licensee sampling plan and Groundwater Protection Program (GWPP). In addition, a one-time composite soil core boring sample from any new well is requested by the NJBNE. Initial sampling provides a baseline history prior to plant operation. (**0019-1** [Brubaker, Scott])

Response: *Potential impacts to groundwater as a result of construction and operation of the proposed plant will be evaluated in EIS Sections 4.2.4-Water Monitoring, 5.2.4- Water Monitoring and 7.2.2 Cumulative Groundwater-Quality Impacts. The State of New Jersey would be responsible for requiring that the applicant provide any type of groundwater monitoring program samples. Such activities are not within the NRC's licensing authority.*

D.2.9 Comments Concerning Ecology—Terrestrial

Comment: During the re-permitting of the existing nuclear facilities at Salem, PSEG developed a bay-wide concept of mitigating the impacts of the existing cooler apparatus at those facilities. They were creative in identifying a variety of ways that the bay-wide resource value could be improved through investment in projects, throughout the Delaware Bay Estuary. I was attracted by the scope of their thinking, and the resources they could bring to the table. I testified in favor of this mitigation idea at the repermitting hearing. (**0001-10-4** [Applegate, Jim])

Response: *Comment noted. The NRC staff will discuss ecological impact mitigation, as necessary, in Section 5.3 of the EIS. The EIS will also include a discussion of the bay- wide approach undertaken by PSEG as part of the existing environment.*

Comment: Since then I have followed, with my students, and with great interest, what has become the largest estuarine enhancement project in the world. Without going into any details, the project has been, in my mind, a resounding success at many levels, in increasing the resource value of large acreages throughout the bay. PSEG has a solid track record in delivering on their commitment to bay-wide health. (**0001-10-6** [Applegate, Jim])

Response: *Comment noted. The NRC staff will discuss PSEG's estuarine enhancement program in Section 2.4 of the EIS as part of the existing environment.*

Comment: Returning, finally, to the purpose of this hearing, should this project move forward with construction, there will be on-site habitat impacts that will be unavoidable. I urge the process to embrace the same bay-wide approach used in the estuarine enhancement program, and to be creative and aggressive, in identifying off-site mitigation opportunity. Hold PSEG's feet to the fire. History suggests that they will deliver. (**0001-10-8** [Applegate, Jim])

Response: *The NRC staff will discuss on-site habitat impacts in Sections 4.3 and 5.3 of the EIS. Potential off-site mitigation measures will be discussed, as necessary, in Section 4.3 of the EIS. A bay-wide approach will be similarly emphasized over a site- specific evaluation that can overlook the benefits of an overall ecosystem approach.*

Comment: With respect to restoration of wetlands, it has been common knowledge, for a long time, that wetlands support the production of most commercial and recreational fin fish and shellfish species, that we all enjoy eating, or capturing, or both. To the extent that you can find citations in the literature, Irand and Lacy, for example, that say 95 percent of all commercial and recreational species produced, marine species produced in the United States, require wetlands as essential habitats during their first year of life. (**0001-14-1** [Weinstein, Michael])

Response: *The NRC staff will describe the existing wetlands that could be affected in Section 2.4 of the EIS.*

Comment: The company had the foresight, long before the Estuarine Restoration Act was passed, with the goal of restoring a million estuarine acres, including many wetlands, in the U.S. by the year 2010. Long before that Act was passed, and the guardian of that act became two entities, essentially, Restore America's Estuaries, a practitioner coalition nation-wide. Actually now world-wide. And the Community Restoration Center, NOAA Restoration Center, Community Based Restoration Center which has, I think, a collective budget, over the years, now exceeding 28 million dollars. Before that became in the public venue, and popular, restoring wetlands is a good thing, and we needed to know why, of course.

Long before that became the popular trend, the company PSEG had been developing this program as a cost-effective basis for offsetting the effects of the power plant, with respect to its take of fin fish and shellfish. And the goal was to produce enough wetland acreage, or to

conserve and restore enough wetland acreage, to produce the number of equivalent adults that would be lost at the facility. (**0001-14-3** [Weinstein, Michael])

Response: *Comment noted. The NRC staff will discuss PSEG's wetland conservation and restoration efforts in Section 2.4 of the EIS as part of the existing environment.*

Comment: We have been able to demonstrate, given the extreme variability around any mean you calculate, in these sites, in terms of processes and functions, that the 20 plus thousand acres produced a new increment of secondary production of these fin fish and shellfish that exceeded the loss, again as I said before, of equivalent adults. Also we have been able to document, everybody says phragmites is bad, and we suspected for a long time that it had to do with habitat, and other functional processes.

Some of our research has now demonstrated that a fish growing up in a phragmites dominated marsh, whatever the combination of factors is, and I should say to you, much to the company's chagrin, I was able with my colleagues to demonstrate that carbon nitrogen nutrients from phragmites is, indeed, finding its way into this fish.

But the quality of the animal, the end of the growing season, falls short of the quality of an animal in a naturally cord grass dominated marsh. In other words, they can't put down the energy reserves, for migration and overwintering, if they grow up in a phragmites marsh. (**0001-14-6** [Weinstein, Michael])

Response: *Comment noted. The NRC staff will describe the existing wetlands that could be affected in Section 2.4 of the EIS. Mitigation with native plant species, as necessary, and control of invasive species (i.e., phragmites) will be discussed in Sections 4.3 and 5.3 of the EIS.*

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Response: *Comment noted. The NRC staff will describe the existing wetlands that could be affected in Section 2.4 of the EIS. Mitigation with native plant species, as necessary, and control of invasive species (i.e., phragmites) will be discussed in Sections 4.3 and 5.3 of the EIS.*

Comment: So let me close with a series of statistics, if I may. First of all, as Seagrant Director, I was able to enter into a public private partnership with the company. The company put up 750,000 dollars over five years, and we Seagrant Directors, in 11 states around the nation, matched those funds, to do some of the basic and applied research to understand what was going on, as we were restoring these sites.

One of those projects funded a young lady by the name of Kristen Solenstal at Yale University. She was the first of many people trying, with that funding, to demonstrate that the variety of phragmites that we call bad is actually an introduced variety, probably from either Asia, or Europe, or probably both.

That was part of this Marsh Ecology Research Program, or the MERP, as we called it. All of these funds were parlayed into many federal grants. For example, I have been funded by the EPA, by NOAA, several agencies within NOAA, ANS, Solestol Kennedy, I have received NSF funding. All as part of the programmatic opportunity, at the Estuary Enhancement Program created for people interested in understanding how to do this restoration, how to make it effective, and why it actually works.

Two contributions, three contributions that will be the last I say. Three contributions that we made, that come immediately to mind is, as a group, the scientists involved in the Estuary Enhancement Program developed the practitioner skills, or methods, for restoring wetlands. What kinds of criteria and metrics should you be thinking about, when you go in to restore a site? Those metrics have been fully adopted by Restore America's Estuaries, and has been published as a public document by them. We published it, of course, in the peer reviewed literature, on our own.

Secondly, one of the toughest things to do, when you are trying to look at these restored sites with respect to the returns of functions and processes, as opposed to the structure of these sites, it is relatively easy to grow grass. I apologize to my friends in the Corps. But you are the guys that told me to keep it simple, stupid. We can defend 85 percent survival after three years in court, to a wetland ecologist that means absolutely nothing, other than you are pretty good at growing grass, which I guess is not bad. (**0001-14-7** [Weinstein, Michael])

Response: *Comment noted. The NRC staff will discuss PSEG's estuarine enhancement program in Section 2.4 of the EIS as part of the existing environment.*

Comment: I mention that we are able to employ new, really state of the art, modeling efforts, something called Echopath and Echosim, if any of you are familiar with it, to demonstrate, once again, that the increment of new production, one is measurable against background, and two, it is equated with the goals of the program. This is one of the most important projects with regard to coastal wetland management, and coastal management in general, that has ever been undertaken.

And I, personally, applaud the foresight of the company to do something like this, when it wasn't considered, at the time, best management practices. And whether it becomes best management practice, regulatory or law, or otherwise it clearly has been. (**0001-14-9** [Weinstein, Michael])

Response: *Comment noted. The NRC staff will discuss PSEG's estuarine enhancement program in Section 2.4 of the EIS as part of the existing environment.*

Comment: Construction of a new nuclear facility and access road, at this location, will result in the damage of wetlands, and adverse effects on a variety of aquatic life, bird life, and wild life. (**0001-19-3** [Blake, Matt])

Response: *The NRC staff will discuss impacts of the proposed project on aquatic and terrestrial wildlife, along with mitigation measures, as necessary, in Sections 4.3 and 5.3 of the EIS.*

Comment: The natural systems of the Delaware River and estuary are critical environments, with major significance for both regional and global biodiversity, for regional water supply, and water quality, and for supporting important environmental activities. Construction on the scale proposed by PSEG, on the Delaware coast, requires careful consideration of environmental factors. (**0001-4-1** [Velinsky, David])

Response: *The NRC staff will discuss cumulative impacts of the project, including potential impacts to the Delaware River and estuary, in Section 7.3 of the EIS.*

Comment: Before addressing the new construction, I would like to point out PSEG's past efforts to mitigate the effects of its operations on the aquatic environment in the vicinity. In particular, faced with concerns of negative impacts on fisheries, by cooling water intake operations, PSEG responded with the largest private wetlands restoration project in the world. The Estuary and Enhancement program began in 1994, and since that time has had large scale efforts to restore and preserve portions of the Delaware River estuary, in both New Jersey and Delaware. It has restored, enhanced and/or preserved more than 20,000 acres of salt marsh, and adjacent uplands to vital, healthy habitat for fish and wildlife. (**0001-4-3** [Velinsky, David])

Response: *Comment noted. The NRC staff will discuss PSEG's restoration, preservation and enhancement efforts in Section 2.4 of the EIS as part of the existing environment.*

Comment: The proposed new construction will permanently impact approximately 230 acres of wetlands. While protection of wetlands is a high national priority, the majority of the wetlands acreage impacted by the new construction, has a degraded hydro period that is now a host of mono culture of phragmites.

An invasive reed plant, phragmites is often found in disturbed marsh areas, where plant communities, hydrology and topography have been altered. Phragmites displaces native plants, and has a negative impact on biodiversity. Targeting these degraded wetlands in close proximity of the existing facilities, will reduce the need for new infrastructure, minimizing the environmental disturbance that would result if development occurred in green field sort of sites.

Moreover, the amount of wetlands impacted represent a small fraction of the total wetland, many with higher quality functions present in the vicinity of the construction.

In addition, 85 acres of the wetland being permanently altered by the construction are located in the Army Corps of Engineers disposal facility. This has been a site for dumping of spoils from

deepening of the Delaware River channel. It is surrounded by dikes, and not open to tidal influences. It is unlikely that this site supports high level wetlands functions, and utilizing it, where the permanent construction is necessary, will limit overall wetland impacts.

PSEG is making acceptable efforts to restrict impact on these wetlands, including a site plan to minimize encroachment, the use of sediment pits to stage some of the construction operations, and the use of raised causeways, rather than using fill material to carry the access road to the new site.

Where permanent disturbance to wetlands occurs, PSEG has outlined a tentative mitigation plan that would create new wetland environments, in adequate amounts, to offset any loss. We anticipate that the resources and expertise in the development of the Estuary Enhancement Program will provide a very strong foundation for the mitigation steps being taken by PSEG, and the new site construction, both in selecting the mitigation sites, and managing the restored and enhanced wetland sites. (**0001-4-5** [Velinsky, David])

Response: *Comment noted. The NRC staff will discuss potential ecological impacts of the proposed project, including causeway construction, in Sections 4.3 and 5.3 of the EIS. Any mitigation measures, proposed by the applicant, including any wetland enhancement efforts, will be discussed in Sections 4.3 and 5.3.*

Comment: You will hear that reactors are a threat to wildlife, but humans are among the species most sensitive to radioactivity, and their health has not been harmed. What will be an immeasurably small effect on wildlife from regulated releases, should be contrasted with the extensive damage to habitat, that would result from renewable installations, which you will hear about shortly. (**0001-5-5** [Meadow, Norman])

Response: *The NRC staff will evaluate the radiological impacts to wildlife from normal operation of the proposed reactor in Section 5.3 of the EIS. Potential effects on ecological receptors will be assessed based on appropriate exposure scenarios. Any mitigation measures, proposed by the applicant, to minimize this potential impact will also be discussed in the EIS in Section 5.3. Potential impacts to terrestrial resources resulting from the proposed project will be contrasted against implementation of other energy alternatives in Chapter 9 of the EIS.*

Comment: Whether the area is on land, or offshore, it is mind boggling to think of the potential harm, and humongous impacts of industrial wind. On land, particularly, the Appalachian Mountains of the East, the 396,000 acres, required, would destroy the mainly unfragmented, biologically rich forests, which are not only habitat for bats and nesting neo-tropical birds, but also habitat for terrestrial flora and fauna. The area is, also, a major migratory corridor for birds, bats, and raptors. Yet without full review of environmental impacts, or cost to taxpayers and customers, permits are being granted. (**0001-7-8** [Eastman, Ajax])

Response: *The NRC staff will discuss potential impacts to terrestrial resources resulting from the proposed project in contrast to implementation of other energy alternatives in Chapter 9 of the EIS.*

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As for the impacts offshore, we really can't know the full extent of the harm turbines will have on the aquatic resources, benthic organisms, oceanic mammals, or pelagic birds. Where is the precautionary principle in the blind acceptance of, and push for, such a destructive form of energy?

As for the impacts offshore, we really can't know the full extent of the harm turbines will have on the aquatic resources, benthic organisms, oceanic mammals, or pelagic birds. Where is the precautionary principle in the blind acceptance of, and push for, such a destructive form of energy? (**0001-7-9** [Eastman, Ajax])

Response: *The NRC staff will discuss potential impacts to terrestrial resources resulting from the proposed project in contrast to implementation of other energy alternatives in Chapter 9 of the EIS.*

Comment: After reviewing the Estuary Enhancement Program, by PSEG, I'm impressed by their innovative mitigation measures, such as wetland restoration, phragmites control, fish protection at the nuclear sites, restoration of anadromous fish migration, through fish ladders, research, et cetera. These programs have resulted in long lasting benefits for the saltwater estuary, including expanded biological diversity and habitats, breeding areas, food sources for aquatic, terrestrial, and avian species, especially threatened and endangered species, and better water quality. This leads me to believe that PSEG will do an excellent job of mitigation in the future. (**0001-7-11** [Eastman, Ajax])

Response: *Comment noted. The NRC staff will discuss PSEG's restoration, preservation and enhancement efforts in Section 2.4 of the EIS as part of the existing environment. Mitigation measures proposed by the applicant to minimize impacts and enhance terrestrial resources will be discussed in Sections 4.3 and 5.3 of the EIS.*

Comment: And I was really pleased to hear that the proposed site for these new reactors will be on land that is primarily phragmites, right now. That is a good thing to get rid of. (**0001-7-13** [Eastman, Ajax])

Response: *Comment noted. The NRC staff will describe the existing wetlands that could be affected in Section 2.4 of the EIS. Staff will discuss impacts to wetland resources in Sections 4.3 and 5.3 of the EIS.*

Comment: The Environmental Report indicates an overall wetlands impact of about 229 acres, from the new plant, and proposed causeway. It is further indicated that there is an abundance of wetlands in the vicinity, totaling more than 25,000 acres, and the quality of a dominant species, as we heard previously, is phragmites.

Additional lands targeted for acquisition through a land right exchange to the north of the site, are part of an existing Army Corps of Engineers confined disposal facility area that is surrounded by dikes and not open to the tides.

PSEG would reduce environmental impacts by placing permanent facilities inside these diked areas. And compensation for use of these wetlands, we would recommend that PSEG create or restore degraded wetlands, within the Delaware Bay region, at an appropriate compensation ratio. (**0001-8-10** [Molzahn, Robert])

Response: *The NRC staff will discuss any mitigation measures proposed by the applicant, including any wetland enhancement efforts, in Sections 4.3 and 5.3 of the EIS. Potential off-site mitigation measures will also be fully discussed in the EIS in Section 4.3. A bay-wide approach will be similarly emphasized over a site-specific evaluation that can overlook the benefits of an overall ecosystem approach.*

Comment: Although the existing PSEG nuclear complex is an ideal location for an additional unit, because all of the important conveyance systems are in place, and those will not have to be developed, such as they would if it was a greenfield site. New improvements, such as roadways, should be carefully placed and designed to minimize their impact on marshlands. An elevated road system would be a design that would help minimize these impacts. We encourage PSEG to pursue such a design, and develop a comprehensive wetlands mitigation and compensation plan for these impacts. (**0001-8-11** [Molzahn, Robert])

Response: *The NRC staff will discuss any mitigation proposed by the applicant for ecological impacts in Sections 4.3 and 5.3 of the EIS. This will include a complete discussion of design measures to minimize such impacts. To the extent that they are deemed necessary, wetlands mitigation and plans for enhancement and compensation will be fully discussed.*

Comment: Particularly impressed, from an ecologist's standpoint, were the tremendous input and environmental plus that they took a 20,000 acre restoration program, instituted by PSEG, has provided in the environment. It is a real, it is internationally recognized as something of real value, and it certainly has made a major change in the ecosystem, in those areas where it has already been established, and we are very optimistic about the program continuing on into the future. (**0001-9-3** [Lacandro, Roger])

Response: *Comment noted. The NRC staff will discuss PSEG's restoration, preservation and enhancement efforts in Section 2.4 of the EIS as part of the existing environment.*

Comment: And I know that one of the potential or likely environmental impacts has to do with wetlands, the proposed construction of this facility. I have to tell you that I'm very comfortable with PSEG dealing with the challenges of mitigating impacts on wetlands and, actually, their commitment to restoring wetlands. They have been involved with, perhaps, one of the largest

estuarine restoration programs in the country, 20,000 acres of wetlands restored in Delaware Bay, the River, and the estuary, and it has led to increased production of fin fish and shell fish. So there are, like, wetland impacts. But I think the company is certainly up to the challenge of mitigating those. (**0002-4-2** [DeLuca, Mike])

Response: *Comment noted. The NRC staff will discuss potential wetland impacts resulting from the proposed project in Sections 4.3 and 5.3 of the EIS. Overall restoration, preservation and enhancement efforts will also be discussed as part of the existing environment in Section 2.4 of the EIS.*

Comment: The Estuary Enhancement Program has done a phenomenal job of creating substantial new areas of high quality wetland habitat, which very definitely has an impact on, in particular, juveniles of a wide variety of aquatic species, and nutrient flow, in the area. And it, really, is a phenomenal laboratory at this point for understanding the importance of, and the development of, those types of habitats. Most of those habitats were much less productive prior to the work that PSEG engaged in, having been really run over by exotic phragmites. That made them much less valuable as natural systems than they are today. (**0002-5-1** [Duvall, Brian])

Response: *Comment noted. The NRC staff will discuss PSEG's restoration, preservation and enhancement efforts in Section 2.4 of the EIS as part of the existing environment.*

Comment: But you know something? The ducks are still flying, the water fowl are still doing well, and there are still muskrats. And I believe if there is going to be an additional plant, it is a great place to have it, the infrastructure is there. (**0002-8-5** [Campbell, Keith])

Response: *Comment noted. The NRC staff will describe the terrestrial ecology of the area, including wildlife resources, in Section 2.4 of the EIS.*

Comment: Construction of a new nuclear facility and access road at this location will result in the damage of wetlands and have adverse effects on a variety of aquatic life, bird life and wildlife. (**0003-3** [Batty, Sandy] [Dillingham, Tim] [Galetto, Jane Morton] [Goldsmith, Amy] [McNutt, Richard] [Nolan, Christine] [O'Gorman, Margaret] [Schulte, James] [van Rossum, Maya])

Response: *The NRC staff will discuss potential impacts to terrestrial resources and wetlands as a result of this project in Sections 4.3 and 5.3 of the EIS. Any mitigation measures proposed by the applicant, including any wetland enhancement efforts, will also be discussed in Sections 4.3 and 5.3 of the EIS. Potential off-site mitigation measures will be fully discussed in the EIS in Section 4.3. A bay-wide approach will be similarly emphasized over a site-specific evaluation that can overlook the benefits of an overall ecosystem approach.*

Comment: The Army Corps and PSEG must consider an alternative to the land swap, such as using the existing access road to Artificial Island instead of creating a second road, if and when a new nuclear facility is permitted. This would avoid destruction of wetlands and obviate the need for a new dredge disposal site. In our view, the existing access road should be sufficient and no additional destruction of wetlands should be permitted at the site. Issues associated with a new spoil disposal site are as yet unknown as the sites under consideration are unknown. But there are likely to be issues, considering the Anny Corps' preference for riverfront lands. (**0003-7**

[Batty, Sandy] [Dillingham, Tim] [Galetto, Jane Morton] [Goldsmith, Amy] [McNutt, Richard] [Nolan, Christine] [O'Gorman, Margaret] [Schulte, James] [van Rossum, Maya])

Response: *The NRC staff will discuss potential impacts to wetlands as a result of this project in Sections 4.3 and 5.3 of the EIS. Any mitigation measures proposed by the applicant, including efforts to minimize wetland impacts, will also be discussed in Sections 4.3 and 5.3 of the EIS.*

Comment: To many environmental groups renewable energy is a preferable alternative to reactors. To those concerned with the conservation of biological diversity, however, the cumulative ecological impacts of large-scale renewable projects will be their most detrimental effect. We believe that concern for cumulative ecological impacts of the Alternatives, wind, solar, and biomass should be included in the final EIS as a reason for rejecting them as an alternative. (**0007-7** [Lewis, Kenneth])

Response: *The NRC staff will discuss potential impacts to terrestrial resources resulting from the proposed project in contrast to implementation of other energy alternatives in Chapter 9 of the EIS.*

Comment: Much of the needed science for the ESP should be at hand since the new station is being sited adjacent to Hope Creek and Salem Creek generation stations; their track record appears to be good, the new site will share the same geology, use of in place dredge spoils constituting all soils of the area-thus, artificial Island. Natural resource impacts must be the same for all sites in this homogeneous environment. The 20,000 acre restoration program instituted by PS&G in the greater area has only provided added benefit to the recovery of nearby wetlands, an internationally recognized success. Plans appear to be in place to expand the restoration program to continue to benefit the area. (**0008-4** [Lacandro, Roger])

Response: *Comment noted. The NRC staff will discuss PSEG's restoration, preservation and enhancement efforts in Section 2.4 of the EIS as part of the existing environment.*

Comment: During the re-permitting of the existing nuclear facilities at Salem, PSE&G developed a bay-wide concept of mitigating the impacts of the existing cooling apparatus at the facilities. They were creative in identifying a variety of ways that the bay-wide resource value could be improved through investment in projects throughout the Delaware Bay estuary. I was attracted by the scope of their thinking and the resources they could bring to the table. I testified in favor of this mitigation idea at the re-permitting hearings.

Since then I have followed, with my students and with great interest, what has become the largest Estuarine Enhancement project in the world. Without going into details, the project has been a resounding success at many levels in increasing the resource value of large acreages throughout the Bay. PSE&G has a solid track record in delivering on their commitment to baywide health. (**0010-4** [Applegate, Jim])

Response: *Comment noted. The NRC staff will discuss ecological impact mitigation, as proposed by the applicant, in Section 5.3 of the EIS. PSEG's estuarine enhancement program*

will be discussed in Section 2.4 of the EIS as part of the existing environment. The EIS will also include a discussion of the bay-wide approach undertaken by PSEG.

Comment: Returning to the purpose of this hearing. Should this project move ahead toward construction, there will be on-site habitat impacts that will be unavoidable. I urge the process to embrace the same baywide approach used in the Estuarine Enhancement program, and to be creative and aggressive in identifying off site mitigation opportunities. (**0010-6** [Applegate, Jim])

Response: *The NRC staff will discuss any off-site mitigation measures as proposed by the applicant in Section 4.3 of the EIS. A bay-wide approach will be similarly emphasized over a site-specific evaluation that can overlook the benefits of an overall ecosystem approach.*

Comment: The Environmental Report indicates an overall wetlands impact of 229 acres from the new plant and proposed causeway. It is further indicated there is an abundance of wetlands in the vicinity totaling more than 25,000 acres and the quality of the dominant species is invasive Phragmites. Additional lands targeted for acquisition through a land right exchange to the north of the site are part of an existing Army Corps of Engineers Confined Disposal Facility area (CDF) that is surrounded by dikes and not open to tides. PSEG would reduce environmental impacts by placing permanent facilities inside these diked areas. In compensation for use of these wetlands we would recommend that PSEG create or restore degraded wetlands within the Delaware Bay region at an appropriate compensation ratio. This should be an achievable undertaking by PSEG as their Estuary Enhancement Program has been recognized nationally for restoring and protecting over 20,000 acres of wetlands and adjoining properties in the Delaware Estuary in both New Jersey and Delaware. (**0011-11** [Molzahn, Robert])

Response: *The NRC staff will discuss any mitigation as proposed by the applicant, including any wetland enhancement efforts, in Section 4.3 of the EIS. Potential off-site mitigation measures will be fully discussed, as necessary, in the EIS in Section 4.3. A bay-wide approach will be similarly emphasized over a site-specific evaluation that can overlook the benefits of an overall ecosystem approach.*

Comment: Although the existing PSEG's existing nuclear complex is an ideal location for an additional unit because all of the important conveyance systems are in place and would not have to be developed and built as with a Greenfield site, new improvements such as roadways should be carefully placed and designed to minimize their impact on marshlands. An elevated road system would be a design that would help minimize these impacts. We encourage PSEG to pursue such a design and develop a comprehensive wetlands mitigation and compensation plan for these impacts. (**0011-13** [Molzahn, Robert])

Response: *The NRC staff will discuss any mitigation measures as proposed by the applicant for ecological impacts in Sections 4.3 and 5.3 of the EIS. This will include a complete discussion of design measures to minimize such impacts. To the extent they are deemed necessary, wetlands mitigation and plans for enhancement and compensation will also be fully discussed.*

Comment: In addition, I urge that the cumulative ecological impacts of alternative energy generating sources be included in the Environmental Impact Statement (EIS) in order to show that by comparison nuclear energy is a far preferable option. (**0012-4** [Eastman, Ajax])

Response: *The NRC staff will discuss potential impacts to terrestrial resources resulting from the proposed project in contrast to implementation of other energy alternatives in Chapter 9 of the EIS.*

Comment: I am particularly interested in addressing the biological impacts of renewables, primarily wind. This technology has a huge impact on the biological world. In order to produce an equivalent amount energy, wind requires an enormous footprint. As pointed out in their Environmental Report, ... to replace the energy equivalent a 2200 MWe of nuclear capacity operating at 90 percent capacity factor, approximately 3300 2 MWe wind turbines operating at a capacity factor of 30 percent would be required. These turbines would be sited on 396,000 acres (619 square miles) and disturb 19,800 acres (31 square miles) to accommodate the physical footprint of the towers themselves. (I like the ESP's comparison of that amount of land to 15 times the area of Newark!) (**0012-8** [Eastman, Ajax])

Response: *The NRC staff will discuss potential impacts to terrestrial resources resulting from the proposed project in contrast to implementation of other energy alternatives in Chapter 9 of the EIS.*

Comment: Whether that area is on land or offshore, it is mind boggling to think of potential harm and humongous impacts of industrial wind. On land, particularly in the Appalachian mountains of the east, the 396,000 acres required would destroy the mainly unfragmented, biologically rich forests which are not only habitat for bats and nesting neo-tropical birds, but also habitat for terrestrial flora and fauna. The area is also a major migratory corridor for birds, bats, and raptors. Yet without full review of the environmental impacts or the costs to taxpayers and customers, permits are being granted. (**0012-9** [Eastman, Ajax])

Response: *The NRC staff will discuss potential impacts to terrestrial resources resulting from the proposed project in contrast to implementation of other energy alternatives in Chapter 9 of the EIS.*

Comment: After reviewing the Estuary Enhancement Program by PSEG, I am impressed by their innovative mitigation measures such as wetland restoration, phragmites control, fish protection at the reactor sites, restoration of anadromous fish migration through fish ladders, research, etc. These programs have resulted in long- lasting benefits for the saltwater estuary including, expanded biological diversity and habitats, breeding areas, food sources for aquatic, terrestrial, and avian species, especially threatened and endangered species, and better water quality. This leads me to believe that PSEG will do an excellent job of mitigation in the future. (**0012-13** [Eastman, Ajax])

Response: *Comment noted. The NRC staff will discuss PSEG's restoration, preservation and enhancement efforts in Section 2.4 of the EIS as part of the existing environment.*

Comment: I have had the opportunity to observe PSE&Gs environmental policies and actions over twenty years, and their restoration and mitigation activities in support of the environment. I know of no company that has such a stellar environmental record, well beyond what has been required of them. Their environmental restoration activities are a model for other states and companies. I have read their Environmental Report, and given what I know about their past performance in habitat enhancement, I am confident that PSE&G will carry out their plans, and create much more habitat than is compromised by the new development. Further, the land that will be used for siting the new facility, is not currently natural high quality salt marsh or other habitat, but is already degraded, By in contrast, I have full confidence that the mitigation habitat will be a functioning, high quality habitat. I encourage the NRC to approve the Early Site Permit, and lend my support to PSE&G for its community-minded, and ecosystem-conscious approach to restoration and mitigation. (**0013-2** [Burger, Joanna])

Response: *Comment noted. The NRC staff will discuss PSEG's restoration, preservation and enhancement efforts in Section 2.4 of the EIS as part of the existing environment.*

Comment: Much of the land that will be used for site construction of the new nuclear facility is degraded Phragmites wetlands, and as such, is not natural productive habitat. (**0013-3** [Burger, Joanna])

Response: *Comment noted. The NRC staff will describe wetlands that could be affected in Section 2.4 of the EIS.*

Comment: Their mitigation efforts include identification of several candidate areas that may be selected for the development of a wetland mitigation plan for the restoration and enhancement in Elsinboro, and work with Mannington Marsh. Both of these habitats will be greatly improved by PSE&G's mitigation work, and the restored habitat will provide much higher quality habitat than is even possible with the planned construction site. The natural tidal flow in the planned restoration/mitigation habitat will lead to habitat with far greater wildlife use and ecosystem integrity. This part of the Delaware Bay ecosystem will be greatly aided by the restoration planned by PSE&G. (**0013-4** [Burger, Joanna])

Response: *Comment noted. The NRC staff will discuss any mitigation measures as proposed by the applicant for impacts to wetlands in Sections 4.3 and 5.3 of the EIS.*

Comment: The Environmental Plan they present is sound, well-thought out, and sufficiently developed to ensure that it can accomplished. The Environmental Report is extensive, comprehensive, and devotes considerable attention not only to the environmental, physical, and ecosystem issues, but to appropriate public involvement and monitoring. As an ecologist I have been impressed with their due diligence in addressing all the outstanding environmental issues, and going well beyond what is necessary in terms of mitigation and restoration of additional habitat. The State of New Jersey will be gaining considerable high quality habitat by these actions, in exchange for degraded, low quality Phragmites marsh that is on the current site (and that will be the site of the new nuclear facility). (**0013-5** [Burger, Joanna])

Response: *Comment noted. The NRC staff will discuss any mitigation measures as proposed by the applicant, including any wetland enhancement efforts, in Sections 4.3 and 5.3 of the EIS.*

Potential off-site mitigation measures will also be discussed, as necessary, in the EIS in Section 4.3. A bay-wide approach will be similarly emphasized over a site-specific evaluation that can overlook the benefits of an overall ecosystem approach.

Comment: The plans proposed by PSE&G can be viewed in light of their past mitigation and restoration activities. They have one of the largest and most successful mitigation projects in the country, where they controlled Phragmites to produce high quality salt marsh with attendant mudflats and intertidal habitat that is used by thousands of shorebirds and other species. Thus their Estuary Enhancement Program is one of the most successful in the country, has received a variety of state and national awards -and unlike many other such programs, it is sustainable. Thus, it is my professional opinion that they are capable of, and will, deliver on their environmental mitigation and restoration plans. The company has integrity and environmental vision to ensure that there is little environmental impact, and that their restoration and. mitigation plans will result in far more, high-quality habitat than is presently on site. (**0013-6** [Burger, Joanna])

Response: *Comment noted. The NRC staff will discuss any mitigation measures as proposed by the applicant for impacts to wetlands in Sections 4.3 and 5.3 of the EIS.*

Comment: Before addressing the new construction, I would point out PSEG's past efforts to mitigate the effects of its operations on the aquatic environment in the Salem vicinity. In particular, faced with concerns of negative impacts on fisheries by cooling water intake operations, PSEG responded with the largest private wetlands restoration project in the world. The Estuary Enhancement Program began in 1994 and since that time has been a large scale effort to restore and preserve portions of the Delaware Estuary in both New Jersey and Delaware. PSEG has restored, enhanced, and/or preserved more than 20,000 acres of salt marsh and adjacent uplands to vital, healthy habitat for fish and wildlife.

Restoration efforts have included the goal of replacing former salt hay farms and marshes dominated by invasive Phragmites australis with salt cord grass-dominated marsh. The Academy has studied many of these sites prior to restoration and visited a number afterwards. The Estuary Enhancement Program has been successful in restoring typical salt marsh conditions at the sites, with most sites meeting targets for reduction in Phragmites and establishment of salt cordgrass. Many of these and related studies have been published in various peer-reviewed scientific journals. (**0014-3** [Velinsky, David])

Response: *Comment noted. The NRC staff will discuss PSEG's restoration, preservation and enhancement efforts in Section 2.4 of the EIS as part of the existing environment.*

Comment: The proposed new construction will permanently impact approximately 229 acres of wetland. While protection of wetland is a high national priority (as demonstrated by Section 404 of the Clean Water Act), the majority of the wetland acreage impacted by the new construction has a degraded hydroperiod and now hosts a monoculture of Phragmites australis. An invasive reed grass, Phragmites is often found in disturbed marsh areas, where plant communities, hydrology and topography have been altered. Phragmites displaces native plants and has a negative impact on biodiversity.

Targeting these degraded wetlands in close proximity to existing PSEG facilities will reduce the need for new infrastructure, minimizing the environmental disturbance that would result if development occurred in “Greenfield” sites. Moreover, the amount of wetlands impacted represents a small fraction of the total wetland - many with higher quality functions - present in the vicinity of the construction.

In addition, 85 acres of the wetland being permanently altered by the construction are located in the U.S. Army Corps of Engineers Combined Disposal Facility (CDF.) This has been the site for dumping of dredge spoils from deepening of the Delaware River Channel. It is surrounded by dikes and is not open to tidal influences. It is unlikely that this site supports high level wetland functions and utilizing it where permanent construction is necessary will limit overall wetland impacts. (**0014-5** [Velinsky, David])

Response: *Comment noted. The NRC staff will discuss any mitigation measures as proposed by the applicant including any wetland enhancement efforts, in Sections 4.3 and 5.3 of the EIS. Potential off-site mitigation measures will also be discussed Section 4.3 of the EIS. A bay-wide approach will be similarly emphasized over a site-specific evaluation that can overlook the benefits of an overall ecosystem approach.*

Comment: PSEG is making acceptable efforts to restrict impact on these wetlands, including a site plan to minimize encroachment, the use of sediments pits to stage some of the construction operations, and the use of a raised causeway rather than using fill material to carry the access road to the new site. Where permanent disturbance to wetland occurs, PSEG has outlined a mitigation plan that should create new wetland environments in adequate amounts to offset any loss. We anticipate that the resources and expertise developed in the EEP will provide a foundation for the mitigation steps being taken by PSEG in the new site construction, both in selecting the mitigation sites and in managing the restored and enhanced wetland sites. (**0014-7** [Velinsky, David])

Response: *Comment noted. The NRC staff will discuss any mitigation measures as proposed by the applicant, including any wetland enhancement efforts, in Sections 4.3 and 5.3 of the EIS.*

Comment: The basic restoration activities developed by the EEP, particularly controlling Phragmites and fostering development of good tidal marsh topography and hydrology, have advanced the field of ecological restoration. The ecological engineering technique of forming primary channels and using estuarine processes to further develop channels and topography is especially notable. As such, the Estuary Enhancement Program has provides an important model for marshland restoration which is an important component of PSEG’s proposed mitigation plan. (**0014-9** [Velinsky, David])

Response: *Comment noted. The NRC staff will discuss any mitigation measures as proposed by the applicant, including any wetland enhancement efforts, in Sections 4.3 and 5.3 of the EIS. Potential off-site mitigation measures will be discussed in Section 4.3. A bay-wide approach will be similarly emphasized over a site-specific evaluation that can overlook the benefits of an overall ecosystem approach.*

Comment: Therefore, DRN urges NRC to review certain issues in more detail, including: clearer evaluation of PSEG's use of the Army Corps confined disposal facility, and cumulative impacts resulting from use of that site; water impacts including dredging and construction impacts; filling of wetlands; floodplain impacts; habitat impacts and impacts to species, especially Atlantic sturgeon; and impacts and evaluation of alternatives for cooling systems. (**0018-3** [Brown, Elizabeth])

Response: *The NRC staff will discuss any mitigation measures as proposed by the applicant for ecological impacts in Sections 4.3 and 5.3 of the EIS. This will include a complete discussion of design measures to minimize such impacts. To the extent they are included, wetlands mitigation and plans for enhancement and compensation will be fully discussed. This will include an evaluation of PSEG's use of the Army Corps of Engineers' confined disposal facility. The cumulative impacts on terrestrial and wetland ecosystems resulting from the use of that site will be discussed in Section 7.3 of the EIS.*

Comment: The ER also estimates that the Project will permanently disturb 126.6 acres of wetlands on the site. The EIS must make a full and fair evaluation of the impacts of this permanent loss of wetlands and habitat, and consider all viable alternatives to this loss. (**0018-11** [Brown, Elizabeth])

Response: *The NRC staff will discuss any mitigation measures as proposed by the applicant for ecological impacts in Sections 4.3 and 5.3 of the EIS. This will include a complete discussion of design measures to minimize such impacts. To the extent they are necessary, wetlands mitigation and plans for enhancement and compensation will be fully discussed.*

Comment: The Division of Land Use Regulation has received the PSEG Early Site Permit (ESP) application and has determined that the project will require permits.

As proposed, the project will require a CAFRA Individual Permit, Coastal Wetlands Permit, Waterfront Development Permit and Freshwater Wetlands Individual Permit from the Division. These permits must be obtained prior to any construction activities on the site related to the project described above. The Division has issued a consistency determination for the project that was sent to PSE&G representatives on July 19, 2010. (**0019-22** [Brubaker, Scott])

Response: *Comment noted. The NRC staff will discuss permit and other regulatory requirements associated with the project in Chapter 1 and Appendix H of the EIS.*

Comment: Guidelines under Section 404(b)(1) of the federal Clean Water Act require that actions proposed within waters of the United States, especially those that are not water-dependent, are required to demonstrate that they have considered all appropriate reasonable and prudent measures to avoid and minimize impacts to waters. If all measures to avoid and minimize wetland impacts have been considered and employed to the extent practicable and result in unavoidable impacts, a compensatory mitigation plan should be developed and implemented.

The applicant should undertake a complete analysis of alternatives that complies fully with the Clean Water Act Section 404 (b)(1) Guidelines that documents avoidance, minimization and

mitigation for all impacts. Alternate locations as well as a documentation of purpose and need should be provided as part of this analysis. For any unavoidable impacts, a compensatory mitigation plan to offset all of the projects impacts to aquatic resources including EFH should be developed in accordance with the federal standards and criteria for compensatory mitigation for losses of aquatic resources published in the Federal Register on April 10, 2008 (vol. 73 No. 70). This plan should be developed as early in the permit process as possible and in consultation with the applicable federal, state and local resource agencies and will be implemented on and in the immediate area of the PSEG Site to the extent practicable. (**0022-5** [Gorski, Stanley])

Response: *The NRC staff will discuss any mitigation measures as proposed by the applicant for ecological impacts in Sections 4.3 and 5.3 of the EIS. This will include a complete discussion of design measures to minimize such impacts. To the extent they are necessary, wetlands mitigation and plans for enhancement and compensation will be fully discussed. Alternative locations will be discussed in Chapter 9 of the EIS.*

Comment: In the State of NJ, coastal wetlands are regulated by the state under the Wetlands Act of 1970. Development in coastal wetlands requires authorization of permits from the NJDEP, and requires separate processes to determine a project's value. However, such processes usually fit in within a federal process. (**0022-8** [Gorski, Stanley])

Response: *Comment noted. The NRC staff will discuss permit and other regulatory requirements associated with the project in Chapter 1 and Appendix H of the EIS.*

Comment: After reasonable measures have been explored to avoid and minimize impacts to wetlands, PSEG will compensate for unavoidable adverse impacts to wetlands by implementing approved wetland restoration and/or rehabilitation measures. PSEG, through their Ecosystem Enhancement Program, has extensive experience and demonstrated success implementing coastal saltmarsh and freshwater wetland restoration and rehabilitation programs. This familiarity with local wetland systems was used to identify appropriate candidate mitigation sites and will be used in developing and implementing the final approved mitigation plan.

Mitigation options mentioned in the NRC's ESP to offset the impacts to NOAA trust resources included the following considerations:

- Minimization of encroachment on coastal wetlands
- Use of previously developed sediment disposal basins for plant development (both PSEG's permitted disposal facility and the USACE's CDF)
- Refinement of the Site Utilization Plan to avoid various wetland areas throughout the PSEG Site

Opportunities for mitigating unavoidable impacts to wetland ecosystems include restoration of natural habitats temporarily disturbed by construction, creation of new habitat types in previously disturbed areas, and enhancement of undisturbed natural habitats.

In general, NMFS does not accept the conversion of one type of aquatic habitat into another habitat as compensatory mitigation when the existing habitat has value to aquatic life. Candidate mitigation areas include portions of the existing PSEG Site, Mannington Meadow, Mason's Point, and additional areas of the PSEG Alloway Creek Watershed restoration site. (**0022-9** [Gorski, Stanley])

Response: *Comment noted. The NRC staff will discuss any mitigation measures as proposed by the applicant, including any wetland enhancement efforts, in Sections 4.3 and 5.3 of the EIS. Potential off-site mitigation measures will also be discussed, as necessary, in the EIS in Section 4.3. A bay-wide approach will be similarly emphasized over a site-specific evaluation that can overlook the benefits of an overall ecosystem approach.*

Comment: Fish and Wildlife Coordination Act

Notwithstanding our mandates under the MSA, the NMFS also has responsibilities under the Fish and Wildlife Coordination Act (FWCA) to provide federal agencies such as the NRC with recommendations to avoid, minimize and to mitigate for direct, indirect and cumulative impacts to any and all NOAA trust resources that are present within the Delaware River Basin. (**0022-11** [Gorski, Stanley])

Response: *Comment noted. The NRC staff will discuss any mitigation measures as proposed by the applicant for ecological impacts in Sections 4.3 and 5.3 of the EIS. This will include a complete discussion of design measures to minimize such impacts. To the extent they are necessary, wetlands mitigation and plans for enhancement and compensation will be fully discussed. The cumulative impacts on terrestrial and wetland ecosystems resulting from this project will be discussed in the EIS in Section 7.3.*

Comment: Submerged aquatic vegetation (SAV) has historically been absent from Delaware Bay. However, to date, there has been no comprehensive mapping of SAV in the Delaware Estuary to verify its presence or absence. Several species have been observed though in the tidal river since 1970, including: Vallisneria americana, Myriophyllum spicatum, Elodea nuttallii, Najasflexillis, Potamogeton sp. and others (Schuyler, 1988). Wild celery (Vallisneria americana) has been documented in some areas of the Delaware River and its tributaries. SAV provides valuable nursery, forage and refuge habitat for a variety of fish including striped bass, American shad, alewife, and blueback herring. It is also an important food source for waterfowl. As water quality in the Delaware River continues to improve, more areas of SAV may be found within the River. (**0022-13** [Gorski, Stanley])

Response: *Comment noted. The NRC staff will describe the terrestrial ecology of the area, including wildlife resources, in Section 2.4 of the EIS.*

D.2.10 Comments Concerning Ecology—Aquatic

Comment: With the new facility a good thing is, if it is built, that it would have a closed loop cooling system, which would greatly reduce the amount of water needed to cool the facility. A closed loop cooling system reduces the water take, compared to an open loop system, by 90 to 95 percent. So however, an average nuclear facility draws in, an open loop system, like a billion

gallons of water a day, over a billion. So even with the closed loop, you are still talking about 50 million to 100 million of gallons a day. So you would be adding to the amount of fish that are killed at that facility. So you must consider the existing damage that the present facility, Salem I and II causes, and adding even more damage. And Salem I and II draws in three billion gallons of water a day, every day. And it kills billions of fish. And the EPA has estimates on how much. And I have a paper I would like to submit as data. And they kill 350 million age one equivalent fish. In other words, fish that would have grown up to be a million, I mean, one year old. That is how they generally use their fish kill data; they call it age one equivalent fish. But, actually, the facility kills billions of fish, billions of smaller fish, which is the food chain for the bigger fish, and the whole ecosystem. So my concern here is that you want to build a new facility, but you are not stopping the existing damage caused by the present facility that is there, units I and II, which draw in three billion gallons of water, and have an open loop cooling system. So before you consider building a new facility you should stop the damage caused by the existing facility, first. I think that is a priority. But it seems like just build another one. But you still have an existing fish kill facility, there. And it kills all species, all ages. And it is destroying the fishing industry along the Delaware Bay and the Delaware River. We used to have a great fishing industry, and we don't now. Not when one facility draws in three billion gallons of water a day. And Salem says we fixed up some wetlands and that will compensate. It is really hard to believe that fixing up a few acres of wetlands will compensate for billions of fish killed, every year, year after year. So I feel that you should fix the first two, units Salem I and II, and then consider moving on. (**0002-6-10** [Schneider, Richard])

Response: *Potential effects of entrainment and impingement on fish populations will be discussed in Sec. 5.3.2. In addition, cumulative impacts of all facilities will be discussed in Chapter 7.*

Comment: Although the water volume withdrawn from the Delaware River by the closed cycle new plant is substantially lower, there will still be impingement and entrainment of aquatic life, as well as potentially significant thermal impacts from the closed-cycle cooling system. Maximum intake of the new plant is estimated in the ER to be equivalent to 3.7 percent of the intake flow of once-through cooling at the existing Salem facility. However, regarding thermal discharge, the new plant discharge is located within the region already influenced by the thermal discharges of the existing Salem and Hope Creek facilities. The impact of this situation on thermal plume must be fully and rigorously evaluated in the EIS, regardless of any applicable mixing zone. (**0018-16** [Brown, Elizabeth])

Response: *Thermal impacts and impacts to surface water as a result of plant operations will be discussed in Sections 5.2.2.1 and 5.2.4 of the EIS. Potential operational impacts to aquatic life, including entrainment and impingement, will be discussed in Section 5.3.2.*

Comment: During the re-permitting of the existing nuclear facilities at Salem, PSEG developed a bay-wide concept of mitigating the impacts of the existing cooler apparatus at those facilities. They were creative in identifying a variety of ways that the bay-wide resource value could be improved through investment in projects, throughout the Delaware Bay Estuary. I was attracted by the scope of their thinking, and the resources they could bring to the table. I testified in favor of this mitigation idea at the repermitting hearing. (**0001-10-5** [Applegate, Jim])

Comment: Since then I have followed, with my students, and with great interest, what has become the largest estuarine enhancement project in the world. Without going into any details, the project has been, in my mind, a resounding success at many levels, in increasing the resource value of large acreages throughout the bay. PSEG has a solid track record in delivering on their commitment to bay-wide health. (**0001-10-7** [Applegate, Jim])

Comment: Returning, finally, to the purpose of this hearing, should this project move forward with construction, there will be on-site habitat impacts that will be unavoidable. I urge the process to embrace the same bay-wide approach used in the estuarine enhancement program, and to be creative and aggressive, in identifying off-site mitigation opportunity. Hold PSEG's feet to the fire. History suggests that they will deliver. (**0001-10-9** [Applegate, Jim])

Comment: The company had the foresight, long before the Estuarine Restoration Act was passed, with the goal of restoring a million estuarine acres, including many wetlands, in the U.S. by the year 2010. Long before that Act was passed, and the guardian of that act became two entities, essentially, Restore America's Estuaries, a practitioner coalition nation-wide. Actually now world-wide. And the Community Restoration Center, NOAA Restoration Center, Community Based Restoration Center which has, I think, a collective budget, over the years, now exceeding 28 million dollars. Before that became in the public venue, and popular, restoring wetlands is a good thing, and we needed to know why, of course.

Long before that became the popular trend, the company PSEG had been developing this program as a cost-effective basis for offsetting the effects of the power plant, with respect to its take of fin fish and shellfish. And the goal was to produce enough wetland acreage, or to conserve and restore enough wetland acreage, to produce the number of equivalent adults that would be lost at the facility. (**0001-14-4** [Weinstein, Michael])

Comment: So let me close with a series of statistics, if I may. First of all, as Seagrant Director, I was able to enter into a public private partnership with the company. The company put up 750,000 dollars over five years, and we Seagrant Directors, in 11 states around the nation, matched those funds, to do some of the basic and applied research to understand what was going on, as we were restoring these sites. One of those projects funded a young lady by the name of Kristen Solenstal at Yale University. She was the first of many people trying, with that funding, to demonstrate that the variety of phragmites that we call bad is actually an introduced variety, probably from either Asia, or Europe, or probably both.

That was part of this Marsh Ecology Research Program, or the MERP, as we called it. All of these funds were parlayed into many federal grants. For example, I have been funded by the EPA, by NOAA, several agencies within NOAA, ANS, Solestol Kennedy, I have received NSF funding. All as part of the programmatic opportunity, at the Estuary Enhancement Program created for people interested in understanding how to do this restoration, how to make it effective, and why it actually works.

Two contributions, three contributions that will be the last I say. Three contributions that we made, that come immediately to mind is, as a group, the scientists involved in the Estuary Enhancement Program developed the practitioner skills, or methods, for restoring wetlands. What kinds of criteria and metrics should you be thinking about, when you go in to restore a

site? Those metrics have been fully adopted by Restore America's Estuaries, and has been published as a public document by them. We published it, of course, in the peer reviewed literature, on our own.

Secondly, one of the toughest things to do, when you are trying to look at these restored sites with respect to the returns of functions and processes, as opposed to the structure of these sites, it is relatively easy to grow grass. I apologize to my friends in the Corps. But you are the guys that told me to keep it simple, stupid. We can defend 85 percent survival after three years in court, to a wetland ecologist that means absolutely nothing, other than you are pretty good at growing grass, which I guess is not bad. (**0001-14-8** [Weinstein, Michael])

Comment: I mention that we are able to employ new, really state of the art, modeling efforts, something called Echopath and Echosim, if any of you are familiar with it, to demonstrate, once again, that the increment of new production, one is measurable against background, and two, it is equated with the goals of the program. This is one of the most important projects with regard to coastal wetland management, and coastal management in general, that has ever been undertaken.

And I, personally, applaud the foresight of the company to do something like this, when it wasn't considered, at the time, best management practices. And whether it becomes best management practice, regulatory or law, or otherwise it clearly has been. (**0001-14-10** [Weinstein, Michael])

Response: *These comments provide general information in support of the application. They do not provide any specific information related to the environmental effects of the proposed action and will not be evaluated in the EIS. However, mitigation measures related to construction and operational impacts will be discussed in Sections 4.3.2 and 5.3.2, respectively.*

Comment: Construction of a new nuclear facility and access road, at this location, will result in the damage of wetlands, and adverse effects on a variety of aquatic life, bird life, and wild life. (**0001-19-4** [Blake, Matt])

Comment: With respect to restoration of wetlands, it has been common knowledge, for a long time, that wetlands support the production of most commercial and recreational fin fish and shellfish species, that we all enjoy eating, or capturing, or both. To the extent that you can find citations in the literature, Irand and Lacy, for example, that say 95 percent of all commercial and recreational species produced, marine species produced in the United States, require wetlands as essential habitats during their first year of life. (**0001-14-2** [Weinstein, Michael])

Comment: We have been able to demonstrate, given the extreme variability around any mean you calculate, in these sites, in terms of processes and functions, that the 20 plus thousand acres produced a new increment of secondary production of these fin fish and shellfish that exceeded the loss, again as I said before, of equivalent adults. Also we have been able to document, everybody says phragmites is bad, and we suspected for a long time that it had to do with habitat, and other functional processes.

Some of our research has now demonstrated that a fish growing up in a phragmites dominated marsh, whatever the combination of factors is, and I should say to you, much to the company's chagrin, I was able with my colleagues to demonstrate that carbon nitrogen nutrients from phragmites is, indeed, finding its way into this fish.

But the quality of the animal, the end of the growing season, falls short of the quality of an animal in a naturally cord grass dominated marsh. In other words, they can't put down the energy reserves, for migration and overwintering, if they grow up in a phragmites marsh. (**0001-14-5** [Weinstein, Michael])

Response: *Potential impacts as a result of construction and operation on wetlands and their associated aquatic life and wildlife will be discussed in Sections 4.3.2 and 5.3.2.*

Comment: The natural systems of the Delaware River and estuary are critical environments, with major significance for both regional and global biodiversity, for regional water supply, and water quality, and for supporting important environmental activities. Construction on the scale proposed by PSEG, on the Delaware coast, requires careful consideration of environmental factors. (**0001-4-2** [Velinsky, David])

Response: *Potential construction impacts on aquatic systems associated with the Delaware coasts (Delaware River, associated wetland systems) will be discussed in Section 4.3.2*

Comment: Before addressing the new construction, I would like to point out PSEG's past efforts to mitigate the effects of its operations on the aquatic environment in the vicinity. In particular, faced with concerns of negative impacts on fisheries, by cooling water intake operations, PSEG responded with the largest private wetlands restoration project in the world.

The Estuary and Enhancement program began in 1994, and since that time has had large scale efforts to restore and preserve portions of the Delaware River estuary, in both New Jersey and Delaware. It has restored, enhanced and/or preserved more than 20,000 acres of salt marsh, and adjacent uplands to vital, healthy habitat for fish and wildlife. (**0001-4-4** [Velinsky, David])

Response: *This comment provides general information in support of the application. It does not provide any specific information related to the environmental effects of the proposed action and will not be evaluated in the EIS. Mitigative actions, however, resulting from any construction and/or operational effects on aquatic environments in the vicinity of the proposed site will be discussed in Sections 4.3.2 and 5.3.2*

Comment: In addition to the steps being taken to protect wetlands impacted by the construction, the aquatic impacts of the proposed facility will be limited by the use of a closed-cycle cooling system. Compared to the once through system, these cooling towers will divert much less water for cooling. Projected maximum diversion, for the new facility, is less than four percent, depending on the type of facility of the current use by Salem, and is less than .05 percent of the total volume of the Delaware flow. As a result, the impingement on fish population will be a small fraction of the current levels at the Salem station. (**0001-4-6** [Velinsky, David])

Response: *This comment provides general information in support of the application. It does not provide any specific information related to the environmental effects of the proposed action and will not be evaluated in the EIS. Operational impacts such as impingement, however, will be discussed in Section 5.3.2*

Comment: After reviewing the Estuary Enhancement Program, by PSEG, I'm impressed by their innovative mitigation measures, such as wetland restoration, phragmites control, fish protection at the nuclear sites, restoration of anadromous fish migration, through fish ladders, research, et cetera. These programs have resulted in long lasting benefits for the saltwater estuary, including expanded biological diversity and habitats, breeding areas, food sources for aquatic, terrestrial, and avian species, especially threatened and endangered species, and better water quality. This leads me to believe that PSEG will do an excellent job of mitigation in the future. (**0001-7-12** [Eastman, Ajax])

Response: *This comment provides general information in support of the application. It does not provide any specific information related to the environmental effects of the proposed action and will not be evaluated in the EIS. Mitigative actions, however, resulting from any construction and/or operational effects will be addressed in Sections 4.3.2 and 5.3.2*

Comment: In reviewing the PSEG Early Site Permit application, and Environmental Report filed on May 25th, 2010, we noted that the new units intake and cooling systems will be designed to minimize the impact to the aquatic community, by utilizing cooling towers, and an intake system and design flows that conform to best available technology as required under Section 316B of the Clean Water Act. The cooling tower blow-down discharge should have little impact on the Delaware River, at this location, or significantly elevate river water temperatures. (**0001-8-7** [Molzahn, Robert])

Response: This comment provides general information in support of the application. It does not provide any specific information related to the environmental effects of the proposed action and will not be evaluated in the EIS. Any potential operational impacts, however, related to the operation of the cooling system will be addressed in Section 5.3.2.

Comment: Much of the needed science, on the Early Site Permit should be, really, right at hand, since this is a contiguous site that is being proposed. Their track record has been good. I, personally, have observed the impingement and entrainment process, since I also teach fishery science, and fishery research, and have had an opportunity to testify as to the value, not only the impingement and entrainment process, but also the continued elevation of new technology, as it came on the scene. (**0001-9-3** [Lacandro, Roger])

Response: *This comment provides general information in support of the application. It does not provide any specific information related to the environmental effects of the proposed action and will not be evaluated in the EIS. Any potential operational-related impacts such as entrainment and impingement, however, will be discussed in Section 5.3.2.*

Comment: A new plant will provide an excellent opportunity to incorporate new technology, hopefully to produce cleaner, safer energy, and especially if a cooling tower is incorporated into the new plans. I'm familiar with the impingement and entrainment, as I said. The much reduced

need for water in a cooling tower process, you know, will reduce much of that impact, considerably. I know of no scientific study that proves that the present cooling processes, at Salem and Hope Creek has generated any impact on the estuary. It can be debated, it can be argued. But I have not seen a scientific study that really proves that fact. After reviewing the EPS [ESP] request, I find no reason to deny the requested permit. (**0001-9-5** [Lacandro, Roger])

Response: *This comment provides general information in support of the application. It does not provide any specific information related to the environmental effects of the proposed action and will not be evaluated in the EIS. Any potential operational impacts, however, such as impingement and entrainment will be evaluated in Section 5.3.2.*

Comment: And I know that one of the potential or likely environmental impacts has to do with wetlands, the proposed construction of this facility. I have to tell you that I'm very comfortable with PSEG dealing with the challenges of mitigating impacts on wetlands and, actually, their commitment to restoring wetlands. They have been involved with, perhaps, one of the largest estuarine restoration programs in the country, 20,000 acres of wetlands restored in Delaware Bay, the River, and the estuary, and it has led to increased production of fin fish and shell fish. So there are, like, wetland impacts. But I think the company is certainly up to the challenge of mitigating those. (**0002-4-3** [DeLuca, Mike])

Response: *This comment provides general information in support of the application. It does not provide any specific information related to the environmental effects of the proposed action and will not be evaluated in the EIS. Mitigative actions, however, resulting from any construction effects on wetlands will be discussed in Sections 4.3.2 and 5.3.2.*

Comment: The other potential impact area which is, again, well known with coastal development, and energy facilities, in particular, is that on fin fish and shell fish. And I do note that the application does call for construction of a cooling tower which is, you know, one of the ideal strategies for mitigating harm to fin fish and shell fish, particularly their eggs and larvae. There are, also, thermal impacts that are mitigated by this particular design component. (**0002-4-5** [DeLuca, Mike])

Response: This comment provides general information in support of the application. It does not provide any specific information related to the environmental effects of the proposed action and will not be evaluated in the EIS. Mitigative actions, however, resulting from any operational effects will be evaluated in Section 5.3.2.

Comment: I would just like to mention two areas of potential interest if, indeed, there is some broader consideration of mitigation strategies. And that is a lot of work has been underway in the Delaware estuary to restore two signature species, the oyster and sturgeon. Oysters are on the rebound. They have beset by disease, and overharvesting, for years. And today we actually enjoy a modest harvest. I don't believe the expansion of this proposed plant will endanger that critter. But, perhaps, there are some opportunities to enhance the restoration of that particular species. And, similarly, with sturgeon. South Jersey used to be the caviar capital of the world, at the turn of the last century. Sturgeon have been just listed as endangered by the federal government. There are efforts, under way, to study their habitat use, their habits,

and their spawning grounds. And, again, I think this is fertile area to explore in terms of some broader restoration strategies that might be considered down the road. (**0002-4-6** [DeLuca, Mike])

Response: *This comment provides general information in support of the application. It does not provide any specific information related to the environmental effects of the proposed action and will not be evaluated in the EIS. Mitigative strategies, however, resulting from any construction and/or operational effects on aquatic resources will be discussed in Sections 4.3.2 and 5.3.2.*

Comment: The Estuary Enhancement Program has done a phenomenal job of creating substantial new areas of high quality wetland habitat, which very definitely has an impact on, in particular, juveniles of a wide variety of aquatic species, and nutrient flow, in the area. And it, really, is a phenomenal laboratory at this point for understanding the importance of, and the development of, those types of habitats. Most of those habitats were much less productive prior to the work that PSEG engaged in, having been really run over by exotic phragmites. That made them much less valuable as natural systems than they are today. (**0002-5-2** [Duvall, Brian])

Response: *This comment provides general information in support of the application. It does not provide any specific information related to the environmental effects of the proposed action and will not be evaluated in the EIS. Mitigative actions, however, resulting from any construction and/or operational effects on aquatic resources will be discussed in Sections 4.3.2 and 5.3.2.*

Comment: And the Salem PSEG, they have a nice new facility over there, they have a display on the environment, and they have a nice little window, outside. But to be truly environmentally concerned, you would go through and stop the fish kill caused by your facility. To be a responsible member of society, and to stop that damage at your existing facilities. And the moral code, and the principle we should all live by, is that if something is causing harm, it should be stopped. And if you look at it in that basic principle, then they should stop killing the fish at Salem I and II. It is destroying the fishing industry, so you are losing jobs. (**0002-6-13** [Schneider, Richard])

Response: *Any potential impacts on aquatic resources due to construction and/or operation of this facility will be discussed in EIS sections 4.3.2 and 5.3.2.*

Comment: And I spoke with some Nuclear Regulatory Commission people tonight. And I have a major concern, that when the Nuclear Regulatory Commission does an evaluation of an existing permit, or a new permit, the issue of water intake, for the cooling system, is left up to the state, as a state permit. I spoke with a gentleman from the Nuclear Regulatory Commission, and he says it is above his ability to change the rulings, that the EPA has made about this issue. But I feel that it should be part of the Nuclear Regulatory Commission's when they evaluate the water intake, for two reasons. Because NRC is a nuclear, is a federal agency. A federal agency applies to any issue that affects more than one state. The fish kill caused by these facilities affects more than one state, it affects the fishermen in Delaware, in Maryland, in Pennsylvania, in New Jersey, and all up and down the coast, where the fish would have gone, and traveled, and be caught by other people. So therefore the NRC needs to be involved with a federal ruling

on it, and not be involved with the water permit. So I'm asking the NRC to talk to the people above them to pursue that. (**0002-6-18** [Schneider, Richard])

Response: *The NRC's regulatory authority includes providing for the adequate protection of public health and safety and the common defense and security, as defined by the Atomic Energy Act. The NRC does not possess authority to act with respect to an issue simply because it involves an interstate matter. Pursuant to NEPA, however, the NRC does examine the reasonably foreseeable environmental impacts attributable to a proposed licensing action regardless of state lines. Subsequently, any potential impacts on aquatic resources due to construction and/or operation of this facility will be discussed in Sections 4.3.2 and 5.3.2.*

Comment: And then, also, the Federal Clean Water Act applies to the fish kill. In the 1970s the Federal Clean Water Act, said that you must use the best technology available to stop the fish kill. This facility, Salem I and II, is killing the fish. And they are not using the best available technology. So, therefore, the federal agency overseeing the nuclear plant, which is the NRC, needs to enforce that particular law. It is a federal law, the Clean Water Act. So, again, I ask the NRC to pursue having open or closed loop systems. (**0002-6-20** [Schneider, Richard])

Response: *Any operational impacts due to the cooling water system will be discussed in EIS Section 5.3.2.*

Comment: Construction of a new nuclear facility and access road at this location will result in the damage of wetlands and have adverse effects on a variety of aquatic life, bird life and wildlife. (**0003-4** [Batty, Sandy] [Dillingham, Tim] [Galetto, Jane Morton] [Goldsmith, Amy] [McNutt, Richard] [Nolan, Christine] [O'Gorman, Margaret] [Schulte, James] [van Rossum, Maya])

Response: *Any potential effects of construction activities on aquatic resources will be discussed in EIS Section 4.3.2.*

Comment: A new plant will provide an excellent opportunity to incorporate new technology, hopefully, to produce cleaner, safer energy especially if a cooling tower is incorporated to significantly reduce bay water usage, impingement and entrainment of aquatic biota and the impact of large quantities of elevated temperature water reentering the estuary. [I know of no scientific study that proves that the present cooling process at Salem has had a negative impact on the estuary.] (**0008-6** [Lacandro, Roger])

Response: *This comment provides general information in support of the application. It does not provide any specific information related to the environmental effects of the proposed action and will not be evaluated in the EIS. Potential impacts of the cooling water system including entrainment, impingement, and thermal discharges on aquatic resources, however, will be discussed in Section 5.3.2.*

Comment: During the re-permitting of the existing nuclear facilities at Salem, PSE&G developed a bay-wide concept of mitigating the impacts of the existing cooling apparatus at the facilities. They were creative in identifying a variety of ways that the bay-wide resource value could be improved through investment in projects throughout the Delaware Bay estuary. I was

attracted by the scope of their thinking and the resources they could bring to the table. I testified in favor of this mitigation idea at the re-permitting hearings.

Since then I have followed, with my students and with great interest, what has become the largest Estuarine Enhancement project in the world. Without going into details, the project has been a resounding success at many levels in increasing the resource value of large acreages throughout the Bay. PSE&G has a solid track record in delivering on their commitment to baywide health. (**0010-5** [Applegate, Jim])

Response: *This comment provides general information in support of the application. It does not provide any specific information related to the environmental effects of the proposed action and will not be evaluated in the EIS. Mitigative actions, however, resulting from any construction and/or operational effects on aquatic resources will be discussed in Sections 4.3.2 and 5.3.2.*

Comment: Returning to the purpose of this hearing. Should this project move ahead toward construction, there will be on-site habitat impacts that will be unavoidable. I urge the process to embrace the same baywide approach used in the Estuarine Enhancement program, and to be creative and aggressive in identifying off site mitigation opportunities. (**0010-7** [Applegate, Jim])

Response: *Any potential impacts on aquatic resources due to construction will be addressed in EIS Section 4.3.2. Mitigative actions relative to the estuarine enhancement program will also be discussed in Section 4.3.2.*

Comment: In reviewing the PSEG ESP Application and Environmental Report filed on May 25, 2010, we noted that the new units intake and cooling systems will be designed to minimize the impact to the aquatic community by utilizing cooling towers and an intake system and design flows that conform to Best Available Technology as required by Section 316(b) of the Clean Water Act. The cooling tower blowdown discharge should have little effect on the Delaware River at this location or significantly elevate river water temperatures. (**0011-9** [Molzahn, Robert])

Response: *This comment provides general information in support of the application. It does not provide any specific information related to the environmental effects of the proposed action and will not be evaluated in the EIS. Potential effects of the cooling water system on aquatic resources, however, will be evaluated in Section 5.3.2.*

Comment: The Environmental Report indicates an overall wetlands impact of 229 acres from the new plant and proposed causeway. It is further indicated there is an abundance of wetlands in the vicinity totaling more than 25,000 acres and the quality of the dominant species is invasive Phragmites. Additional lands targeted for acquisition through a land right exchange to the north of the site are part of an existing Army Corps of Engineers Confined Disposal Facility area (CDF) that is surrounded by dikes and not open to tides. PSEG would reduce environmental impacts by placing permanent facilities inside these diked areas. In compensation for use of these wetlands we would recommend that PSEG create or restore degraded wetlands within the Delaware Bay region at an appropriate compensation ratio. This should be an achievable undertaking by PSEG as their Estuary Enhancement Program has been recognized nationally for restoring and protecting over 20,000 acres of wetlands and adjoining properties in the Delaware Estuary in both New Jersey and Delaware. (**0011-12** [Molzahn, Robert])

Response: *This comment provides general information in support of the application. It does not provide any specific information related to the environmental effects of the proposed action and will not be evaluated in the EIS. Mitigative actions, however, resulting from any construction and/or operational effects on wetlands and aquatic resources will be discussed in Sections 4.3.2 and 5.3.2.*

Comment: In addition, I urge that the cumulative ecological impacts of alternative energy generating sources be included in the Environmental Impact Statement (EIS) in order to show that by comparison nuclear energy is a far preferable option. (**0012-2** [Eastman, Ajax])

Response: *Cumulative ecological impacts and alternative energy sources will be discussed in EIS Chapters 7 and 9, respectively.*

Comment: After reviewing the Estuary Enhancement Program by PSEG, I am impressed by their innovative mitigation measures such as wetland restoration, phragmites control, fish protection at the reactor sites, restoration of anadromous fish migration through fish ladders, research, etc. These programs have resulted in long- lasting benefits for the saltwater estuary including, expanded biological diversity and habitats, breeding areas, food sources for aquatic, terrestrial, and avian species, especially threatened and endangered species, and better water quality. This leads me to believe that PSEG will do an excellent job of mitigation in the future. (**0012-14** [Eastman, Ajax])

Response: *This comment provides general information in support of the application. It does not provide any specific information related to the environmental effects of the proposed action and will not be evaluated in the EIS. Mitigative actions, however, resulting from any construction and/or operational effects on wetlands and aquatic resources will be evaluated in Sections 4.3.2 and 5.3.2.*

Comment: Before addressing the new construction, I would point out PSEG's past efforts to mitigate the effects of its operations on the aquatic environment in the Salem vicinity. In particular, faced with concerns of negative impacts on fisheries by cooling water intake operations, PSEG responded with the largest private wetlands restoration project in the world. The Estuary Enhancement Program began in 1994 and since that time has been a large scale effort to restore and preserve portions of the Delaware Estuary in both New Jersey and Delaware. PSEG has restored, enhanced, and/or preserved more than 20,000 acres of salt marsh and adjacent uplands to vital, healthy habitat for fish and wildlife.

Restoration efforts have included the goal of replacing former salt hay farms and marshes dominated by invasive Phragmites australis with salt cord grass-dominated marsh. The Academy has studied many of these sites prior to restoration and visited a number afterwards. The Estuary Enhancement Program has been successful in restoring typical salt marsh conditions at the sites, with most sites meeting targets for reduction in Phragmites and establishment of salt cordgrass. Many of these and related studies have been published in various peer-reviewed scientific journals. (**0014-4** [Velinsky, David])

Response: *This comment provides general information in support of the application. It does not provide any specific information related to the environmental effects of the proposed action*

and will not be evaluated in the EIS. Mitigative and restoration actions, however, resulting from any construction and/or operational effects on wetlands and aquatic resources will be evaluated in Sections 4.3.2 and 5.3.2.

Comment: In looking at the proposed new construction on the PSEG Site, I will be speaking primarily to specific projected ecological impacts on local aquatic systems. The natural systems of Delaware River and Estuary are critical environments with major significance for both regional and global biodiversity, for regional water supply and water quality, and for supporting important economic activities. Construction on the scale proposed by PSEG on the Delaware coast requires careful consideration of environmental factors. (**0014-2** [Velinsky, David])

Response: *This comment provides general information in support of the application. It does not provide any specific information related to the environmental effects of the proposed action and will not be evaluated in the EIS. Any effects of construction, however, on aquatic resources of the Delaware Bay ecosystem will be evaluated in Section 4.3.2.*

Comment: Before addressing the new construction, I would point out PSEG's past efforts to mitigate the effects of its operations on the aquatic environment in the Salem vicinity. In particular, faced with concerns of negative impacts on fisheries by cooling water intake operations, PSEG responded with the largest private wetlands restoration project in the world. The Estuary Enhancement Program began in 1994 and since that time has been a large scale effort to restore and preserve portions of the Delaware Estuary in both New Jersey and Delaware. PSEG has restored, enhanced, and/or preserved more than 20,000 acres of salt marsh and adjacent uplands to vital, healthy habitat for fish and wildlife.

Restoration efforts have included the goal of replacing former salt hay farms and marshes dominated by invasive Phragmites australis with salt cord grass-dominated marsh. The Academy has studied many of these sites prior to restoration and visited a number afterwards. The Estuary Enhancement Program has been successful in restoring typical salt marsh conditions at the sites, with most sites meeting targets for reduction in Phragmites and establishment of salt cordgrass. Many of these and related studies have been published in various peer-reviewed scientific journals. (**0014-4** [Velinsky, David])

Response: *This comment provides general information in support of the application. It does not provide any specific information related to the environmental effects of the proposed action and will not be evaluated in the EIS. Mitigative actions, however, resulting from any construction and/or operational effects on the aquatic resources of wetland ecosystems will be discussed in Sections 4.3.2 and 5.3.2.*

Comment: The proposed new construction will permanently impact approximately 229 acres of wetland. While protection of wetland is a high national priority (as demonstrated by Section 404 of the Clean Water Act), the majority of the wetland acreage impacted by the new construction has a degraded hydroperiod and now hosts a monoculture of Phragmites australis. An invasive reed grass, Phragmites is often found in disturbed marsh areas, where plant communities, hydrology and topography have been altered. Phragmites displaces native plants and has a negative impact on biodiversity. Targeting these degraded wetlands in close proximity to existing PSEG facilities will reduce the need for new infrastructure, minimizing the

environmental disturbance that would result if development occurred in “Greenfield” sites. Moreover, the amount of wetlands impacted represents a small fraction of the total wetland - many with higher quality functions - present in the vicinity of the construction.

In addition, 85 acres of the wetland being permanently altered by the construction are located in the U.S. Army Corps of Engineers Combined Disposal Facility (CDF.) This has been the site for dumping of dredge spoils from deepening of the Delaware River Channel. It is surrounded by dikes and is not open to tidal influences. It is unlikely that this site supports high level wetland functions and utilizing it where permanent construction is necessary will limit overall wetland impacts. (**0014-6** [Velinsky, David])

Response: *Impacts as a result of construction including potential impacts to wetlands will be discussed in Section 4.3. of the EIS. Mitigative actions, proposed by the applicant, as a result from any construction effects on aquatic resources will be addressed in Section 4.3.2. In addition, the U.S. Army Corps of Engineers-Philadelphia District is a Cooperating Agency on the EIS for PSEG's ESP application. As such, the environmental impacts of any actions proposed by the Corps to facilitate PSEG's ESP application, including the land exchange and relocation of the confined disposal facility, will be discussed in EIS.*

Comment: PSEG is making acceptable efforts to restrict impact on these wetlands, including a site plan to minimize encroachment, the use of sediments pits to stage some of the construction operations, and the use of a raised causeway rather than using fill material to carry the access road to the new site. Where permanent disturbance to wetland occurs, PSEG has outlined a mitigation plan that should create new wetland environments in adequate amounts to offset any loss. We anticipate that the resources and expertise developed in the EEP will provide a foundation for the mitigation steps being taken by PSEG in the new site construction, both in selecting the mitigation sites and in managing the restored and enhanced wetland sites. (**0014-8** [Velinsky, David])

Response: *This comment provides general information in support of the application. It does not provide any specific information related to the environmental effects of the proposed action and will not be evaluated in the EIS. Mitigative actions, however, resulting from any construction effects on wetlands will be evaluated in Section 4.3.2.*

Comment: The basic restoration activities developed by the EEP, particularly controlling Phragmites and fostering development of good tidal marsh topography and hydrology, have advanced the field of ecological restoration. The ecological engineering technique of forming primary channels and using estuarine processes to further develop channels and topography is especially notable. As such, the Estuary Enhancement Program has provides an important model for marshland restoration which is an important component of PSEG’s proposed mitigation plan. (**0014-10** [Velinsky, David])

Response: *This comment provides general information in support of the application. It does not provide any specific information related to the environmental effects of the proposed action and will not be evaluated in the EIS. Mitigative actions, however, resulting from any construction and/or operational effects on wetlands and tidal marshes will be discussed in Sections 4.3.2 and 5.3.2.*

Comment: Therefore, DRN urges NRC to review certain issues in more detail, including: clearer evaluation of PSEG's use of the Army Corps confined disposal facility, and cumulative impacts resulting from use of that site; water impacts including dredging and construction impacts; filling of wetlands; floodplain impacts; habitat impacts and impacts to species, especially Atlantic sturgeon; and impacts and evaluation of alternatives for cooling systems. (**0018-4** [Brown, Elizabeth])

Response: *The U.S. Army Corps of Engineers-Philadelphia District is a Cooperating Agency on the EIS for PSEG's ESP application. As such, the environmental impacts of any actions proposed by the Corps to facilitate PSEG's ESP application, including the land exchange and relocation of the confined disposal facility, will be discussed in EIS. Potential cumulative impacts as a result of the proposed project will be evaluated in Chapter 7.*

Comment: Impacts to habitat and important aquatic species must also be rigorously evaluated in the EIS. In particular, DRN is concerned with the impact of the Project on Atlantic sturgeon. The ER acknowledges that appropriate habitat for juvenile Atlantic sturgeon exists in the project area, that direct impacts to Atlantic sturgeon could include exposure to fine sediments, or collisions with propellers or water borne equipment, and that "dredging activities will likely displace this and other fish from the immediate dredge zone."

Since the preparation of the ER, NOAA's National Marine Fisheries Service (NMFS) issued a proposed rule (October 6, 2010) to list five distinct population segments (DPS) of the Atlantic sturgeon as threatened or endangered under the Endangered Species Act (ESA). In recognition of the many threats to riverine habitat, including dredging, filling, and degraded water quality, facing Atlantic sturgeon in the Hudson and Delaware Rivers, NMFS proposed to list a DPS consisting of these populations, the New York Bight (NYB) DPS, as endangered. See, 75 Fed. Reg. 61,872 at 61,881(Oct. 6, 2010). We also note with alarm that the Delaware River population of Atlantic sturgeon is more precariously poised than the Hudson River population, according to research on the record. According to the Delaware River State of the Basin Report, 2008, which is based on science collected in the region, the status of the Atlantic Sturgeon is considered "poor and getting worse" with numbers "estimated to be less than 1,000 and probably less than 100 across the Estuary." Furthermore, there is scientific evidence that the Delaware River is home to a genetically unique population of Atlantic Sturgeon, and that this small but distinct population is currently reproducing. That the Delaware River population is not only genetically unique but also may have a population of fewer than 100 fish makes protection of this portion of the NYB DPS a critical priority.

This change in status means that a critical piece of information is missing from the ER, and must be evaluated fresh in NRC's creation of the EIS. (**0018-13** [Brown, Elizabeth])

Response: *Potential impacts of construction and operation of the proposed facility as they relate to threatened or endangered species such as the Atlantic sturgeon will be evaluated in Sections 4.3.2 and 5.3.2.*

Comment: Although the water volume withdrawn from the Delaware River by the closed cycle new plant is substantially lower, there will still be impingement and entrainment of aquatic life, as well as potentially significant thermal impacts from the closed-cycle cooling system.

Maximum intake of the new plant is estimated in the ER to be equivalent to 3.7 percent of the intake flow of once-through cooling at the existing Salem facility. However, regarding thermal discharge, the new plant discharge is located within the region already influenced by the thermal discharges of the existing Salem and Hope Creek facilities. The impact of this situation on thermal plume must be fully and rigorously evaluated in the EIS, regardless of any applicable mixing zone. (**0018-17** [Brown, Elizabeth])

Comment: In addition to the steps being taken to protect the wetlands impacted by construction, the aquatic impacts of the proposed facility will be limited by the use of a closed cycle cooling system. Compared to a once-through system, these cooling towers will divert much less water for cooling. Projected maximum diversion for the new facility is less than 4% of the current amount used by the Salem Generating Station and is a very small fraction the total volume of the Delaware River flow. As a result, impingement of fish populations will be a small fraction--less than 3% of the current level of the Salem station.

Because of the closed cooling system, we would also expect the thermal plume of the new plant to be localized and relatively small, with no significant impact on the local aquatic biota. The conclusion is based on past studies of the impact of thermal plumes from the existing PSEG generating plants, the expected operation of the proposed cooling structures, and our understanding of the ecology of aquatic species in the vicinity of the plant. (**0014-12** [Velinsky, David])

Response: *Potential impacts related to entrainment, impingement, and thermal discharges of the proposed facility on aquatic resources will be discussed in Section 5.3.2 of the EIS. Also, potential cumulative impacts due to operation of the closed-cycle cooling system will be addressed in Chapter 7.*

Comment: Clearly, the EIS will need to address the impact of dredging and related shoreline disturbance and take all viable alternatives into account. (**0018-21** [Brown, Elizabeth])

Response: *Potential impacts of construction activities such as dredging and shoreline disturbances will be evaluated in Section 4.3.2 of the EIS. In addition, alternatives will be discussed in Chapter 9.*

Comment: The New Jersey Division of Fish & Wildlife (DFW) continues to be concerned with the issue of impingement and entrainment of the eggs, larval forms, juveniles and adults of the fish, shellfish and other invertebrate species which exist in the Delaware River Estuary. Six species of invertebrates occurring near the PSEG Site have been harvested commercially in NJ to include -blue crab, eastern oyster and other shellfish.

Environmental Report, CHAPTER 6, ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS, 6.5.3.2 Aquatic Ecology -includes proposals for monitoring programs to include impingement sampling and entrainment sampling at the new intake for fish and shellfish species.

At present the 1995 -2009 BIOLOGICAL MONITORING PROGRAM ANNUAL REPORT; include data on finfish and blue crabs. The DFW feels that data on shellfish should be included in this report and in the pre-application, construction, pre-operational and operational monitoring.

The possible additional withdrawal of 78,196 gpm from the Delaware River for the CWS and SWS only adds to the existing concerns the DFW has for the impingement and entrainment of the eggs, larval forms, juveniles and adults of the fish, shellfish and other invertebrate species which exist in the Delaware River Estuary. (**0019-23** [Brubaker, Scott])

Response: *Potential operational impacts such as entrainment and impingement on aquatic organisms will be discussed in Section 5.3.2 and the potential cumulative effects of all facilities operating at the Salem-Hope Creek site will be evaluated in Chapter 7.*

Comment: General Comments

The permittee included various estimates of projected impingement and entrainment values for the proposed system. Impingement and entrainment can be assessed by a wide variety of tools and it is not possible to comment on the accuracy of these estimates without understanding more regarding the underlying assumptions. However, as noted above, the Department supports the use of closed cycle cooling as best technology available to minimize water withdrawal rates.

The Department recognizes that the proposed closed cycle cooling system using cooling towers and a low intake velocity of less than 0.5 feet per second constitutes the best technology available for minimizing impingement and entrainment impacts under Section 3l6(b) of the Clean Water Act. (**0019-25** [Brubaker, Scott])

Response: *This comment provides general information in support of the application. It does not provide any specific information related to the environmental effects of the proposed action and will not be evaluated in the EIS. Any potential impacts, however, related to entrainment and impingement will be discussed in Section 5.3.2.*

Comment: B - The ESPA includes only a cursory and simplistic evaluation of the potential impacts to the aquatic ecosystem (water quality, biota, wetlands, etc.) that could result from the construction and operation of the proposed project (Chapter 3 of the Environmental Report). Likewise, measures to mitigate such impacts are described in only a general manner. In general, the detailed evaluation of potential impacts is relegated to future permit and other approval actions. (**0020-3** [Brubaker, Scott])

Response: *Potential impacts on aquatic ecosystems due to construction and/or operation of the proposed facility and mitigation of such potential impacts will be discussed in Sections 4.3.2 and 5.3.2 of the EIS.*

Comment: (8) ER Section 4.1.2.2, page 4.1-7: indicates that dredged material from the USACE Artificial Island CDF and from dredging activities associated with the intake and barge facility areas would be used as fill material on-site.

At a May 9, 2010 meeting with the NJDEP, PSEG representatives indicated that dredging of ~975,000 cubic yards of sediments from the Delaware River would be needed to support the project - this has apparently been reduced to ~ 590,000 CY (see Comment #9). All dredging and dredged material management activities associated with the construction of the proposed project must be described and comprehensively evaluated. This would include testing of dredged material consistent with the requirements of the 1997 NJDEP Dredging Technical Manual. The documents submitted in support of the ESPA barely discuss dredging and dredged material aspects of the proposed project. Section 2.3.1 of the Environmental Report only briefly summarizes some Delaware River sediment samples collected in the vicinity of the project site and subjected only to grain size analyses.

Dredging and dredged material management activities will also require a variety of permits from the NJDEP, including a CZM Consistency Determination. The use of any dredged material as on-site fill - including material excavated from the USACE Artificial Island Upland CDF - will require an Acceptable Use Determination from the Department.

At the May 9, 2010 meeting, it was also stated that construction of a new dredged material upland CDF on the PSEG property may be needed. If still needed, the potential impacts of the construction and use of such a facility must also be comprehensively evaluated and approved by the Department, consistent with the requirements specified in the 1997 NJDEP Dredging Technical Manual. (**0020-9** [Brubaker, Scott])

Response: *Any potential impacts of construction activities such as effects of dredging on aquatic resources will be discussed in Section 4.3.2.*

Comment: (9) ER, Section 4.2.1.1.4, page 4.2-5: briefly describes construction and dredging activities along the Delaware River shoreline. A total area of 92 acres - approximately 590,000 CY of sediment - is proposed to be dredged. The document concludes that impacts associated with dredging are small. However, much more work is needed to comprehensively evaluate the potential impacts resulting from dredging and dredged material management activities - see Comment #8. (**0020-12** [Brubaker, Scott])

Response: *Any potential impacts on aquatic ecosystems resulting from construction activities such as dredging will be discussed in Section 4.3.2.*

Comment: (10) ER, Section 4.2.3.1, page 4.2-13, para #2: states that "Based on the findings of the USACE's Delaware River main channel deepening project Environmental Assessment, dredging is not expected to result in degradation of water quality." The evaluation of potential impacts presented in the referenced Environmental Assessment are of little relevance to the evaluation of the potential impacts of dredging and dredged material management activities associated with the proposed PSEG project. (**0020-14** [Brubaker, Scott])

Comment: (12) ER, Section 4.3.2.3, page 4.3-19, para. #3: see Comment #9. The ~590,000 CY of sediments to be dredged have not been tested/evaluated, nor has a disposal site been selected. (**0020-17** [Brubaker, Scott])

Response: *Any potential impacts of construction activities such as dredging on aquatic resources will be discussed in Section 4.3.2.*

Comment: (13) ER, Section 4.3.2.3, page 4.3-19, para. #3: concludes that impacts associated with dredging activities are small; see Comment #9. (**0020-19** [Brubaker, Scott])

Response: *This comment provides general information in support of the application. It does not provide any specific information related to the environmental effects of the proposed action and will not be evaluated in the EIS. Any construction impacts, however, on ecological resources will be discussed in Section 4.3.2.*

Comment: (13) ER, Section 4.3.2.3, page 4.3-19, para. #3: concludes that impacts associated with dredging activities are small; see Comment #9. (**0020-19** [Brubaker, Scott])

Response: *This comment provides general information in support of the application. It does not provide any specific information related to the environmental effects of the proposed action and will not be evaluated in the EIS. Any impacts associated with dredging, however, on aquatic resources will be discussed in Section 4.3.2*

Comment: (14) ER, Section 4.3.2.5, page 4.3-21, paras. #1 and #2: briefly discuss potential impacts to a variety of fish, including T/E species that could result from construction of the proposed project - particularly as a result of dredging activities. The ER must also consider the various dredging windows that have been established in the Delaware River and Estuary when evaluating potential project impacts. (**0020-21** [Brubaker, Scott])

Response: *Potential effects of dredging activities on fish populations in the Delaware River and estuary will be discussed in Section 4.3.2.*

Comment: (15) ER, Table 4.6-1: regarding potential measures to mitigate potential water quality and aquatic ecosystem impacts resulting from dredging and dredged material management activities - see Comments #9 and #14. (**0020-23** [Brubaker, Scott])

Response: *Measures to mitigate potential aquatic ecosystem impacts resulting from dredging and dredged material management activities will be discussed in Section 4.3.*

Comment: (17) Section 5.1.1.1, page 5.1-1, para. #2: briefly discusses dredging activities that may be needed during operation of the proposed facility, and concludes that - since the dredged material will be disposed of in approved upland areas - any resulting impacts will be small. See Comments #8 and #9. [Also see Sections 5.2.1.2 and 10.5.2.1] (**0020-26** [Brubaker, Scott])

Response: *This comment provides general information in support of the application. It does not provide any specific information related to the environmental effects of the proposed action and will not be evaluated in the EIS. Any impacts due to construction activities such as dredging on aquatic resources will be evaluated, however, in Section 4.3.2.*

Comment: Impacts to the quality of surface waters and the alteration of river bottom sediments within the Delaware River and adjacent marsh creeks are expected as a result of the construction and operation of the proposed facility, and will include those associated with the

development of shoreline features (intake structure, barge facility, heavy haul road), dredging of sediments from the near-shore area of the Delaware River to provide for water intake and discharge and to provide adequate draft for barge access during construction, and the filling of 9.5 acres of coastal tidal wetlands and shallow open water areas. (**0022-2** [Gorski, Stanley])

Response: *Potential impacts due to construction and operation of the proposed facility on aquatic ecosystems will be discussed in Sections 5.3.2 and 4.3.2.*

Comment: Increases in turbidity through the resuspension of sediments into the water column from dredging and port operations will degrade water quality, lower dissolved oxygen levels, and potentially release chemical contaminants bound to the fine-grained estuarine/marine sediments. Sedimentation and wave patterns in the area may be altered as a result of vessels entering and exiting the proposed mooring area also resulting in increased turbidity. Suspended sediments mask pheromones used by migratory fishes, and can smother immobile benthic organisms and demersal newly- settle juvenile fish (Auld and Schubel 1978; Breitburg 1988; Newcombe and MacDonald 1991; Burton 1993; Nelson and Wheeler 1997). As supported above, the project area provides important habitat for striped bass including valuable spawning grounds and nursery habitat. Increases in turbidity will adversely affect striped bass larvae's ability to capture prey (Fay et al. 1983 in Able and Fahay 1998). The decrease in water circulation can also adversely affect striped bass survival as strong current is needed to keep the eggs suspended in the water column and prevent them from being smothered by silt (Bigelow and Schroeder 1953). (**0022-4** [Gorski, Stanley])

Response: *Any potential effects of dredging activities such as increases in turbidity and alteration of water circulation on fish and benthic organisms will be discussed in Section 4.3.2.*

Comment: Guidelines under Section 404(b)(1) of the federal Clean Water Act require that actions proposed within waters of the United States, especially those that are not water-dependent, are required to demonstrate that they have considered all appropriate reasonable and prudent measures to avoid and minimize impacts to waters. If all measures to avoid and minimize wetland impacts have been considered and employed to the extent practicable and result in unavoidable impacts, a compensatory mitigation plan should be developed and implemented.

The applicant should undertake a complete analysis of alternatives that complies fully with the Clean Water Act Section 404 (b)(1) Guidelines that documents avoidance, minimization and mitigation for all impacts. Alternate locations as well as a documentation of purpose and need should be provided as part of this analysis. For any unavoidable impacts, a compensatory mitigation plan to offset all of the projects impacts to aquatic resources including EFH should be developed in accordance with the federal standards and criteria for compensatory mitigation for losses of aquatic resources published in the Federal Register on April 10, 2008 (vol. 73 No. 70). This plan should be developed as early in the permit process as possible and in consultation with the applicable federal, state and local resource agencies and will be implemented on and in the immediate area of the PSEG Site to the extent practicable. (**0022-6** [Gorski, Stanley])

Response: *Potential impacts on aquatic ecosystems, including wetlands, due to construction and/or operation of the proposed facility and mitigation of such potential impacts will be discussed in Sections 4.3.2 and 5.3.2 of the EIS. In addition, alternative energies will be discussed in Chapter 9.*

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Burton, W.H. 1993. Effects of bucket dredging on water quality in the Delaware River and the potential for effects on fisheries resources. Prepared for: Delaware Basin Fish and Wildlife Management Cooperative, by Versar Inc, Columbia MD.

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Newcombe, C.P. and D.D. MacDonald. 1991. Effects of Suspended Sediments on Aquatic Ecosystems. North American Journal of Fisheries Management. 11: 72-82.

O'Herron. J.C., K.W. Able and R.W. Hastings. 1993. Movements of shortnose sturgeon in the Delaware River. Estuaries 16(2):235-240.

Ryder, J.A. 1888. The sturgeon and sturgeon industries of the Eastern U.S., with and account of experiments bearing on sturgeon culture. Bulletin of the U.S. Fisheries Commission. 1888. p.231-281.

Schuyler, A.E. 1988. Submergent and planmergent flora of the freshwater portion of the Delaware Estuary. Chapter 10. In: S.K. Majumdar, E.W. Miller and L.E. Sage (Eds.), Ecology and Restoration of the Delaware River Basin. PA. Academy of Science, Easton, PA.
(**0022-15** [Gorski, Stanley])

Response: *The comment is noted. The NRC staff will consider the scientific studies referenced in the comment as part of the environmental review.*

Comment: Endangered and Threatened Species

The Atlantic sturgeon (Acipenser oxyrinchus) may be found in the Delaware River in the vicinity of the project area at certain times of the year. On October 6, 2010, NOAA issued a Federal Register Notice (75 FRN 61872). The notice identifies the Hudson River and Delaware River Atlantic sturgeon stocks as a distinct population segment (DPS) called the New York Bight DPS. This DPS has been proposed to be listed as endangered. The Atlantic Sturgeon Status Review Team (ASSRT) identified 15 different stressors that may impact the Atlantic sturgeon populations including poor water quality and habitat loss (2007). Dredging and vessel strikes are also considered to be important stressors on the populations of Atlantic sturgeon (75 FRN 61872 et seq.) According to the ASSRT (2007), Ryder (1888) suggested that juvenile Atlantic sturgeon used the tidal freshwater reach of the Delaware River as a nursery area and Lazzari et al. (1986) frequently captured juvenile Atlantic sturgeon from May -December in the upper tidal portion of the river below Trenton, New Jersey.

Shortnose sturgeon (Acipenser brevirostrum) typically occurs in deep water channels although they do occur in the shallower waters while foraging. The abundance of adult shortnose sturgeon is greatest in the tidal river from Trenton to Philadelphia (Hastings et al. 1987; O'Herron et al. 1993). In-water construction activities can affect shortnose and Atlantic sturgeon through direct injury or mortality, displacing species from the area, or by altering the habitat and destroying forage items.

Shortnose sturgeon (Acipenser brevirostrum) typically occurs in deep water channels although they do occur in the shallower waters similar to that of the project area while foraging. Any discretionary federal action, such as the approval or funding of a project by a Federal agency, that may affect a listed species must undergo consultation pursuant to Section 7 of the Endangered Species Act (ESA) of 1973, as amended. The NRC should submit its determination of effects, along with justification for the determination and a request for concurrence, to the attention of the Endangered Species Coordinator, NMFS, Northeast Regional Office, Protected

Resources Division, One Blackburn Drive, Gloucester, MA 01930. For additional information on the Section 7 consultation process or shortnose sturgeon, please contact Julie Crocker at (978) 282-8480 or julie.crocker@noaa.gov. (**0022-14** [Gorski, Stanley])

Response: *The NRC initiated informal consultation with the National Marine Fisheries Service (NMFS) for a list of species protected by the Endangered Species Act that are under the jurisdiction of NMFS and that NMFS believes to occur in the region of influence associated with construction and operation of the PSEG site. NRC will evaluate the impacts of construction and operation of the proposed facility on threatened and endangered species including the Atlantic and Shortnose sturgeon. These potential impacts will be discussed in Sections 5.3.2 and 4.3.2 of the EIS.*

Comment: Fish and Wildlife Coordination Act

Notwithstanding our mandates under the MSA, the NMFS also has responsibilities under the Fish and Wildlife Coordination Act (FWCA) to provide federal agencies such as the NRC with recommendations to avoid, minimize and to mitigate for direct, indirect and cumulative impacts to any and all NOAA trust resources that are present within the Delaware River Basin.

The Delaware Estuary including its tributaries provides habitat for a wide variety of NOAA trust resources including alewife (Alosa pseudoharengus), American eel (Anguilla rostrata) American shad (Alosa sapidissima), Atlantic croaker (Micropogonias undulatus), Atlantic menhaden (Brevoortia tyrannus), Atlantic sturgeon (Acipenser oxyrinchus), blueback herring (Alosa aestivalis), bluefish, hickory shad (Alosa mediocris), spot (Leiostomus xanthurus) tautog (Tautoga onitis), weakfish, white perch (Morone americana), yellow perch (Percajlavescens), striped bass (Morone saxatilis), hogchoker (Trinectes maculatus), killifish, bay anchovy, silversides, mummichog and may others.

Because landing statistics and the number of fish observed on annual spawning runs indicate a drastic decline in alewife and blueback herring populations throughout much of their range since the mid-1960's, they have been designated as species of concern by NMFS in a Federal Register Notice dated October 17, 2006 (71 FRN 61022). Species of concern are those species about which NMFS has some concerns regarding status and threats, but for which insufficient information is available to indicate a need to list the species under the Endangered Species Act. The shallow water environment in this section of the Delaware River provides valuable habitat for these species as well as striped bass and American shad.

The New Jersey Department of Environmental Protection (NJDEP) also has sampled the Delaware River and Bay in the project area for nearly 30 years since 1980. This long- term survey documents the use of the this portion of the river by a wide variety of species including blueback herring, alewife, American shad American shad (Alosa sapidissima), American eel (Anguilla rostrata), Atlantic herring (Clupea harengus), Atlantic menhaden (Brevoortia tyrannus), bay anchovy, (Anchoa mitchilli), blueback herring, gizzard shad (Dorosoma cepedianum), hogchoker (Trinectes maculatus), striped bass, yellow perch (Percajlavescens), white perch (Morone americana), Atlantic silverside (Menidia menidia), and many others (NJDEP 2010). Many of these species are both commercially and recreationally important and managed by the ASFMC or are valuable prey species for ASFMC or federally managed fish.

Buckel and Conover (1997) in Fahey et al. (1999) reports that diet items of juvenile bluefish include Alosa species such American shad, blueback herring and alewife as well as bay anchovy, silversides and other fish species. We note that the NJDEP survey data show that federally managed bluefish are present in the project area. This indicates that both the prey species and the predator are present in the Delaware River in and around the project area. Juvenile Alosa species have all been identified as prey species for windowpane (Scophthalmus aquosus) and summer flounder (Paralichthys dentatus) in Steimle et al. (2000). Windowpane and summer flounder are federally managed species whose EFH has been designated in the mixing zone of the Delaware River.

Submerged aquatic vegetation (SAV) has historically been absent from Delaware Bay. However, to date, there has been no comprehensive mapping of SAV in the Delaware Estuary to verify its presence or absence. Several species have been observed though in the tidal river since 1970, including: Vallisneria americana, Myriophyllum spicatum, Elodea nuttallii, Najasflexillis, Potamogeton sp. and others (Schuyler, 1988). Wild celery (Vallisneria americana) has been documented i (**0022-12** [Gorski, Stanley])

Response: *This comment provides general information relevant to some of the aquatic organisms present in the Delaware Bay but it does not provide any specific information related to the environmental effects of the proposed action. Any potential impacts, however, resulting from construction and/or operational effects on aquatic resources will be addressed in Sections 4.3.2 and 5.3.2 of the EIS.*

Comment: Magnuson Stevens Fishery Conservation and Management Act (MSA) Section 305 (b)(2) of the 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSA) requires all federal agencies to consult with NOAA Fisheries on any action, including those proposed by the NRC, that is authorized, funded, or undertaken by that agency and that may adversely affect EFH. Included in this consultation process is the preparation of a complete and appropriate EFH assessment to provide necessary information on which to consult. Our EFH regulation at 50 CFR 600.905 mandates the preparation of EFH assessments and generally outlines each agency's obligations in this consultation procedure.

The estuarine portions of the Delaware River and its tributaries including the estuarine areas of both Alloway and Hope Creeks have been designated as EFH for a wide variety of species including red hake (Urophycis chuss), winter flounder (Pseudopleuronectes americanus), windowpane flounder (Scophthalmus aquosus), bluefish (Pomatomus saltatrix), Atlantic butterfish (Peprilus triacanthus), scup (Stenotomus chrysops), summer flounder (Paralichthys dentatus), scup (Stenotomus chrysops), black sea bass (Centropristis striata), king mackerel (Scomberomorus cavalla), Spanish mackerel (Scomberomorus maculatus), cobia (Rachycenlron canadum), little skate (Leucoraja erinacea), winter skate (Leucoraja ocellata) and clearnose skate (Raja eglanteria). A more detailed listing of EFH and federally managed species and EFH consultation requirements can be found on our website at: www.nero.nmfs.gov/hcd.

The EFH final rule published in the Federal Register on January 17, 2002 defines an adverse effect as: any impact which reduces the quality and/or quantity of EFH. The rule further states that:

"An adverse effect may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat and other ecosystems components, if such modifications reduce the quality and/or quantity of EFH. Adverse effects to EFH may result from action occurring within EFH or outside EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions."

The rule also states:

"Loss of prey may be an adverse effect on EFH and managed species because the presence of prey makes waters and substrate function as feeding habitat and the definition of EFH includes waters and substrate necessary to fish for feeding. Therefore, actions that reduce the availability of a major prey species, either through direct harm or capture, or through adverse impacts to the prey species' habitat that are known to cause a reduction in the population of the prey species, may be considered adverse effects on EFH if such actions reduce the quality of EFH."

In order to initiate consultation pursuant to the MSA, the NRC must submit a full and complete EFH assessment that considers the individual and cumulative and the direct and indirect impacts of the proposed project on EFH, federal managed species and their prey recognizing the definition of adverse impact discussed above. The required contents of an EFH assessment includes: 1) a description of the action; 2) an analysis of the potential adverse effects of the action on EFH and the managed species; 3) the NRC's conclusions regarding the effects of the action on EFH; 4) proposed mitigation, if applicable. Given the scope of this project, other information that should be contained in the EFH assessment includes: 1) the results of on-site inspections to evaluate the habitat and site-specific effects; 2) the views of recognized experts on the habitat or the species that may be affected; 3) a review of pertinent literature and related information; and 5) an analysis of alternatives to the action that could avoid or minimize the adverse (**0022-10** [Gorski, Stanley])

Response: *The NRC initiated informal consultation with the National Marine Fisheries Service (NMFS) for a list of species protected by the Endangered Species Act that are under the jurisdiction of NMFS and that NMFS believes to occur in the region of influence associated with construction and operation of the PSEG site. Correspondence with NMFS will also occur for the presence of essential fish habitat (EFH). NRC intends to include an EFH assessment in the EIS. In addition, any potential impacts of construction and/or operational activities on the fish populations of the Delaware estuary will be addressed in Sections 4.3.2 and 5.3.2 of the EIS.*

Comment: ER Page 27 of 136-Hydrological Alterations

"Dredged material removed as part of this construction activity will be transported to and placed in an on-site or other approved upland disposal facility."

Does the licensee plan on expanding the REMP program to include air particulate/iodine monitoring, surface water runoff, or soil sampling in the area of this CDP (if onsite area is used for materials)? An air monitoring site should be placed downwind of the CDP based on annual meteorological direction (SE). Also, will there be expanded ground water monitoring in the vicinity of the CDF?

Once complete, sampling locations near the intake and discharge canals will be needed, especially for media such as aquatic biota and sediment. Since the structures are upstream in the Delaware, PSEG will need to rethink their exiting collection location north of the plant that is considered, 'control'. This site may need to be moved further upstream. (**0019-4** [Brubaker, Scott]) (**0019-5** [Brubaker, Scott])

Response: *Any potential impacts due to construction activities such as dredging on aquatic ecosystems will be addressed in Section 4.3.2 of the EIS. Sampling locations for aquatic ecology monitoring will be addressed in Section 4.3.2.4. Finally, regarding the comment to expand the current Radiological Environmental Monitoring Program (REMP) in place for the operating reactors Salem/Hope Creek as a result of construction of the proposed facility, will be discussed as part of the staff's evaluation in Chapter 4 of the EIS.*

D.2.11 Comments Concerning Socioeconomics

Comment: And if you want to create jobs in this state, here, the way to do it is build solar farms, build wind farms. Build two new cooling towers at Salem I and II. They will create hundreds of construction jobs. And, also, you will create fishing jobs, which add up to thousands and thousands of jobs. That should be the approach, also, that should be considered in the overall discussion of this issue. (**0002-6-16** [Schneider, Richard])

Response: *The NRC is not involved in establishing employment programs or policy nor in promoting employment opportunities within any state; rather, it regulates nuclear energy to protect public health and safety within existing policy. Nevertheless, the potential impacts of constructing a nuclear unit(s) at the PSEG site, including the impacts associated with employment, will be evaluated in Chapter 4 of the EIS.*

Comment: Building a new plant means local jobs, and it would drive business to our little town. (**0001-1-1** [Davis, Robert])

Comment: This new application represents the principles in which the county's economic development strategy is based on. And that being green technology, and construction methods, sustainability, focus location on preservation of open space, regional cooperation, creation of a wide range of employment opportunities, reduction in property taxes, and transparent and civil involvement. (**0001-12-2** [Kugler, John])

Comment: I would just like to mention a few things, that the key facts would be related, if this application is approved. They would generate roughly 430 million in sales of goods and services, in the local community. It would create an additional 40 million dollars in total labor income, for the new unit. This plant would create approximately 450 new permanent jobs, that are so desperately needed in Salem County. While under construction it would be roughly 15 to 2,000 construction jobs that would be created. The plant would generate roughly 20 million dollars in state and local tax revenue. There would be educational opportunities, and local infrastructure benefits from the tax revenues. And the facility would roughly generate 75 million in federal tax payments annually. (**0001-12-3** [Kugler, John])

Comment: And in these difficult economic times, the development of a new nuclear facility would provide much needed job growth. The construction phase, as was mentioned by Jack, creates 1,400 to almost 2,000 jobs. And when completed, the facility would employ over 450 jobs in local, high paying jobs. Every year nuclear plants generate approximately 430 million in sales of goods and services to the local community, not to mention their significant tax benefits that benefit local infrastructure, public services, and schools. (**0001-13-12** [Salmon, Edward])

Comment: With unemployment in the county hovering around 12 percent, the economic possibilities of this expansion cannot be understated. (**0001-15-2** [Gaye, Earl])

Comment: Construction of a new plant would also be very good for the local economy. Building a new plant would result in the creation of thousands of jobs for the construction side of the house. And, afterwards, up to 700 permanent jobs, that pay about 36 percent more than the average salaries in the area. Salem County is a rural community at heart, with very few industries, and very few jobs to offer. If you are fortunate, as our members, and myself, and all others in the company are, PSEG is the place to work. Building a new plant opens doors of opportunities for stable employment, a better career, and a better life for thousands of people in the area. (**0001-17-6** [Hassler, Charles])

Comment: The potential construction of a new plant would mean so much to Salem County, with the increase of hundreds of permanent local jobs, in addition to just on the site, with a ripple effect on other businesses, restaurants, hotels, clothing stores, and other vendors of that nature, would truly benefit. There probably isn't a family, in Salem County, who doesn't benefit, at least indirectly, from the economic impact that PSEG now has, and the increase in their effect in the future would only be a plus. The dollars that are invested here would be unprecedented, and would contribute to increased prosperity and economic development in Salem County for many years to come. (**0001-18-5** [Duffy, Brian])

Comment: Construction of an additional nuclear facility and access road on this location will impact the health, aesthetics, and quality of life of those fishing, boating, and birding, and living in the region. (**0001-19-5** [Blake, Matt])

Comment: On this project, over 4,000 craftsmen will be needed for several years to construct this unit. The economy in southern New Jersey is such right now, 50 percent of the building trades are out of work right now. (**0001-22-3** [Kehoe, Jim])

Comment: A potential new power plant would have many impacts. Some of them are 4,100 construction jobs, during the peak construction, including 1,500 electricians, iron workers, and pipe fitters. It would create an additional 4,000 jobs in New Jersey, Delaware and Pennsylvania, as a result of the purchase of goods and services during construction. And, finally, 600 permanent jobs that would be at the plant when it becomes operational. These impacts, as well as many others, will affect our community. (**0001-3-2** [Joyce, Tom])

Comment: WRA is interested in PSEG's proposed project, because the proposed nuclear plant would be a major water user located in the Delaware River basin, and it is an important part of the economy of New Jersey, and the region at large. (**0001-8-2** [Molzahn, Robert])

Comment: My questions would include concern for extreme floods, which may be different now than when the original plants were put into existence, adequate entrance and egress systems, maintaining a good, continuous dialogue with the community. (**0001-9-8** [Lacandro, Roger])

Comment: With unemployment in the county hovering around 12 percent, the economic possibilities of this expansion cannot be understated. (**0002-2-2** [Bobbitt, Bruce])

Comment: Again, there are no surprises, including our plans to explore the construction of a new nuclear plant. The potential new plant would have many impacts, including some 4,100 construction jobs, during peak construction, including 1,500 electricians, iron workers, and pipe fitters. The creation of an additional 4,000 jobs in New Jersey, Delaware, and Pennsylvania, as a result of the purchases of goods and services during the construction. And, finally, 600 permanent jobs when the new plant would become operational. These impacts, as well as many others, will positively affect our community. (**0002-3-2** [Braun, Bob])

Comment: Will the new jobs have a tremendous impact in Salem County? Absolutely. And that is a good thing. (**0002-8-4** [Campbell, Keith])

Comment: Construction of an additional nuclear facility and access road on this location will impact the health, aesthetics and quality of life of those fishing, boating, birding and living in the region. (**0003-6** [Batty, Sandy] [Dillingham, Tim] [Galetto, Jane Morton] [Goldsmith, Amy] [McNutt, Richard] [Nolan, Christine] [O'Gorman, Margaret] [Schulte, James] [van Rossum, Maya])

Comment: And in these difficult economic times, the development of a new nuclear facility would provide much-needed job growth. The construction phase creates 1,400 to 1,800 jobs, and when completed the facility would employ over 500 people in local high- paying jobs. Every year nuclear plants generate approximately $430 million in the sales of goods and services in their local communities, not to mention their significant tax contributions that benefit local infrastructure, public services and schools. (**0004-4** [Salmon, Edward])

Comment: Construction of a new plant would also be very good for the local economy. Building a new plant would result in the creation of between 1400 to 1800 jobs and as high as 2500 or more at peak employment during the construction. After that, a new plant would mean 400 to 700 permanent jobs that pay about 36 percent more than average salaries in the area. Salem County is a rural community at heart, with very few industries and very few jobs to offer. If you are fortunate, as our members and all others in the company are, PSEG is the place to work. Building a new plant opens the doors of opportunity for stable employment, a better career and a better way of life for hundreds of people. (**0005-7** [Hassler, Charles])

Comment: Construction of a new plant would result in much needed jobs in the construction trade, which in New Jersey is experiencing unemployment rates of 30% and higher. Plant construction would result in more than 2,000 jobs for steelworkers, pipefitters, electrical contractors and concrete workers. The new plant would also employ between 400 and 700 people with good paying salaries. (**0006-3** [Patouhas, Maria])

Comment: My questions would include: concern for extreme floods and adequate entrance and egress systems, maintaining a good, continuous dialog with the community and an insistence that only the best science be incorporated in planning and construction. (**0008-9** [Lacandro, Roger])

Comment: This new application represents the "principles" in which the County's Economic Development Strategy is based on. That being:

"Green" technologies and construction method
Sustainability
Focused location with preservation of open space
Regional cooperation
Creation of a wide range of employment opportunities
Reduction in property taxes
Transparency and civic involvement (**0009-3** [Kugler, John])

Comment: I would like to mention some keys facts that would be related to this application if approved:

Generate roughly $430 million in sales of goods and services in the local community. Create an additional $40 million in total labor income for the new unit. This new plant would create approximately 450 new permanent jobs that are so desperately needed. While under construction roughly 1,400 to 1,800 construction jobs would be created. This new plant would generate roughly $20 million in state and local tax revenue. Education and local infrastructure benefit from tax revenues. This facility would generate roughly $75 million in federal tax payment annually. A substantial number of non nuclear jobs estimated to be 400 to 500 would be created as a result of a new unit being built.

Other benefits to building this new unit that would have a positive impact regionally are the boost to the local economy with the purchase of commodities such as:

400,000 cubic feet of concrete
66,000 tons of steel
44 miles of piping
300 miles of electrical wiring
130,000 electrical components (**0009-4** [Kugler, John])

Comment: WRA is interested in PSEG's proposed project because PSEG's proposed nuclear plant will be a major water user located in the Delaware River Basin and is an important part of the economy of New Jersey and the region at large. (**0011-2** [Molzahn, Robert])

Comment: In summary, I believe that the construction of a properly permitted additional nuclear power generating facility at Artificial Island will be a benefit to not only the residents and landowners of Elsinboro Township, but also provide a much needed economic boon to Salem County and Southern New Jersey as a whole. (**0016-5** [Elk, John])

Response: *The NRC staff will evaluate the regional socioeconomic impacts of the proposed action in Chapters 4 and 5 of the EIS, including impacts related to the local economy, taxes, transportation, aesthetics and recreation, housing, education, community infrastructure and social services.*

Comment: PSEG has also supported the Chamber of Commerce's efforts to enhance business relationships with the other businesses and organizations in Salem County, and the surrounding areas. In fact, one of our initiatives, recently, has been to buy locally, and we have expanded that message not only to citizens with consumer goods, but to large businesses. And PSEG was already way of the curve with that. They support many local businesses, and vendors. And I think Tom mentioned the figure of 80 million dollars, annually, into the local economy.

One of the most important things is to bring dollars into the county, and not have dollars drift out. And I just did a little bit of rough math, with our 60,000 or so citizens of Salem County. That 80 million dollars would probably be about 5,000 dollars per family, in Salem County, and I hate to think how bad it would be without that. Salem County and Cumberland County are the two poorest counties in the state. So the economic impact, in a positive way, of PSEG is tremendously important, and any growth would only help our situation down here. (**0001-18-3** [Duffy, Brian])

Comment: Just to reiterate some other comments that have been said today. PSEG Nuclear plays a very important role in our regional economy. The company is the largest employer in Salem County, employing 1,500 people, and pays more than two million in local property taxes. Each year PSEG Nuclear spends millions of dollars with local companies in southern New Jersey, to help them generate electricity. This investment results in direct jobs for hundreds of people, and even more indirect jobs in our region. (**0001-23-2** [Patouhas, Maria])

Comment: We recognize the impact of the current operations that we have on the community. We have 1,500 local employees, forty percent of them from Salem County. We purchase goods and services totaling more than 81 million dollars in southern New Jersey. And we pay more than two million dollars in property taxes a year. (**0001-3-1** [Joyce, Tom])

Comment: The jobs to this region, PSEG is the largest employer to Salem. They invest 84, 85 million dollars into the economy of southern New Jersey, and they provide excellent jobs. (**0002-1-4** [Sweeney, Steve])

Comment: We recognize the impact that our current operations have on the community, including 1,500 local employees, some 40 percent of which hail from Salem County. The purchase of goods and services, totaling more than 80 million dollars, per year, from south Jersey businesses, and more than two million dollars a year in local property taxes. (**0002-3-1** [Braun, Bob])

Comment: And if you look at it in that basic principle, then they should stop killing the fish at Salem I and II. It is destroying the fishing industry, so you are losing jobs. (**0002-6-14** [Schneider, Richard])

Comment: PSEG Nuclear plays a very important role in our regional economy. The company is the largest employer in Salem County, employing 1,500 people and pays more than $2 million

in local property taxes. Each year, PSEG Nuclear spends millions of dollars with local companies in Southern New Jersey to help them generate electricity. This investment results in direct jobs for hundreds of people, and even more indirect jobs, in our region. In fact, a Nuclear Energy Institute analysis shows that every dollar spent by the average nuclear plant results in the creation of $1.07 in the local community. The electricity generated by the current plant provides millions of businesses and homes with reliable, safe, clean and efficient power. (**0006-2** [Patouhas, Maria])

Comment: PSEG has provided good paying jobs for numerous Elsinboro Residents. The operation of the facilities has not placed any financial burden on the local school system, fire company or rescue squad. Rather, to the contrary, PSEG has been a strong supporter of these entities with their time and financial support. (**0016-4** [Elk, John])

Response: *The existing socioeconomic environment in the region, including the PSEG ESP site's potential impact on the local economy, will be described in Section 2.5 of the EIS.*

Comment: So you would be adding to the amount of fish that are killed at that facility. So you must consider the existing damage that the present facility, Salem I and II causes, and adding even more damage. And Salem I and II draws in three billion gallons of water a day, every day. And it kills billions of fish. And the EPA has estimates on how much. And I have a paper I would like to submit as data. And they kill 350 million age one equivalent fish. In other words, fish that would have grown up to be a million, I mean, one year old. That is how they generally use their fish kill data; they call it age one equivalent fish. But, actually, the facility kills billions of fish, billions of smaller fish, which is the food chain for the bigger fish, and the whole ecosystem. So my concern here is that you want to build a new facility, but you are not stopping the existing damage caused by the present facility that is there, units I and II, which draw in three billion gallons of water, and have an open loop cooling system. So before you consider building a new facility you should stop the damage caused by the existing facility, first. I think that is a priority. But it seems like just build another one. But you still have an existing fish kill facility, there. And it kills all species, all ages. And it is destroying the fishing industry along the Delaware Bay and the Delaware River. We used to have a great fishing industry, and we don't now. (**0002-6-12** [Schneider, Richard])

Response: *Cumulative socioeconomic impacts of the proposed action will be discussed in Section 7.4 of the EIS.*

D.2.13 Comments Concerning Historic and Cultural Resources

Comment: It is also likely that the land swap and resulting new access road would obstruct the view shed of the historic 1722 Able Mary Nicholson brick house, which is a national historic landmark. (**0001-19-6** [Blake, Matt])

Comment: It is likely that the land swap and resulting new access road would obstruct the viewshed of the historic 1722 Abel and Mary Nicholson pattern brick house, which is a National Historic Landmark. (**0003-7** [Batty, Sandy] [Dillingham, Tim] [Galetto, Jane Morton] [Goldsmith, Amy] [McNutt, Richard] [Nolan, Christine] [O'Gorman, Margaret] [Schulte, James] [van Rossum, Maya])

Comment: The Society's research has provided a strong foundation for the study of the New Sweden Colony in 1638-1655 and is devoted to preserving the historical sites of New Sweden. The New Sweden Colony was an effort by Sweden to claim a stake in colonial America and, from 1643-1652, Fort Elfsborg was a strategic fortification utilized to guard the South River (Delaware River).

It is now the intention of the Swedish Colonial Society to discover the location of Fort Elfsborg built in Southern New Jersey along the Delaware River. The bulk of the documentation for the location of Fort Elfsborg is scattered in The Swedish Settlements on the Delaware 1638-1664, Amandus Johnson, 1911. Additional clues are found in New York Historical Manuscripts-Dutch, Gehring, and in original documents housed in the Swedish National archives. Dr. Johnson cited a number of sources of Swedish, Dutch and English on the specific location. For example: Winsor, IV. 462: Doc. XII 28, 29 "This island was most judiciously selected for the erection of a fort, being protected by the river on the west, on the north by Fishing Creek (Mill Creek), turning east and south, on the south by an immense expanse of wild marsh." This is probably the most definitive location and is bolstered by a number of other clues. For example: Governor Printz's account books mention the loss of stockpiled lumber when the Indians set fire to the "island." The key here is what is considered an island. The entire area is broken into numerous "islands" by narrow channels. Other clues are citations of the distance of Fort Elfsborg south of Fort Christina and in several reports of where ships were anchored in relation to the fort. The location of the site in Johnson is the hub of the general area we wish to search.

The US Army Corp of Engineers, 1986, Heite and Heite Report concludes the river has washed the fort site away. This is based mostly on a 19th century farmer's request for monetary compensation for land he claimed had been washed away by the river. The area the farmer cited is about a mile from the historical fort location given in Johnson. The Heite and Heite Report cites almost no original 17th century sources regarding the fort location, but relies solely on secondary sources which are based on the farmer's land washed-away money request. These sources were all created after the farmer's claim. The Heite and Heite Report was obviously not familiar with New Sweden research.

Although it does not appear that the Mill Creek area, where it is believed the Fort Elfsborg was located, will be affected, we respectfully request that due diligence be exercised when the NRC does the environmental review of the PSEG ESP application. It is of the most importance that the NRC ensures a more comprehensive Phase 1 survey of the area to assure that the Fort Elfsborg historical site is not impacted, compromised or obliterated. (**0015-1** [Birdwell, Margaret (Sally) Sooy])

Comment: The New Jersey Historic Preservation Office (HPO) is currently in consultation with the Nuclear Regulatory Commission (NRC), and other interested parties, regarding the proposed Hope Creek/Salem Nuclear Power Station expansion project pursuant to Section 106 of the National Historic Preservation Act and its implementing regulations 36 CFR part 800. Through ongoing consultation, this undertaking has identified underwater and terrestrial archaeological sites, as well as, historic properties within the physical and visual area of potential effects. Additional investigations are on-going. If historic properties will be adversely affected by the undertaking; NRC, through consultation, shall work to avoid, minimize, and/or mitigate those effects pursuant to the Section 106 process. (**0019-27** [Brubaker, Scott])

Comment: The Historic Preservation Office (HPO) provided comment on July 9, 2009 that the Salem and Hope Creek Generating Stations license renewal would not adversely effect historic properties. The post-license renewal activities (stations expansion, access roads and possible power line upgrades) were subject to a separate review for impacts on historic properties. In your letter dated November 5, 2010, you have identified that the license renewal and post-license renewal activities are in fact one undertaking. In consequence, the following consultation comments for the above- referenced undertaking are provided. (**0021-3** [Brubaker, Scott])

Comment: 800.4 Identifying Historic Properties

The initial cultural resource surveys for expanding the Salem and Hope Creek Generating Stations as part of post-license renewal activities have identified the following archaeological and historic properties within the above-referenced undertaking's area of potential effects (APE). Previous HPO comment on post-license renewal activities is attached and summarized below:

Archaeology

Proposed Barge Facility and Water Intake

Underwater survey identified four probably shipwreck locations (Clusters 1, 2, 3, & 4). If avoidance is not possible, Phase II archaeological survey will be necessary for each cluster to assess their eligibility for listing on the National Register of Historic Places. To date, the HPO has not received any site avoidance documentation, avoidance plan, or Phase II archaeological survey.

Money Island Road Access Alternative Alignment

Phase I archaeological survey for the proposed Money Island Road Access Alternative Alignment identified the following archaeological sites:

Sites 28-Sa-179, 28-Sa-180, 28-Sa-182, 28-Sa-183, and 28-Sa-186

If avoidance is not possible, Phase II archaeological survey will be necessary for each site to assess their eligibility for listing on the National Register of Historic Places. To date, the HPO has not received any site avoidance documentation, avoidance plan, or Phase II archaeological survey.

Alloway Creek Neck Road Access Alternative Alignment

Phase I archaeological survey for the proposed Alloway Creek Neck Road Access Alternative Alignment did not identify any archaeological deposits eligible for listing on the National Register of Historic Places. In consequence, no additional archaeological survey is required unless the alignment, as defined in the 2009 submission, changes in the future. (**0021-4** [Brubaker, Scott])

Comment: Historic Architecture

On January 11, 2010, the HPO received:

Brown, J. Emmett. July 31, 2009. *Draft Historic Properties Visual Impact Assessment PSEG Early Site Permit Application, Salem, New Jersey*. Prepared for PSEG Power, LLC. Prepared by MACTEC Engineering and Consulting, Inc., Knoxville, TN.

The submitted report does not meet the NJ SHPO's guidelines for Architectural Survey. The methodology section of this draft report notes that only known properties listed on the National Register of Historic Places were considered for assessment of visual impacts within the APE. Section 106 of the National Historic Preservation Act requires that the applicant identify all listed and eligible properties within the APE, and then provide an assessment of effects and proposed mitigation, if applicable, pursuant to 36 CFR Part 800.5. To complete the Section 106 process, the applicant must complete the identification of historic properties, and then provide an assessment of the project's effect on the identified properties. (**0021-5** [Brubaker, Scott])

Comment: In consequence, the HPO cannot concur at this time with your November 5, 2010 letter stating that the above-referenced undertaking will not adversely affect historic properties. Pursuant to 36 CFR Part 800.4, Phase II archaeological survey and intensive level architectural survey will provide for evaluation of the National Register eligibility of the sites/structures and assessment of project impacts. For properties on or eligible for National Register inclusion, recommendations must be provided for avoidance of impacts. If impacts cannot be avoided, analyses must be provided exploring alternatives to minimize and/or mitigate impacts. Means to avoid, minimize and/or mitigate impacts to National Register eligible properties will need to be developed and undertaken prior to project implementation. (**0021-6** [Brubaker, Scott])

Response: *As part of its environmental review of historic and cultural resources, the staff will meet with the necessary State Historic Preservation Offices (SHPOs) and will review other appropriate information sources. The results of the analysis will be presented in Chapter 4 of the EIS, and the staff will take any appropriate action called for as a result this review. The NRC will also fulfill its responsibilities under Section 106 of the National Historic Preservation Act with regard to historic properties for the project. The results of the Section 106 review will also be presented in the EIS.*

D.2.14 Comments Concerning Meteorology and Air Quality

Comment: ER Page 22 of 42, Meteorological Monitoring

Comment: Is there any concern with the existing cement pad for the main meteorological tower with regard to stress cracks and integrity? When was the last inspection of the tower pad performed? (**0019-9** [Brubaker, Scott])

Response: *Issues related to the structural safety and integrity of the meteorology tower pad is outside of the scope of environmental review. This evaluation can be found in the Safety Evaluation Report.*

Comment: The Bureau of Air permit has reviewed the proposed Early Site Permit application for the proposed Nuclear Reactor Units at Salem and Hope Creek Generating Stations. The new plant is proposed to have supporting equipment such as cooling towers; auxiliary boilers, emergency diesel generators and/or combustion turbines that emit air pollutants. The

application gives details of the expected size of each piece of equipment, the stack height and emissions from the equipment. These equipment will be subject to Federal and State Air Pollution Control Regulations and requires air pollution control permits. PSEG Nuclear will be required to submit a permit modification to incorporate these equipment and their associated emissions in the existing Title V Air Operating Permit for Hope Creek and Salem Generating Stations. (**0019-10** [Brubaker, Scott])

Response: *Comment noted. Meteorology and air quality impacts resulting from the construction and operation of the proposed facility will be discussed Chapters 4 and 5 of the EIS.*

Comment: The Bureau of Technical Services (BTS) has reviewed the air quality modeling sections of the proposed Early Site Permit application for the proposed Nuclear Reactor Units at Salem and Hope Creek Generating Stations. These sections briefly describe the results of a preliminary analysis of the air quality impacts of the proposed changes.

The new equipment being proposed that emit air pollutants (cooling towers; auxiliary boilers, emergency diesel generators and/or combustion turbines) will require a detailed modeling analysis of their impact on sulfur dioxide, nitrogen oxides, PM-10, and PM-2.S air quality. This modeling must be part of their air permit application that incorporates the new equipment into the existing Title V Air Operating Permit for Hope Creek and Salem Generating Stations. Prior to submittal of the modeling analysis, a modeling protocol which describes the techniques and modeling assumption which will be used should be submitted to BTS prior to submittal of the modeling analysis. Note that the modeling analysis must address the new l-hour sulfur dioxide National Ambient Air Quality Standard. (**0019-11** [Brubaker, Scott])

Response: *Comment noted. Meteorology and air quality impacts resulting from the construction and operation of the proposed facility will be discussed Chapters 4 and 5 of the EIS.*

Comment: 1) Environmental Report, Chapter 1, Page 1.3-9, Table 1.3-2 Authorizations Required for Preconstruction, Construction, and Operation Activities

The Early Site Permit (ESP) states that the requirements of the Federal Clean Air Act (42 USC 7401) for this project include a Title V Operating Permit and a Prevention of Significant Deterioration Preconstruction Permit.

Comment

Section 40 CFR 93.150 (a) (Prohibition) of the Federal General Conformity regulation states, "No department, agency or instrumentality of the Federal Government shall engage in, support in any way or provide financial assistance for, license or permit, or approve any activity which does not conform to an applicable implementation plan."

Also, Section 40 CFR 93.150 (b) of the Federal General Conformity regulation states, "A Federal agency must make a determination that a Federal action conforms to the applicable implementation plan in accordance with the requirements of this subpart before the action is

taken." The Federal General Conformity regulation requires that a General Conformity Applicability Analysis for ozone (Volatile Organic Compounds (VOCs) and Oxides of Nitrogen (NOx)) and if necessary a Conformity Determination is needed for this project.

In addition, Sections 93.153(b) and (1) (Applicability) in the Federal General Conformity regulation states, " . . . a conformity determination is required for each criteria pollutant or precursor where the total direct or indirect emissions of the criteria pollutant or precursor in a nonattainment or maintenance area caused by a Federal action would equal or exceed any of the rates in paragraphs (b) (1) of this section." Under the 1-hour Ozone National Ambient Air Quality Standards (NAAQS), the Philadelphia-Wilmington- Atlantic City (PA-DE-MD-NJ) nonattainment area was classified as a "severe" nonattainment area. Under this classification, the de minimis level for Oxides of Nitrogen (NOx) is 25 tons per year (tpy) and the de minimis level for Volatile Organic Compounds (VOCs) is 25 tpy. The State of New Jersey continues to be in nonattainment for the 8-hour ozone NAAQS. In order to prevent backsliding and to meet the goal of the Clean Air Act (42 U.S.C. 7502(e)) to achieve attainment of the Ozone NAAQS, it is necessary to use the de minimis emissions levels established for General Conformity projects under the 1-hour Ozone NAAQS at (40 CFR 93.153(b)(1). When preparing the Applicability Analysis, please use the de minimis levels for the 1-hour Ozone NAAQS.

In addition, Section 93.158 (d) of the Federal General Conformity regulation states, "Any analyses required under this section must be completed, and any mitigation requirements necessary for a finding of conformity must be identified before the determination of conformity is made." A mitigation plan will be required for criteria pollutant emissions and precursors above the 1-hour de minimis levels. (**0019-12** [Brubaker, Scott])

Comment: 6) Environmental Report, Chapter 4, Page 4.4-2,

4.4.1.1.1.2.1 Proposed Causewav

The ESP states, "Construction of the proposed causeway and any improvements of connecting roadways may expose residents of this and other nearby buildings to temporary and intermittent increases in noise, dust, and air pollution emissions associated with these activities."

Comment

Comment 1 (above) also applies to this portion of the project. (**0019-16** [Brubaker, Scott])

Comment: 8) Environmental Report, Chapter 4, Page 4.4-6

4.4.1.3 Dust and Other Emissions

The ESP states, "Construction activities result in increased air emissions. Earthmoving and material handling activities may generate fugitive dust and fine particulate matter. Vehicles and engine-driven equipment (e.g. generators and compressors) generate combustion product emissions such as carbon monoxide, nitrogen oxides and, to a lesser extent, sulfur dioxides. Painting, coating and similar operations also generate emissions from the use of volatile organic compounds."

Comment

Comment 1 (above) also applies to this portion of the project. (**0019-18** [Brubaker, Scott])

Comment: 11) Environmental Report, Chapter 4, Page 4.6-12, Table 4.6-1 Summary of Measures and Controls to Limit Adverse Impact During Construction

Table 4.6-1 (Socioeconomic Impacts -Physical Impacts) of the ESP indicates that, "the adverse impacts include exposure to fugitive dust, exhaust emissions, and vibrations. The specific measures and controls include best management practices for controlling fugitive dust and proper maintenance of construction equipment for controlling emissions."

Comment

Comment 1 (above) also applies to this portion of the project.

12) Environmental Report, Chapter 5, Page 5.5-3

5.5.1.3 Impacts of Discharges to Air

The ESP states, "The new plant will comply with all regulatory requirements of the Clean Air Act, including requirements of the NJDEP Division of Air Quality and Delaware Department of Natural Resources and Environmental Control, Division of Air and Waste Management, thereby minimizing any impacts on state and regional air quality."

Comment

Please see comment 1 for a description of one of the Federal regulations that is applicable to this project. (**0019-19** [Brubaker, Scott])

Comment: 15) Environmental Report, Chapter 10, Page 10.1-11 Table 10.1-1 Construction-Related Unavoidable Adverse Environmental Impacts

Table 10.1-1 of the ESP indicates that "the atmospheric and meteorological impacts of the project include an increase in dust and emissions from construction equipment and construction workforce vehicles occurs. The mitigation measures in Table 10.1-1 include BMPs for controlling fugitive dust and proper maintenance of construction equipment and vehicles is used to control air emissions."

Comment

Comment 1 (above) also applies to this portion of the project. (**0019-20** [Brubaker, Scott])

Response: *These comments refer to the NJDEQ's assertion that the proposed action must comply with the Federal General Conformity Act (40 CFR 93.150), which addresses air pollution emissions. The NRC will conduct a conformity determination under 40 CFR Part 93, Subpart B, outside of the NEPA process to determine whether additional mitigation is warranted.**

*Subsequent to the issuance of the Scoping Summary Report, NRC determined the following: The Federal action of issuing an ESP with no Limited Work Authorization for the PSEG Site does not directly or indirectly cause any emissions, and therefore, an applicability analysis and potential conformity determination will not be performed at this time. Compliance with 40 CFR Part 93, Subpart B, will be demonstrated when a CP, an OL, or a COL is submitted to the NRC.

D.2.16 Comments Concerning Health—Radiological

Comment: ER Page 27 of 136-Hydrological Alterations

"Dredged material removed as part of this construction activity will be transported to and placed in an on-site or other approved upland disposal facility."

Does the licensee plan on expanding the REMP program to include air particulate/iodine monitoring, surface water runoff, or soil sampling in the area of this CDP (if onsite area is used for materials)? An air monitoring site should be placed downwind of the CDP based on annual meteorological direction (SE). Also, will there be expanded ground water monitoring in the vicinity of the CDF?

Once complete, sampling locations near the intake and discharge canals will be needed, especially for media such as aquatic biota and sediment. Since the structures are upstream in the Delaware, PSEG will need to rethink their exiting collection location north of the plant that is considered, 'control'. This site may need to be moved further upstream. (**0019-3** [Brubaker, Scott])

Comment: ER Page 13 of 42, Radiological Environmental Monitoring Program, Table 6.2-1

Comment: The NJBNE is requesting that the licensee consider increasing the REMP sample frequency from quarter annual to monthly, based on the public interest of tritium contamination in groundwater in New Jersey. Samples of groundwater, including local drinking water wells, are collected in order to provide assurance to the public that these water resources are not impacted. (**0019-8** [Brubaker, Scott])

Comment: ER Page 12 of 42, Section 6 -Environmental Measurements and Monitoring Programs

6.2.2.1 Radiological Monitoring Program

"The existing PSEG REMP serves as the new plant construction/preoperational radiological monitoring program. Additional on-site thermoluminescent dosimetry (TLD) monitoring locations will be added to the north of the HCGS to support the ODCM/REMP for the construction and preoperational period. A description of the new monitoring locations and other applicable parameters will be provided in the combined license (COL) application."

Comment: The NJBNE requests that the licensee establish a Groundwater Protection Program for the proposed site at the construction/pre-operational stage rather than waiting for the

operation of the facility. During the construction phase, there will be knowledge as to where all applicable tanks and pipes are going to be located, along with buildings containing radioactive fluids and areas of further investigation for potential tritium in groundwater. (**0019-6** [Brubaker, Scott])

Response: *Impacts to ground and surface water as result of construction and operation, including potential tritium releases, of the proposed facility will be discussed in Sections 4.3 and 5.3 of the EIS. In addition, the Radiological Environmental Monitoring Program (REMP) and additional mitigative actions, proposed by the applicant, during the construction and operation phase will be discussed in Chapter 4 and 5.*

D.2.20 Comments Concerning the Uranium Fuel Cycle

Comment: Is the current Independent Spent Fuel Storage Installation (ISFSI) capable of providing storage for all three nuclear generating stations (Salem 1 & 2 and Hope Creek) plus the proposed new plant? Will there be an addition to the existing pad or will a separate new pad be built? How will the cumulative effects of all this storage of spent fuel be assessed? In the Early Site Permit SEIS? (**0021-1** [Brubaker, Scott])

Response: *.The Commission has made a generic determination that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 60 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor in a combination of storage in its spent fuel storage basin and at either onsite or offsite independent spent fuel storage installations. Section 5.9 of the EIS will discuss radiological impacts during operation of the proposed new facility including the storage of spent fuel. The NRC will discuss potential cumulative impacts in Chapter 7 of the EIS, based on the plant parameter envelope established for the site.*

Comment: We worried about safety issues, and even more, about the lack of a long- term safe repository for nuclear wastes. We weren't experts, our concerns were real. (**0001-10-3** [Applegate, Jim])

Comment: In fact, if you have had an opportunity, I have been to Yucca Mountain four times. And I have watched that develop, and know the need that we have of the right place for a waste disposal plant. (**0001-13-3** [Salmon, Edward])

Comment: The storage of spent fuel is widely thought to be a hazard. But a recent proposal from the Health Physics Society, which is the professional scientific society of radiation safety officers, states that dry cask storage of spent fuel for several hundred years, will reduce its radioactivity to the point where reprocessing would not be difficult.

And this very valuable fuel could then be reused. This interim storage would eliminate the necessity for storing large masses of radioactive material in a site like Yucca Mountain, where it must remain physically and chemically stable for hundreds of thousands of years. And the NRC has already approved the safety of dry casks. (**0001-5-6** [Meadow, Norman])

Comment: And then another concern with nuclear is also the waste that is produced by the facility. The half life of nuclear materials, like the 100,000 years, which is basically how much it will degrade in its nuclear power. Well, the problem is you have to worry about this nuclear waste forever. And maintain it, and make sure it is safe. If you don't produce nuclear waste you don't have to worry about it. And we do have a problem with nuclear waste in this country. Salem is storing some there and, you know, it is a concern. (**0002-6-5** [Schneider, Richard])

Comment: We worried about safety issues and even more about the lack of a long- term safe repository for nuclear wastes. We were not experts. The concerns are real. (**0010-3** [Applegate, Jim])

Response: *The NRC staff will assess the environmental impacts of the uranium fuel cycle, including the impacts of solid radioactive waste management in Chapter 6 of the EIS. The NRC staff will assess the environmental impacts of accidents in Chapter 5 of the EIS. The Commission has made a generic determination that, if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 60 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor in a combination of storage in its spent fuel storage basin and at either onsite or offsite independent spent fuel storage installations. Further, the Commission believes there is reasonable assurance that sufficient mined geologic repository capacity will be available to dispose of the commercial high-level radioactive waste and spent fuel generated in any reactor when necessary (75 FR 81037).*

D.2.25 Comments Concerning Cumulative Impacts

Comment: To many environmental groups renewable energy is a preferable alternative to nuclear reactors. To those concerned with the conservation of biological diversity, however, the cumulative ecological impacts of large scale, renewable projects, will be their most detrimental effect. We believe that concerns for the cumulative ecological impacts of the alternatives, wind, solar, and biomass, should be included in the final EIS, as a reason for rejecting them as an alternative to nuclear power. (**0001-6-7** [Lewis, Kenneth])

Comment: In addition, I urge that the cumulative ecological impacts of alternative energy generating sources be included in the Environmental Impact Statement, in order to show that, by comparison, nuclear energy is far preferable, is a far preferable option. (**0001-7-4** [Eastman, Ajax])

Response: *The cumulative impacts associated with alternative energy sources will be discussed in EIS Chapter 9.*

Comment: This meeting is about the environmental impact of a new facility. And my comments cover a variety of issues that I feel are important to bring up, and have on the record, also, pertaining to the new facility, and the existing complex, which must also be considered, as a whole, when you add one more to three existing, it is a bigger picture, and a bigger effect. (**0002-6-1** [Schneider, Richard])

Response: *These comments allude to cumulative impacts, which are impacts that result from the combination of a proposed action with past, present, and reasonably foreseeable actions,*

regardless of who takes the actions. The cumulative impacts associated with issuing the proposed ESP for the existing Salem/Hope Creek site will be evaluated for each affected resource. The results of cumulative impact analyses will be presented in EIS Chapter 7.

Comment: With the new facility a good thing is, if it is built, that it would have a closed loop cooling system, which would greatly reduce the amount of water needed to cool the facility. A closed loop cooling system reduces the water take, compared to an open loop system, by 90 to 95 percent. So however, an average nuclear facility draws in, an open loop system, like a billion gallons of water a day, over a billion. So even with the closed loop, you are still talking about 50 million to 100 million of gallons a day. So you would be adding to the amount of fish that are killed at that facility. So you must consider the existing damage that the present facility, Salem I and II causes, and adding even more damage. And Salem I and II draws in three billion gallons of water a day, every day. And it kills billions of fish. And the EPA has estimates on how much. And I have a paper I would like to submit as data. And they kill 350 million age one equivalent fish. In other words, fish that would have grown up to be a million, I mean, one year old. That is how they generally use their fish kill data; they call it age one equivalent fish. But, actually, the facility kills billions of fish, billions of smaller fish, which is the food chain for the bigger fish, and the whole ecosystem. So my concern here is that you want to build a new facility, but you are not stopping the existing damage caused by the present facility that is there, units I and II, which draw in three billion gallons of water, and have an open loop cooling system. So before you consider building a new facility you should stop the damage caused by the existing facility, first. I think that is a priority. But it seems like just build another one. But you still have an existing fish kill facility, there. And it kills all species, all ages. And it is destroying the fishing industry along the Delaware Bay and the Delaware River. We used to have a great fishing industry, and we don't now. Not when one facility draws in three billion gallons of water a day. And Salem says we fixed up some wetlands and that will compensate. It is really hard to believe that fixing up a few acres of wetlands will compensate for billions of fish killed, every year, year after year. So I feel that you should fix the first two, units Salem I and II, and then consider moving on. (**0002-6-11** [Schneider, Richard])

Comment: And I spoke with some Nuclear Regulatory Commission people tonight. And I have a major concern, that when the Nuclear Regulatory Commission does an evaluation of an existing permit, or a new permit, the issue of water intake, for the cooling system, is left up to the state, as a state permit. I spoke with a gentleman from the Nuclear Regulatory Commission, and he says it is above his ability to change the rulings, that the EPA has made about this issue. But I feel that it should be part of the Nuclear Regulatory Commission's when they evaluate the water intake, for two reasons. Because NRC is a nuclear, is a federal agency. A federal agency applies to any issue that affects more than one state. The fish kill caused by these facilities affects more than one state, it affects the fishermen in Delaware, in Maryland, in Pennsylvania, in New Jersey, and all up and down the coast, where the fish would have gone, and traveled, and be caught by other people. So therefore the NRC needs to be involved with a federal ruling on it, and not be involved with the water permit. So I'm asking the NRC to talk to the people above them to pursue that. (**0002-6-17** [Schneider, Richard])

Comment: And then, also, the Federal Clean Water Act applies to the fish kill. In the 1970s the Federal Clean Water Act, said that you must use the best technology available to stop the fish kill. This facility, Salem I and II, is killing the fish. And they are not using the best available

technology. So, therefore, the federal agency overseeing the nuclear plant, which is the NRC, needs to enforce that particular law. It is a federal law, the Clean Water Act. So, again, I ask the NRC to pursue having open or closed loop systems. (**0002-6-19** [Schneider, Richard])

Response: *These comments allude to cumulative impacts on aquatic resources, which are impacts that result from the combination of a proposed action with past, present, and reasonably foreseeable actions, regardless of who takes the actions. The cumulative impacts associated with issuing the proposed ESP will be evaluated for each affected resource, including aquatic resources. The results of cumulative impact analyses will be presented in EIS Chapter 7.*

Comment: There are two key sections in every EIS: The first is an analysis of the cumulative impacts of the proposed action, and the second is an analysis of alternatives to the proposed action. Thus, the dEIS states: Cumulative impacts result when the effects of an action are added to or interact with other past, present, and reasonably foreseeable future effects on the same resources. And further: These combined impacts ... include individually minor but collectively potentially significant actions taking place over a period of time. To many environmental groups renewable energy is a preferable alternative to reactors. To those concerned with the conservation of biological diversity, however, the cumulative ecological impacts of large-scale renewable projects will be their most detrimental effect. We believe that concern for cumulative ecological impacts of the Alternatives, wind, solar, and biomass should be included in the final EIS as a reason for rejecting them as an alternative. (**0007-6** [Lewis, Kenneth])

Comment: In addition, I urge that the cumulative ecological impacts of alternative energy generating sources be included in the Environmental Impact Statement (EIS) in order to show that by comparison nuclear energy is a far preferable option. (**0012-5** [Eastman, Ajax])

Response: *The cumulative impacts associated with alternative energy sources will be discussed in EIS Chapter 9.*

D.2.26 Comments Concerning the Need for Power

Comment: We need to keep pace with our state's energy needs. The U.S. Department of Energy predicts that the national electrical demand will increase 28 percent by 2035, and to maintain nuclear energy's current 20 percent contribution, which they do today, we must build about one new reactor per year, starting in 2016. (**0001-13-13** [Salmon, Edward])

Response: *This comment affirms the need to build new capacity to keep pace with the nation's energy needs and suggests nuclear should continue to constitute a constant share of this capacity. NRC's assessment of Need for Power will be discussed in detail in Chapter 8 of the EIS.*

Comment: New Jersey Nuclear Power supplies the state of New Jersey with about 52 percent of its electric needs. It is important in meeting electric demand, of not only the state, but the region also. Producing this electricity with nuclear power is done without creating greenhouse gases, which is an important and critical component to this discussion, given the global warming situation. Equally important is that there is no impact on the local environment. Without these

plants the reliability of electric delivery to meet demand, would be put at risk. As demand increases, we must consider the need for another nuclear power plant. (**0001-17-9** [Hassler, Charles])

Response: *This comment describes a number of reasons that nuclear power should be considered as a source of new capacity in the New Jersey Region. The balance of benefits and costs will be considered in Chapter 10 in the EIS.*

Comment: At the May 4th, 2010 public meeting that NRC held on the project I commented on the importance of providing additional electrical generating capacity to meet the energy needs of New Jersey residents and businesses. These comments are, of course, still applicable, especially the need to provide base load generating capacity, supplemented by renewable energy projects, such as wind and solar, in New Jersey. (**0001-8-3** [Molzahn, Robert])

Response: *This comment provides a general need for additional generating capacity in the New Jersey region and the desirability of a portfolio of capacity containing nuclear and renewable energy sources. Capacity requirements will be discussed in Chapter 8 of the EIS.*

Comment: This facility is critical to the State of New Jersey for its energy needs. And as we move forward, and we know it is going to take some time to build, I'm excited that we are finally starting it. I think it took them eight years too long to get started, but we started. (**0002-1-2** [Sweeney, Steve])

Response: *This comment offers general support for the construction of the proposed facility and notes the lead time required for such a construction project. This comment will not be discussed specifically in the EIS, but the project's background, including length of the construction period, will be discussed in Chapter 1 of the EIS.*

Comment: And my final point is that I'm very familiar with the efforts to pursue renewable energy off the coast of New Jersey, including wind, wave, and tidal energy. These are in the nascent stages of development. But if you look at the projected production, energy production from these sources, it certainly will not meet the future demand for our state, which continues to grow, as we continue to develop. (**0002-4-8** [DeLuca, Mike])

Response: *This comment suggests that a number of advanced renewable energy sources will be insufficient to meet power needs in the New Jersey region. Capacity requirements will be discussed in Chapter 8 of the EIS.*

Comment: And we feel that it is important to develop nuclear power generation, and feel that siting a plant, here in an area that is already dedicated to producing nuclear power, is a particularly efficient way to do it, because it takes advantage of the infrastructure that is already in place, for the plants that exist there now. (**0002-5-4** [Duvall, Brian])

Response: *This comment provides general support for the construction of additional power generation units at the existing PSEG site, noting they will take advantage of existing infrastructure. Site attributes will be discussed in detail in Chapter 2 of the EIS.*

Comment: And one other thing, the power that is produced by this facility is sold wholesale; it is on the PGM grid, which includes power plants in 13 states, and 50 million people. They are wholesale producers of electricity. It just doesn't go to the people of New Jersey. The people of New Jersey buy their power on the wholesale market, like everybody else in the PGM grid. So it is slightly misleading to say the power generated in New Jersey comes, so much percentage comes from the Salem Nuclear Plant. That power they produce goes to 13 different states. So if that unit IV is not built, the people in New Jersey will still get power from all the other facilities in the PGM grid. And that is an important aspect that a lot of people don't know about. (**0002-6-21** [Schneider, Richard])

Response: *This comment notes that power from the proposed power plant will be sold to the PJM grid (regional transmission organization that coordinates the movement of wholesale electricity within the New Jersey region) and will not be specifically reserved for the State of New Jersey. The nature of the power grid and circumstances relevant to the New Jersey region will be discussed in Chapter 8 of the EIS.*

Comment: The key thing I think, when I take a look at the energy question that we have in the United States, has to do with coal generation, and the fact that fewer and fewer coal generated facilities are going to be used in our future. Whether Cap and Trade passes or not, coal generation is on the way out. And what is going to replace it? At Mannington Mills we have solar generation, and I'm very proud of what we have been able to do with that. But, quite frankly, that solar generation would not be economical unless the federal government had heavy tax subsidies, in order to make it happen. The same thing has to do with wind. And while I think the solar and wind generation title, etcetera, is wonderful, sustainable and good, we have to have large generation of fossil free, in order for us to be able to get environmental goal posts that we would like to hit as a society. And, obviously, I'm here tonight saying I think nuclear is a very, very good alternative. And I have a high degree of confidence in the fact that PSEG can deliver. (**0002-8-2** [Campbell, Keith])

Response: *This comment describes issues associated with several alternative sources of power for the New Jersey region. These and related issues will be discussed in detail in Chapters 8, 9, and 10 of the EIS.*

Comment: We need to keep pace with our state's energy needs. The U.S. Department of Energy projects that national electricity demand will increase 28 percent by 2035, and to maintain nuclear energy's current 20 percent contribution, we must build about one new reactor per year starting in 2016. New wind and solar power will definitely play a part in our energy future, but the simple nature of their intermittency requires something more. The New Jersey Energy Coalition supports the development of a new nuclear facility here in Salem County as it will help mitigate rising energy demand with a clean power source that fuels job growth and strengthens our economy. (**0004-6** [Salmon, Edward])

Comment: And, the power generated by the new plant will help meet the ever growing energy demand. (**0006-4** [Patouhas, Maria])

Response: *These comments note the general need for additional generating capacity in the New Jersey region and the desirability of a portfolio of capacity containing nuclear and renewable energy sources. Need for power will be discussed in Chapter 8 of the EIS.*

Comment: Nuclear power supplies the State of New Jersey with about 52% of its electric needs. It is important in meeting the energy demand of not only the State and but the region as well. Producing this electricity with Nuclear power is done without creating greenhouse gases, which is an important and critical component to this discussion, given the global warming situation. Equally important is that there is no impact on the local environment. (**0005-3** [Hassler, Charles])

Response: *This comment provides general support for nuclear power in the New Jersey region, noting a number of environmental advantages. This comment will not be addressed specifically in the EIS, but a discussion of the balance between benefits and costs of the proposed facility will be discussed in Chapter 10 of the EIS.*

Comment: Without these plants the reliability of the electric delivery to meet demand would be put at risk. As demand increases, we must consider the need for another nuclear power plant. (**0005-5** [Hassler, Charles])

Comment: At the May 4, 2010 public meeting that the NRC held on this project I commented on the importance of providing additional electrical generation capacity to meet the energy needs of New Jersey residents and businesses. Those comments are still applicable especially the need to provide base load generating capacity supplemented by renewable energy projects such as wind and solar in New Jersey. (**0011-4** [Molzahn, Robert])

Response: *These comments note the need to increase generating capacity to maintain electric reliability in the face of increasing demand for power. Need for Power will be addressed in detail in Chapter 8 of the EIS.*

Comment: Nuclear energy now supplies over 50% of our state's energy needs and it is recognized an efficient, clean, low carbon form of energy production; our needs for energy continues to grow. (**0008-2** [Lacandro, Roger])

Response: *This comment notes the general attributes of nuclear power that makes it attractive as a power source. This comment will not be discussed specifically, but a balance of the benefits and costs associated with the proposed power plant will be contained in Chapter 10 of the EIS.*

D.2.28 Comments Concerning Alternatives—Energy

Comment: First, let's reduce our demand for energy. More efficient fuel construction in the transportation sector, better construction design, both in new construction and retrofitting existing living and working spaces, were top candidates. We recognized, however, that the economics of inexpensive fossil fuels made voluntary action unlikely without government incentives. (**0001-10-1** [Applegate, Jim])

Comment: New Jersey Nuclear Power supplies the state of New Jersey with about 52 percent of its electric needs. It is important in meeting electric demand, of not only the state, but the region also. Producing this electricity with nuclear power is done without creating greenhouse gases, which is an important and critical component to this discussion, given the global warming situation. Equally important is that there is no impact on the local environment. Without these plants the reliability of electric delivery to meet demand, would be put at risk. (**0001-17-4** [Hassler, Charles])

Comment: In the case of global warming our solutions fell into 3 categories: First: Reduce our demand for energy. More efficient fuel consumption in the transportation sector and better construction design -both in new construction and in retrofitting existing living and working spaces -were top candidates. We recognized, however, that the economics of inexpensive fossil fuels made voluntary action unlikely without government incentives.

Second: Bringing more renewable energy sources on line. Here we liked solar energy, wind energy and biofuels. At the time we were discussing these ideas we had only limited experience with these technologies. Experience over the past decade tells us that each of these solutions comes with a cost. We cover fragile desert habitats with solar panels while ignoring the warehouse rooftops and other existing opportunities that have much less impact. Wind energy leaves a construction and service footprint at the expense of wildlife habitats and operation can have serious impacts on mortality of migrating birds. Land growing biofuels has very limited wildlife habitat value. Barry Commoner was right -There is no such thing as a free lunch.

Our third option was a re-examination of nuclear power generation -a technology not considered a part of the package while we taught the course, but evidently back on the table as evidenced by this hearing. We recognized the value of generating usable energy without increasing greenhouse gases. (**0010-1** [Applegate, Jim])

Response: *The NRC is not involved in establishing energy policy; rather, it regulates nuclear energy to protect public health and safety within existing policy. While energy efficiency measures could reduce demand in the PSEG service area, in accordance with NUREG-1555 a merchant plant is not required to perform a demand-side management analysis or consider measures to increase energy efficiency as an alternative to the proposed action. Chapter 9 of the EIS will describe the potential environmental impacts of alternative energy sources, including fossil fuels and renewable sources of energy.*

Comment: Our second class of solutions was bringing more renewable energy sources online. Here we liked solar energy, wind energy, and biofuels. At the time we were discussing these ideas, we had only limited experience with these technologies. Experience, over the past decade, tells that each of these solutions comes with a cost. We cover fragile desert habitats with solar panels, while ignoring the warehouse rooftops, and other existing opportunities that would have much less impact. Wind energy leaves a construction and service footprint at the expense of wildlife habitats, and operation can have serious impacts on mortality of migrating birds. Land growing biofuels have very limited wildlife habitat value. Barry Commoner was right, 50 years ago, there is no such thing as a free lunch. (**0001-10-2** [Applegate, Jim])

Comment: Our third option was reexamination of nuclear power generation. A technology not considered a part of the package while we taught that course but, evidently, back on the table, as evidenced by this hearing. We recognized the value of generating large amounts of usable energy without increasing greenhouse gases. (**0001-10-4** [Applegate, Jim])

Comment: Salem County is now recognized as the alternative energy capital of the northeast. Not only are we fortunate enough to have three operating nuclear plants, we recently had ground breaking on significant solar projects that will develop 92 megawatts of energy. With the addition of the fourth unit, which has the majority of the infrastructure to support it, we believe that this county, and this country, is moving in the right direction by creating alternative energy projects, and removing our dependency on foreign oil. (**0001-12-4** [Kugler, John])

Comment: New wind and solar power would definitely play a role in our energy future. But the simple nature of their intermittency requires something more. (**0001-13-14** [Salmon, Edward])

Comment: Nuclear is clean, it produces zero carbon emissions, or critical air pollutants. In 2009, alone, New Jersey's nuclear power plants avoided the emission of 142,000 tons of sulfur dioxide, and 30 million, trillion metric tons of carbon dioxide emissions that contribute to green house gases, smog, and acid rain. Nuclear energy accounts for 73 percent of the nation's emission-free, electrical generation. And it needs to expand this role, in commitment with other renewable sources, to meet the rising energy demand in an environmentally responsive manner. (**0001-13-6** [Salmon, Edward])

Comment: As previously stated, we believe that nuclear power, as a source for clean, reliable, carbon free electrical generation, is the best solution to the nation's current and future energy needs. And it poses the least potential threat to the natural environment, when compared with other generation sources, such as wind, solar, and biomass. (**0001-6-2** [Lewis, Kenneth])

Comment: This proposed 2,200 megawatt nuclear facility, sited on 350 acres, operating at a slightly conservative capacity of 90 percent, will produce 1,980 megawatts. By comparison, to grow enough switch grass to fire boilers for electrical generation, equal to the output of this proposed facility, assuming a middle range per acre harvest of switch grass, would require 3,700 square miles. That area required in this particular region, makes the solution really not of any consideration, because it represents about 40 percent of the state area. (**0001-6-4** [Lewis, Kenneth])

Comment: Another alternative, solar cell installations on open land, requires large areas, and poses a significant threat to the flora and fauna in the geographical regions in which they are proposed. For example, at Nellis Air Force Base in the Nevada desert, one megawatt devices installations on 9.3 acres of land, with solar tracking devices, which makes them highly efficient. In New Jersey, where the sun is less intense, a 275 square mile installation would be required to equal the electrical output of the proposed reactor. Solar cells installed on existing structure may not pose any, as yet, recognized threat to the environment. And we support that particular application. (**0001-6-5** [Lewis, Kenneth])

Comment: To many environmental groups renewable energy is a preferable alternative to nuclear reactors. To those concerned with the conservation of biological diversity, however, the

cumulative ecological impacts of large scale, renewable projects, will be their most detrimental effect. We believe that concerns for the cumulative ecological impacts of the alternatives, wind, solar, and biomass, should be included in the final EIS, as a reason for rejecting them as an alternative to nuclear power. (**0001-6-6** [Lewis, Kenneth])

Comment: These factors are major part of the reason that the Maryland Conservation Council is bucking the trend of most of the major environmental groups, in our enthusiastic support of nuclear energy, and our opposition to most of the renewable options, particularly wind. (**0001-7-14** [Eastman, Ajax])

Comment: In addition, I urge that the cumulative ecological impacts of alternative energy generating sources be included in the Environmental Impact Statement, in order to show that, by comparison, nuclear energy is far preferable, is a far preferable option. (**0001-7-3** [Eastman, Ajax])

Comment: The PSEG site application, part three, environmental reports, contains a good analysis of the renewable options compared to the nuclear option. The ESP concludes that wind turbines, solar thermal power, and photovoltaic technologies, due to the intermittency of wind and sun, are not competitive to the reliability of nuclear power. (**0001-7-5** [Eastman, Ajax])

Comment: I'm particularly interested in addressing the biological impacts of renewables, primarily wind. This technology has had a huge impact on the biological world. In order to produce an equivalent amount of energy, wind requires an enormous footprint. As pointed out, in their Environmental Report, quote, to replace the energy equivalent of a 2,000 MWe of nuclear capacity, operating at 90 percent capacity factor, approximately 3,300 two MWes, wind turbines, operating at a capacity factor of 30 percent, would be required.

These turbines would be sited on 396,000 acres. That is 619 square miles, and disturbs 19,800, or 31 acres, or 31 square miles, to accommodate the physical footprint of the towers themselves. I like that the ESP's comparison of that amount of land, I like the comparison to 15 times the area of Norfolk, that is a lot of land. (**0001-7-6** [Eastman, Ajax])

Comment: Whether the area is on land, or offshore, it is mind boggling to think of the potential harm, and humongous impacts of industrial wind. On land, particularly, the Appalachian Mountains of the East, the 396,000 acres, required, would destroy the mainly unfragmented, biologically rich forests, which are not only habitat for bats and nesting neo-tropical birds, but also habitat for terrestrial flora and fauna. The area is, also, a major migratory corridor for birds, bats, and raptors. Yet without full review of environmental impacts, or cost to taxpayers and customers, permits are being granted.

As for the impacts offshore, we really can't know the full extent of the harm turbines will have on the aquatic resources, benthic organisms, oceanic mammals, or pelagic birds. Where is the precautionary principle in the blind acceptance of, and push for, such a destructive form of energy? (**0001-7-7** [Eastman, Ajax])

Comment: At the May 4th, 2010 public meeting that NRC held on the project I commented on the importance of providing additional electrical generating capacity to meet the energy needs of New Jersey residents and businesses. These comments are, of course, still applicable,

especially the need to provide base load generating capacity, supplemented by renewable energy projects, such as wind and solar, in New Jersey. (**0001-8-4** [Molzahn, Robert])

Comment: I also mentioned that PSEG new nuclear unit will provide power for more than 3 million homes each day, as opposed to fossil fuel power plants, and there will be no green house gas emissions, such as CO2 or methane, as was mentioned by previous speakers. No SO2 or NOX emissions that could contribute to acid rain, or nitrification of our waterways. And also no mercury emissions that could detrimentally affect aquatic life in the Delaware River and Bay. (**0001-8-5** [Molzahn, Robert])

Comment: Solar and wind is safe, and clean energy (**0002-6-22** [Schneider, Richard])

Comment: We need to keep pace with our state's energy needs. The U.S. Department of Energy projects that national electricity demand will increase 28 percent by 2035, and to maintain nuclear energy's current 20 percent contribution, we must build about one new reactor per year starting in 2016. New wind and solar power will definitely play a part in our energy future, but the simple nature of their intermittency requires something more. The New Jersey Energy Coalition supports the development of a new nuclear facility here in Salem County as it will help mitigate rising energy demand with a clean power source that fuels job growth and strengthens our economy. (**0004-5** [Salmon, Edward])

Comment: In evaluating environmental issues relative to this nuclear power facility and alternative energy sources that might be proposed to negate its necessity biomass is listed as a consideration. This proposed 2200 Megawatt (MW) nuclear facility sited on 350 acres operating at a slightly conservative capacity factor of 90% will produce 1980 MW. By comparison to grow enough switch grass to fire boilers for electrical generation equal to the output of the nuclear facility (assuming a middle of the range yield of 2.5 metric tons per acre per year would require planting 3700 square miles. The area required in this region makes this solution impractical because it represents about 40% of the area of the state. (**0007-3** [Lewis, Kenneth])

Comment: Another alternative, solar cell installations on open land, requires large areas and pose a significant threat to the flora and fauna in the geographical regions in which they are proposed. For example, at Nellis Air Force Base in the Nevada desert 1 MW of NAMEPLATE capacity is installed on 9.3 acres of land and these are sophisticated devices that track the sun. In New Jersey where the sun is less intense a 275 square mile installation would be required to equal the electrical output of the proposed reactor. Solar cells installed on existing structure may not pose any as yet recognized threat to the environment and we support them. (**0007-4** [Lewis, Kenneth])

Comment: There are two key sections in every EIS: The first is an analysis of the cumulative impacts of the proposed action, and the second is an analysis of alternatives to the proposed action. Thus, the dEIS states: Cumulative impacts result when the effects of an action are added to or interact with other past, present, and reasonably foreseeable future effects on the same resources. And further: These combined impacts ... include individually minor but collectively potentially significant actions taking place over a period of time. To many environmental groups renewable energy is a preferable alternative to reactors. To those concerned with the conservation of biological diversity, however, the cumulative ecological

impacts of large-scale renewable projects will be their most detrimental effect. We believe that concern for cumulative ecological impacts of the Alternatives, wind, solar, and biomass should be included in the final EIS as a reason for rejecting them as an alternative. (**0007-5** [Lewis, Kenneth])

Comment: Salem County is now recognized as the alternative energy capital of the Northeast. Not only are we fortunate enough to have three operating nuclear power plants we recently had ground breakings on significant solar projects that will develop 92 megawatts of energy. With the addition of a fourth unit, which has the majority of the infrastructure to support it, we believe this country is moving in the correct direction by creating alternative energy projects and removing our dependency on foreign oil. (**0009-5** [Kugler, John])

Comment: At the May 4, 2010 public meeting that the NRC held on this project I commented on the importance of providing additional electrical generation capacity to meet the energy needs of New Jersey residents and businesses. Those comments are still applicable especially the need to provide base load generating capacity supplemented by renewable energy projects such as wind and solar in New Jersey. (**0011-3** [Molzahn, Robert])

Comment: I also mentioned that PSEG's new nuclear unit will provide power for more than three million homes each day and, as compared to fossil fuel power plants, there will be no greenhouse gas emissions such as C02 or methane. There will also be no S02 or NOx emissions that would contribute to acid rain or nitrification of our waterways. There will also be no mercury emissions that could detrimentally affect aquatic life in the Delaware River and Bay. (**0011-5** [Molzahn, Robert])

Comment: Whether that area is on land or offshore, it is mind boggling to think of potential harm and humongous impacts of industrial wind. On land, particularly in the Appalachian mountains of the east, the 396,000 acres required would destroy the mainly unfragmented, biologically rich forests which are not only habitat for bats and nesting neo-tropical birds, but also habitat for terrestrial flora and fauna. The area is also a major migratory corridor for birds, bats, and raptors. Yet without full review of the environmental impacts or the costs to taxpayers and customers, permits are being granted. As for impacts offshore, we really can't know the full extent of the harm turbines will have on aquatic resources, benthic organisms, oceaneantic mammals, or pelagic birds. Where is the precautionary principle in the blind acceptance of and push for such a destructive form of energy? (**0012-10** [Eastman, Ajax])

Comment: In addition, I urge that the cumulative ecological impacts of alternative energy generating sources be included in the Environmental Impact Statement (EIS) in order to show that by comparison nuclear energy is a far preferable option. (**0012-3** [Eastman, Ajax])

Comment: The PSEG Site ESP application, Part 3, environmental reports contains a good analysis of the renewable options compared to the nuclear option. The ESP concludes that the wind turbines, solar thermal power, and photovoltaic technologies, due to the intermittency of the wind and sun are not competitive to the reliability of nuclear power. (**0012-6** [Eastman, Ajax])

Comment: I am particularly interested in addressing the biological impacts of renewables, primarily wind. This technology has a huge impact on the biological world. In order to produce

an equivalent amount energy, wind requires an enormous footprint. As pointed out in their Environmental Report, ... to replace the energy equivalent a 2200 MWe of nuclear capacity operating at 90 percent capacity factor, approximately 3300 2 MWe wind turbines operating at a capacity factor of 30 percent would be required. These turbines would be sited on 396,000 acres (619 square miles) and disturb 19,800 acres (31 square miles) to accommodate the physical footprint of the towers themselves. (I like the ESP's comparison of that amount of land to 15 times the area of Newark!) (**0012-7** [Eastman, Ajax])

Response: *Alternate energy sources, including fossil fuels and renewable sources of energy (such as wind, solar, and biomass), will be evaluated and discussed in Chapter 9 of the EIS in comparison to a nuclear plant. The potential environmental impacts of these alternate energy sources will also be addressed in Chapter 9.*

Comment: So we want to educate, and stress the need for a broad energy platform, that includes conservation, green job initiatives, energy efficiency, supply diversity, transmission upgrade, clean baseload generation, and healthy, smart, economically viable, renewable energy projects. (**0001-13-1** [Salmon, Edward])

Comment: Alternative sources are important, and we support them. But they only can take us so far. Wind and solar are intermittent, and lack the sheer capacity of baseload plants. Conservation efforts, energy efficiency enhancements, and a diverse mix of energy sources will serve us best. However, we should promote an increase in the use of nuclear energy, as an environmentally clean and reliable solution. (**0001-13-7** [Salmon, Edward])

Comment: And my final point is that I'm very familiar with the efforts to pursue renewable energy off the coast of New Jersey, including wind, wave, and tidal energy. These are in the nascent stages of development. But if you look at the projected production, energy production from these sources, it certainly will not meet the future demand for our state, which continues to grow, as we continue to develop. (**0002-4-7** [DeLuca, Mike])

Comment: Most of the Academy's programs have a component in them that focuses on global climate change. And we feel that that is an extremely important thing for people to be exposed to, to learn about, and especially the kids that we deal with, in education programs. There is no question that conservation measures, in terms of electrical usage, is an important part of combating that trend, as well as developing increased access to renewable sources of energy. But there is nuclear technology, which has been around for a long time, and has successfully been applied to providing baseload for the state of New Jersey, and the country as a whole, it is a proven technology, and is one that is carbon free. (**0002-5-3** [Duvall, Brian])

Comment: The goal is to make electricity. But I feel that PSEG is going to be spending tens of billions of dollars on this nuclear plant. I think they would be better invested to invest in solar and wind farms, which could be built in the matter of a year, one year; you could have a farm built. With this new plant it will take, probably, ten years to build. You could be generating electricity immediately. I think it is a better investment. (**0002-6-2** [Schneider, Richard])

Comment: As a young engineer, in the nuclear industry, one of the most exciting aspects of my future career, is the possibility of new nuclear. And while wind, solar, and other carbon-free

forms of energy are important, and definitely needed, to provide for the energy demand that we have now and in the future, new nuclear must be a part of that equation. (**0002-7-1** [Nedd, Sheranee])

Comment: The key thing I think, when I take a look at the energy question that we have in the United States, has to do with coal generation, and the fact that fewer and fewer coal generated facilities are going to be used in our future. Whether Cap and Trade passes or not, coal generation is on the way out. And what is going to replace it? At Mannington Mills we have solar generation, and I'm very proud of what we have been able to do with that. But, quite frankly, that solar generation would not be economical unless the federal government had heavy tax subsidies, in order to make it happen. The same thing has to do with wind. And while I think the solar and wind generation title, etcetera, is wonderful, sustainable and good, we have to have large generation of fossil free, in order for us to be able to get environmental goal posts that we would like to hit as a society. And, obviously, I'm here tonight saying I think nuclear is a very, very good alternative. And I have a high degree of confidence in the fact that PSEG can deliver. (**0002-8-3** [Campbell, Keith])

Comment: Nuclear generation is clean. It produces zero carbon emissions or criteria air pollutants. In 2009 alone, New Jersey's nuclear power plants avoided the emission of one hundred and forty-two thousand tons of sulfur dioxide and 30 million metric tons of carbon dioxide, emissions that commonly contribute to greenhouse gases, smog and acid rain. Nuclear energy accounts for 73 percent of the nation's emission-free electrical generation, and it needs to expand this role in compliment with other renewable sources to meet rising energy demand in an environmentally responsible matter. Alternative sources are important, but can only take us so far -wind and solar are intermittent and lack the sheer capacity of base load plants. (**0004-1** [Salmon, Edward])

Comment: Conservation efforts, energy efficiency enhancements and a diverse mix of energy sources will serve us best. However, we should promote an increase in the use of nuclear energy as an environmentally clean and reliable solution. New Jersey needs to better acknowledge and take advantage of the proven technology capable of providing carbon-free base load electricity. The development of new nuclear generating facilities is essential if we are going to address climate change, meet demand increases in a meaningful way, and promote energy independence from the Middle East. Changes in federal air regulations, the age of existing facilities and an improving economy all signal the need for new clean base load power supplies. (**0004-2** [Salmon, Edward])

Comment: While I am not an expert in energy generation, there is no question that the future welfare of human society depends on reducing energy use and developing zero carbon sources of energy. Many experts have indicated that nuclear power represents a viable alternative in the short term and must be part of any mix of conservation and new energy sources that are used to make the transition to a zero carbon future. (**0014-15**, **0001-4-10**, **0014-18** [Velinsky, David])

Response: *The NRC is not involved in establishing energy policy; rather, it regulates nuclear energy to protect public health and safety within existing policy. An assessment of a broad energy platform that includes such items as conservation and energy efficiency and/or alternate sources of energy is beyond the scope of this EIS. Nevertheless, Chapter 9 of the EIS will*

describe the potential environmental impacts of alternative energy sources, including fossil fuels and renewable sources of energy, in comparison to nuclear power.

Comment: Another factor to consider, in comparing nuclear power to wind, is the life expectancy of the turbines. Many of the nuclear reactors, in the United States, are over 40 years old, and are still producing energy at 90 percent capacity. Whereas the thousands of turbines, being proposed, or already built, have a life expectancy of only 25 years, at a 30 percent capacity. (**0001-7-10** [Eastman, Ajax])

Comment: Another factor to consider in comparing nuclear power to wind is the life expectancy of the turbines. Many of the nuclear reactors in the United States are over 40 years old and are still producing energy at 90 percent capacity, whereas the thousands of turbines being proposed or already built have a life expectancy of only 25 years at a 30 percent capacity. (**0012-12** [Eastman, Ajax])

Response: *A detailed assessment of the engineering details of alternate power production (such as those associated with wind turbines) is beyond the scope of this environmental review and will thus not be addressed in the EIS. Nevertheless, the potential environmental impacts of alternatives, such as wind energy, will be addressed in Chapter 9 of the EIS.*

Comment: Whether the area is on land, or offshore, it is mind boggling to think of the potential harm, and humongous impacts of industrial wind. On land, particularly, the Appalachian Mountains of the East, the 396,000 acres, required, would destroy the mainly unfragmented, biologically rich forests, which are not only habitat for bats and nesting neo-tropical birds, but also habitat for terrestrial flora and fauna. The area is, also, a major migratory corridor for birds, bats, and raptors. Yet without full review of environmental impacts, or cost to taxpayers and customers, permits are being granted.

As for the impacts offshore, we really can't know the full extent of the harm turbines will have on the aquatic resources, benthic organisms, oceanic mammals, or pelagic birds. Where is the precautionary principle in the blind acceptance of, and push for, such a destructive form of energy? (**0001-7-8** [Eastman, Ajax])

Response: *Impacts of alternative energy sources such as industrial and wind will be discussed in Chapter 9.0*

Comment: As for impacts offshore, we really can't know the full extent of the harm turbines will have on aquatic resources, benthic organisms, oceaneantic mammals, or pelagic birds. (**0012-11** [Eastman, Ajax])

Response: *Alternative energy sources and their potential impacts to aquatic resources will be discussed in Chapter 9.*

D.2.29 Comments Concerning Alternatives—System Design

Comment: The Army Corps of Engineers and PSEG must consider an alternative to the land swap, such as using the existing road to Artificial Island, instead of creating a second road if, and when, a nuclear facility is permitted. In our view the existing access road should be

sufficient. Issues associated with new spoil disposal site are, as yet, unknown, as the sites under consideration are unknown. But there are likely to be issues, considering the Army Corps of Engineers for riverfront lands. (**0001-19-7** [Blake, Matt])

Comment: The Army Corps and PSEG must consider an alternative to the land swap, such as using the existing access road to Artificial Island instead of creating a second road, if and when a new nuclear facility is permitted. This would avoid destruction of wetlands and obviate the need for a new dredge disposal site. In our view, the existing access road should be sufficient and no additional destruction of wetlands should be permitted at the site. Issues associated with a new spoil disposal site are as yet unknown as the sites under consideration are unknown. But there are likely to be issues, considering the Anny Corps' preference for riverfront lands. (**0003-6** [Batty, Sandy] [Dillingham, Tim] [Galetto, Jane Morton] [Goldsmith, Amy] [McNutt, Richard] [Nolan, Christine] [O'Gorman, Margaret] [Schulte, James] [van Rossum, Maya])

Comment: The EIS should require clearer evaluation of PSEG's use of the Army Corps confined disposal facility, the agreement to do so, and any cumulative impacts resulting from use of the site. According to the ER 4.1-9, there will be construction laydown and related activities located in the Corps CDF site. It is unclear what long-term or permanent impacts may result, despite the site use for temporary activity. The NRC should consider these potential impacts and the full range of alternatives in its EIS. Moreover, the EIS should consider the chain reaction of environmental impacts if the CDF is used for another purpose. The NRC should also examine the mechanism by which the Army Corps is providing the use of this land and any impacts this may have on Army Corps permit reviews or regulatory processes for the Project. (**0018-8** [Brown, Elizabeth])

Response: *In regard to the "land swap" mentioned in the comments, Chapters 4 and 5 of the EIS will address the proposed use of the Corps' existing Containment Disposal Facility (CDF) at the north end of Artificial Island, as well as the proposed exchange of property between PSEG and the Corps to provide a functional replacement for the existing CDF. The potential environmental impacts of the proposed new access road to the PSEG site will be addressed in Chapter 4 of the EIS.*

Comment: In reviewing the PSEG Early Site Permit application, and Environmental Report filed on May 25th, 2010, we noted that the new units intake and cooling systems will be designed to minimize the impact to the aquatic community, by utilizing cooling towers, and an intake system and design flows that conform to best available technology as required under Section 316B of the Clean Water Act. The cooling tower blow-down discharge should have little impact on the Delaware River, at this location, or significantly elevate river water temperatures. (**0001-8-6** [Molzahn, Robert])

Comment: A new plant will provide an excellent opportunity to incorporate new technology, hopefully to produce cleaner, safer energy, and especially if a cooling tower is incorporated into the new plans. I'm familiar with the impingement and entrainment, as I said. The much reduced need for water in a cooling tower process, you know, will reduce much of that impact, considerably. I know of no scientific study that proves that the present cooling processes, at Salem and Hope Creek has generated any impact on the estuary. It can be debated, it can be

argued. But I have not seen a scientific study that really proves that fact. After reviewing the EPS request, I find no reason to deny the requested permit. (**0001-9-4** [Lacandro, Roger])

Comment: A new plant will provide an excellent opportunity to incorporate new technology, hopefully, to produce cleaner, safer energy especially if a cooling tower is incorporated to significantly reduce bay water usage, impingement and entrainment of aquatic biota and the impact of large quantities of elevated temperature water reentering the estuary. (**0008-5** [Lacandro, Roger])

Comment: In reviewing the PSEG ESP Application and Environmental Report filed on May 25, 2010, we noted that the new units intake and cooling systems will be designed to minimize the impact to the aquatic community by utilizing cooling towers and an intake system and design flows that conform to Best Available Technology as required by Section 316(b) of the Clean Water Act. The cooling tower blowdown discharge should have little effect on the Delaware River at this location or significantly elevate river water temperatures. (**0011-8** [Molzahn, Robert])

Comment: In addition to the steps being taken to protect the wetlands impacted by construction, the aquatic impacts of the proposed facility will be limited by the use of a closed cycle cooling system. Compared to a once-through system, these cooling towers will divert much less water for cooling. Projected maximum diversion for the new facility is less than 4% of the current amount used by the Salem Generating Station and is a very small fraction the total volume of the Delaware River flow. As a result, impingement of fish populations will be a small fraction--less than 3% of the current level of the Salem station.

Because of the closed cooling system, we would also expect the thermal plume of the new plant to be localized and relatively small, with no significant impact on the local aquatic biota. The conclusion is based on past studies of the impact of thermal plumes from the existing PSEG generating plants, the expected operation of the proposed cooling structures, and our understanding of the ecology of aquatic species in the vicinity of the plant. (**0014-17** [Velinsky, David])

Response: *No specific nuclear reactor or reactor design has yet been proposed for the PSEG site; rather, the ESP application is merely seeking approval from the NRC to bank the PSEG site for possible future use. Subsequent approvals would be needed from the NRC prior to the construction and operation of any nuclear reactor unit(s) at the PSEG site. Nevertheless, Chapter 3 of the EIS will describe the plant parameter envelope on which the assessment of potential environmental impacts will be based. The hypothetical design of any water intake systems and/or cooling towers will be developed by PSEG and offered to the NRC for review as part of the assessment in the EIS. The potential environmental impacts of such facilities will be addressed in Chapter 4 and 5 of the EIS.*

Comment: Finally, NRC must evaluate the impacts and all viable alternatives for cooling. DRN notes that EPA's Phase I regulations for new sources require closed-cycle cooling, which the new plant will have. 68 Fed. Reg. 36749-36755 (June 19, 2003). DRN has long advocated for closed-cycle cooling at the existing Salem facility. However, that does not mean that closed-cycle cooling is without impacts, or that one size fits all when selecting the specific cooling technology. According to the ER "Compared with a once- through cooling system, a closed

cycle cooling system substantially reduces the volume of water diverted for cooling but increases consumptive water use as a result of evaporation loss in the cooling tower." (**0018-14** [Brown, Elizabeth])

Comment: The ER notes that PSEG is evaluating three different closed-loop designs for the cooling water system of the new plant: mechanical draft, natural draft, and fan- assisted natural draft. However, only the mechanical and natural draft designs were evaluated in the ER. The EIS must evaluate all alternatives, including any not evaluated in the ER, to ensure that all environmental impacts are adequately assessed. (**0018-18** [Brown, Elizabeth])

Comment: Therefore, DRN urges NRC to review certain issues in more detail, including: clearer evaluation of PSEG's use of the Army Corps confined disposal facility, and cumulative impacts resulting from use of that site; water impacts including dredging and construction impacts; filling of wetlands; floodplain impacts; habitat impacts and impacts to species, especially Atlantic sturgeon; and impacts and evaluation of alternatives for cooling systems. (**0018-5** [Brown, Elizabeth])

Response: *The impacts of viable alternatives for the cooling system will be addressed in Chapter 9 of the EIS.*

Comment: Clearly, the EIS will need to address the impact of dredging and related shoreline disturbance and take all viable alternatives into account. (**0018-10** [Brown, Elizabeth])

Response: *Potential impacts of construction activities such as dredging and shoreline disturbances will be evaluated in Section 4.3.2 of the EIS. In addition, alternative technologies will be discussed in Chapter 9.*

Comment: And if you want to create jobs in this state, here, the way to do it is build solar farms, build wind farms. Build two new cooling towers at Salem I and II. They will create hundreds of construction jobs. And, also, you will create fishing jobs, which add up to thousands and thousands of jobs. That should be the approach, also, that should be considered in the overall discussion of this issue. (**0002-6-15** [Schneider, Richard])

Response: *The NRC is not involved in establishing employment programs or policy nor in promoting employment opportunities within any state; rather, it regulates nuclear energy to protect public health and safety within existing policy. The alternatives described in the comment are beyond the scope of the review being conducted by the NRC for this Early Site Permit application; hence, they will not be addressed in the EIS.*

D.2.31 Comments Concerning Benefit-Cost Balance

Comment: With rising energy costs a concern for every American, nuclear power plants are the lowest cost producer of baseload electricity, especially in a region that is densely populated, and whose industry drives demand, nuclear generation's low cost, and reliability, fosters a competitive energy market, and keeps electric costs down for the ratepayer. (**0001-13-11** [Salmon, Edward])

Comment: Other benefits to building this new unit that would have a positive impact regionally are the boost to the local economy with the purchase of commodities such as:

400,000 cubic feet of concrete
66,000 tons of steel
44 miles of piping
300 miles of electrical wiring
130,000 electrical components (**0009-8** [Kugler, John])

Comment: And, lastly, we are all ratepayers. And what does a ratepayer want? The ratepayer wants to pay a lower energy cost. And with the added value of a fourth nuclear power plant we will all get that. So with that we support this plan one hundred percent, and I thank you very much. (**0001-22-6** [Kehoe, Jim])

Comment: Nuclear energy is also affordable and reliable. With rising energy costs a concern for every American, nuclear power plants are the lowest-cost producer of base load electricity. Especially in a region that is densely populated and whose industry drives demand, nuclear generation's low cost and reliability fosters a competitive energy market and keeps electric costs down for the ratepayer. (**0004-3** [Salmon, Edward])

Response: *The comments note the general attributes of nuclear power that makes it attractive as a power source. This comment will not be discussed specifically, but a balance of the benefits and costs associated with the proposed power plant will be contained in Chapter 10 of the EIS.*

APPENDIX E

DRAFT ENVIRONMENTAL IMPACT STATEMENT COMMENTS AND RESPONSES

APPENDIX E

DRAFT ENVIRONMENTAL IMPACT STATEMENT COMMENTS AND RESPONSES

This appendix is intentionally left blank. The final Environmental Impact Statement (EIS) will contain the comment on and responses to the draft EIS in this appendix

APPENDIX F

KEY CONSULTATION CORRESPONDENCE

APPENDIX F

KEY CONSULTATION CORRESPONDENCE

Consultation correspondence sent and received during the environmental review of the early site permit application for the PSEG Site near Salem, New Jersey, is identified in Table F-1. The correspondence can be found in the Nuclear Regulatory Commission's (NRC's) Agencywide Document Access and Management System (ADAMS), which is accessible from the NRC website at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room) (note that the URL is case sensitive). ADAMS accession numbers also are provided in Table F-1.

A copy of the correspondence received from the U.S. Army Corps of Engineers is on display in Section F.1, and copies of correspondence received regarding historic and cultural resources are on display in Section F.2.

Section F.3 contains copies of correspondence from Federal agencies regarding threatened, endangered, and sensitive species and their habits, and it also includes full copies of the National Marine Fisheries Service (NMFS) Biological Assessment (see Section F.3.1), the NMFS Essential Fish Habitat Assessment (see Section F.3.2), and the U.S. Fish and Wildlife Biological Assessment (see Section F.3.3).

Table F-1. Key Early Site Permit Consultation Correspondence Regarding the PSEG Site

Source	Recipient	Date and Accession Number
Correspondence with Native American Tribes		
U.S. Nuclear Regulatory Commission (NRC) (Mark Notich)	Eastern Lenape Nation of Pennsylvania (Doris Pieschel)	October 26, 2010 ML102990155
NRC (Mark Notich)	Cherokee Nation of New Jersey (C. W. Longbow)	October 26, 2010 ML102850579
NRC (Mark Notich)	Nanticoke Tribe Association (Larry Jackson)	October 26, 2010 ML102990090
NRC (Mark Notich)	NJ-US Taino Tribal Affairs Office (Taino Tribal Council of Jatibonicu)	October 26, 2010 ML102990045
NRC (Mark Notich)	Ramapough Mountain Indians (Doreen Scott)	October 26, 2010 ML102990059
NRC (Mark Notich)	Delaware Tribe of Indians (Jerry Douglas)	October 26, 2010 ML102990185
NRC (Mark Notich)	The Delaware Nation–Delaware Tribe of Western Oklahoma (Kerry Holton)	October 26, 2010 ML102990210

Table F-1 (continued)

Source	Recipient	Date and Accession Number
NRC (Mark Notich)	Eastern Delaware Nation (Mollie Eliot)	October 26, 2010 ML102990165
NRC (Mark Notich)	Powhatan Renape Nation (Curtis W. Diggs)	October 26, 2010 ML102990071
NRC (Mark Notich)	Nanticoke Lenni-Lenape Indians of New Jersey (Mark Gould)	October 26, 2010 ML102990114
Correspondence with the U.S. Army Corps of Engineers (see Section F.1)		
NRC (Gregory Hatchett)	U.S. Army Corps of Engineers (William Jenkins)	November 5, 2010 ML102930260
Department of the Army (Frank J. Cianfrani)	NRC (Gregory Hatchett)	January 24, 2011 ML110380482
Correspondence Regarding Historic and Cultural Resources (see Section F.2)		
NRC (Mark Notich)	Historic Preservation Office (Vincent Maresca)	October 26, 2010 ML102850545
NRC (Mark Notich)	Advisory Council on Historic Preservation (Reid Nelson)	October 26, 2010 ML102850562
State of Delaware Historical and Cultural Affairs (Timothy Slaven)	NRC (Jack Cushing)	September 25, 2013 ML13275A113
New Jersey Historic Preservation Office (Daniel Saunders)	NRC (Jack Cushing)	December 9, 2013 ML13358A139
Correspondence Regarding Threatened, Endangered, and Sensitive Species and their Habitats (see Section F.3)		
NRC (Mark Notich)	U.S. Fish and Wildlife Service (Marvin Moriarty)	October 26, 2010 ML102860150
NRC (Mark Notich)	N.J. Department of Environmental Protection (NJDEP) (David Chanda)	October 26, 2010 ML102850556
NRC (Mark Notich)	National Marine Fisheries Service (Peter Colosi)	October 26, 2010 ML102860101
National Marine Fisheries Service (Stanley Gorski)	NRC (Gregory Hatchett)	December 9, 2010 ML103570197
NRC (Samuel Lee)	National Marine Fisheries Service (Louis Chiarella)	July 31, 2013 ML13206A180
National Marine Fisheries Service (Mary Colligan)	NRC (Samuel Lee)	October 25, 2013 ML13319A998

Table F-1 (continued)

Source	Recipient	Date and Accession Number
NRC (Samuel Lee)	U.S. Fish and Wildlife Service (Wendi Weber)	December 13, 2013 ML13346A667
NRC (Samuel Lee)	NJDEP, New Jersey Natural Heritage Program (Larry Miller)	October 4, 2013 ML13275A623
NJDEP, New Jersey Natural Heritage Program (Robert Cartica)	NRC (Allen Fetter)	October 24, 2013 ML14154A451
NJDEP, New Jersey Natural Heritage Program (Robert Cartica)	NRC (Allen Fetter)	October 24, 2013 ML14142A004
NJDEP, New Jersey Natural Heritage Program (Robert Cartica)	NRC (Allen Fetter)	October 24, 2013 ML14154A448
NJDEP, New Jersey Natural Heritage Program (Robert Cartica)	NRC (Allen Fetter)	October 24, 2013 ML14154A439

F.1 Copy of Correspondence Received from the U.S. Army Corps of Engineers, Philadelphia District

DEPARTMENT OF THE ARMY

PHILADELPHIA DISTRICT CORPS OF ENGINEERS
WANAMAKER BUILDING, 100 PENN SQUARE EAST
PHILADELPHIA, PENNSYLVANIA 19107-3390

REPLY TO
ATTENTION OF

JAN 24 2011

Regulatory Branch
Applications Section I

SUBJECT: CENAP-OP-R-2009-157
PSE&G NUCLEAR, LLC

Mr. Gregory P. Hatchett, Branch Chief
Environmental Projects Branch 1
Division of Site and Environmental Reviews
Office of New Reactors
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Dear Mr. Hatchett:

This is in response to your letter dated November 5, 2010, inviting the United States Army Corps of Engineers (Corps), Philadelphia District, to participate as a cooperating agency in the development of an Environmental Impact Statement (EIS) associated with the proposal of the Public Service Electric and Gas (PSE&G) Power, LLC, and PSE&G Nuclear, LLC to construct and operate a new nuclear power plant, along the Delaware River, on the southern part of Artificial Island, in Lower Alloways Creek Township, Salem County, New Jersey.

The Philadelphia District is accepting your invitation to serve as a cooperating agency in the development of the EIS. By participating as a cooperating agency, the Corps can work with the United States Nuclear Regulatory Commission (NRC) to ensure that sufficient information is included in the EIS for the Corps to adopt the environmental document, conduct a timely review of the PSE&G application, and make a final decision and/or project compliance with Section 404 of the Clean Water Act and Section 10 of the River and Harbor Act of 1899.

We are looking forward to working with you as a cooperating agency. If you have any questions regarding this matter, please contact Mr. Bryan P. Bellacima at (215) 656-7632

Sincerely,

Frank J. Ciantrani
Chief, Regulatory Branch

1

F.2 Copies of Correspondence Received Regarding Historic and Cultural Resources

1

State of Delaware
Historical and Cultural Affairs

21 The Green
Dover, DE 19901-3611

Phone: (302) 736.7400 Fax: (302) 739.5660

FINDING OF NO ADVERSE EFFECT

September 25, 2013

Mr. Jack Cushing
United States Nuclear Regulatory Commission
Office of New Reactors
Mail Stop T7F7
Washington, D.C. 20555-0001

Project: **PSEG Early Site Permit Application; Salem County, New Jersey**
Review Code: 2010.01.19.02
Agency: NRC

Dear Mr. Cushing:

The staff of the State Historic Preservation Office of the Division of Historical & Cultural Affairs has reviewed the above-noted project. Based on our review of the initial *Historic Properties Visual Impact Assessment* (2009, MACTEC) and subsequent *Addendum* (2013, ARKF), we concur with your determination that the proposed project will not adversely affect any properties listed on or eligible for listing on the National Register of Historic Places.

Timothy A. Slavin
State Historic Preservation Officer

Reviewed By:

Jesse Zanavich, Architectural Historian
Jesse.Zanavich@state.de.us
(302) 736-7433

cc: Gwenyth Davis, Deputy State Historic Preservation Officer

2

3

HPO Project No. 09-0740-18
HPO-L2013-130

State of New Jersey

MAIL CODE 501-04B
DEPARTMENT OF ENVIRONMENTAL PROTECTION
NATURAL & HISTORIC RESOURCES
HISTORIC PRESERVATION OFFICE
PO Box 420
Trenton, NJ 08625-0420
TEL. (609) 984-0176 FAX (609) 984-0578

CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

BOB MARTIN
Commissioner

December 9, 2013

Mr. Jack Cushing
United State Nuclear Regulatory Commission
Office of New Reactors
Mail Stop: T7F7
Washington, D.C. 20555-0001

Dear Mr. Cushing:

As Deputy State Historic Preservation Officer for New Jersey, in accordance with 36 CFR Part 800: Protection of Historic Properties, as published with amendments in the Federal Register on 6 July 2004 (69 FR 40544-40555), I am providing **Consultation Comments** for the following proposed undertaking:

Salem County, Lower Alloways Creek Township
Salem and Hope Creek Generating Station License Renewal
PSEG Early Site Permit (ESP) Application
United States Nuclear Regulatory Commission

800.4 Identifying Historic Properties

As Deputy State Historic Preservation Officer, I concur with your finding that there are no historic properties affected within the project's area of potential effects for the Early Site Permit (ESP) Application for the above referenced undertaking.

The HPO looks forward to continued consultation during the future Combined Construction and Operating License (COL) Application to evaluate direct and indirect project effects on historic properties pursuant to Section 106 of the National Historic Preservation Act.

Additional Comments

Thank you again for providing the opportunity to review and comment on the potential for the project to effect historic properties. The HPO looks forward to continued consultation and evaluating any direct effects on archaeological sites 28-Sa-179, 28-Sa-180, 28-Sa-182, and 28-Sa-186 along Money Island Road, assessing visual effects, and assessment of effects of any new project elements on historic properties pursuant to Section 106. Please reference the HPO

1

2

HPO Project No. 09-0740-18
HPO-L2013-130

project number 09-0740 in any future calls, emails, submissions or written correspondence to help expedite your review and response. If you have any questions, please do not hesitate to contact Vincent Maresca of my staff at (609) 633-2395 with questions regarding archaeology or Caroline Scott (609-633-2396) with questions regarding historic architecture, historic districts, or historic landscapes.

Sincerely,

Daniel D. Saunders
Deputy State Historic
Preservation Officer

c. James Mallon, PSEG Power, LLC
Nikki Minnichbach, U.S. Army Corps of Engineers
Daniel O'Rourke, Argonne National Laboratory
Molly McDonald, AKRF

2

1

F.3 Copies of Correspondence Received from Federal Agencies Regarding Threatened, Endangered, and Sensitive Species and Their Habitats

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Habitat Conservation Division
James J. Howard Marine Sciences Laboratory
74 Magruder Road
Highlands, NJ 07732

December 9, 2010

Gregory Hatchett, Branch Chief
Environmental Project Branch 1
Division of Site and Environmental Reviews
Office of New Reactors
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Re: Notification and Request for Consultation and Participation in the Scoping Process for the PSEG Early Site Permit Application

Dear Mr. Hatchett:

The NOAA's National Marine Fisheries Service (NMFS), Northeast Region, Habitat Conservation Division is in receipt of your letter dated October 26, 2010 initiating consultation and seeking our involvement in the Scoping Process for the construction and operation of a new nuclear power plant, by PSEG Power, LLC and PSEG Nuclear, LLC (PSEG), on the southern part of Artificial Island and the east bank of the Delaware River in Lower Alloways Creek Township, Salem County, New Jersey.

A complimentary compact disc containing complementary documents and figures to PSEG's *Site Safety and Analysis Report (SSAR)* for the proposed facility, was also included in the Early Site Permit (ESP) application package for our review.

According to your letter, the Nuclear Regulatory Commission (NRC) is currently preparing an environmental impact statement (EIS) under the provisions of the National Environmental Policy Act of 1969 (NEPA), as amended. In addition, the NRC has requested a list of endangered, threatened and candidate species, and designated critical habitat under the jurisdiction of the NMFS, that may be in the vicinity of the PSEG site. Your letter further requests a list of federally-managed species that have designated essential fish habitat (EFH) in that area as well as any appropriate information under the provisions of the Fish and Wildlife Coordination Act of 1984, as amended.

PSEG currently has three operating nuclear reactors, Salem Units 1 and 2, and Hope Creek Unit 1. The proposed construction site will encompass approximately 819 acres immediately adjacent and to the north of the existing units at the Salem and Hope Creek Nuclear Generating Station (SHCNGS).

Impacts to the quality of surface waters and the alteration of river bottom sediments within the Delaware River and adjacent marsh creeks are expected as a result of the construction and operation of the proposed facility, and will include those associated with the development of shoreline features (intake structure, barge facility, heavy haul road), dredging of sediments from the near-shore area of the Delaware River to provide for water intake and discharge and to provide adequate draft for barge access during construction, and the filling of 9.5 acres of coastal tidal wetlands and shallow open water areas.

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The construction of the new intake structure and the new barge unloading facility and mooring area will result in the deepening of the existing river bottom (~10 ft. MLLW) by an average of 4.5 ft. over an area of 31 acres (volume of 150,000 cubic yards), and an area of 61 acres, (a volume of 440,000 cubic yards), respectively. The total area to be dredged is 92 acres extending riverward 1700 ft. from the shoreline. Dredging techniques may include both mechanical and hydraulic dredging methods and the material removed as part of this construction activity will be transported to and placed in an on-site or other approved upland disposal facility.

Increases in turbidity through the resuspension of sediments into the water column from dredging and port operations will degrade water quality, lower dissolved oxygen levels, and potentially release chemical contaminants bound to the fine-grained estuarine/marine sediments. Sedimentation and wave patterns in the area may be altered as a result of vessels entering and exiting the proposed mooring area also resulting in increased turbidity. Suspended sediments mask pheromones used by migratory fishes, and can smother immobile benthic organisms and demersal newly-settle juvenile fish (Auld and Schubel 1978; Breitburg 1988; Newcombe and MacDonald 1991; Burton 1993; Nelson and Wheeler 1997). As supported above, the project area provides important habitat for striped bass including valuable spawning grounds and nursery habitat. Increases in turbidity will adversely affect striped bass larvae's ability to capture prey (Fay et al. 1983 in Able and Fahay 1998). The decrease in water circulation can also adversely affect striped bass survival as strong current is needed to keep the eggs suspended in the water column and prevent them from being smothered by silt (Bigelow and Schroeder 1953).

Guidelines under Section 404(b)(1) of the federal Clean Water Act require that actions proposed within "waters of the United States," especially those that are not water-dependent, are required to demonstrate that they have considered all appropriate reasonable and prudent measures to avoid and minimize impacts to waters. If all measures to avoid and minimize wetland impacts have been considered and employed to the extent practicable and result in unavoidable impacts, a compensatory mitigation plan should be developed and implemented.

The applicant should undertake a complete analysis of alternatives that complies fully with the Clean Water Act Section 404 (b)(1) Guidelines that documents avoidance, minimization and mitigation for all impacts. Alternate locations as well as a documentation of purpose and need should be provided as part of this analysis. For any unavoidable impacts, a compensatory mitigation plan to offset all of the projects impacts to aquatic resources including EFH should be developed in accordance with the federal standards and criteria for compensatory mitigation for losses of aquatic resources published in the Federal Register on April 10, 2008 (vol. 73 No. 70). This plan should be developed as early in the permit process as possible and in consultation with the applicable federal, state and local resource agencies and will be implemented on and in the immediate area of the PSEG Site to the extent practicable.

In the State of NJ, coastal wetlands are regulated by the state under the Wetlands Act of 1970. Development in coastal wetlands requires authorization of permits from the NJDEP, and requires separate processes to determine a project's value. However, such processes usually fit in within a federal process.

After reasonable measures have been explored to avoid and minimize impacts to wetlands, PSEG will compensate for unavoidable adverse impacts to wetlands by implementing approved wetland restoration and/or rehabilitation measures. PSEG, through their Ecosystem Enhancement Program, has extensive experience and demonstrated success implementing coastal saltmarsh and freshwater wetland restoration and rehabilitation programs. This familiarity with local wetland systems was used to identify appropriate candidate mitigation sites and will be used in developing and implementing the final approved mitigation plan.

Mitigation options mentioned in the NRC's ESP to offset the impacts to NOAA trust resources included the following considerations:

- Minimization of encroachment on coastal wetlands
- Use of previously developed sediment disposal basins for plant development (both PSEG's permitted disposal facility and the USACE's CDF)
- Refinement of the Site Utilization Plan to avoid various wetland areas throughout the PSEG Site

Opportunities for mitigating unavoidable impacts to wetland ecosystems include restoration of natural habitats temporarily disturbed by construction, creation of new habitat types in previously disturbed areas, and enhancement of undisturbed natural habitats.

In general, NMFS does not accept the conversion of one type of aquatic habitat into another habitat as compensatory mitigation when the existing habitat has value to aquatic life. Candidate mitigation areas include portions of the existing PSEG Site, Mannington Meadow, Mason's Point, and additional areas of the PSEG Alloway Creek Watershed restoration site.

Magnuson Stevens Fishery Conservation and Management Act (MSA)
Section 305 (b)(2) of the 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSA) requires all federal agencies to consult with NOAA Fisheries on any action, including those proposed by the NRC, that is authorized, funded, or undertaken by that agency and that may adversely affect EFH. Included in this consultation process is the preparation of a complete and appropriate EFH assessment to provide necessary information on which to consult. Our EFH regulation at 50 CFR 600.905 mandates the preparation of EFH assessments and generally outlines each agency's obligations in this consultation procedure.

The estuarine portions of the Delaware River and its tributaries including the estuarine areas of both Alloway and Hope Creeks have been designated as EFH for a wide variety of species including red hake (*Urophycis chuss*), winter flounder (*Pseudopleuronectes americanus*), windowpane flounder (*Scophthalmus aquosus*), bluefish (*Pomatomus saltatrix*), Atlantic butterfish (*Peprilus triacanthus*), scup (*Stenotomus chrysops*), summer flounder (*Paralichthys dentatus*), scup (*Stenotomus chrysops*), black sea bass (*Centropristis striata*), king mackerel (*Scomberomorus cavalla*), Spanish mackerel *(Scomberomorus maculatus*), cobia (*Rachycentron canadum*), little skate (*Leucoraja erinacea*), winter skate (*Leucoraja ocellata*) and clearnose skate (*Raja eglanteria*). A more detailed listing of EFH and federally managed species and EFH consultation requirements can be found on our website at: www.nero.nmfs.gov/hcd.

The EFH final rule published in the Federal Register on January 17, 2002 defines an adverse effect as: "any impact which reduces the quality and/or quantity of EFH." The rule further states that:

> "An adverse effect may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat and other ecosystems components, if such modifications reduce the quality and/or quantity of EFH. Adverse effects to EFH may result from action occurring within EFH or outside EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions."

The rule also states:

> Loss of prey may be an adverse effect on EFH and managed species because the presence of prey makes waters and substrate function as feeding habitat and the definition of EFH includes waters and substrate necessary to fish for feeding. Therefore, actions that reduce the availability of a

major prey species, either through direct harm or capture, or through adverse impacts to the prey species' habitat that are known to cause a reduction in the population of the prey species, may be considered adverse effects on EFH if such actions reduce the quality of EFH.

In order to initiate consultation pursuant to the MSA, the NRC must submit a full and complete EFH assessment that considers the individual and cumulative and the direct and indirect impacts of the proposed project on EFH, federal managed species and their prey recognizing the definition of adverse impact discussed above. The required contents of an EFH assessment includes: 1) a description of the action; 2) an analysis of the potential adverse effects of the action on EFH and the managed species; 3) the NRC's conclusions regarding the effects of the action on EFH; 4) proposed mitigation, if applicable. Given the scope of this project, other information that should be contained in the EFH assessment includes: 1) the results of on-site inspections to evaluate the habitat and site-specific effects; 2) the views of recognized experts on the habitat or the species that may be affected; 3) a review of pertinent literature and related information; and 5) an analysis of alternatives to the action that could avoid or minimize the adverse effects on EFH.

Fish and Wildlife Coordination Act

Notwithstanding our mandates under the MSA, the NMFS also has responsibilities under the Fish and Wildlife Coordination Act (FWCA) to provide federal agencies such as the NRC with recommendations to avoid, minimize and to mitigate for direct, indirect and cumulative impacts to any and all NOAA trust resources that are present within the Delaware River Basin.

The Delaware Estuary including its tributaries provides habitat for a wide variety of NOAA trust resources including alewife (*Alosa pseudoharengus*), American eel (*Anguilla rostrata*) American shad (*Alosa sapidissima*), Atlantic croaker (*Micropogonias undulatus*), Atlantic menhaden (*Brevoortia tyrannus*), Atlantic sturgeon (*Acipenser oxyrinchus*), blueback herring (*Alosa aestivalis*), bluefish, hickory shad (*Alosa mediocris*), spot (*Leiostomus xanthurus*) tautog (*Tautoga onitis*), weakfish, white perch (*Morone americana*), yellow perch (*Perca flavescens*), striped bass (*Morone saxatilis*), hogchoker (*Trinectes maculatus*), killifish, bay anchovy, silversides, mummichog and may others.

Because landing statistics and the number of fish observed on annual spawning runs indicate a drastic decline in alewife and blueback herring populations throughout much of their range since the mid-1960's, they have been designated as species of concern by NMFS in a Federal Register Notice dated October 17, 2006 (71 FRN 61022). "Species of concern" are those species about which NMFS has some concerns regarding status and threats, but for which insufficient information is available to indicate a need to list the species under the Endangered Species Act. The shallow water environment in this section of the Delaware River provides valuable habitat for these species as well as striped bass and American shad.

The New Jersey Department of Environmental Protection (NJDEP) also has sampled the Delaware River and Bay in the project area for nearly 30 years since 1980. This long-term survey documents the use of the this portion of the river by a wide variety of species including blueback herring, alewife, American shad American shad (*Alosa sapidissima*), American eel (*Anguilla rostrata*), Atlantic herring (*Clupea harengus*), Atlantic menhaden (*Brevoortia tyrannus*), bay anchovy, (*Anchoa mitchilli*), blueback herring, gizzard shad (*Dorosoma cepedianum*), hogchoker (*Trinectes maculatus*), striped bass, yellow perch (*Perca flavescens*), white perch (*Morone americana*), Atlantic silverside (*Menidia menidia*), and many others (NJDEP 2010). Many of these species are both commercially and recreationally important and managed by the ASFMC or are valuable prey species for ASFMC or federally managed fish.

Buckel and Conover (1997) in Fahey et al. (1999) reports that diet items of juvenile bluefish include *Alosa* species such American shad, blueback herring and alewife as well as bay anchovy, silversides and other fish species. We note that the NJDEP survey data show that federally managed bluefish are present

in the project area. This indicates that both the prey species and the predator are present in the Delaware River in and around the project area. Juvenile *Alosa* species have all been identified as prey species for windowpane (*Scophthalmus aquosus*) and summer flounder (*Paralichthys dentatus*) in Steimle et al. (2000). Windowpane and summer flounder are federally managed species whose EFH has been designated in the mixing zone of the Delaware River

Submerged aquatic vegetation (SAV) has historically been absent from Delaware Bay. However, to date, there has been no comprehensive mapping of SAV in the Delaware Estuary to verify its presence or absence. Several species have been observed though in the tidal river since 1970, including: *Vallisneria americana*, *Myriophyllum spicatum*, *Elodea nuttallii*, *Najas flexillis*, *Potamogeton* sp. and others (Schuyler, 1988). Wild celery (*Vallisneria americana*) has been documented in some areas of the Delaware River and its tributaries. SAV provides valuable nursery, forage and refuge habitat for a variety of fish including striped bass, American shad, alewife, and blueback herring. It is also an important food source for waterfowl. As water quality in the Delaware River continues to improve, more areas of SAV may be found within the River.

Native eastern oysters (*Crassostrea virginica)* are an ecologically important species. According to the New Jersey Department of Environmental Protection, an expansive area of oyster habitat has been identified near the SHCNGS . In recent years, efforts have been made to restore oyster beds in Delaware Bay. Since 2004, the Army Corps of Engineers has worked with the States of New Jersey and Delaware to plant shell in portions of natural oyster beds in Delaware Bay (http://www.delawareestuary.org/science_projects_oyster_restoration.asp).

Blue crab (*Callinectes sapidus*) can also be found in the vicinity of the SHCNGS. The crabs can generally be found in the lower salinity areas of the estuary in the summer and higher salinities in the winter. Following mating in the summer, which typically occurs in lower salinity waters, the females move to high salinity waters found in the Delaware Bay to spawn. After spawning, the larvae move toward the lower salinity areas in the Delaware River Estuary to mature.

Endangered and Threatened Species

The Atlantic sturgeon (*Acipenser oxyrinchus*) may be found in the Delaware River in the vicinity of the project area at certain times of the year. On October 6, 2010, NOAA issued a Federal Register Notice (75 FRN 61872). The notice identifies the Hudson River and Delaware River Atlantic sturgeon stocks as a distinct population segment (DPS) called the New York Bight DPS. This DPS has been proposed to be listed as endangered. The Atlantic Sturgeon Status Review Team (ASSRT) identified 15 different stressors that may impact the Atlantic sturgeon populations including poor water quality and habitat loss (2007). Dredging and vessel strikes are also considered to be important stressors on the populations of Atlantic sturgeon (75 FRN 61872 et seq.) According to the ASSRT (2007), Ryder (1888) suggested that juvenile Atlantic sturgeon used the tidal freshwater reach of the Delaware River as a nursery area and Lazzari et al. (1986) frequently captured juvenile Atlantic sturgeon from May - December in the upper tidal portion of the river below Trenton, New Jersey.

Shortnose sturgeon (*Acipenser brevirostrum*) typically occurs in deep water channels although they do occur in the shallower waters while foraging. The abundance of adult shortnose sturgeon is greatest in the tidal river from Trenton to Philadelphia (Hastings et al. 1987; O'Herron et al. 1993). In-water construction activities can affect shortnose and Atlantic sturgeon through direct injury or mortality, displacing species from the area, or by altering the habitat and destroying forage items.

Shortnose sturgeon (*Acipenser brevirostrum*) typically occurs in deep water channels although they do occur in the shallower waters similar to that of the project area while foraging. Any discretionary federal action, such as the approval or funding of a project by a Federal agency, that may affect a listed species

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must undergo consultation pursuant to Section 7 of the Endangered Species Act (ESA) of 1973, as amended. The NRC should submit its determination of effects, along with justification for the determination and a request for concurrence, to the attention of the Endangered Species Coordinator, NMFS, Northeast Regional Office, Protected Resources Division, One Blackburn Drive, Gloucester, MA 01930. For additional information on the Section 7 consultation process or shortnose sturgeon, please contact Julie Crocker at (978) 282-8480 or julie.crocker@noaa.gov.

We look forward to continued coordination with the NRC as it moves forward with the development of the EIS and the scoping process. Should you have any questions, need additional information or would like to arrange a meeting to discuss the EFH consultation process or impacts to resources of concern to the NMFS, please contact Brian May at (732) 872-3116 or Karen Greene at 732 872-3023.

Sincerely,

Stanley W. Gorski
Field Offices Supervisor

cf: PRD - J. Crocker
ACOE – Phila. District
FWS – Pleasantville
EPA- Region II
NJDEP
DRFWMC

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
NORTHEAST REGION
55 Great Republic Drive
Gloucester, MA 01930-2276

Samuel S. Lee, Chief
Environmental Projects Branch 2
Division of New Reactor Licensing
Office of New Reactors
U.S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852-2738

OCT 25 2013

Received 11/13/2013

Re: PSEG Early Site Permit Application

Dear Mr. Lee,

This letter provides updated information on resources under the jurisdiction of NOAA's National Marine Fisheries Service (NMFS) located near the existing Hope Creek and Salem Nuclear Plants in Salem County, New Jersey. The U.S. Nuclear Regulatory Commission (NRC) is preparing an Environmental Impact Statement (EIS) regarding the effects of granting an Early Site Permit (ESP) for construction of a new nuclear power plant site on Artificial Island, New Jersey. PSEG currently has three operating nuclear reactors, Salem Units 1 and 2, and Hope Creek Unit 1. The proposed construction site will encompass approximately 819 acres immediately adjacent and to the north of the existing units at the Salem and Hope Creek Nuclear Generating Station (SHCNGS). We previously provided information on our trust resources to PSEG in 2009 and to NRC in 2010. Below, we provide updated information on trust resources and your consultation responsibilities.

Endangered Species Act
Several species listed by National Marine Fisheries Service (NMFS) occur in the Delaware River where the intake for a new unit would be located. Four species of sea turtles occur seasonally (May – November) in the Delaware River estuary, including the threatened Northwest Atlantic Distinct Population Segment (DPS) of loggerhead sea turtles (*Caretta caretta*), and endangered Kemp's ridley (*Lepidochelys kempi*), green (*Chelonia mydas*), and leatherback (*Dermochelys coriacea*) sea turtles. Additionally, a population of endangered shortnose sturgeon (*Acipenser brevirostrum*) occurs in the Delaware River. Individuals from any of the five listed DPSs of Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) also occur in the Delaware River. More information on these species is available on our website (http://www.nero.noaa.gov/protected/section7/listing/index.html).

As you know, consultation pursuant to Section 7 of the ESA between NRC and NMFS on the effects of the operation of the existing Salem and Hope Creek facilities has been ongoing since 1979. Most recently, a Biological Opinion was issued by us on May 14, 1993 concluding the ongoing operation was not likely to jeopardize shortnose sturgeon, Kemp's ridley, green or loggerhead sea turtles. This Opinion was amended by a letter dated January 21, 1999, which modified the Incidental Take Statement. A new Biological Opinion is currently in process and

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drafts have been reviewed by PSEG and NRC staff. We expect the EIS being prepared for a new nuclear unit to consider effects of construction and operation on all NMFS listed species. Specifically, the EIS should consider the potential for impingement and entrainment of listed species and their prey, discharge of pollutants, including heated effluent, and effects of shoreline construction, including dredging.

As noted in your letter, the ESP will not authorize the construction or operation of a new nuclear unit. Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended, states that each Federal agency shall, in consultation with the Secretary, insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. Any discretionary federal action that may affect a listed species must undergo Section 7 consultation. If you determine that the proposed action is "not likely to adversely affect" any listed species (i.e., when direct or indirect effects of the proposed project or its interdependent and/or interrelated actions on listed species are expected to be discountable, insignificant or completely beneficial), you should send us a letter documenting your determination, providing justification and requesting our concurrence. If we concur with this determination, we will reply in a letter that will convey the concurrence, thus completing Section 7 consultation. If you determine the project is "likely to adversely affect" any listed species (i.e., if any adverse effect to listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effects are not: discountable, insignificant, or beneficial) or we do not concur with your "not likely to adversely affect" determination, then formal Section 7 consultation, resulting in the issuance of a Biological Opinion with an appropriate Incidental Take Statement, may be required. Any effects that amount to the take of a listed species (defined by the ESA as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct") are not discountable, insignificant or entirely beneficial. Therefore, if any take is anticipated, formal consultation is required. NMFS staff is available to discuss the proposed project and assist you in determining the likely effects of the proposed action.

Magnuson Stevens Fishery Conservation and Management Act (MSA)
Section 305 (b)(2) of the 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSA) requires all federal agencies to consult with us on any action, including those proposed by the NRC, that is authorized, funded, or undertaken by that agency and that may adversely affect EFH. Included in this consultation process is the preparation of a complete and appropriate EFH assessment to provide necessary information on which to consult. Our EFH regulation at 50 CFR 600.905 mandates the preparation of EFH assessments and generally outlines each agency's obligations in this consultation procedure.

The estuarine portions of the Delaware River and its tributaries including the estuarine areas of both Alloway and Hope Creeks have been designated as EFH for a wide variety of species including red hake (*Urophycis chuss*), winter flounder (*Pseudopleuronectes americanus*), windowpane flounder (*Scophthalmus aquosus*), bluefish (*Pomatomus saltatrix*), Atlantic butterfish (*Peprilus triacanthus*), scup (*Stenotomus chrysops*), summer flounder (*Paralichthys dentatus*), scup (*Stenotomus chrysops*), black sea bass (*Centropristis striata*), king mackerel (*Scomberomorus cavalla*), Spanish mackerel (*Scomberomorus maculatus*), cobia (*Rachycentron canadum*), little skate (*Leucoraja erinacea*), winter skate (*Leucoraja ocellata*) and clearnose skate (*Raja eglanteria*). A more detailed listing of

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EFH and federally managed species and EFH consultation requirements can be found on our website at: www.nero.nmfs.gov/hcd.

The EFH final rule published in the Federal Register on January 17, 2002 defines an adverse effect as: "any impact which reduces the quality and/or quantity of EFH." The rule further states that:

> "An adverse effect may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat and other ecosystems components, if such modifications reduce the quality and/or quantity of EFH. Adverse effects to EFH may result from action occurring within EFH or outside EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions."

The rule also states:

> "Loss of prey may be an adverse effect on EFH and managed species because the presence of prey makes waters and substrate function as feeding habitat and the definition of EFH includes waters and substrate necessary to fish for feeding. Therefore, actions that reduce the availability of a species' habitat that are known to cause a reduction in the population of the prey species, may be considered adverse effects on EFH if such actions reduce the quality of EFH."

In order to initiate consultation pursuant to the MSA, you must submit a full and complete EFH assessment that considers the individual and cumulative and the direct and indirect impacts of the proposed project on EFH, federal managed species and their prey recognizing the definition of adverse impact discussed above. The required contents of an EFH assessment includes: 1) a description of the action; 2) an analysis of the potential adverse effects of the action on EFH and the managed species; 3) the NRC's conclusions regarding the effects of the action on EFH; 4) proposed mitigation, if applicable. Given the scope of this project, other information that should be contained in the EFH assessment includes: 1) the results of on-site inspections to evaluate the habitat and site-specific effects; 2) the views of recognized experts on the habitat or the species that may be affected; 3) a review of pertinent literature and related information; and 4) an analysis of alternatives to the action that could avoid or minimize the adverse effects on EFH.

Fish and Wildlife Coordination Act

We also have responsibilities under the Fish and Wildlife Coordination Act (FWCA) to provide federal agencies such as the NRC with recommendations to avoid, minimize and to mitigate for direct, indirect and cumulative impacts to any and all NOAA trust resources that are present within the Delaware River Basin.

The Delaware Estuary including its tributaries provides habitat for a wide variety of NOAA trust resources including: alewife (*Alosa pseudoharengus*), American eel (*Anguilla rostrata*), American shad (*Alosa sapidissima*), Atlantic croaker (*Micropogonias undulatus*), Atlantic menhaden (*Brevoortia tyrannus*), Atlantic sturgeon, blueback herring (*Alosa aestivalis*), bluefish, hickory shad (Alosa mediocris), spot (*Leiostomus xanthurus*) tautog (*Tautoga onitis*), weakfish, white perch (*Marone americana*), yellow perch (*Percajlavescens*), striped bass (*Marone saxatilis*), hogchoker (*Trinectes maculatus*), killifish, bay anchovy, silversides, mummichog and many others.

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Landing statistics and the number of fish observed on annual spawning runs indicate a drastic decline in alewife and blueback herring populations throughout much of their range since the mid-1960's. The shallow water environment in this section of the Delaware River provides valuable habitat for these species as well as striped bass and American shad.

The New Jersey Department of Environmental Protection (NJDEP) also has sampled the Delaware River and Bay in the project area for nearly 30 years since 1980. This long-term survey documents the use of this portion of the river by a wide variety of species including: blueback herring, alewife, American shad (*Alosa sapidissima*), American eel (*Anguilla rostrata*), Atlantic herring (*Clupea harengus*), Atlantic menhaden (*Brevoortia tyrannus*), bay anchovy, (*Anchoa mitchilli*), blueback herring, gizzard shad (*Dorosoma cepedianum*), hogchoker (*Trinectes maculatus*), striped bass, yellow perch (*Percajlavescens*), white perch (*Marone americana*), Atlantic silverside (*Menidia menidia*), and many others (NJDEP 2010). Many of these species are both commercially and recreationally important and managed by the ASFMC or are valuable prey species for ASFMC or federally managed fish.

Buckel and Conover (1997) in Fahey et al. (1999) reports that diet items of juvenile bluefish include Alosa species such as American shad, blueback herring and alewife as well as bay anchovy, silversides and other fish species. We note that the NJDEP survey data show that federally managed bluefish are present in the project area. This indicates that both the prey species and the predator are present in the Delaware River in and around the project area. Juvenile Alosa species have all been identified as prey species for windowpane (*Scophthalmus aquosus*) and summer flounder (*Paralichthys dentatus*) in Steimle et al. (2000). Windowpane and summer flounder are federally managed species whose EFH has been designated in the mixing zone of the Delaware River

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Native eastern oysters (*Crassostrea virginica*) are an ecologically important species. According to the NJDEP, an expansive area of oyster habitat has been identified near the SHCNGS. In recent years, efforts have been made to restore oyster beds in Delaware Bay. Since 2004, the Army Corps of Engineers has worked with the States of New Jersey and Delaware to plant shell in portions of natural oyster beds in Delaware Bay (http://www.delawareestuary.org/science_projects_oyster_restoration.asp).

Blue crab (*Callinectes sapidus*) can also be found in the vicinity of the SHCNGS. The crabs can generally be found in the lower salinity areas of the estuary in the summer and higher salinities in the winter. Following mating in the summer, which typically occurs in lower salinity waters, the

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females move to high salinity waters found in the Delaware Bay to spawn. After spawning, the larvae move toward the lower salinity areas in the Delaware River Estuary to mature.

Other Comments from NMFS Habitat Conservation Division
The construction of the new intake structure and the new barge unloading facility and mooring area will result in the deepening of the existing river bottom (10ft. MLLW) by an average of 4.5 ft. over an area of 31 acres (volume of 150,000 cubic yards), and an area of 61 acres, (a volume of 440,000 cubic yards), respectively. The total area to be dredged is 92 acres extending riverward 1700 ft. from the shoreline. Dredging techniques may include both mechanical and hydraulic dredging methods and the material removed as part of this construction activity will be transported to and placed in an on-site or other approved upland disposal facility.

Increases in turbidity through the resuspension of sediments into the water column from dredging and port operations will degrade water quality, lower dissolved oxygen levels, and potentially release chemical contaminants bound to the fine-grained estuarine/marine sediments. Sedimentation and wave patterns in the area may be altered as a result of vessels entering and exiting the proposed mooring area also resulting in increased turbidity. Suspended sediments mask pheromones used by migratory fishes, and can smother immobile benthic organisms and demersal newly-settle juvenile fish (Auld and Schubel 1978; Breitburg 1988; Newcombe and MacDonald 1991; Burton 1993; Nelson and Wheeler 1997). As supported above, the project area provides important habitat for striped bass including valuable spawning grounds and nursery habitat. Increases in turbidity will adversely affect striped bass larvae's ability to capture prey (Fay et al. 1983 in Able and Fahay 1998). The decrease in water circulation can also adversely affect striped bass survival as strong current is needed to keep the eggs suspended in the water column and prevent them from being smothered by silt (Bigelow and Schroeder 1953).

Guidelines under Section 404(b)(l) of the federal Clean Water Act require that actions proposed within "waters of the United States," especially those that are not water-dependent, are required to demonstrate that they have considered all appropriate reasonable and prudent measures to avoid and minimize impacts to waters. If all measures to avoid and minimize wetland impacts have been considered and employed to the extent practicable and result in unavoidable impacts, a compensatory mitigation plan should be developed and implemented.

The applicant should undertake a complete analysis of alternatives that complies fully with the Section 404 (b)(1) Guidelines that documents avoidance, minimization and mitigation for all impacts. Alternate locations as well as a documentation of purpose and need should be provided as part of this analysis. For any unavoidable impacts, a compensatory mitigation plan to offset all of the projects impacts to aquatic resources including EFH should be developed in accordance with the federal standards and criteria for compensatory mitigation for losses of aquatic resources published in the Federal Register on April 10, 2008 (vol. 73 No. 70). This plan should be developed as early in the permit process as possible and in consultation with the applicable federal, state and local resource agencies and will be implemented on and in the immediate area of the PSEG Site to the extent practicable.

In the State of NJ, coastal wetlands are regulated by the state under the Wetlands Act of 1970. Development in coastal wetlands requires authorization of permits from the NJDEP, and requires

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separate processes to determine a project's value. However, such processes usually fit in within a federal process.

After reasonable measures have been explored to avoid and minimize impacts to wetlands, PSEG will compensate for unavoidable adverse impacts to wetlands by implementing approved wetland restoration and/or rehabilitation measures. PSEG, through their Ecosystem Enhancement Program, has extensive experience and demonstrated success implementing coastal saltmarsh and freshwater wetland restoration and rehabilitation programs. This familiarity with local wetland systems was used to identify appropriate candidate mitigation sites and will be used in developing and implementing the final approved mitigation plan.

Mitigation measures mentioned in the ESP to offset impacts to NOAA trust resources include the following considerations:

- Minimization of encroachment on coastal wetlands
- Use of previously developed sediment disposal basins for plant development (both PSEG's permitted disposal facility and the USACE's CDF)
- Refinement of the Site Utilization Plan to avoid various wetland areas throughout the PSEG Site

Opportunities for mitigating unavoidable impacts to wetland ecosystems include restoration of natural habitats temporarily disturbed by construction, creation of new habitat types in previously disturbed areas, and enhancement of undisturbed natural habitats.

In general, we do not accept the conversion of one type of aquatic habitat into another habitat as compensatory mitigation when the existing habitat has value to aquatic life. Candidate mitigation areas include portions of the existing PSEG Site, Mannington Meadow, Mason's Point, and additional areas of the PSEG Alloway Creek Watershed restoration site.

Conclusions

My staff looks forward to working with PSEG as you move forward with the ESP process. Should you have any questions regarding this correspondence or would like to arrange a meeting to discuss the effects of the proposed action on NMFS trust resources, please contact Julie Crocker in the Protected Resources Division ((978)282-8480 or Julie.Crocker@noaa.gov) and Karen Greene in the Habitat Conservation Division ((732)872-3023 or Karen.Greene@noaa.gov).

Sincerely,

Mary A. Colligan
Assistant Regional Administrator for
Protected Resources

EC: Crocker, F/NER3

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Greene, F/NER4

File Code: Sec 7 NRC PSEG Early Site Permit Artificial Island

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F.3.1. National Marine Fisheries Service Biological Assessment

Biological Assessment

National Marine Fisheries Service

PSEG Site
Early Site Permit Application

U.S. Nuclear Regulatory Commission Early Site Permit Application
Docket Number 52-043

Salem County, New Jersey

June 2014

U.S. Nuclear Regulatory Commission
Rockville, Maryland

U.S. Army Corps of Engineers
Philadelphia District

Table of Contents

List of Figures....ii
List of Tables....ii
Abbreviations/Acronyms....iii
1.0 Introduction 1
2.0 Description of Proposed Action 3
2.1 Site Location and Description.... 3
2.2 Dredging and In-Water Installation Activities 8
2.3 Cooling Water System Description and Operation.... 10
3.0 Federally Listed Species Considered 20
3.1 Loggerhead Sea Turtle.... 20
3.2 Green Sea Turtle.... 21
3.3 Hawksbill Sea Turtle 23
3.4 Kemp's Ridley Sea Turtle.... 24
3.5 Leatherback Sea Turtle 25
3.6 Shortnose Sturgeon 26
3.7 Atlantic Sturgeon.... 28
4.0 Proposed Action Effects Analysis 29
4.1 Dredging and In-Water Building 29
4.2 Impingement 29
4.3 Entrainment.... 30
4.4 Discharge Impacts 30
4.5 Maintenance Dredging 30
4.6 Barge Traffic 31
5.0 Cumulative Effects Analysis 31
5.1 Continued Operation of the SGS Once-Through Cooling System 32
5.2 Continued Operation of the HCGS Closed-Cycle Cooling System 32
5.3 SGS and HCGS Effects on Protected Species.... 33
5.4 Commercial and Recreational Harvest of Fish and Shellfish 35
5.5 Habitat Loss and Restoration 36
5.6 Climate Change 37
5.7 Summary of Cumulative Effects 38
6.0 Conclusion and Determination of Effects.... 38
7.0 References.... 40

List of Figures

Figure 1. Location of the PSEG Site Within 6-Mile and 50-Mile Radius. 4
Figure 2. PSEG Site with Nearby Water Bodies and Proposed Causeway. 5
Figure 3. PSEG Site Utilization Plan. 6
Figure 4. Predicted PSEG Thermal Plume in Relation to HCGS HDA and SGS Plume Boundary Under Flood Tide Conditions. 19

List of Tables

Table 1. Endangered (E) or Threatened (T) Species under the Jurisdiction of NMFS in the Vicinity of the PSEG Site 2
Table 2. Impingement Rate for Most Abundant Species and Total Finfish Species Impinged at SGS and HCGS 12
Table 3. SGS and HCGS Incidental Take Statement Limits 34
Table 4. SGS Incidental Takes of Sea Turtle Species and Sturgeon Species Between 2000 and 2013 35

Abbreviations/Acronyms

°C	degrees Celsius
°F	degrees Fahrenheit
ac	acre(s)
BMPs	best management practices
CDF	confined disposal facility
CFR	*Code of Federal Regulations*
cfs	cubic feet per second
cm	centimeter(s)
COL	combined construction permit and operating license
CP	construction permit
DPS	distinct population segment(s)
DRBC	Delaware River Basin Commission
EEP	Estuary Enhancement Program
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act of 1973, as amended
ESP	early site permit
fps	feet per second
ft	foot (feet)
FWS	U.S. Fish and Wildlife Service
gpm	gallon(s) per minute
HCGS	Hope Creek Generating Station
HDA	heat dissipation area
in.	inch(es)
kg	kilogram(s)
km	kilometer(s)
lb	pound(s)
m	meter(s)
m^3	cubic meter(s)
mi	mile(s)
NJDEP	New Jersey Department of Environmental Protection
NJPDES	New Jersey Pollutant Discharge Elimination System
NMFS	National Marine Fisheries Service

NOAA	National Oceanic and Atmospheric Administration
NRC	U.S. Nuclear Regulatory Commission
OL	operating license
ppt	parts per thousand
PSEG	PSEG Power, LLC, and PSEG Nuclear, LLC
RKM	River Kilometer
RM	River Mile
SGS	Salem Generating Station, Units 1 and 2
SWPPP	stormwater pollution prevention plan
USACE	U.S. Army Corps of Engineers
WMA	Wildlife Management Area
yd^3	cubic yard(s)

Biological Assessment of the Potential Effects on Federally Listed Endangered or Threatened Species from the Proposed Early Site Permit for the PSEG Site

1.0 Introduction

The U.S. Nuclear Regulatory Commission (NRC) review team is reviewing an application submitted by PSEG Power, LLC, and PSEG Nuclear, LLC (PSEG) for an early site permit (ESP) for a site located adjacent to the existing Hope Creek Generating Station (HCGS) and Salem Generating Station (SGS), Units 1 and 2, on the eastern shore of the Delaware River Estuary in Lower Alloways Creek Township, Salem County, New Jersey. As part of its review of the ESP application, the NRC is preparing an environmental impact statement (EIS) as required by Title 10 of the *Code of Federal Regulations* (CFR) Part 51, the NRC regulations that implement the National Environmental Policy Act of 1969, as amended. The EIS includes an analysis of pertinent environmental issues, including endangered and threatened species and impacts to fish and wildlife. The U.S. Army Corps of Engineers (USACE), Philadelphia District, is a cooperating agency on the EIS.

An ESP is NRC approval of a site or sites for one or more nuclear power facilities. Issuance of an ESP is a process that is separate from the issuance of a construction permit (CP), an operating license (OL), or a combined construction permit and operating license (COL) for such a facility. The ESP application and review process makes it possible to evaluate and resolve safety and environmental issues related to siting before the applicant makes a large commitment of resources. If the ESP is approved, the applicant can “bank” the site for up to 20 years for future reactor siting and can conduct certain site preparation and preliminary construction activities enumerated in 10 CFR 50.10(e)(1) (10 CFR 50-TN249). An ESP does not, however, authorize construction and operation of a nuclear power plant. To construct and operate a nuclear power plant, an ESP holder must obtain a CP and an OL, or a COL, which are separate major Federal actions that require their own environmental reviews in accordance with 10 CFR Part 51 (10 CFR 51-TN250). An applicant for a CP or COL for a new nuclear plant to be located at a site for which an ESP has been issued may reference the ESP, and matters resolved in the ESP proceeding are considered resolved in any subsequent proceeding absent the identification of new and significant information.

Upon issuance of the draft EIS, PSEG plans to submit a Federal and a State application to the USACE and the New Jersey Department of Environmental Protection (NJDEP) for the Alteration of Any Floodplains, Waterways, or Tidal or Nontidal Wetlands in New Jersey. The USACE application number, the NJDEP Tidal Application number, and the NJDEP Nontidal Application number all will be included in the final EIS. The final EIS will be issued after considering public comments on the draft EIS.

The proposed actions related to the PSEG application are (1) NRC issuance of an ESP for the PSEG Site (10 CFR 52-TN251) and (2) USACE permit action on a Department of the Army permit application pursuant to Section 404 of the Federal Water Pollution Control Act (Clean Water Act; 33 USC 1251-TN662) and Section 10 of the Rivers and Harbors Appropriation Act of 1899 (33 USC 403-TN660). The U.S. Environmental Protection Agency (EPA) has the authority to review and veto USACE decisions on

Section 404 permits. The USACE is participating as a cooperating agency with the NRC in preparing the EIS and participates collaboratively on the review team. The NRC and USACE have prepared this biological assessment to support their joint consultation with the National Marine Fisheries Service (NMFS) in accordance with Section 7(c) of the Endangered Species Act of 1973, as amended (ESA) (16 USC 1531-TN1010). The USACE permit decision will be made following issuance of the final EIS.

By letter dated October 26, 2010 (NRC 2010-TN2203), the NRC initiated Endangered Species Act Section 7 consultation with NMFS and requested a list of endangered, threatened, candidate, and proposed species as well as designated and proposed critical habitat that may be in the vicinity of the PSEG Site. NMFS provided the requested information for marine species by letter dated December 9, 2010 (NMFS 2010-TN2171). An update for endangered, threatened, candidate, and proposed species was requested on July 31, 2013 (NRC 2013-TN2805). NMFS provided updated information by letter dated October 25, 2013 (NMFS 2013-TN2804). Based on this correspondence and review of electronic sources from NMFS and the states of Delaware and New Jersey, two fish and five sea turtle species were identified that occur, or have the potential to be present, in the site vicinity and are listed as either Federally endangered or threatened; they are listed in Table 1.

Table 1. Endangered (E) or Threatened (T) Species under the Jurisdiction of NMFS in the Vicinity of the PSEG Site.

Species Name	Common Name	ESA Status
Reptiles		
Caretta caretta	Loggerhead sea turtle	T
Chelonia mydas	Atlantic green sea turtle	T
Eretmochelys imbricata	Hawksbill sea turtle	E
Dermochelys coriacea	Leatherback sea turtle	E
Lepidochelys kempii	Kemp's ridley sea turtle	E
Fish		
Acipenser brevirostrum	Shortnose Sturgeon	E
Acipenser oxyrinchus oxyrinchus	Atlantic Sturgeon	E

Source: NMFS 2013-TN2614.

Accordingly, this biological assessment focuses on evaluating the potential effects from building and operating a new nuclear plant at the PSEG Site, adjacent to SGS and HCGS, on the Federally listed species under NMFS's jurisdiction that occur in the Delaware River Estuary.

2.0 Description of Proposed Action

PSEG is seeking an ESP for a new nuclear power plant at a site (the PSEG Site) located adjacent to the existing HCGS and SGS. Building activities that could directly affect onsite and offsite aquatic ecosystems include site preparation for installation of plant structures and cooling towers, switchyards, temporary laydown area, improvements to the HCGS barge slip, building the barge storage area and unloading facility, installing the cooling water system intake and discharge structures, and building the proposed 5-mi causeway.

2.1 Site Location and Description

The PSEG Site is located on the southern part of Artificial Island in Lower Alloways Creek Township, Salem County, New Jersey. Artificial Island was formed from dredge spoils produced as a result of maintenance dredging of the Delaware River navigation channel by the USACE. The site is approximately 7 mi east of Middletown, Delaware; 7.5 mi southwest of Salem, New Jersey; and 9 mi south of Pennsville, New Jersey (PSEG 2014-TN3452). Figure 1 shows the location of the PSEG Site and the areas within a 6-mi (10-km) radius and 50-mi (80-km) radius of the facility.

The PSEG Site is located adjacent to HCGS and SGS on the northwestern portion of the existing PSEG property. Figure 2 depicts the PSEG Site in relation to the existing units and nearby water bodies. PSEG owns 734 ac of the PSEG Site and is developing an agreement with the USACE to acquire 85 ac immediately north of the site. Thus, the total PSEG Site would encompass 819 ac. Figure 3 provides aerial plan view of the proposed site layout for a new nuclear power plant at the PSEG Site.

The region within 15 mi (24 km) of the site is used primarily for agriculture. The area also includes numerous parks, wildlife refuges, and preserves such as Mad Horse Creek Wildlife Management Area (WMA) to the east; Cedar Swamp State WMA to the south in Delaware; Appoquinimink, Silver Run, and Augustine State WMAs to the west in Delaware; and Supawna Meadows National Wildlife Refuge to the north (PSEG 2014-TN3452).

Delaware River Estuary

The Delaware River and Delaware Bay are a part of the larger Delaware Estuary and River Basin that extends from headwaters in New York to the coastal plains near Cape Henlopen in Delaware (PDE 2012-TN2191). The Delaware Bay extends from the confluence of the Delaware River with the Atlantic Ocean from Delaware River Mile (RM) 0 to RM 54 (River Kilometer [RKM] 0 to RKM 86.9). The Delaware River Estuary includes the Delaware Bay and extends up the tidal Delaware River, which is characterized by brackish water between Delaware RM 54 and RM 80 (RKM 86.9 and RKM 128.8) and becomes freshwater at Delaware RM 80 (BBL and Integral 2007-TN2126). The PSEG Site near the mouth of Alloway Creek is at Delaware RM 52 (DRBC 2011-TN2412) and is considered to be in the lower estuary watershed unit of the Delaware River Estuary (PDE 2012-TN2191).

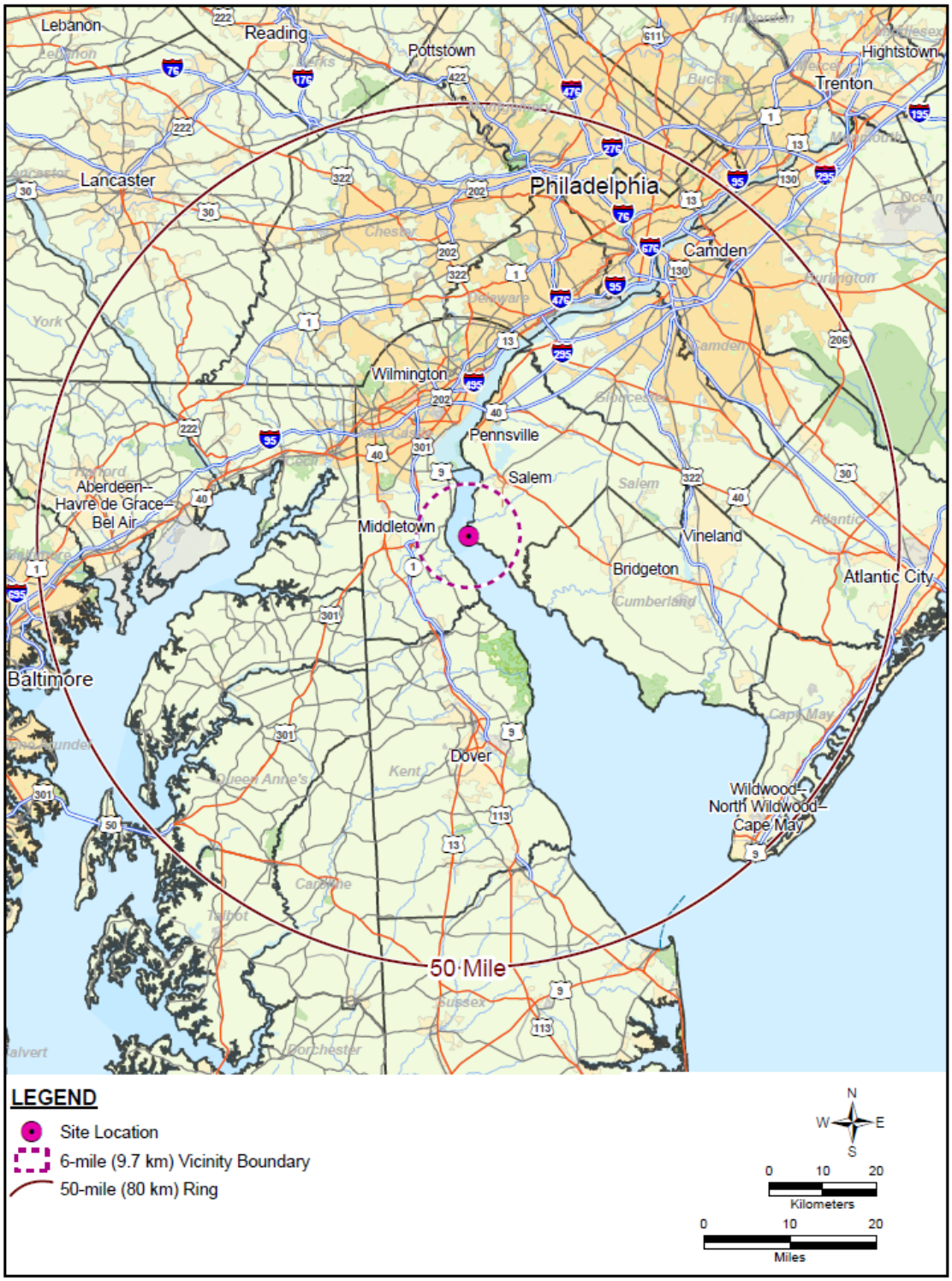

Figure 1. Location of the PSEG Site Within 6-Mile and 50-Mile Radius
(Source: Modified from PSEG 2014-TN3452).

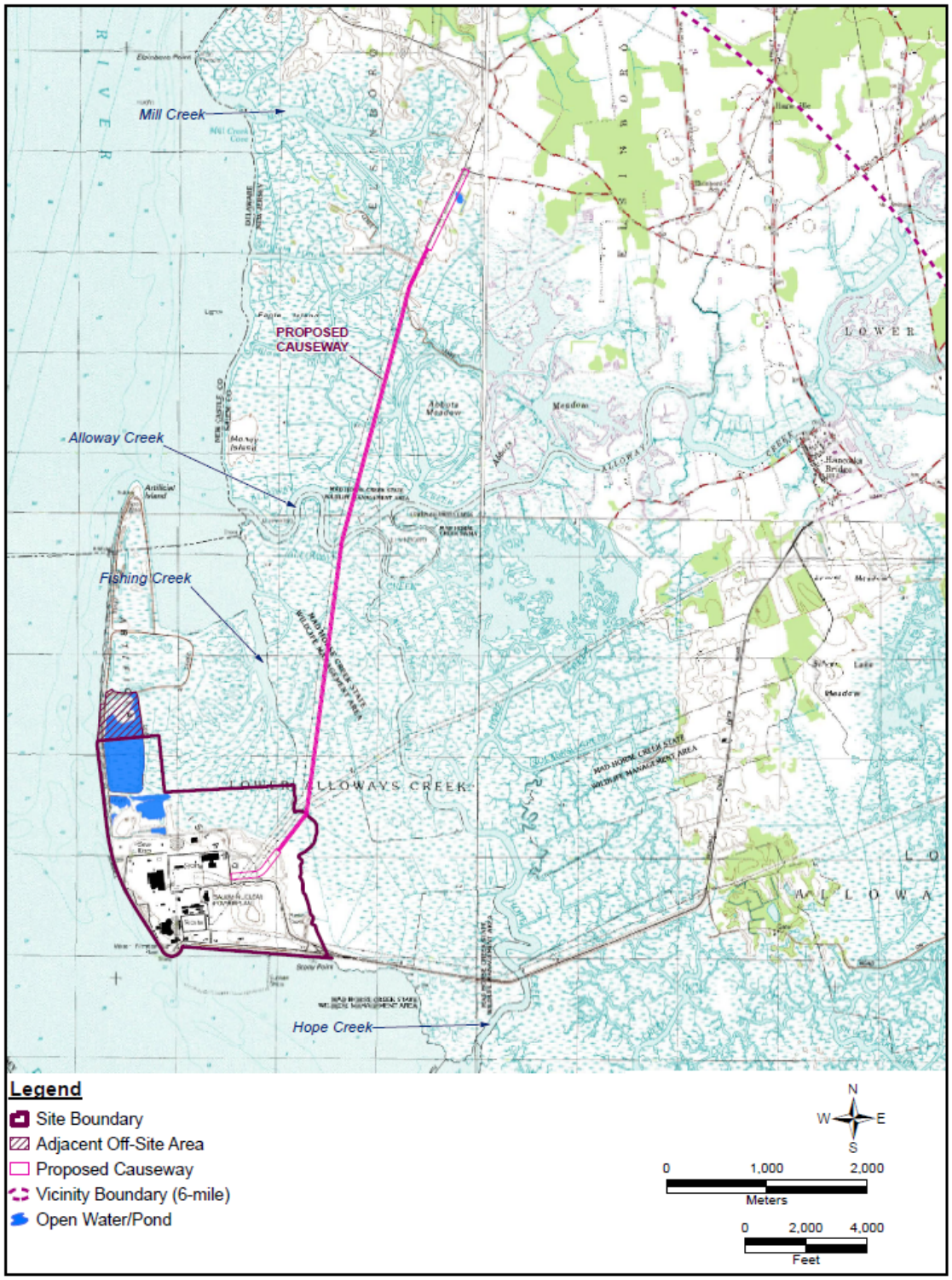

Figure 2. PSEG Site with Nearby Water Bodies and Proposed Causeway
(Source: Modified from PSEG 2014-TN3452).

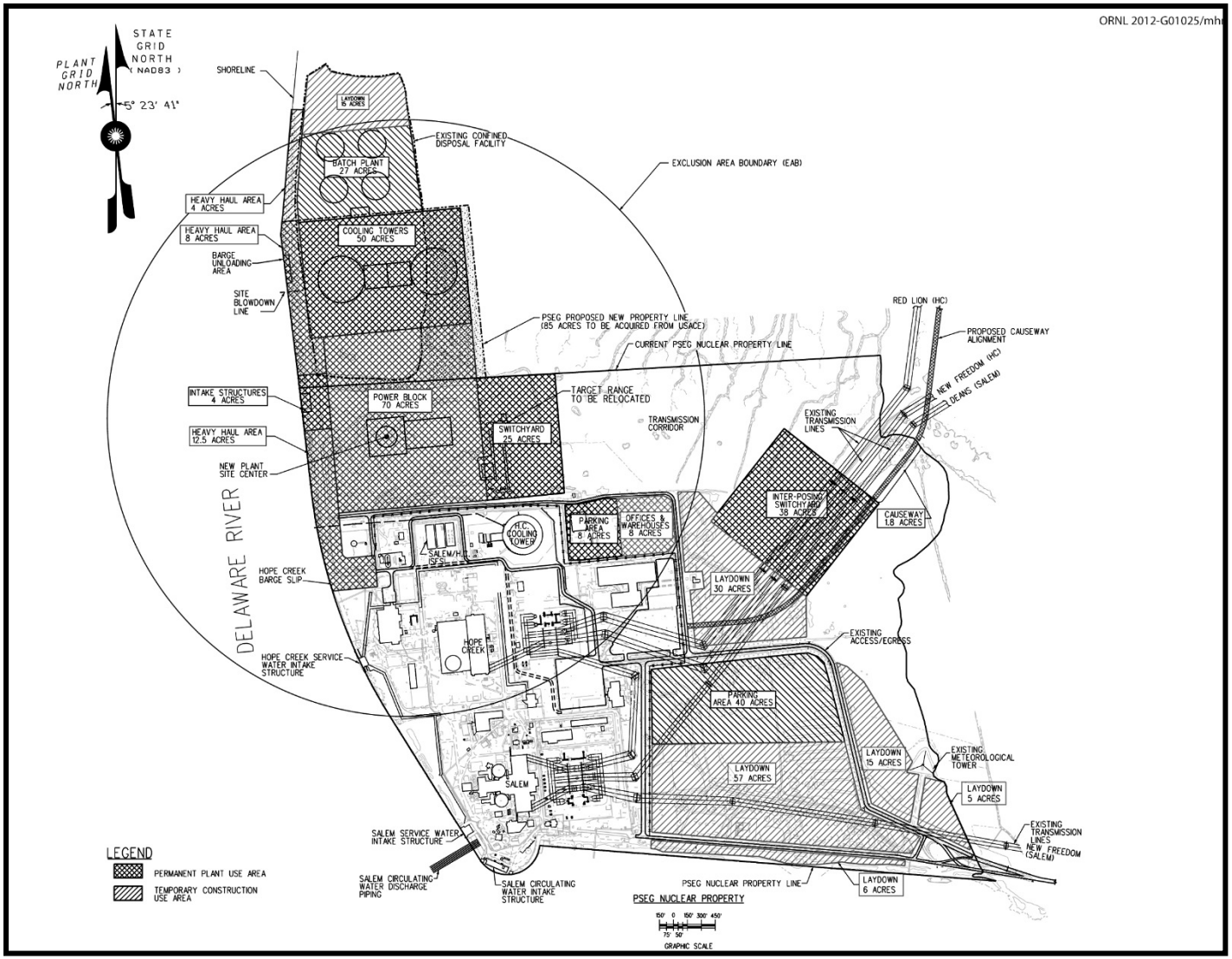

Figure 3. PSEG Site Utilization Plan *(Source: PSEG 2012-TN1489).*

Characterization of the region dates back to pre-Revolutionary War times when shipping and trading at developing ports from the mouth of the Delaware River Estuary to inland Delaware, Pennsylvania, and New Jersey increased use of the watershed (Berger et al. 1994-TN2127). Increasing urbanization and industrialization of the region from 1840 to present day have significantly contributed to the degradation of the watershed with habitat alteration, water diversion, and increased pollution of the Delaware Estuary and River Basin ecosystems because no environmental policies were established until the 1960s and later (Berger et al. 1994-TN2127).

According to the most recent status report on the Delaware Estuary and River Basin, the region continues to see some decline in environmental health indicators such as removal of estuary sediments and increases in nitrogen and contaminant levels. However, environmental conditions such as technology implementation to increase fish passage and restoration of targeted aquatic habitats have improved the aquatic ecology for the watershed (PDE 2012-TN2191). The Delaware River Basin Commission (DRBC) stated in the State of the Delaware River Basin report for 2013 that increases in temperature and salinity are expected with future sea level rise and climate change (DRBC 2013-TN2609). These potential changes are likely to result in movement of populations of more marine and euryhaline species further up the Delaware River Estuary.

The boundary of salinity intrusion in the Delaware River Estuary, also known as the salt line, fluctuates with flow changes. The salt line moves in response to the tides and variations in Delaware River Estuary freshwater discharge. During most of the year, the salt line is located between the Commodore Barry Bridge at Delaware RM 82 (RKM 132) and Reedy Island at Delaware RM 54 (RKM 86.9) (DRBC 2008-TN2277). During the drought of record in the 1960s, the salt line moved to its most upstream historically observed location at Delaware RM 102 (DRBC 2008-TN2277). Salinity is an important determinant of biotic distribution in estuaries, and salinity near the PSEG Site varies with river flow. Salinity measurements taken over a number of years between RM 51 and RM 49 report a minimum salinity of 0.1 parts per thousand (ppt) and a maximum of 17.9 ppt (PSEG 2014-TN3452).

At the PSEG Site on Artificial Island, the estuary is tidal with a net flow to the south. The USACE maintains a dredged navigation channel near the center of the estuary about 6,600 ft (2,000 m) west of the shoreline of the PSEG Site. The navigation channel is about 40 ft (12 m) deep and 1,300 ft (400 m) wide; however, starting in 2010, the USACE began implementing the Delaware River Main Channel Deepening Project to deepen the existing navigation channel from 40 to 45 ft (USACE 2011-TN2262). On the New Jersey side of the channel, water depths in the open estuary at mean low water are fairly uniform at about 20 ft (6 m). Predominant tides in the area are semi-diurnal, with a period of approximately 12 hours and a mean tidal range of 5.3 ft (1.6 m) at RM 52 (PSEG 2014-TN3452).

The biological communities of the Delaware River Estuary in the area of the PSEG Site are typical of those that exist all along the main reaches of the Delaware Bay system. To mitigate egg and larval fish loss through the cooling system for SGS, PSEG proposed and established an estuary enhancement program (EEP) to restore salt marshes and provide monitoring and other structural enhancements to mitigate losses of aquatic species through impingement and entrainment at SGS (Balletto and Teal 2011-TN2612).

The PSEG EEP was established in 1995 as part of New Jersey Pollutant Discharge Elimination System (NJPDES) requirements for SGS and includes an ongoing biological monitoring program in addition to habitat restoration to track the success of the

mitigation actions. Because of the biological monitoring surveys that have been conducted in this area of the Delaware River Estuary since the mid-1980s in support of environmental requirements for the construction and operation of SGS and HCGS, an extensive long-term data set exists on the fishery and benthic macroinvertebrate communities of this area.

Submerged aquatic vegetation has not historically been observed in the Delaware River Estuary primarily because of the high levels of turbidity (Miller et al. 2012-TN2686), and there is little to no submerged aquatic vegetation observed in the sampling areas near the PSEG Site (PSEG 2014-TN3452). Phytoplankton and zooplankton studies between 1973 and 1976 identified over 100 genera of phytoplankton in the area of the site, with three diatom taxa dominating the phytoplankton community: *Skeletonema costatum*, *Melosira* spp., and *Chaetoceros* spp. (IAI 1980-TN2608). The primary production contributed by the phytoplankton community is highest during the warmer months and lowest during the winter. Because estuarine systems are typically characterized by a shallow euphotic zone and high turbidity, contribution of organic carbon to the base of the food web by phytoplankton production is relatively small compared to that supplied by organic detritus and other primary producers such as benthic algae, periphyton, and submergent and emergent macrophytes (IAI 1980-TN2608). Surveys of zooplankton communities in the Delaware River Estuary near the site have identified over 100 taxa of microzooplankton (IAI 1980-TN2608). Dominant taxa consisted of rotifers and copepods (largely nauplii). Macroinvertebrate plankton samples were composed of 46 taxa (32 arthropods), with the dominant groups being amphipods *Gammarus* spp., the mysid shrimp *Neomysis americana*, larvae of the crabs *Rhithropanopeus harrisii* and *Uca minax*, and the isopod *Chiridotea almyra*. Seasonal variations in total density of zooplankton were not as consistent as that observed for the phytoplankton community and were generally related to short-lived differential abundances of a few dominant taxa (IAI 1980-TN2608).

The Delaware River Estuary is a complex ecosystem with many species playing different roles throughout their lifecycles. Major assemblages of organisms within the estuarine community include plankton, benthic invertebrates, and fish. Detailed descriptions of these assemblages can be found in Section 2.4.2.3 of the EIS for a new nuclear power plant at the PSEG Site.

2.2 Dredging and In-Water Installation Activities

Before initiating any site preparation or development activities, PSEG would be required to obtain the appropriate authorizations regulating alterations to waters of the United States, including ponds and creeks. Building activities that could directly affect onsite and offsite aquatic ecosystems include site preparation for installing plant structures and cooling towers, switchyards, and the temporary laydown area; making improvements to the HCGS barge slip; building the barge storage area and unloading facility; installing the cooling water system intake and discharge structures; and building the proposed causeway. Aquatic habitats potentially affected include the onsite artificial ponds and small marsh creeks, habitats associated with the Delaware River Estuary, and the interconnected system of tidal wetlands and marsh creeks primarily north of the PSEG Site. Potential direct impacts on aquatic resources as a result of building activities would involve physical alteration of habitat (e.g., infilling, cofferdam placement, dredging, pile driving) including temporary or permanent removal of associated benthic organisms, sedimentation, changes in hydrological regimes, and changes in water quality. Potential indirect impacts include increased

runoff from impervious surfaces and subsequent erosion, as well as sedimentation and isolation of marsh creek segments due to infilling (PSEG 2014-TN3452).

Installation activities with the potential to affect the aquatic resources of the Delaware River Estuary include improvements to and use of the existing HCGS barge slip, a new barge storage area and unloading facility, an adjacent heavy haul road, the intake and discharge structures along the eastern shore of the Delaware River Estuary (Figure 3), and installation of a causeway extending from a new plant at the PSEG Site to the north (Figure 2). Shoreline installation and site preparation activities would require a stormwater pollution prevention plan (SWPPP), developed as part of the NJPDES stormwater permit, which would describe best management practices (BMPs) to control sedimentation and erosion and provide stormwater management. Shoreline structures would be hardened to protect from shoreline erosion using placement of concrete or riprap (PSEG 2014-TN3452).

Improvements to the HCGS barge slip would include deepening the existing barge slip by another 2 ft to accommodate equipment-carrying barges (Cook 2009-TN2713). An estimated 1,350 yd^3 of dredged material would be removed within the existing HCGS barge slip to allow for additional clearance of barges carrying equipment that can be delivered to the PSEG Site. If the final plant designs indicate modules larger than 54 ft in width are required, the existing 60 ft-wide HCGS barge slip may be widened an additional 20 ft along the south side of the barge slip and dredged an additional 2 ft below current barge slip depth. A double row of sheet piling would need to be placed before removal of excess earth by dredging. An estimated 5,800 yd^3 of material would be removed, and the existing riprap at the front end of the slip would be removed and then replaced at the widened river end of the slip (Cook 2009-TN2713).

The new barge storage area and unloading facility would require dredging about 440,000 yd^3 of sediment to lower the river bottom by 4.5 ft over 61 ac (PSEG 2014-TN3452). An additional 0.05 ac of river bottom habitat would be removed for installation of seven 20-ft-diameter barge mooring caissons. Installation of a new intake structure would require dredging of about 150,000 yd^3 of sediment to lower the river bottom by 4.5 ft over 31 ac (PSEG 2014-TN3452). Dredging would also be required for installation of a new discharge structure; however, specific details on the amount of material to be dredged for discharge structure placement likely would depend on final design and placement criteria. Dredged material disposal would be either on the site or in another approved upland disposal facility (PSEG 2014-TN3452).

The installation of the barge storage and unloading facilities as well as the intake and discharge structures would result in temporary disturbances to the aquatic habitat in those portions of the Delaware River Estuary. An increase in suspended sediments could occur during dredging activities; however, PSEG would comply with NJDEP and USACE permitting regulations regarding type of dredge used, timing and duration of dredging, and appropriate BMPs to minimize sedimentation effects as required for Federal and State permitting. Motile invertebrates, fish, and sea turtles might swim into this portion of the Delaware River Estuary, but they would be able to swim away or likely would avoid the area because of vibratory noise from pile-driving activities. Mobile macroinvertebrates in this area might be able to occupy adjacent habitat in the Delaware River Estuary as the species composition and abundance of the macroinvertebrate community in the Delaware River Estuary near the site are similar to those of benthic communities in adjacent benthic areas of southern portion of the Delaware River Estuary. Although permanent alteration of at least 92 ac of river bottom habitat would occur, the impacts to aquatic communities in the vicinity are expected to be minimal.

Offsite, an estimated 2,123 linear ft of marsh creek channels would be crossed by the proposed causeway (PSEG 2014-TN3452). Installation of the elevated causeway would require permanent pier placement for support structures. However, PSEG plans to avoid placement in stream channels (PSEG 2014-TN3452). Runoff from disturbed areas would be temporary and controlled through the use of BMPs required for water quality in compliance with Federal and New Jersey permitting, and runoff is not expected to adversely affect Delaware River Estuary surface waters (PSEG 2014-TN3452).

Vessel use during the dredging or installation of the in-water structures and transportation of large system components to the PSEG Site may affect the aquatic resources of the Delaware River Estuary, particularly the benthos. The main impacts of using vessels would include turbulence from propellers (prop wash) and accidental spills of materials overboard. Vessels would be used during installation of the cooling-water discharge pipeline and during offloading of materials from barges (PSEG 2014-TN3452). Vessel operation during building or operation activities may cause short-term, localized impacts on aquatic species in the Delaware River Estuary. These impacts should not affect the general resources in the area of the PSEG Site or the region along this coast of the Delaware River Estuary.

2.3 Cooling Water System Description and Operation

All cooling water for the operation of a new nuclear power plant at the PSEG Site would be withdrawn from the Delaware River Estuary, and impacts associated with operation of the water intake system would be limited to aquatic resources within the Delaware River Estuary. For aquatic resources, the primary concerns are related to the amount of water withdrawn and the amount of water consumed through evaporation and the potential for organisms to be impinged on the intake screens or entrained into the cooling water system. Impingement occurs when aquatic organisms are drawn into the cooling water intake and are trapped against the intake screens by the force of the water passing through the cooling water intake structure (66 FR 65256-TN243). Impingement can result in starvation, exhaustion, asphyxiation, descaling of fish, and other physical injuries (66 FR 65256-TN243). Entrainment occurs when aquatic organisms drawn into the intake structure are small enough to pass through the intake screens and the cooling system. Entrained organisms are usually passively drifting forms (plankton) or small, weakly swimming early life stages of fish and shellfish (66 FR 65256-TN243). As entrained organisms pass through the cooling system for a new nuclear power plant at the PSEG Site, they would be subjected to mechanical, thermal, pressure, and chemical stresses.

A number of factors, such as the type of cooling system, the design and location of the intake structure, and the amount of water withdrawn from the source water body greatly influence the degree to which impingement and entrainment affect aquatic biota. Impingement and entrainment impacts are regulated by EPA or its designees (in this case, the NJDEP) under 316(b) of the Clean Water Act (33 USC 1251-TN662). Section 316(b) “requires that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact.” A new nuclear power plant at the PSEG Site would employ closed-cycle cooling. Depending on the quality of the makeup water, closed-cycle, recirculating cooling-water systems can reduce water use by 96 to 98 percent of the amount that the facility would use if it employed a once-through cooling system (66 FR 65256-TN243). This significant reduction in the water withdrawal rate results in a corresponding reduction in impingement and entrainment losses.

The intake design through-screen velocity is another factor that greatly influences the rate of impingement of fish and shellfish at a facility. In general, the higher the through-screen velocity, the greater the number of fish impinged. The EPA has established a national standard for the maximum design through-screen velocity of no more than 0.5 feet per second (fps) (66 FR 65256-TN243). The EPA determined that species and life stages evaluated in various studies could endure a velocity of 1.0 fps; they then applied a safety factor of 2 to drive the threshold of 0.5 fps. PSEG has stated that the proposed intake structure would be located flush with the east shoreline of the Delaware River Estuary and would be designed to have a through-screen velocity of less than 0.5 fps (PSEG 2014-TN3452). The resulting low through-screen velocity would reduce the probability of impingement because most fish can swim against such low flows to avoid the intake screens. The fish protection system, including the traveling screens and fish return, would be designed and operated to comply with the NJPDES permit that would be issued for the cooling system (PSEG 2014-TN3452).

Another factor affecting impingement and entrainment losses is the percentage of the flow of the source water body past the site that is withdrawn by the station. To minimize impacts, the EPA determined that for estuaries or tidal rivers, intake flow must be less than or equal to one percent of the tidal excursion (one tidal cycle of flood and ebb) volume (66 FR 65256-TN243). Makeup water for the cooling system would be drawn from the Delaware River Estuary at an average rate of 78,196 gallons per minute (gpm) (174 cubic feet per second [cfs]), with consumptive use at a rate of 26,420 gpm (59 cfs) (PSEG 2014-TN3452). Tidal flows near the PSEG Site average 400,000 to 472,000 cfs, and the freshwater flow from the Delaware River and its tributaries averages 20,240 cfs. Therefore, the makeup water use rate is less than 0.05 percent of the average flow of the Delaware River Estuary near the PSEG Site (PSEG 2014-TN3452).

Impingement

Because of its location on the Delaware River Estuary, a new nuclear power plant at the PSEG Site would impinge a variety of freshwater and marine fish and shellfish. Data from the impingement studies for SGS (once-through cooling) indicate that 50 to 67 finfish species are impinged each year compared to just under 50 species of finfish impinged at HCGS (closed-cycle cooling) between 1986 and 1987. However, the number of sampling events differed dramatically between the two plants with only 46 to 48 sampling events at HCGS over the same years (1986–87) as the more than 530 sampling events per year at SGS (VJSA 1988-TN2564; ECS 1989-TN2572). The species composition in the screen samples also varied between SGS and HCGS during the 1986 to 1987 sampling and varied at SGS between the sampling dates in the 1980s and sampling dates since 2003. Table 2 compares important, most abundant, and total finfish species, as well as blue crab (*Callinectes sapidus*) impinged at SGS and HCGS between 1986 and 1987 and at SGS between 2003 and 2010.

Table 2. Impingement Rate for Important, Most Abundant, and Total Finfish Species and Blue Crab Impinged at SGS and HCGS

		Impingement Rate (number of individuals/10^6 m^3)		
Common Name	**Scientific Name**	**SGS (1986–87)[a]**	**HCGS (1986–87)[a]**	**SGS (2003–10)[b]**
American Eel	*Anguilla rostrata*	7.6	13.4	4.1
Blueback Herring	*Alosa aestivalis*	49.1	5.0[d]	37.2
Alewife	*Alosa pseudoharengus*	7.6	1.1[d]	8.14
Bay Anchovy	*Anchoa mitchilli*	601.9	521.5	115.4[d]
Atlantic Menhaden	*Brevoortia tyrannus*	31.0	3.7[d]	28.9
Atlantic Silverside	*Menidia menidia*	18.6	15.1	46.7[c]
White Perch	*Morone americana*	359.3	27.9[e]	1,066.4[c]
Striped Bass	*Morone saxatilis*	5.3	0.7[d]	78.8[e]
Weakfish	*Cynoscion regalis*	585.4	143.0[c]	486.4
Spot	*Leiostomus xanthurus*	13.8	2.1[d]	16.6
Atlantic Croaker	*Micropogonias undulatus*	109.8	965.4[d]	636.7[d]
Summer Flounder	*Paralichthys dentatus*	13.0	4.7[c]	4.1[c]
Oyster Toadfish	*Opsanus tau*	16.2	38.3[c]	1.8[d]
Northern Pipefish	*Syngnathus fuscus*	2.1	40.6[e]	4.1
Naked Goby	*Gobiosoma bosc*	2.3	303.2[e]	3.3
Hogchoker	*Trinectes maculatus*	636.4	112.2[d]	152.3[c]
Spotted Hake	*Urophycis regia*	58.6	7.0[d]	83.5
Gizzard Shad	*Dorosoma cepedianum*	14.3	1.7[d]	63.0[c]
American Shad	*Alosa sapidissima*	5.5	0.2	12.3[c]
Black Drum	*Pogonias cromis*	2.8	0.8	3.0
Black Sea Bass	*Centropristis striata*	3.0	2.0	0.4
Butterfish	*Peprilus triacanthus*	0.7	ND	0.6
Channel Catfish	*Ictalurus punctatus*	0.9	1.0	8.2[d]
Conger Eel	*Conger oceanicus*	0.1	0.4	0.1
Northern Kingfish	*Menticirrhus saxatilis*	0.2	ND	12.2[e]
Northern Searobin	*Prionotus carolinus*	3.8	1.8	6.0
Scup	*Stenotomus chrysops*	ND	ND	1.4

Table 2 (continued)

Common Name	Scientific Name	Impingement Rate (number of individuals/10^6 m^3)		
		SGS (1986–87)[a]	HCGS (1986–87)[a]	SGS (2003–10)[b]
Silver Hake	*Merluccius bilinearis*	0.4	0.1	0.1
Windowpane Flounder	*Scophthalmus aquosus*	4.7	2.4	5.2
Winter Flounder	*Pseudopleuronectes americanus*	0.3	0.4	1.1
Total finfish density rate[f]		2,643.6	2,095.4	3,152.5
Blue Crab	*Callinectes sapidus*	1,542.5	2,450.1	690.4[c]
Total finfish and blue crab density rate[f]		4,186.1	4,545.5	3,842.9

Note: ND = not detected.
(a) Sources: VJSA 1988-TN2564; ECS 1989-TN2572.
(b) Sources: PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571.
(c) Differs from 1986–87 SGS impingement rate by more than a factor of 2.
(d) Differs from 1986–87 SGS impingement rate by more than a factor of 5.
(e) Differs from 1986–87 SGS impingement rate by more than a factor of 10.
(f) Includes all finfish impinged, not just those listed in table.

Within the 1986 to 1987 sampling years, species composition differed between SGS and HCGS. Many of the abundant or important species impinged at SGS were either not as abundant at HCGS at similar densities or were noticeably more abundant at HCGS than at SGS. Species that shared similar densities included blue crab, American Eel (*Anguilla rostrata*), Bay Anchovy (*Anchoa mitchilli*), and Atlantic Silverside (*Menidia menidia*). Total density of impinged fish at both SGS and HCGS between 1986 and 1987 was comparable and was calculated using the number of a given species collected per million cubic meters of intake water volume sampled.

Differences in impinged species composition between SGS and HCGS may be attributable to the different physical locations of the intake structures of the two existing sites (i.e., southwest for the SGS cooling water intake structure versus west for the HCGS service water intake structure) and differences in intake screening technology and screen approach velocities (PSEG 2014-TN3452).

The comparison of the SGS 1986–87 impingement data with SGS 2003–10 impingement data shows shifts in specific species abundance. Calculating mean density impinged per volume of water corrects for the difference in number of sampling events as more frequent samples were collected between 2003 and 2010. Interestingly, the total abundance of blue crab, Bay Anchovy, Summer Flounder (*Paralichthys dentatus*), Oyster Toadfish (*Opsanus tau*), and Hogchoker (*Trinectes maculatus)* diminished by a factor of 2 or more since the 1986–87 sampling events. However, increases in Atlantic Silverside, White Perch (*Morone americana*), Striped Bass (*Morone saxatilis*), Atlantic Croaker (*Micropogonias undulatus*), American Shad (*Alosa sapidissima*), Channel

Catfish (*Ictalurus punctatus*), Northern Kingfish (*Menticirrhus saxatilis*), and Gizzard Shad (*Dorosoma cepedianum*) are evident since the 1986–87 sampling. Of note, impingement data for SGS from 2008 to 2010 (PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571) were also examined and compared with SGS impingement data from 2003 to 2007 (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569) to assess any recent deviation from the previous 2003 to 2007 trend (data not shown in table). Gizzard Shad, Northern Kingfish, Black Drum (*Pogonias cromis*), and Atlantic Menhaden (*Brevoortia tyrannus*) all increased by a factor of 2 in the more recent sampling. However, Blueback Herring (*Alosa aestivalis*), Atlantic Croaker, Butterfish (*Peprilus triacanthus*), Channel Catfish, Scup (*Stenotomus chrysops*), and Spotted Hake (*Urophycis regia*) were all reduced by a factor of 2 in the more recent sampling. These deviations in annual averages may represent changes to environmental conditions at the larger regional scale, such as climate, seasonal weather extremes, and fishing pressure, and do not appear to reflect any longer term trends in abundance.

Impingement mortality was not reported during the HCGS impingement sampling in 1986 or 1987 (VJSA 1988-TN2564; ECS 1989-TN2572). However, sampling at SGS between 1986 and 1987 and between 2003 and 2010 reported between 97 percent and 100 percent live, undamaged blue crab, and live condition for greater than 50 percent of the finfish impinged with the exception of White Perch and Atlantic Croaker juveniles between 1986 and 1987 (VJSA 1988-TN2564; ECS 1989-TN2572; PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571).

Historical impingement rates for the aquatic community from SGS (2003 to 2010) and HCGS (1986 to 1987) were used to estimate potential impingement losses associated with the operation of a new nuclear power plant at the PSEG Site (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571; VJSA 1988-TN2564; ECS 1989-TN2572). HCGS is more similar to a new nuclear power plant at the PSEG Site with a closed-cycle cooling system design, versus the once-through cooling system of SGS. SGS withdraws larger volumes of water from the Delaware River Estuary with a faster through-screen velocity (roughly 0.9 fps), and therefore, SGS would be expected to impinge more fish than the closed-cycle cooling systems of HCGS and a new nuclear power plant at the PSEG Site.

PSEG examined the most recent HCGS impingement data from 1986 and 1987 with same year impingement data for SGS and derived a correction factor by dividing the HCGS data by the SGS data to allow comparison between the two plants and normalize the differences in intake volume and velocity (VJSA 1988-TN2564; ECS 1989-TN2572). Examination of 1986 to 1987 density impingement rates for finfish show a total impingement density average of 2,095.4 organisms per million m^3 total water volume for HCGS and 2,643.6 organisms per million m^3 total water volume for SGS. When combining both finfish and blue crab impingement rates, HCGS has a total impingement density average of 4,545.5 organisms per million m^3 total water volume, and SGS has a total impingement density average of 4,189.1 organisms per million m^3 total water volume. The more recent impingement rates for SGS between 2003 and 2010 report a finfish impingement rate of 3,152.5 organisms per million m^3 total water volume and a combined blue crab and finfish impingement rate of 3,842.9 organisms per million m^3 total water volume. Therefore, a correction factor may not be needed to assess total organism impingement, and PSEG used a conservative approach in its environmental

report for assessing potential impingement rates for a new nuclear power plant. However, for comparative purposes, PSEG presented in its environmental report both the conservative assumption and the correction factor for estimating potential impingement rates (PSEG 2014-TN3452).

Sampled total finfish density was moderately lower at HCGS relative to SGS using data sets either from 1986 to 1987 or from 2003 to 2010, possibly because of the lower approach velocities to the HCGS screens. The only commercially important invertebrate vulnerable to substantial impingement by the intake structure of a new nuclear power plant at the PSEG Site is the blue crab. Blue crab densities for impingement samples at SGS were 690.4 per million m^3 total water volume between 2003 and 2010 and 1,542.5 per million m^3 total water volume in 1986 to 1987. At HCGS, blue crabs were impinged at a mean rate of 2,450.1 per million m^3 total water volume in 1986 to 1987 (see Table 2). It is possible that the rate of impingement at a new nuclear power plant at the PSEG Site for blue crab may be less than in 1986 to 1987 because there was a significant drop in impingement abundance of blue crab at SGS between the sampling dates in the 1980s and the average of 8 years of more recent sampling.

The applicant estimated impingement rates of finfish at a new nuclear power plant at the PSEG Site by multiplying the more recent SGS impingement densities by a correction factor representing the ratio of the total finfish impingement density at HCGS (1986 to 1987) to that of SGS for the same period. Recent examination of these data sets and impingement rates derives the correction factor to be 0.79 (2,095.4/2,643.6). It is reasonable to use the historical HCGS impingement rate correction factor for the estimate of impingement rate at a new plant at the PSEG Site because the intake design velocity for a new plant (less than 0.5 fps) is more comparable to HCGS than to SGS (roughly 0.9 fps). Thus, the estimated total impingement rate of finfish due to operation of a new plant is 2,490.5 per million m^3 total water volume compared to the more recent impingement rate of 3,152.5 per million m^3 total water volume for SGS. White Perch, Atlantic Croaker, and Weakfish (*Cynoscion regalis*) are expected to comprise the majority of the impingement total. The proposed maximum rate of water withdrawal for a new nuclear power plant at the PSEG Site is equivalent to 3.7 percent of the intake flow at SGS (PSEG 2014-TN3452). Assuming a constant withdrawal of 78,196 gpm for a new plant, and using the 79 percent correction factor for finfish impingement, a new plant would result in impingement of an estimated 386,526 fish annually. Using the conservative assumption with no correction factor, and a maximum rate of water withdrawal for a new plant of 3.7 percent of the intake flow of SGS, approximately 489,148 fish would be impinged annually at a new plant at the PSEG site (PSEG 2014-TN3452).

The intake structure for a new nuclear power plant at the PSEG Site would contain traveling screens to collect debris and fish. Impinged organic debris and aquatic organisms would be washed from the traveling screens and returned to the Delaware River Estuary. Mixed organic and manmade debris (e.g., wood, plastic) collected from the trash racks would be disposed of offsite.

Details about the screen design, screen wash, and fish return system for a new plant are not available, but PSEG has stated in its environmental report that the screen design would be compliant with EPA 316(b) Phase I requirements specified in 40 CFR 125.84 (40 CFR 125-TN254), would be similar to screens at HCGS, and would include low-pressure screen washes to safely remove impinged organisms and water-filled fish buckets to improve the survival of screen-washed fish and shellfish until they are transported back to the Delaware River Estuary by the fish return system (PSEG 2014-TN3452).

In terms of numbers, the estimated impingement of most fish species is a small percentage of the commercial and recreational harvests of these species in Delaware and New Jersey as described in Section 2.4.2. Blue crab, Weakfish, White Perch, and Atlantic Croaker potentially would have the highest impingement rates at a new nuclear power plant at the PSEG Site. However, it is expected that a large portion of these impinged organisms would survive because of the comparable impingement mortality recorded for SGS with a higher through-screen velocity than would be used for a new plant. Based on the planned low through-screen intake velocity and the use of closed-cycle cooling, the review team concludes that impacts from impingement of aquatic organisms at a new nuclear plant at the PSEG Site would be minor.

Entrainment

Small, passively drifting, or weakly swimming aquatic organisms that are drawn into the intake and pass through the openings in the traveling screens would be killed by passage through the closed-cycle cooling system. Some entrained organisms are present year-round, such as phytoplankton and many types of zooplankton. These diverse plant and animal species (often referred to as holoplankton) are abundant throughout the Delaware River Estuary and have short generation times, so they can rapidly replace losses due to entrainment, heat shock, and other stresses. Other entrained organisms, such as the larval stages of fish, crabs, and other bottom-dwelling crustaceans, are present only seasonally near the proposed intake of a new nuclear power plant at the PSEG Site. However, many of these seasonally planktonic organisms (collectively referred to as meroplankton) have longer life spans and generation times, so losses from cooling system effects are not as readily replaced.

The history of entrainment sampling at SGS and analyses of entrainment losses are described in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants—Supplement 45: Regarding Hope Creek Generating Station and Salem Nuclear Generating Station, Units 1 and 2 Final Report* (NRC 2011-TN3131). Most recently, entrainment of fish eggs, larvae, juveniles, and adults in the SGS cooling water system was studied between 2003 and 2010 (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571). Over the 8-year period, between 25 and 38 species were identified each year among the entrained fish (eggs, larvae, small juveniles, and adults). Of these, 92 percent of the entrainment samples were composed of two species: Bay Anchovy (75.3 percent) and Naked Goby (*Gobiosoma bosc*) (16.7 percent). Additional species that comprised over 98 percent of all entrained species included Atlantic Croaker (3.5 percent), Striped Bass (1.4 percent), Weakfish (0.8 percent), Atlantic Menhaden (0.4 percent), and Atlantic Silverside (0.4 percent). Bay Anchovy was the most abundantly entrained species for the egg (99.7 percent) and adult (57 percent) life stages, while Naked Goby was the most abundantly entrained larval species (49 percent), and Atlantic Croaker was the most abundantly of entrained juvenile species (56 percent) (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571). Seasonal vulnerability to entrainment is species-specific. For example, eggs, larvae, and juveniles of Bay Anchovy were most numerous in entrainment samples in summer months (June and July), whereas Atlantic Croaker juveniles were most abundant in the fall (October and November) (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571). In general, the densities of entrained individuals for most fish species were greatest in the spring and/or

summer, corresponding to the spawning periods for these species. Total densities of all fish life stages in the entrainment samples ranged from 54.0/100 m^3 (2003) to 264.2/100 m^3 (2007) and averaged 125.0/100 m^3 (PSEG 2014-TN3452).

PSEG applied estimated annual entrainment rates from SGS directly to calculate entrainment rates for a new nuclear power plant at the PSEG Site. The entrainment rates at SGS were applied to a new plant without a correction factor because entrained organisms are planktonic. Entrainment rates are a function of water withdrawal rates and are not influenced by through-screen velocities. Entrainment rates of holoplankton and meroplankton would be much smaller for a new plant than for SGS because of the smaller volume of water withdrawn by the closed-cycle system at a new nuclear power plant. Based on the small volume of water withdrawn for the closed-cycle cooling water system at a new nuclear power plant at the PSEG Site, the annual entrainment of organisms during operation of the intake system is expected to be minor and average less than 125 organisms per 100 m^3. Bay Anchovy, the likely dominantly entrained species for a new plant at the PSEG Site, is a highly abundant species in the area, with females spawning every 4 to 5 days over the spawning season (Zastrow et al. 1991-TN2670).

Cooling-Water Discharge Impacts

Blowdown from the cooling towers, service water system, and other aqueous waste streams at a new nuclear power plant at the PSEG Site would be combined and discharged to the Delaware River Estuary at an average flow rate of 50,516 gpm (113 cfs) and a velocity of 9.2 fps, as described in Section 5.2.3.1 of the EIS. The submerged 48-in. diameter discharge pipe would be located 8,000 ft north of the SGS discharge pipe and 4,000 ft north of the HCGS discharge pipe. The outlet of the discharge pipe would be 100 ft from the shoreline, and the discharge point would be at a location 12 ft below mean lower low water and 3 ft above the river bottom (PSEG 2014-TN3452). Relative to the Delaware River Estuary, the discharged water would have an elevated temperature and increased concentration of both natural chemical constituents and chemical contaminants. Because of the tidal nature of the Delaware River Estuary in this area, the direction of the thermal discharge plume would vary with the tidal cycle (PSEG 2014-TN3452).

<u>Thermal Impacts</u>

Potential thermal impacts on aquatic organisms could include heat stress, cold shock, and the creation of favorable conditions for invasive species.

As described in Section 5.2.3.1 of the EIS, the portion of the Delaware River Estuary where discharge would occur is located in Zone 5 between Delaware RM 78.8 and RM 48.2. The DRBC temperature-related standards for Zone 5 require that the discharge-induced water temperature increases above the ambient water temperature in the river outside the permitted heat dissipation area (HDA) may not increase by more than 4°F (2.2°C) from September through May and by 1.5°F (0.8°C) from June through August, with a year-round maximum water temperature of 86°F (30°C) (18 CFR Part 410; DRBC 2011-TN2371) (see Figure 4). Recent trawling of the Delaware River Estuary zone in the vicinity of SGS and HCGS between 2003 and 2010 has not identified significant shifts in species abundances near the SGS and HCGS discharge areas compared with adjacent zones (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571). The volume of the thermal discharge from a new

nuclear power plant at the PSEG Site (50,516 gpm) is only 2.4 percent of that from SGS (about 2,100,000 gpm circulated through the once-through cooling system) (PSEG 2014-TN3452). As discussed in Section 5.2.3.1, the thermal plume of the discharge from a new plant would have a maximum extent of about 700 ft into the river from the discharge location, about 300 ft upstream from the discharge, and about 500 ft downstream from the discharge. This thermal plume would be contained completely within the existing SGS HDA and would not be expected to impede fish migration. During flood tide conditions, when the median water temperature exceeds 79.4°F (26.3°C), the review team estimated that a portion of the thermal plume would exceed 86°F (30°C) because of the cumulative effects from SGS, HCGS, and a new nuclear power plant (3.6°F, 1.5°F, 1.5°F, respectively). However, the combination of high velocity discharge, turbulence in the discharge outlet area, and rapid mixing of the discharge effluent would limit the size of the thermal plume.

A factor related to thermal discharges that may affect aquatic biota is cold shock, which occurs when aquatic organisms that have been acclimated to warm water are exposed to a sudden temperature decrease. This sometimes occurs when single-unit power plants shut down suddenly in winter, or when an unseasonable cold weather event occurs. Cold shock is less likely to occur at a multiple-unit plant because the temperature decrease from shutting down one unit is moderated by the heated discharge from the units that continue to operate. Based on the foregoing, any thermal impacts on the fish populations due to cold shock would be expected to be minor.

Chemical Impacts

As described in EIS Section 3.2.1.2, the cycles of concentration increase the concentration of total dissolved solids and minerals in the blowdown. In addition, the blowdown would contain chemical additives such as biocides and pH-adjusting chemicals to ensure proper functioning of the cooling towers. Predicted concentrations of dissolved chemical constituents in the discharges from the cooling water and other systems are expected to be compliant and controlled by the terms of the NJPDES permit that would be issued for a new nuclear power plant at the PSEG Site (PSEG 2014-TN3452).

<u>Physical Impacts</u>

Because of the increased temperature and chemical content of the discharged water compared to ambient conditions, the plume is expected to be negatively buoyant (PSEG 2014-TN3452). Due to the high discharge velocity of 9.21 fps, there would be rapid mixing with tidal currents upstream and downstream, with some potential for scouring (erosion) occurring at the point of discharge. To minimize the scouring potential, PSEG would place riprap or other engineered features near the end of the discharge pipe and reduce the possible interactions of the discharge plume with bottom habitats and bottom-dwelling aquatic organisms (PSEG 2014-TN3452).

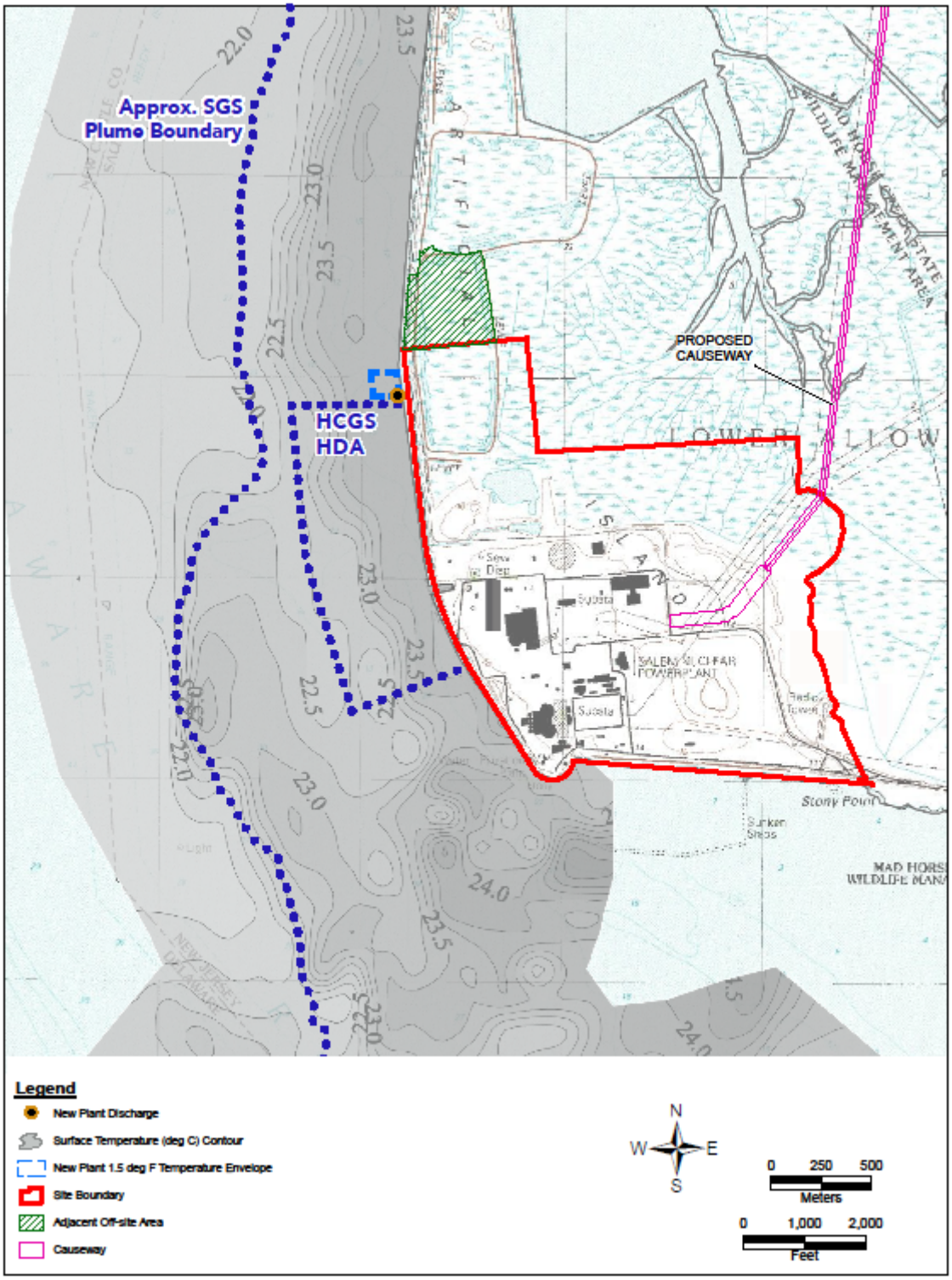

Figure 4. Predicted PSEG Thermal Plume in Relation to HCGS HDA and SGS Plume Boundary Under Flood Tide Conditions.
(Source: Modified from PSEG 2014-TN3452).

Barge Traffic

Use of the HCGS barge slip and the new barge storage and unloading facility are expected to be infrequent during operation. However, propeller wash may cause localized scouring and sedimentation within the barge slip. Because this area would be previously disturbed during site preparation and used during transport of building materials, it is unlikely that the temporary habitat disruption would have adverse effects on the aquatic communities in the area (PSEG 2014-TN3452). Adjacent, undisturbed habitat is available, and mobile aquatic organisms would likely avoid the barge slip area.

Maintenance Dredging

Dredging may be required to maintain use of the HCGS barge slip and intake channel, as well as the barge storage and unloading facility during operation. Any effects to water quality, such as siltation, during these infrequent periods would be temporary and would be managed through the use of Federal and State permitting requirements for use of BMPs, and dredged material disposal would be in approved upland disposal areas (PSEG 2014-TN3452). Mobile organisms in the area would avoid activities involved in dredging and could use adjacent, undisturbed habitat during the temporary disruption.

Stormwater Management

As described in EIS section 5.2.3.1, PSEG would develop an SWPPP to minimize stormwater drainage effects to nearby surface waters. The SWPPP would be required to meet NJPDES stormwater discharge requirements.

3.0 Federally Listed Species Considered

NMFS (NMFS 2010-TN2171) identified aquatic species under its jurisdiction that are Federally listed as threatened or endangered and one species that was listed as a candidate species that may occur in the Delaware River Estuary in the vicinity of a new nuclear power plant at the PSEG Site. By 2013, the previously listed candidate species (Atlantic Sturgeon, *Acipenser oxyrinchus oxyrinchus*) was updated to endangered, and an updated list of Federally protected species near the PSEG Site was provided by NMFS (NMFS 2013-TN2804). These species are listed in Table 1 and also are described in detail in the following sections.

3.1 Loggerhead Sea Turtle

Species Description

The Federally threatened loggerhead turtle (*Caretta caretta*) has a slightly elongated, heart shaped carapace that tapers towards the posterior and has a broad, triangular head (NRDC 2009-TN2788). Loggerheads normally weigh up to 450 pounds (lb; 200 kilograms [kg]) and attain a straight carapace length of up to 48 in. (120 cm) (NRDC 2009-TN2788).

Loggerheads reach sexual maturity at about 35 years of age (NMFS 2013-TN2792). Females nest on sandy ocean beaches every other to every third year from April through September along the southeastern coast of the U.S., and nesting usually peaks in late June and July (Dodd 1988-TN354). Females lay 2 to 3 clutches of eggs per nesting year, and each clutch consists of 35 to 180 eggs that hatch in 46 to 68 days (NMFS 2013-TN2792).

Distribution and Habitat

Loggerhead turtles are circumglobal and, in the western Atlantic Ocean, occur from Argentina northward to Newfoundland, including the Gulf of Mexico and the Caribbean Sea. Adult loggerheads occupy oceanic beaches, deepwater ocean, and nearshore ocean habitats during their migration from foraging habitats to nesting beaches (Dodd 1988-TN354). Adult female loggerheads nest above the high-tide line and sometimes in vegetation at the top of sandy beaches. Approximately 90 percent of the loggerhead nesting activity in the United States is in Florida (Meylan et al. 1994-TN2806). Newly emerged turtles immediately crawl toward the sea, probably orienting toward the reflected light of the moon (Dodd 1988-TN354). Those that reach the water swim rapidly offshore. The initial swimming frenzy may take them 13 to 17 mi offshore. They remain offshore for 3 to 5 years (NMFS 2013-TN2792) and are about 1.5 ft long when they return to coastal waters to forage as subadults. Subadult and adult loggerheads are primarily bottom feeders, foraging in coastal waters for benthic mollusks and crustaceans (Plotkin 1995-TN2508).

Population Trends and ESA Status

The U.S. Fish and Wildlife Service (FWS) listed the loggerhead on the Federal List of Endangered and Threatened Wildlife under the ESA on July 28, 1978 (43 FR 32800-TN2753). A 5-year review considered 52 populations throughout the Atlantic, Pacific, and Indian oceans and concluded loggerhead populations could be separated into distinct population segments (DPSs) (NMFS and FWS 2008-TN360). On March 16, 2010, the NMFS published a proposed rule to list nine loggerhead DPSs under the ESA (75 FR 12598-TN2763). The proposed rule identifies the Northwest Atlantic DPS, which includes those loggerheads nesting along the coasts of North America, Central America, northern South America, the Antilles, and the Bahamas, as an endangered DPS. This DPS constitutes the most significant nesting assemblage of loggerheads in the western hemisphere, would include those loggerheads that migrate as far north as New Jersey, and has been reported to show declining numbers of observable nests over the last several decades (75 FR 12598-TN2763). In addition, mortality from fishery bycatch of commercial gillnet, longline, and trawl fisheries throughout the nearshore and offshore Atlantic Ocean is a significant threat to the persistence of this DPS, and increased risk of vessel strike for migrating loggerheads has also become a growing concern (75 FR 12598-TN2763). Despite conservation efforts to protect nesting habitat and improve fishing methods to reduce bycatch, the Northwest Atlantic DPS is currently under consideration to be upgraded from threatened to endangered (75 FR 12598-TN2763). There is no reported loggerhead turtle nesting along Delaware Bay beaches, though they do forage in the bay. Loggerhead turtles are historically the most commonly observed sea turtle species in the vicinity of PSEG (Eggers 1989-TN2778).

3.2 Green Sea Turtle

Species Description

The Federally threatened green sea turtle (*Chelonia mydas*) is the largest of the hard-shelled sea turtles but has a small, nearly oval carapace and a small, rounded head (NRDC 2009-TN2788). Full grown adult green turtles weigh 220 to 330 lb (100 to 150 kg) and attain a straight carapace length of 35 to 40 in. (90 to 100 cm) (NRDC 2009-TN2788).

Green turtles reach sexual maturity at 20 to 50 years of age (NMFS 2013-TN2796). In the southeastern U.S., females nest between June and September, with peak nesting between June and July (NMFS 2013-TN2796). Although males mate annually, females only nest every two to four years (NMFS 2013-TN2796). Mature females may nest an average of 5 times per season at about 14-day intervals. The average clutch size is around 135 eggs, which usually hatch within 60 days (NMFS 2013-TN2796).

Distribution and Habitat

In the western Atlantic, several major assemblages have been identified and studied (NMFS and FWS 1991-TN358). In U.S. Atlantic waters, green turtles are found around the U.S. Virgin Islands, Puerto Rico, and the continental United States from Texas to Massachusetts (NMFS and FWS 1991-TN358). Nesting grounds extend from Texas to North Carolina, as well as in the U.S. Virgin Islands and Puerto Rico, and important feeding ground within the U.S. Atlantic and Gulf of Mexico includes the Indian River Lagoon, the Florida Keys, Florida Bay, Crystal River, and St. Joseph Bay (NMFS 2013-TN2796). Critical habitat is designated in waters around Isla Culebra, Puerto Rico (NMFS 2013-TN2796).

Green turtles occupy three habitat types at different stages in their life cycle. For nesting, females require the high-energy (wave active), sandy beaches of barrier islands and mainland shores above the high-water line. Upon emergence, hatchlings immediately seek out the shore and open water. Juvenile green turtles drift with the prevailing surface-water currents until they reach a size of 12 to 16 in., at 1 to 3 years, and then return to shallow coastal waters. Juvenile green turtles and adults spend most of their lives in shallow benthic feeding grounds. Foraging habitats for juvenile and adult green turtles are primarily pastures of seagrasses or macroalgae in less than 66 ft of water. A favorite seagrass food of green turtles throughout the Caribbean and south Florida is turtle grass (*Thalassia testudinum*). *Thalassia* is a highly productive seagrass and can support as many as 138 adult female green turtles per hectare. However, juvenile green turtles often are found over shallow hard-bottom habitats, such as coral and rocky reefs (NMFS and FWS 1991-TN358). During feeding, subadult green turtles do not wander far but rather remain within a small area of 0.4 mi^2 or less. A typical dive cycle during feeding in Florida lasts about 33 minutes, of which 1 minute is spent at the surface between dives and 30 minutes is spent on the bottom foraging on seagrass or algae. Thus, green turtles are hard to monitor in their feeding grounds because they spend more than 50 minutes of each hour submerged (Nelson 1988-TN2808).

Population Trends and ESA Status

The FWS listed the green sea turtle on the Federal List of Endangered and Threatened Wildlife under the ESA on July 28, 1978 (43 FR 32800-TN2753), and the NMFS and FWS published a recovery plan for the U.S. green turtle population in 1991 (NMFS and FWS 1991-TN358). In 2007, the NMFS and FWS published a 5-year review of the green sea turtle (NOAA and FWS 2007-TN1587) and reported that four of the six major nesting rookeries had shown population increases, and data for the other two nesting rookeries indicated that the populations were stable. NMFS and FWS (NOAA and FWS 2007-TN1587) recommended that the green sea turtle remain listed under the ESA but that a review of the species should be conducted to determine the applicability of the 1996 DPS policy (61 FR 4722-TN2756) to the species.

Most sources of mortality for sea turtles in U.S. coastal waters, including green turtles, are human activities, such as incidental take in bottom trawls, particularly shrimp and summer flounder nets; coastal gill net and pound net fisheries (Witzell and Cramer

1995-TN2809); ingestion of marine debris (Witzell and Teas 1994-TN2509); and channel dredging (NMFS and FWS 1991-TN358).

Collisions with boats, particularly boat propellers, also are an important cause of the death of green turtles found stranded on the shore. Oil pollution from spills and tank cleaning may kill some green turtles and other marine turtles through tarball ingestion or fouling of the body with oil from surface slicks. Three Atlantic green sea turtles were reported at the SGS intake between 1980 and 1992 (PSEG 2014-TN3452), but none have been reported at the SGS intake since 1992 (NRC 2010-TN2811).

3.3 Hawksbill Sea Turtle

Species Description

The Federally endangered hawksbill (*Eretmochelys imbricata*) is a medium-sized tropical and subtropical species that inhabits the warm waters of the Atlantic, Pacific, and Indian oceans (NMFS and FWS 2013-TN2507). The hawksbill is the most tropical of the sea turtles and is restricted primarily to warmer waters more than the other four sea turtles found in the Gulf of Mexico. In U.S. territorial waters, hawksbills occur along the U.S. coast of south Texas and along the Gulf and Atlantic coasts of Florida, although adults may migrate farther up the Atlantic coast as opportunistic foragers. Adult nesting females have a carapace length of about 34 in. and weigh about 176 lb. The largest hawksbill on record weighed 276 lb. Hatchlings are about 1.7 in. long and weigh 0.5 to 0.7 ounce (NMFS and FWS 2013-TN2507). Hawksbills are believed to reach reproductive age in 20 years, and females nest approximately every other year (NMFS and FWS 2013-TN2507). Newly hatched hawksbill turtles occupy oceanic habitats associated with sargassum mats and other floating vegetation. Once juveniles reach 20 to 30 cm in carapace length, they switch to neritic habitats and feed on algae and small crustaceans (NMFS and FWS 2013-TN2507).

Distribution and Habitat

Much more is known about hawksbill nesting sites than habitat usage during non-reproduction life histories. Hawksbills show a high fidelity to their nesting beaches and return to the same or a nearby beach year after year (Meylan 1989-TN2163). There have only been a few verified reports of hawksbill turtle nesting in south Florida, mostly on the east coast (NMFS and FWS 2013-TN2507). Juveniles and subadults tend to remain and feed on coral reefs near their natal beaches. Like other species of sea turtles, hatchling hawksbills congregate in sargassum rafts to feed and grow for a year or more after emerging from the nest (NMFS and FWS 2013-TN2507). While in the sargassum rafts, they consume pelagic fish eggs and larvae, small invertebrates associated with the floating algae, and the sargassum itself. Subadults and adults are omnivorous scavengers. They seem to prefer benthic invertebrate prey, particularly sponges and biofouling organisms. Because of their food preferences, they tend to be most abundant in shallow coral and rocky reef habitats.

Population Trends and ESA Status

First listed as endangered in 1970 (35 FR 8491-TN2751), the status of the hawksbill was reviewed for status potential in 1995 (Plotkin 1995-TN2508). A 5-year review published in 2013 indicates that numbers of adults, subadults, and juveniles are increasing in the Caribbean and Florida foraging areas (NMFS and FWS 2013-TN2507). In the U.S. Caribbean and the Florida Keys, overexploitation severely depleted

hawksbills during the 20th century. At present, since banning the sale of turtle shell products, they may be no longer in decline in the Atlantic region.

Hawksbill turtles are subjected to and share many of the natural and anthropogenic disturbances as the other sea turtles in Atlantic waters. The two main concerns that affect hawksbills are climate change and commercial fishery activities. Climate change through increased sea temperatures, changes in circulation patterns, and sea-level rise may result in reproductive behaviors and temperature-dependent sex determination, beach erosion, and reduced availability of foraging resources (IPCC 2007-TN2801). Hawksbills are also susceptible to nearshore fishery practices such as drift netting, trawling, and long-lining (NMFS and FWS 2013-TN2507). Strandings of hawksbills are restricted almost exclusively to Florida, Puerto Rico, and the U.S. Virgin Islands. Hawksbills appear to be unusually vulnerable to ingestion of marine debris, particularly plastics. Nearly 90 percent of the debris ingested by hawksbills is plastic bags, plastic and Styrofoam particles, and tar (Witzell and Teas 1994-TN2509). There have been no formal documented reports of hawksbill sea turtles in the vicinity of the PSEG Site.

Hawksbill turtles do not nest along Delaware Bay beaches, have not been documented in Delaware Bay water, and have not been taken at SGS since preoperational and operational monitoring studies were initiated. The review team concludes that building and operation of a new nuclear power plant at the PSEG Site would have no effect on hawksbill sea turtles, and this species will not be discussed further.

3.4 Kemp's Ridley Sea Turtle

Species Description

The Federally endangered Kemp's ridley (*Lepidochelys kempii*) is the smallest of living sea turtle species. Adults weigh up to 90 lb (42 kg) and attain a straight carapace length up to 27 in. (70 cm) (NRDC 2009-TN2788).

Kemp's ridleys reach sexual maturity between the ages of 10 and 15 years (IUCN-MTSG 2013-TN2800). During the nesting season, females aggregate onshore in large groups to lay 2 to 3 clutches of about 100 eggs each between May and July along the coast near Rancho Nuevo, Tamaulipas, Mexico (NMFS 2013-TN2795). Kemp's ridley eggs hatch in 45 to 70 days, and 1.5-in. (3.8-cm) hatchlings emerge 2 to 3 days later (NMFS 2013-TN2795). Those hatchlings that reach the water quickly move offshore and remain in the open sea until maturity.

Distribution and Habitat

The Kemp's ridley has the most restricted geographical range of the sea turtle species because it is only known to primarily nest in one main beach area—Rancho Nuevo, Tamaulipas, Mexico (NMFS and FWS 2007-TN2793). Females occasionally use two additional nesting grounds in Padre Island, Texas, and Veracruz, Mexico (TEWG 2000-TN2784). Adults migrate through the Gulf of Mexico, the Caribbean, and the northwest Atlantic Ocean.

Hatchlings migrate rapidly down the beach and out to sea, where they spend a period of perhaps 2 years in the pelagic zone. They are about 8 in. long at the end of the pelagic period. Little is known about the feeding behavior and food preferences of hatchling Kemp's ridley turtles during their pelagic stage; they presumably feed on zooplankton and floating matter, including sargassum weed and the associated biotic community. Following a pelagic feeding stage shortly after hatching and lasting for several months, the juvenile ridleys move into shallow coastal waters to feed and grow. The young

subadults often forage in water less than 3 ft deep, but they tend to move into deeper water as they grow. Juvenile to adult ridleys prey on crabs, particularly blue crabs; mollusks; and small fish. Because of their preference for crabs and other primarily shallow-water demersal prey, juvenile and adult ridley turtles concentrate in coastal waters less than 30 ft deep throughout their range. They make long dives to the bottom and may feed on the bottom for an hour or more at a time (TEWG 2000-TN2784).

Population Trends and ESA Status

The FWS listed the Kemp's ridley on the Federal List of Endangered and Threatened Wildlife under the ESA on December 2, 1970 (35 FR 18319-TN2752), and NMFS and FWS published a recovery plan for the species in 1992 (NMFS and FWS 1992-TN2798). The major factors in the historic decline of ridley turtles are thought to be predation (animal and human) of eggs on the major nesting beach and incidental take in commercial fisheries in the U.S. and Mexican Gulf of Mexico and western North Atlantic. Current impacts include anthropogenic disturbance, entanglement in fishing gear (e.g., monofilament fishing line or discarded fishing nets), and marine debris ingestion (e.g., plastic bags and plastic particles). Under some circumstances, chemical pollution may be a threat to ridley turtles. Recovery efforts have made progress in the protection of this species, and the current Kemp's ridley recovery plan (NMFS et al. 2010-TN1691) predicts that, assuming current survival rates remain constant, the Kemp's ridley population will grow between 12 and 16 percent per year and could reach 10,000 nesting females per season by 2015. Kemp's ridley sea turtles are known to occur in Delaware Bay waters near the PSEG Site (Eggers 1989-TN2778).

3.5 Leatherback Sea Turtle

Species Description

The Federally endangered leatherback sea turtle (*Dermochelys coriacea*) is the largest living sea turtle and the only sea turtle that does not have a hard, bony shell. It has a leathery, blue-black shell composed of a thick layer of oily, vascularized, cartilaginous material, strengthened by a mosaic of thousands of small bones. Leatherbacks can weigh up to 2,000 lb (900 kg) and attain a straight carapace length of 55 in. (140 cm) (NMFS 2013-TN2794; NRDC 2009-TN2788).

Leatherbacks reach sexual maturity at the age of 12 to 15 years. Leatherbacks mate in waters adjacent to nesting grounds, and the species nests around the world, including along the coasts of northern South America, west Africa, the U.S. Caribbean, the U.S. Virgin Islands, and southeast Florida (NMFS 2013-TN2794). Females nest from late February or March through September; during the season, they nest 1 to 9 times at about 9- to 17-day intervals. Females lay between 50 and 170 eggs, which hatch within 50 to 75 days (NMFS 2013-TN2794).

Distribution and Habitat

Leatherbacks are circumglobally distributed and occur in the Atlantic, Indian, and Pacific oceans. Leatherback turtles are a largely oceanic, pelagic species, but they also forage in coastal waters. Juveniles and adults feed throughout the water column to depths of at least 3,900 ft, consuming jellyfish and other gelatinous zooplankton, such as salps, ctenophores, and siphonophores (NMFS 2013-TN2794). Most feeding dives average about 200 ft but frequently extend from 985 to 1300 ft (Eckert 2002-TN3359). In the past, the leatherback's seasonal inshore movements off south Texas have been linked to inshore movements of their preferred jellyfish prey. Only a small fraction of the Gulf of

Mexico and North Atlantic leatherback populations nest on beaches of the continental United States, mostly in Florida and the U.S. Virgin Islands, where nesting occurs from April to July (Meylan et al. 1994-TN2806). Because leatherback turtles are a largely oceanic, pelagic species, estimates of their population status and trends have been difficult to obtain. In addition, nesting females do not have the nest-site fidelity exhibited by other turtles and tend to move to different beaches in different years (NMFS 2013-TN2794). Therefore, it has been difficult to estimate temporal trends in population size.

Population Trends and ESA Status

The FWS listed the leatherback on the Federal List of Endangered and Threatened Wildlife under the ESA on June 2, 1970 (35 FR 8491-TN2751). In the 2007 5-year review of the species, NMFS and FWS (NMFS and FWS 2007-TN1690) indicated that the Atlantic population within Florida has shown an increase in nests from 98 in 1988 to 800 to 900 in the early 2000s. Nesting also increased in Puerto Rico, the U.S. Virgin Islands, and the British Virgin Islands from the 1980s to the 2000s (NMFS and FWS 2007-TN1690). Leatherbacks are especially susceptible to entanglement in fishing gear and plastic debris (Witzell and Teas 1994-TN2509). Because they are adapted to a pelagic existence, they have trouble maneuvering in tight places, swimming backward, and avoiding obstructions in shallow waters. The large front flippers of leatherbacks often bear cuts or chafing marks or are severed altogether, possibly because of entanglement. Because of their preferred diet of gelatinous zooplankton, particularly jellyfish, leatherback turtles often ingest floating plastic debris, mistaking it for food (Wallace 1985-TN2810). The leatherback turtle does not nest along Delaware Bay beaches and has not been documented in Delaware Bay waters. Like the hawksbill turtle, leatherback turtles have not been taken at the SGS since preoperational and operational monitoring studies were initiated. Therefore, the review team concludes that building and operating a new nuclear power plant at the PSEG Site would have no effect on leatherback sea turtles, and this species will not be discussed further.

3.6 Shortnose Sturgeon

Species Description

The Shortnose Sturgeon (*Acipenser brevirostrum*) is an anadromous, primitive bony fish that can be differentiated by other sturgeon species by its smaller size and shorter and blunter nose than other sturgeon species. Shortnose Sturgeon grow to a length of 4.7 ft (1.4 m) and typically weigh up to 50.7 lb (23 kg) (NMFS 2013-TN2791). Juveniles mature into adults at a fork length of 18 to 22 in. (45 to 55 cm), which, in the Delaware River Estuary, coincides to about 3 to 5 years of age in males and 6 to 7 years of age in females (NMFS 2013-TN2791). The Shortnose's lifespan varies from 30 years (males) to 67 years (females). The Shortnose Sturgeon migrates earlier in the year than other Atlantic Sturgeon species. Adults begin to migrate upstream to freshwater in the winter, spend most of the winter in deep waters of rivers and estuaries, and spawn between January and mid-May (Dadswell et al. 1984-TN2780). Water temperature is a major determining factor of spawning time, and Shortnose begin to spawn when water temperatures reach 46 to 48°F (8 to 9°C) (Gilbert 1989-TN2149), which in the Delaware River Estuary is early to mid-April (NOAA 2013-TN2790). Females produce 40,000 to 200,000 dark brown to black-colored eggs each spring and lay their eggs in fast flowing waters over rock, rubble, or hard clay substrate (Gilbert 1989-TN2149). Eggs are separate when spawned but become adhesive within 20 minutes of being fertilized and adhere to hard substrates on the river bottom (Dadswell et al. 1984-TN2780). Eggs hatch in 4 to 15 days with incubation time being inversely correlated with water

temperate; eggs hatch in 8 days at 63°F (17°C) and in 13 days at 50°F (10°C) (Gilbert 1989-TN2149). Larvae consume their yolk sac and begin feeding in 8 to 12 days, as they migrate downstream and away from the spawning site (Gilbert 1989-TN2149). Juveniles feed on benthic insects and crustaceans and remain in freshwater until the following winter, at which time they migrate to brackish estuaries, where they remain for 3 to 5 years. As adults, they migrate to the nearshore marine environment, where their diet consists of mollusks and large crustaceans (Shepherd 2006-TN2785).

Distribution and Habitat

Shortnose Sturgeon inhabit rivers, estuaries, and nearshore marine environments. The species spawns in coastal rivers along the Atlantic coast from St. John River, New Brunswick, Canada, south to St. Johns River, Florida (NMFS 2013-TN2791). Shortnose occur in most major river systems along the Atlantic coast, including the Savannah River, Georgia; the Chesapeake Bay system; the Delaware River; the Hudson River, New York; the Connecticut River; and the lower Merrimack River, Massachusetts (NMFS 2013-TN2791). Surveys of Shortnose Sturgeon movement in the Delaware River Estuary revealed an overwintering population of about 6,000 to 14,000 fish in the upper tidal portion of the Delaware River Estuary near Trenton at RKM 211.8 (RM 131.6) (Hastings et al. 1987-TN2260). Shortnose Sturgeon move upstream into the non-tidal reach of the Delaware River in late March presumably to spawn before traveling downstream to lower tidal waters near Philadelphia (O'Herron et al. 1993-TN2261). Hastings et al. (Hastings et al. 1987-TN2260) observed upstream movement to non-tidal water as far as Lambertville at RKM 238 (RM 147.9), and there are some records that indicate Shortnose Sturgeon occur as far upriver as Frenchtown near RKM 263.5 (RM 163.7) (NJDEP 2013-TN2722).

Shortnose Sturgeon larvae hatch in freshwater, and juveniles migrate from freshwater riverine environments to brackish estuarine environments between the ages of 3 and 5 years. Adults inhabit nearshore marine areas and are not believed to travel long distances offshore during their annual migration routes (NMFS 2013-TN2791).

Population Trends and ESA Status

No historical population estimates are available for the Shortnose Sturgeon. Though never widely commercially fished, the species was often incidentally taken in fishing gear, and by the 1950s, the lack of recorded Shortnose landings led the FWS to conclude that the species was in danger of extinction (NMFS 2013-TN2791). The FWS listed the Shortnose Sturgeon on the Federal List of Endangered and Threatened Wildlife under the ESA on March 11, 1967 (32 FR 4001-TN2750). A Recovery Plan was developed for the species in 1998, which recognized 19 DPSs along the Atlantic Coast because Shortnose Sturgeon return to their natal rivers to spawn each year, resulting in minimal genetic intermixing (NMFS 1998-TN2783). NMFS initiated a status review of the Shortnose Sturgeon on November 30, 2007 (72 FR 67712-TN2759). NMFS expected to complete the status review in 2009; however, the deadline for providing comments pertaining to the review was extended on January 29, 2008 (73 FR 5177-TN2760), and to date, this status review has not been published. Shortnose Sturgeon are known to occur in waters near the PSEG Site.

3.7 Atlantic Sturgeon

Species Description

The Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) is an anadromous bony fish that can grow to 14 ft (4.3 m) and weigh up to 800 lbs (370 kg) (Gilbert 1989-TN2149; NMFS 2012-TN2797). Atlantic Sturgeon are similar in appearance to Shortnose Sturgeon—bluish-black to olive brown dorsally with pale sides and underbelly—but are larger in size and have a smaller and differently shaped mouth (NMFS 2012-TN2797). Females reach maturity at 7 to 30 years of age, and males reach maturity at 5 to 24 years of age, with those fish inhabiting the southern range maturing earlier (ASMFC 2007-TN2771).

In the mid-Atlantic, adults migrate upriver from April to May to spawn. Females in the Delaware River produce 0.8 to 2.4 million highly adhesive eggs, which fall to the bottom of the water column and adhere to cobble or other hard bottom substrate (ASSRT 2007-TN2082; Gilbert 1989-TN2149). Eggs hatch in 94 to 140 hours at temperatures of 20°C (68°F) and 18°C (64.4°F), respectively (ASSRT 2007-TN2082). Larvae consume their yolk sac in 8 to 12 days, during which time larvae migrate downstream into brackish water, where they live for a few months (ASSRT 2007-TN2082). When juveniles reach a size of 30 to 36 in. (76 to 92 cm), they migrate to nearshore coastal waters, where they feed on benthic invertebrates, including crustaceans, worms, and mollusks (NMFS 2012-TN2797).

Distribution and Habitat

Historically, the Atlantic Sturgeon has inhabited riverine, estuarine, and coastal ocean waters from the St. Lawrence River, Canada, to St. Johns River, Florida (ASMFC 2013-TN2770). However, within the U.S., the species is only known to remain in the Hudson River, Delaware River, and a few South Carolina river systems (ASMFC 2013-TN2770). At one time, the Delaware River Estuary supported the largest population of Atlantic Sturgeon along the Atlantic coast (Secor and Waldman 1999-TN2207). Tagging studies in 2005 and 2006 indicated that Atlantic Sturgeon follow migration patterns similar to Shortnose Sturgeon with spawning potentially occurring in mid-to-late June in the upper tidal Delaware reaches between Philadelphia, Pennsylvania, and Trenton, New Jersey (Simpson and Fox 2007-TN2194).

Atlantic Sturgeon larvae hatch in freshwater, and larvae migrate from freshwater to brackish estuarine environments, where they remain for a few months to a few years (NMFS 2012-TN2797). Juveniles and non-spawning adults inhabit estuaries and coastal marine waters dominated by gravel and sand substrates (NMFS 2012-TN2797).

Population Trends and ESA Status

Atlantic Sturgeon have been commercially fished from as early as 1628, though a substantial Atlantic Sturgeon fishery did not appear until the late 1800s (Shepherd 2006-TN2785). In 1998, the Atlantic States Marine Fisheries Commission, which manages the commercial harvest of the species, instituted a moratorium on Atlantic Sturgeon harvest in U.S. waters (NMFS 2012-TN2797). Based on data from 2001 to 2006, the ASMFC (ASMFC 2007-TN2771) estimated that between 2,752 and 7,904 individuals per year are caught as bycatch in sink gillnets, and 2,167 to 7,210 individuals per year are caught as bycatch in trawls. In a 2007 Status Review of the species, the Atlantic Sturgeon Status Review Team (ASSRT 2007-TN2082) noted that little is known about the size and spawning of the Delaware River population, but that the current population has been greatly reduced within all life stages.

On October 6, 2010, the NMFS published Proposed Listing Determinations for five Atlantic Sturgeon DPSs and listed the Atlantic Sturgeon as endangered (75 FR 61872-TN2758; 75 FR 61904-TN2764). The PSEG Site in the Delaware River Estuary is part of the proposed New York Bight DPS, which includes the Long Island Sound, the New York Bight, and the Delaware Bay from Chatham, Massachusetts, to the Delaware–Maryland border. On February 6, 2012, the Atlantic Sturgeon New York Bight DPS was listed as endangered (77 FR 5880-TN2081). Atlantic Sturgeon are known to occur in waters near the PSEG Site.

4.0 Proposed Action Effects Analysis

A new nuclear power plant at the PSEG Site may affect Federally listed species in the Delaware River Estuary in the following ways:

(1.) Dredging and in-water installation activities associated with improvements to the existing HCGS barge slip, a new barge storage area and unloading facility, the intake and discharge structures, and causeway structures
(2.) Impingement of listed individuals as juveniles or adults at the facilities' water intake point (impingement occurs when aquatic organisms are pinned against intake screens or other parts of the cooling water system intake structure)
(3.) Entrainment of eggs or larvae of listed species at the facilities' water intake point (entrainment occurs when aquatic organisms—usually eggs, larvae, and other small organisms—are drawn into the cooling water system)
(4.) Discharge of cooling water effluent at the facilities' discharge point (thermal, chemical, and physical effects may occur to aquatic organisms present in the vicinity of the point of discharge in the Delaware River Estuary)
(5.) Maintenance dredging of the HCGS barge slip, barge storage, and unloading facility
(6.) Barge traffic during building and operation may cause localized sedimentation and scouring

4.1 Dredging and In-Water Building

For each of the sea turtle and sturgeon species, dredging and in-water building activities and barge traffic are not likely to affect Federally listed species that may be in the vicinity of the intake, discharge, and barge facility areas at the PSEG Site or HCGS barge slip area because the turtles and sturgeon would avoid any noise or disturbances. Causeway installation activities also are not likely to affect any sea turtle or sturgeon species because of their lack of preference for marsh creek habitat.

4.2 Impingement

HCGS has not reported any impingement of listed turtle and sturgeon species in its intake since it began operating in 1986 (PSEG 2009-TN2209), and thus, has no historical impingement records. Because a new nuclear power plant at the PSEG Site would operate using intake and discharge technologies similar to HCGS (closed-cycle cooling) and would be compliant with NJPDES permitting requirements, it is reasonable to assume that a new plant also would not be expected to impinge listed turtle or sturgeon species. The review team concludes that turtle or sturgeon strandings on the PSEG Site intake trash bars are unlikely and would be limited to moribund or compromised individuals.

4.3 Entrainment

Entrainment of sea turtle eggs or hatchlings is not possible because sea turtles lay their eggs on beaches along the southeastern coast of the United States and, after emerging, hatchlings quickly swim to deep ocean water where they remain until breeding age (NMFS 2013-TN2792). When juveniles are old enough to migrate to nearshore coastal areas, they are large enough that they would not be susceptible to entrainment.

The life history of the Shortnose and Atlantic Sturgeon species suggests that entrainment of sturgeon eggs or larvae is unlikely. As mentioned in Sections 3.6 and 3.7, respectively, within the Delaware River Estuary, Shortnose Sturgeon spawn upriver of Trenton (RM 131 [RKM 211], whereas Atlantic Sturgeon spawn between Philadelphia and Trenton (between RM 109 and RM 131 [RKM 176 and RKM 211]) in the upper freshwater–tidal reaches of the Delaware River Estuary. The PSEG site is located downriver at RM 52 (RKM 84) in brackish water. Eggs adhere to river substrate, and juvenile stages tend to remain in freshwater or fresher areas of the Delaware River Estuary for 3 to 5 years before moving downriver to more saline reaches of the Delaware River Estuary or ocean. The NRC (NRC 2011-TN3131) noted that PSEG has not collected the eggs or larvae of sturgeon in annual entrainment monitoring samples from 1978 to 2008 at either HCGS or SGS. Thus, sturgeon eggs or larvae are unlikely to be present in the water column at the PSEG Site intake, and entrainment of sturgeon eggs or larvae is unlikely.

4.4 Discharge Impacts

The potential impacts of increased water temperatures at the PSEG discharge on sea turtles and sturgeon species is expected to be minimal. Both SGS and HCGS have NJPDES permits that place thermal limits on the maximum discharge temperature and maximum change in ambient estuary temperature caused by facility discharge (NRC 2011-TN3131). The high exit velocity of discharge water produces rapid dilution, which limits high temperatures to relatively small areas of the initial mixing zone for HCGS, and is assumed to be similar for a new plant at the PSEG Site. Sea turtles and sturgeon species may largely avoid these areas because of high velocity and turbulence. As described in Section 2.3, the thermal discharge is not expected to alter foraging behavior because the buoyant thermal plume would rise toward the surface of the estuary and is limited in size. Reproduction and nursery areas for sea turtles and sturgeon species do not occur in the area of the discharge. Chemical and physical impacts also are not expected to adversely affect water quality or habitat quality in the Delaware River Estuary due to compliance with chemical discharge permitting required by the NJPDES permit, engineered placement of discharge structures, and protection of bottom habitat from scouring. Therefore, the review team does not expect the discharge from a new plant at the PSEG Site to adversely affect sea turtles or sturgeon species.

4.5 Maintenance Dredging

Dredging may be required to maintain use of the HCGS barge slip and the cooling water intake channel as well as barge storage and the unloading facility during operation. As with in-water installation activities, sea turtle and sturgeon species are not likely to be affected by maintenance dredging because sea turtles and sturgeon would avoid any noise or disturbances in the area.

4.6 Barge Traffic

Disruption of habitat in the Delaware River Estuary from sedimentation and scouring due to propeller wash is expected to be localized and temporary (PSEG 2014-TN3452). Sea turtles and sturgeon species likely would avoid habitats in the area of incoming and outgoing barge traffic and could find unaffected habitat nearby for foraging activities.

5.0 Cumulative Effects Analysis

Many historical events have affected the Delaware Estuary and River Basin and its resources (Berger et al. 1994-TN2127). As Europeans began settling the estuary region early in the 17th century, agriculture expanded, and the clearing of forest led to erosion. Dredging, diking, and filling gradually altered extensive areas of shoreline and tidal marsh. By the late 1800s, industrialization had altered much of the watershed of the upper estuary, and fisheries were declining because of overfishing as well as pollution from ships, sewers, and industry. By the 1940s, anadromous fish were blocked from migrating upstream to spawn because of a barrier of low oxygen levels in the Philadelphia area. This barrier, combined with small dams on tributaries, nearly destroyed the herring and shad fisheries. A large increase in industrial pollution in the early-to-mid 1900s resulted in the Delaware River near Philadelphia becoming one of the most polluted river reaches in the world. Major improvements in water quality began in the 1960s and continued through the 1980s as a result of State, multi-State, and Federal actions, including the Clean Water Act and the activities of the DRBC (PDE 2012-TN2191). The Delaware Estuary and River Basin is the subject of numerous restoration activities and projects under the purview of the Partnership for the Delaware Estuary, the DRBC, and numerous research and academic institutions. In its 2012 annual report, the Partnership for the Delaware Estuary suggested that the overall environmental conditions of the region were fair (PDE 2012-TN2191). Since 2008, some conditions were found to be declining in areas such as sediment removal impairing estuarine habitats and a decline in young-of-year Atlantic Sturgeon, and some areas were seeing improvements such as a reduction of total organic carbon and an increase in Striped Bass populations (PDE 2012-TN2191).

Other actions in the vicinity that have present and reasonably foreseeable future impacts on the Delaware River Estuary include the continued operation of SGS and HCGS, the completion of dredging operations for the Delaware River Main Channel Deepening Project by the USACE, and potential construction of a new transmission corridor and transmission line by PJM Interconnection, LLC, for grid stability. Planning and development for the new transmission corridor would avoid or span channelized waterways, perennial streams, and intermittent streams (PSEG 2014-TN3452). Development for new transmission-line crossings would require BMPs to protect water quality and minimize effects to aquatic habitats that may be at risk from clearing activities, runoff, and bank erosion. An estimated 77,088 linear ft of stream habitat (S&L 2010-TN2671) is within the 5-mi-wide macro-corridor for the hypothetical transmission line discussed in Sections 7.1 and 7.3.2. The hypothetical transmission line would cross the Delaware River and would require installation of footings. Placement of footings would result in permanent benthic habitat loss, but this loss would be minimal when compared to available adjacent habitat. Installation activities would be managed through use of BMPs required for Federal and State permitting to minimize siltation and protect adjacent aquatic habitats. PSEG would consult with Federal and State agencies, as required, when an exact route is identified and installation effects to protected species can be directly assessed (PSEG 2014-TN3452).

Water quality in the region may be affected by continued withdrawal and discharge of water to support power generation. Large commercial and recreational fisheries harvest fish and invertebrates that make up the ecological community within the Delaware River Estuary. The effects of natural environmental stressors such as climate change and extreme weather events also would affect aquatic communities in the region.

Each of the current and reasonably foreseeable future activities may influence the structure and function of estuarine food webs and result in observable changes to the aquatic resources in the Delaware River Estuary. In most cases, it is not possible to determine quantitatively the impact of individual stressors or groups of stressors on aquatic resources because they affect the region simultaneously, and their effects are cumulative.

5.1 Continued Operation of the SGS Once-Through Cooling System

Based on the assessment presented in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants—Supplement 45: Regarding Hope Creek Generating Station and Salem Nuclear Generating Station, Units 1 and 2 Final Report* (NRC 2011-TN3131), NRC staff concluded that "entrainment, impingement, and thermal discharge impacts on aquatic resources from the operation of SGS Units 1 and 2 collectively have not had a noticeable adverse effect on the balanced indigenous community of the Delaware Estuary." However, operation of SGS Units 1 and 2 continues to impinge and entrain aquatic species and would contribute, in part, to the cumulative loss of these species in the Delaware River Estuary. Several improvements to the cooling water intake structures have been made to reduce impingement mortality at SGS. Some of these improvements included installation of modified traveling screens, installation of improved screen mesh, and modifications to spray wash nozzle configurations (PSEG 2009-TN2513). Decades of monitoring and survey data for finfish and aquatic invertebrates have been used to assess species density and richness in the vicinity of SGS as directed under NJPDES permits starting in 1994 and in subsequent renewals (PSEG 2014-TN3452). Impingement, entrainment, and fish assemblage sampling by trawling and seining are conducted each year, in accordance with NJPDES permit requirements for biological monitoring. The reporting emphasis is on targeted representative important species that include Blueback Herring, Alewife (*Alosa pseudoharengus*), American Shad, Atlantic Menhaden, Bay Anchovy, Atlantic Silverside, White Perch, Striped Bass, Bluefish (*Pomatomus saltatrix*), Weakfish, Spot (*Leiostomus xanthurus*), and Atlantic Croaker (PSEG 2014-TN3452). All of these representative important species also are considered either recreationally or commercially important or are ecologically important as forage fish for sustainability of the ecosystem within the Delaware River Estuary. They are discussed in more detail in Section 2.4.2.3 of the EIS. Although individual species abundances change year to year, the overall trends in community abundances and diversity show no significant changes (PSEG 2014-TN3452).

5.2 Continued Operation of the HCGS Closed-Cycle Cooling System

HCGS uses closed-cycle cooling and therefore requires substantially less water volume for cooling operations (maximum of 66,000 gpm from the Delaware River Estuary). Accordingly, effects on the aquatic community through impingement, entrainment, and discharge also are expected to be reduced when compared with the once-through cooling system at SGS (NRC 2011-TN3131). Impingement studies at HCGS were performed only in 1986 and 1987 at the commencement of operation for the single unit

and showed a reduced overall impingement rate when compared to SGS (see EIS Section 5.3.2). Because HCGS was operating concurrently with SGS, the NJPDES permit-directed biological monitoring of the aquatic community through trawling and seining studies also reflected the combined effect of both HCGS and SGS operations. Therefore, the conclusions regarding the effect of continued operation of SGS also apply to HCGS in that the overall species diversity and community abundances near the PSEG Site are expected to continue to show no noticeable effects from operations (NRC 2011-TN3131).

5.3 SGS and HCGS Effects on Protected Species

Relicensing of SGS and HCGS is under ongoing consultation pursuant to Section 7 of the ESA for species under NMFS jurisdiction (NRC 2010-TN2811). NMFS issued a Biological Opinion for the two facilities on May 14, 1993 (PSEG 1999-TN2787), which was amended by letter dated January 21, 1999 (NMFS 1999-TN2711).

Consultation pursuant to Section 7 of the ESA regarding the nearby SGS and HCGS has been ongoing between the NRC and NMFS since 1979. In 1980, NMFS issued a Biological Opinion that concluded that the continued operation of these facilities was not likely to jeopardize the Shortnose Sturgeon and set a take limit of up to 11 Shortnose Sturgeon per year. Sea turtles were not included in the 1980 Biological Opinion.

The NRC reinitiated consultation on August 19, 1988, because SGS had impinged a number of sea turtles. NMFS issued a revised Biological Opinion on January 2, 1991, to include sea turtles. In this Biological Opinion, NMFS concluded that continued operation of SGS and HCGS would affect sea turtles but would not jeopardize the continued existence of any populations of threatened or endangered species. The 1991 Biological Opinion also reduced the number of allowable Shortnose Sturgeon takes based on actual levels of impingement at SGS and HCGS up to that point.

NMFS modified the 1991 Biological Opinion on August 4, 1992, to increase the total allowable take limit for loggerheads and Shortnose Sturgeon. However, between June and October 1992, SGS and HCGS exceeded their take limit for Kemp's ridley mortalities and met their take limit for Shortnose Sturgeon mortalities. NMFS issued another Biological Opinion on May 14, 1993 (PSEG 1999-TN2787), which did not change the take limits of listed species but specified that SGS and HCGS should develop a research program using mark/recapture to determine whether SGS has features that attract sea turtles. Also in 1993, PSEG implemented a policy of removing the ice barriers from the trash racks on the intake structure between May 1 and October 24, which resulted in substantially lower turtle impingement rates at SGS.

The NRC reinitiated Section 7 Consultation in 1998 to remove the study requirement from the SGS and HCGS Incidental Take Statement. The NRC cited the change in PSEG procedure regarding removal of ice barriers during the spring and summer. In response, NMFS issued a Biological Opinion on January 21, 1999, that removed the study requirement and decreased the number of annual allowable takes of Shortnose Sturgeon from 10 individuals to 5 individuals based on the review of Shortnose Sturgeon capture rates at SGS and HCGS. The Biological Opinion also formalized ice barrier removal from May 1 through October 24 by making it a requirement in the "Terms and Conditions" section of the Biological Opinion. To implement the 1999 Biological Opinion, PSEG developed associated guidance documents, *Biological Opinion Compliance* and *Species Management* (PSEG 1999-TN2787).

Table 3 provides a summary of the incidental take limits for each Biological Opinion that NMFS issued, including the current 1999 Biological Opinion take limits. The leatherback sea turtle, hawksbill sea turtle, and the Atlantic Sturgeon have not been included in previous assessments of SGS and HCGS impacts or in previous Biological Opinions.

The current Biological Opinion (NMFS 1999-TN2711) Incidental Take Statement was amended on January 21, 1999, and revised the number of incidental takes of listed species as detailed in Table 3.

Table 3. SGS and HCGS Incidental Take Statement Limits

	Annual Take Limit Set by NMFS Biological Opinions[(a)]				
Species	**1980**	**1991**	**1992**	**1993**	**1999**
Loggerhead sea turtle	–	10 (5)	30 (5)	30 (5)	30 (5)
Green sea turtle	–	5 (2)	5 (2)	5 (2)	5 (2)
Kemp's ridley sea turtle	–	5 (1)	5 (1)	5 (1)	5 (1)
Shortnose Sturgeon	11	2 (2)	10 (2)	10 (10)	5 (5)

(a) The first number given is the total number of allowable takes. The second number, in parentheses, is the number of takes out of the total that may be lethal takes.

Sources: PSEG 1999-TN2787; NMFS 1999-TN2711.

The Biological Opinion also contains the following "Reasonable and Prudent Measures," which apply to SGS:

- Removable ice barriers located on the trash racks must be removed by May 1 of each year and replaced after October 24 of each year.
- Trash racks associated with SGS's circulating water system must be cleaned three times per week from May 1 through November 15 and must be cleaned daily from June 1 through October 15.
- Trash racks must be inspected every two hours from June 1 through October 15.
- If a lethal incidental take that is directly attributable to the plant occurs between June 1 and October 15, monitoring of the trash racks must be increased to hourly for the remainder of the year.

A previous Biological Opinion (PSEG 1999-TN2787) concluded that HCGS would not affect listed species because no species had been documented at the site between when the plant began operating in 1986 and the 1993 Biological Opinion, which did not require monitoring at HCGS beyond normal cleaning operations. The 1999 Biological Opinion did not modify any requirement specific to HCGS.

The "Terms and Conditions" portion of the Biological Opinion requires PSEG to report all incidental takes to NMFS within 30 days of the take and to include appropriate documentation in the report. Additionally, the "Terms and Conditions" detail a number of requirements for sea turtle resuscitation, live sea turtle inspection, dead sea turtle necropsy reports, and Shortnose Sturgeon tagging and inspection. An updated

Biological Opinion is expected to be issued by NMFS, and it will include requirements for the Atlantic Sturgeon, which has been recently listed as endangered.

Between 1992 and 2001, 16 loggerhead turtles were stranded at SGS (NRC 2010-TN2811), while 3 Atlantic green turtles have been captured at SGS since it began operations, with all captures occurring between 1980 and 1992 (PSEG 2014-TN3452). In 1992, two live and two dead Kemp's ridley sea turtles were found at the SGS cooling water intake; the cause of mortality was not reported (PSEG 1992-TN3173). In 1993, a live Kemp's ridley sea turtle was found at the SGS cooling water intake (PSEG 1999-TN2787). Implementation of mitigation measures in 1993 reduced the likelihood of additional turtle strandings; however, two Kemp's ridley turtles were stranded at SGS in 2013 (PSEG 2013-TN2690; PSEG 2013-TN3137). Incidental takes of sea turtle and sturgeon species at SGS between 2000 and 2013 are summarized in Table 4.

Table 4. SGS Incidental Takes of Sea Turtle Species and Sturgeon Species Between 2000 and 2013[a]

Species	Year	Number of Takes	Condition[b]
Sea turtle			
Loggerhead	2000	2	1 live, 1 dead
	2001	1	dead
Kemp's ridley	2013	2	1 live, 1 dead
Sturgeon			
Shortnose	2000	1	dead
	2003	1	dead
	2004	1	dead
	2007	1	dead
	2008	1	dead
	2011	2	2 dead
	2012	1	live
	2013	4	2 live, 2 dead
Atlantic[c]	2012	2	1 live, 1 dead
	2013	19	13 live, 6 dead

(a) References provided in text.
(b) Found live or dead in intake area; counted as dead if found live but died shortly afterward.
(c) Atlantic Sturgeon reported at SGS only in 2012 and 2013.

Since 2000, three live and nine dead Shortnose Sturgeon have been collected on SGS intake structures (PSEG 2000-TN3150; PSEG 2003-TN3149; PSEG 2004-TN3144; PSEG 2007-TN3148; PSEG 2008-TN3147; PSEG 2011-TN3146; PSEG 2011-TN3365;

PSEG 2013-TN2707; PSEG 2013-TN2691; PSEG 2013-TN2692; PSEG 2013-TN2695; PSEG 2013-TN2704). Atlantic Sturgeon were not reported at the SGS intake screens until after this species was considered for listing as a Federally endangered species. Ongoing consultation with NMFS to revise the Biological Opinion will result in the inclusion of Atlantic Sturgeon. During 2012 and 2013, 14 live and 7 dead Atlantic Sturgeon were reported at the SGS intake system (PSEG 2012-TN3143; PSEG 2012-TN3142; PSEG 2013-TN2693; PSEG 2013-TN2694; PSEG 2013-TN2696; PSEG 2013-TN2697; PSEG 2013-TN2698; PSEG 2013-TN2699; PSEG 2013-TN2700; PSEG 2013-TN2701; PSEG 2013-TN2702; PSEG 2013-TN2703; PSEG 2013-TN2705; PSEG 2013-TN3138; PSEG 2013-TN3139; PSEG 2013-TN3140; PSEG 2013-TN3141; PSEG 2013-TN3198).

5.4 Commercial and Recreational Harvest of Fish and Shellfish

The Delaware River Estuary supports a diverse commercial and recreational fishery for finfish and invertebrates. Losses to the ecosystem from fishery harvest are managed at the Federal and State levels through catch limits, regulations on fishing gear, and seasonal closures. Unintended harvest or mortality is another source of loss through bycatch while targeting a different species. These activities have the potential to contribute to cumulative effects on aquatic species in the Delaware River Estuary. However, the direct contribution is difficult to assess because many of these fish populations have life histories that involve a large migratory territory offshore and along the Atlantic coast of the United States, and therefore, effects to populations are difficult to directly attribute to Delaware River Estuary habitat effects.

5.5 Habitat Loss and Restoration

Current and future land use development for industry, agriculture, or other habitat alterations in the Delaware River Estuary watershed may affect water quality. These types of activities may also result in shoreline habitat loss.

Dredging activities from past efforts to maintain navigation in the Delaware River Estuary may have affected estuarine habitats, and future dredging activities are planned that may continue to affect the aquatic ecosystem. Starting in 2010, the USACE began implementing the Delaware River Main Channel Deepening Project to deepen the existing navigation channel from 40 to 45 ft (USACE 2011-TN2262). To deepen the channel, material would be dredged by hydraulic and hopper dredges and placed in USACE confined disposal facilities (CDFs) or used for beneficial reuse purposes (e.g., wetland and beach restoration; habitat creation) in lower Delaware Bay. The USACE estimates that 1,012,428 yd^3 of material were dredged from Reach D of the Delaware River Estuary near Artificial Island and placed in the Federally-owned Artificial Island CDF (USACE 2013-TN2851). When completed, the entire deepening project would remove and dispose of an estimated 16 million yd^3 of sediments from the Delaware River in Philadelphia down to the mouth of the Delaware Bay. The subsequent maintenance dredging would remove an estimated 4,317,000 yd^3 of sediment from the 45-ft-deep channel each year (USACE 2011-TN2262). Maintenance dredging would be carried out as needed, generally over a 2-month period between August and December. As with building in-river components of a new nuclear power plant at the PSEG Site, fish and benthic invertebrates in the Delaware River Estuary would be displaced during the USACE dredging activities but are expected to recolonize the affected areas. The USACE would implement appropriate measures required by Federal and State agencies and organizations to protect aquatic resources, including

endangered species (sturgeon and sea turtles), sharks, horseshoe crabs (*Limulus polyphemus*), blue crabs, freshwater mussels, and American Eels (USACE 2011-TN2262). For example, mechanical dredge activities between March 15 and June 30 would be avoided within selected reaches of the project area to prevent sedimentation and turbidity effects on reproduction of Atlantic Sturgeon, Striped Bass, American Shad, and river herring (USACE 2013-TN2851).

While aquatic habitats continue to be affected by natural and anthropogenic activities in the Delaware River Estuary, efforts to restore salt marsh and estuary habitat have met with some success and are expected to continue in the future. For example, ongoing restoration activities within the Mad Horse Creek WMA, located 4 mi east of the PSEG Site, would restore nearly 200 ac of the Mad Horse Creek WMA to address injuries to shoreline and bird resources resulting from the 2004 *Athos I* oil spill (NOAA 2008-TN2721). NJDEP and the National Oceanic and Atmospheric Administration proposed a tidal wetland restoration project that would allow development of smooth cordgrass (*Spartina alterniflora*) habitat to improve habitat quality in the area. Restoration would be accomplished through fill material removal to lower the marsh elevation and allow tidal inundation (PSEG 2014-TN3452). As described in EIS Section 4.3.1, unavoidable impacts to wetlands during development of a new nuclear power plant at the PSEG Site and the proposed causeway would be mitigated by habitat restoration and enhancement, using experience and proven techniques developed by the PSEG EEP. Sensitive species that utilize such marsh habitats would be affected positively by the proposed Mad Horse Creek WMA restoration effort and by the proposed mitigation for a new nuclear power plant at the PSEG Site and causeway (i.e., restoration of low quality marsh habitats) (PSEG 2014-TN3452).

5.6 Climate Change

The potential impacts of climate change on aquatic organisms and habitat in the geographic area of interest are not precisely known. In addition to rising sea levels, climate change could lead to regional increases in the frequency and intensity of extreme precipitation events, increases in annual precipitation, and increases in average temperature (GCRP 2014-TN3472). Such changes in climate could alter aquatic community composition on or near the PSEG Site through changes in species diversity, abundance, and distribution. In 2012, Hurricane Sandy created increased storm surge during this event within the Delaware River Estuary and had moderate effects on water quality and coastal habitats within the southernmost portion of the Delaware River Estuary through erosion, sedimentation, and resuspension of contaminants within sediments (ALS 2012-TN2720). Elevated water temperatures, droughts, and severe weather phenomena could adversely affect or severely reduce aquatic habitat; however, specific predictions on aquatic habitat changes in this region due to climate change are inconclusive at this time. The level of impact resulting from these events would depend on the intensity of the perturbation and the resiliency of the aquatic communities. The DRBC stated in the State of the Delaware River Basin report for 2013 that increases in temperature and salinity are expected with future sea level rise and climate change (DRBC 2013-TN2609). These potential changes are likely to result in movement of populations of more marine and euryhaline species farther up the Delaware River Estuary. For example, in a recent report, hard bottom areas north and south of the Chesapeake and Delaware Canal (upriver of the PSEG Site) were identified as having potential as reef sites for the establishment of new oyster beds and were discussed as a future conservation target due to changing climate conditions resulting in increases in salinity farther upriver (PDE 2011-TN2190).

5.7 Summary of Cumulative Effects

Aquatic resources of the Delaware River Estuary are cumulatively affected to varying degrees by multiple activities and processes that have occurred in the past, are occurring currently, and are likely to occur in the future. The food web and the abundance of important aquatic forage species and other species have been substantially affected by these stressors historically, as described in EIS Section 2.4.2. The effects of some of these stressors associated with human activities are addressed by management actions (e.g., cooling system operation, regulation of fishing pressure, water quality improvements, and habitat restoration).

Other stressors, such as climate change and increased human population and associated development in the Delaware River Basin, cannot be directly managed, and their effects are more difficult to quantify and predict. It is likely, however, that future anthropogenic and natural environmental stressors would cumulatively affect the aquatic community of the Delaware River Estuary sufficiently that they would noticeably alter important attributes, such as species ranges, populations, diversity, habitats, and ecosystem processes, just as they have in the past. These stressors have modified important attributes of aquatic resources and would continue to exert an influence in the future, potentially destabilizing some of the attributes of the aquatic ecosystem. Based on these observations, the review team concludes that cumulative effects have been noticeable and destabilizing for some aquatic resources, primarily based on past stressors affecting aquatic resources in the Delaware Estuary and River Basin.

Cumulative effects on aquatic ecology resources are estimated based on the information provided by PSEG, NMFS, and the review team's independent review. The significant history of the degradation of the Delaware River Estuary has had a noticeable and sometimes destabilizing effect on many aquatic species and communities. Commencement of operations at SGS Units 1 and 2 resulted in significant numbers of aquatic species being entrained and impinged, which led to required restoration of the area through the PSEG EEP as a form of mitigation. In addition, present and reasonably foreseeable future activities such as the continued operation of SGS and HCGS and the completion of dredging operations for the Delaware River Main Channel Deepening Project would continue to have effects on the aquatic resources in the Delaware River Estuary. However, the review team concludes that the incremental contribution of the NRC-authorized activities related to construction and operation of a new nuclear power plant at the PSEG Site would be negligible.

6.0 Conclusion and Determination of Effects

Building activities associated with cooling water intake and discharge structures, HCGS barge slip improvements, barge storage area and unloading facility, and causeway would require dredging and in-water work that may cause siltation and disturbance of benthic habitats on the immediate areas of building and in nearby coastal waters. However, Federal and State permitting requires BMPs associated with use of cofferdams, siltation barriers, and avoidance of in-water activities in marsh creeks during spawning cycles to control and minimize the potential for adverse impacts to protected species. Dredging and installation of intake and discharge structures would occur in a portion of the Delaware River Estuary that is used by sea turtles and anadromous fish. While installation activities are expected to be temporary and localized, the presence of any of the species described in this document within the installation area may occur, although these species should be able to migrate around the installation area and forage in adjacent, unaffected habitat.

Because PSEG proposes to use a cooling water intake configuration similar to the closed-cycle cooling at HCGS, and operation of HCGS has been determined to have no adverse effects on any listed sea turtle or sturgeon species in the future (NRC 2010-TN2811), the review team has determined that building and operation activities for a new nuclear power plant at the PSEG Site may affect, but are not likely to adversely affect the loggerhead sea turtle, green sea turtle, Kemp's ridley sea turtle, Shortnose Sturgeon, and Atlantic Sturgeon.

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F.3.2. National Marine Fisheries Service Essential Fish Habitat Assessment

Essential Fish Habitat Assessment

PSEG Site

Early Site Permit Application

June 2014

Docket Number 52-043

U.S. Nuclear Regulatory Commission
Rockville, Maryland

Table of Contents

List of Figures ii
List of Tables ii
Abbreviations, Acronyms, and Symbols iii
1.0 Introduction 1
2.0 Description of the Proposed Action 1
2.1 Site Location and Description 2
2.2 Dredging and In-Water Installation Activities 8
2.3 Cooling Water System Description and Operation 9
3.0 EFH Species Near the Site 19
3.1 EFH Species Identified for Preliminary Analysis 19
3.2 EFH Species Identified for In-Depth Analysis 23
3.2.1 Black Sea Bass (*Centropristis striata*) 23
3.2.2 Clearnose Skate (*Raja eglanteria*) 24
3.2.3 Little Skate (*Leucoraja erinacea*) 24
3.2.4 Scup (*Stenotomus chrysops*) 25
3.2.5 Summer Flounder (*Paralichthys dentatus*) 25
3.2.6 Windowpane Flounder (*Scophthalmus aquosus*) 26
3.2.7 Winter Flounder (*Pseudopleuronectes americanus*) 27
3.2.8 Winter Skate (*Leucoraja ocellata*) 28
4.0 Potential Adverse Effects to EFH 29
4.1 Black Sea Bass 29
4.2 Clearnose Skate 30
4.3 Little Skate 32
4.4 Scup 33
4.5 Summer Flounder 34
4.6 Windowpane Flounder 35
4.7 Winter Flounder 37
4.8 Winter Skate 38
5.0 Cumulative Effects to EFH 39
5.1 Continued Operation of the SGS Once-Through Cooling System 40
5.2 Continued Operation of the HCGS Closed-Cycle Cooling System 41
5.3 Commercial and Recreational Harvest of Fish and Shellfish 41
5.4 Habitat Loss and Restoration 41
5.5 Climate Change 42
5.6 Summary of Cumulative Impacts 43
6.0 Conclusions 44
6.1 Black Sea Bass 44
6.2 Clearnose Skate 44
6.3 Little Skate 44
6.4 Scup 44
6.5 Summer Flounder 45
6.6 Windowpane Flounder 45
6.7 Winter Flounder 45
6.8 Winter Skate 46
7.0 References 49

List of Figures

Figure 1. Location of the PSEG Site Within 6-Mile and 50-Mile Radius 3
Figure 2. PSEG Site with Nearby Water Bodies and Proposed Causeway 4
Figure 3. PSEG Site Utilization Plan 5
Figure 4. Predicted PSEG Thermal Plume in Relation to HCGS HDA and SGS Plume Boundary Under Flood Tide Conditions 17

List of Tables

Table 1. Impingement Rate for Most Abundant Species and Total Species Impinged at SGS and HCGS. 11
Table 2. Species with Designated EFH in the Delaware Bay 20
Table 3. Habitat Requirements of Identified EFH Species 21
Table 4. Species Retained for In-Depth EFH Analysis 23
Table 5. Impacts on EFH from Building Activities and Operation of a New Nuclear Power Plant at the PSEG Site 47

Abbreviations, Acronyms, and Symbols

°C	degrees Celsius
°F	degrees Fahrenheit
ac	acre(s)
ASMFC	Atlantic States Marine Fisheries Commission
BMPs	best management practices
CDF	confined disposal facility
CFR	*Code of Federal Regulations*
COL	combined construction permit and operating license
CP	construction permit
DRBC	Delaware River Basin Commission
EEP	Estuary Enhancement Program
EFH	essential fish habitat
EIS	environmental impact statement
ER	Environmental Report
ESP	early site permit
fps	feet per second
ft	foot (feet)
gpm	gallon(s) per minute
ha	hectare(s)
HCGS	Hope Creek Generating Station
HDA	heat dissipation area
in.	inch(es)
km	kilometer(s)
lb	pound(s)
m	meter(s)
m^3	cubic meter(s)
MAFMC	Mid-Atlantic Fishery Management Council
Mgd	million gallons per day
mi	mile(s)
MSA	Magnuson-Stevens Fishery and Conservation Management Act
MSL	mean sea level
MT	metric ton(nes)
NAVD	North American Vertical Datum (sea level reference point used in surveying)

NEFMC	New England Fishery Management Council
NJDEP	New Jersey Department of Environmental Protection
NJPDES	New Jersey Pollutant Discharge Elimination System
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRC	U.S. Nuclear Regulatory Commission
OL	operating license
PDE	Partnership for the Delaware Estuary
ppt	parts per thousand
PSEG	PSEG Power, LLC, and PSEG Nuclear, LLC
RKM	River Kilometer
RM	River Mile
SGS	Salem Generating Station, Units 1 and 2
SWPPP	stormwater pollution prevention plan
USACE	U.S. Army Corps of Engineers
WMA	Wildlife Management Area
yd^3	cubic yard(s)

Essential Fish Habitat Assessment for the PSEG Site Early Site Permit Application

1.0 Introduction

In compliance with Section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended by the Sustainable Fisheries Act of 1996 (16 USC 1801-TN1061), the U.S. Nuclear Regulatory Commission (NRC) review team prepared this essential fish habitat (EFH) assessment for the proposed Federal action: NRC issuance of an early site permit (ESP) for a site (the PSEG Power, LLC, and PSEG Nuclear, LLC [PSEG] site) located adjacent to the existing Hope Creek Generating Station (HCGS) and Salem Generating Station Units 1 and 2 (SGS) in Lower Alloways Creek Township, Salem County, New Jersey, on the eastern shore of the Delaware River Estuary.

Pursuant to the MSA, the review team requested via letter dated October 26, 2010, that the National Marine Fisheries Service (NMFS) provide information on EFH in the vicinity of the PSEG Site (NRC 2010-TN2203). In their response to the NRC dated December 9, 2010, NMFS indicated that the estuarine portions of the Delaware River and its tributaries contain designated EFH for a number of species and directed the NRC to prepare an EFH assessment as part of the EFH consultation process (NMFS 2010-TN2171). Another request was sent to NMFS dated July 31, 2013, to confirm designated EFH for the species provided in the December 9, 2010, NMFS letter, or to provide an updated EFH species list (NRC 2013-TN2805). A slightly revised list of species with designated EFH was received from NMFS (PNNL 2013-TN2687; NMFS 2013-TN2804).

Accordingly, this EFH assessment describes the proposed action, identifies relevant commercially, Federally managed species within the vicinity of the proposed action site, assesses whether the proposed action may adversely affect any designated EFH, and describes potential measures to avoid, minimize, or offset potential adverse impacts to EFH as a result of the proposed action. This assessment also considers the recent EFH assessment prepared for relicensing of SGS and HCGS (NRC 2011-TN2611).

2.0 Description of the Proposed Action

The proposed NRC Federal action is the issuance, under the provisions of Title 10 of the *Code of Federal Regulations* (CFR) Part 52 (10 CFR 52-TN251), of an ESP for the PSEG Site for nuclear power facilities with characteristics that fall within the plant parameter envelope. An ESP is NRC approval of a site or sites for one or more nuclear power facilities. Issuance of an ESP is a process that is separate from the issuance of a construction permit (CP), an operating license (OL), or a combined construction permit and operating license (COL) for such a facility. The ESP application and review process makes it possible to evaluate and resolve safety and environmental issues related to siting before the applicant makes a large commitment of resources. If the ESP is approved, the applicant can “bank” the site for up to 20 years for future reactor siting and can conduct certain site preparation and preliminary construction activities enumerated in 10 CFR 50.10 (e)(1) (10 CFR 50-TN249). An ESP does not, however, authorize construction and operation of a nuclear power plant. To construct and operate a nuclear power plant, an ESP holder must obtain a CP and an OL, or a COL, which are separate major Federal actions that require their own environmental reviews in accordance with 10 CFR Part 51 (10 CFR 51-TN250). An applicant for a CP or COL for a new nuclear

power plant to be located at a site for which an ESP has been issued may reference the ESP, and matters resolved in the ESP proceeding are considered resolved in any subsequent proceeding absent the identification of new and significant information.

PSEG is seeking an ESP for the PSEG Site located adjacent to the existing HCGS and SGS. As part of its review of the ESP application, the NRC is preparing an environmental impact statement (EIS) as required by Title 10 of CFR Part 51, the NRC regulations that implement the National Environmental Policy Act of 1969, as amended. The EIS will include an analysis of pertinent environmental issues, including endangered and threatened species and impacts to fish and wildlife.

The U.S. Army Corps of Engineers (USACE) is participating as a cooperating agency with the NRC in preparing the EIS and participates collaboratively on the review team. Upon issuance of the draft EIS, PSEG plans to submit a Federal and a State application to the USACE and the New Jersey Department of Environmental Protection (NJDEP) for the Alteration of Any Floodplains, Waterways, or Tidal or Nontidal Wetlands in New Jersey. The USACE application number, the NJDEP Tidal Application number, and the NJDEP Nontidal Application number all will be included in the final EIS. The final EIS will be issued after considering public comments on the draft EIS. The USACE permit action on a Department of the Army individual permit application pursuant to Section 404 of the Federal Water Pollution Control Act (Clean Water Act; 33 USC 1251-TN662) and Section 10 of the Rivers and Harbors Appropriation Act of 1899 (33 USC 403-TN660) will be made following issuance of the final EIS.

2.1 Site Location and Description

The PSEG Site lies on Artificial Island, directly north of the existing SGS and HCGS located on the east bank of the Delaware River in Lower Alloways Creek Township, Salem County, New Jersey, at which point the river is approximately 2.5 mi (4 km) wide. Artificial Island is a human-made island approximately 1,500 ac (600 ha) in size that consists of tidal marsh and grassland. The USACE created the island in the 20th century by the deposition of hydraulically dredged material atop a natural sand bar that projected into the river. The average elevation of the island is about 9 ft (3 m) above mean sea level (MSL) with a maximum elevation of approximately 18 ft (5.5 m) above MSL (PSEG 2014-TN3452). The site is located approximately 17 mi (27 km) south of the Delaware Memorial Bridge; 35 mi (56 km) southwest of Philadelphia, Pennsylvania; and 8 mi (13 km) southwest of the City of Salem, New Jersey (PSEG 2014-TN3452). Figure 1 shows the location of the PSEG Site and the areas within a 6-mi (10-km) radius and 50-mi (80-km) radius of the facility.

PSEG owns approximately 740 ac (300 ha) at the southern end of the Artificial Island, of which SGS occupies approximately 220 ac (89 ha) and HCGS occupies about 153 ac (62 ha). PSEG is developing an agreement in principle with the USACE to acquire an additional 85 ac of the USACE's Confined Disposal Facility (CDF) land immediately north of HCGS. Figures 2 and 3 provide a context for the site in relation to nearby water bodies and a plan view of the proposed site layout for PSEG, respectively. The region within 15 mi (24 km) of the site is primarily used for agriculture. The area also includes numerous parks, wildlife refuges, and preserves such as Mad Horse Creek Wildlife Management Area (WMA) to the east; Cedar Swamp State WMA to the south in Delaware; Appoquinimink, Silver Run, and Augustine State WMAs to the west in Delaware; and Supawna Meadows National Wildlife Refuge to the north (PSEG 2014-TN3452).

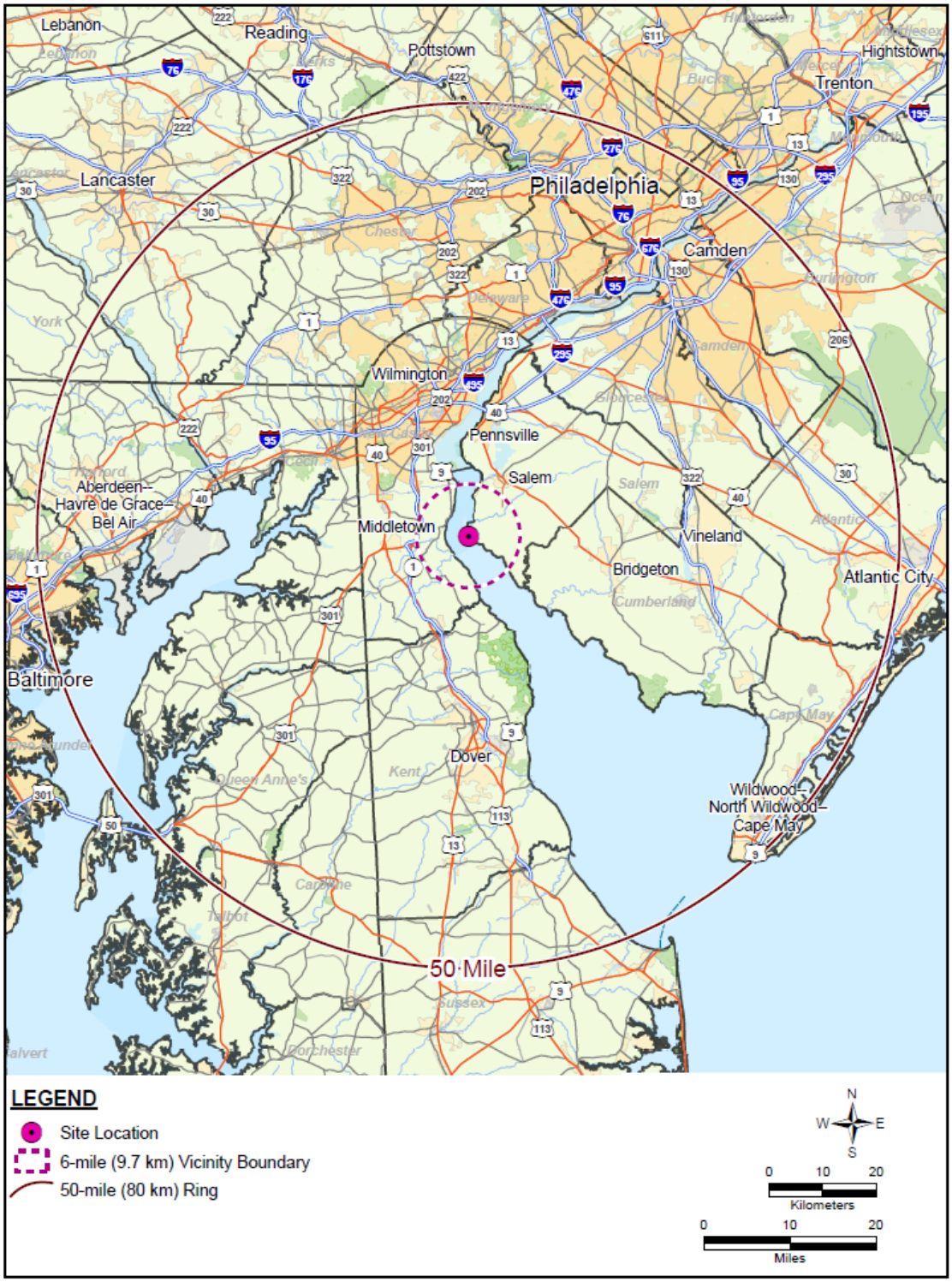

Figure 1. Location of the PSEG Site Within 6-Mile and 50-Mile Radius
(Source: Modified from PSEG 2014-TN3452).

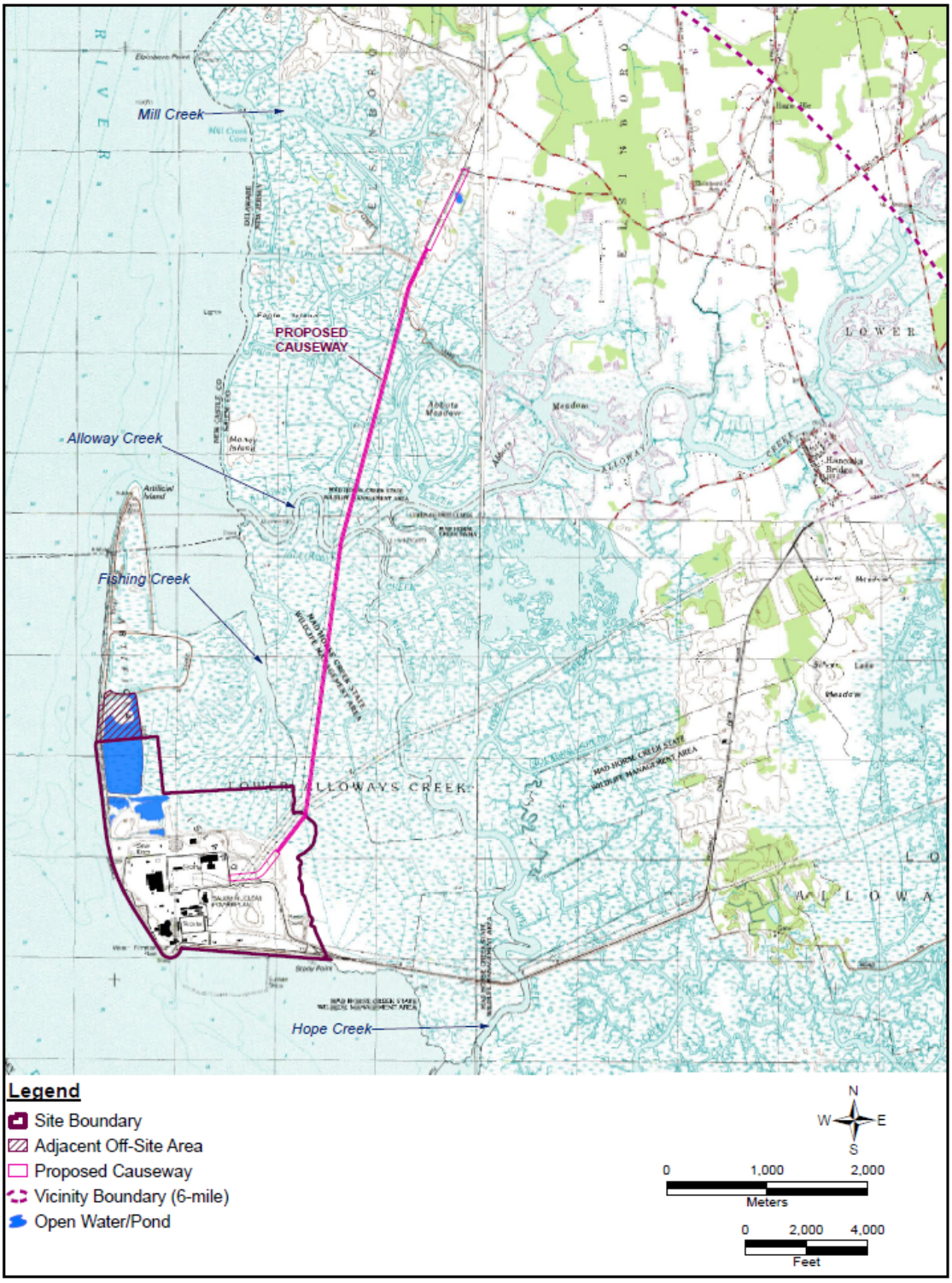

Figure 2. PSEG Site with Nearby Water Bodies and Proposed Causeway
(Source: Modified from PSEG 2014-TN3452).

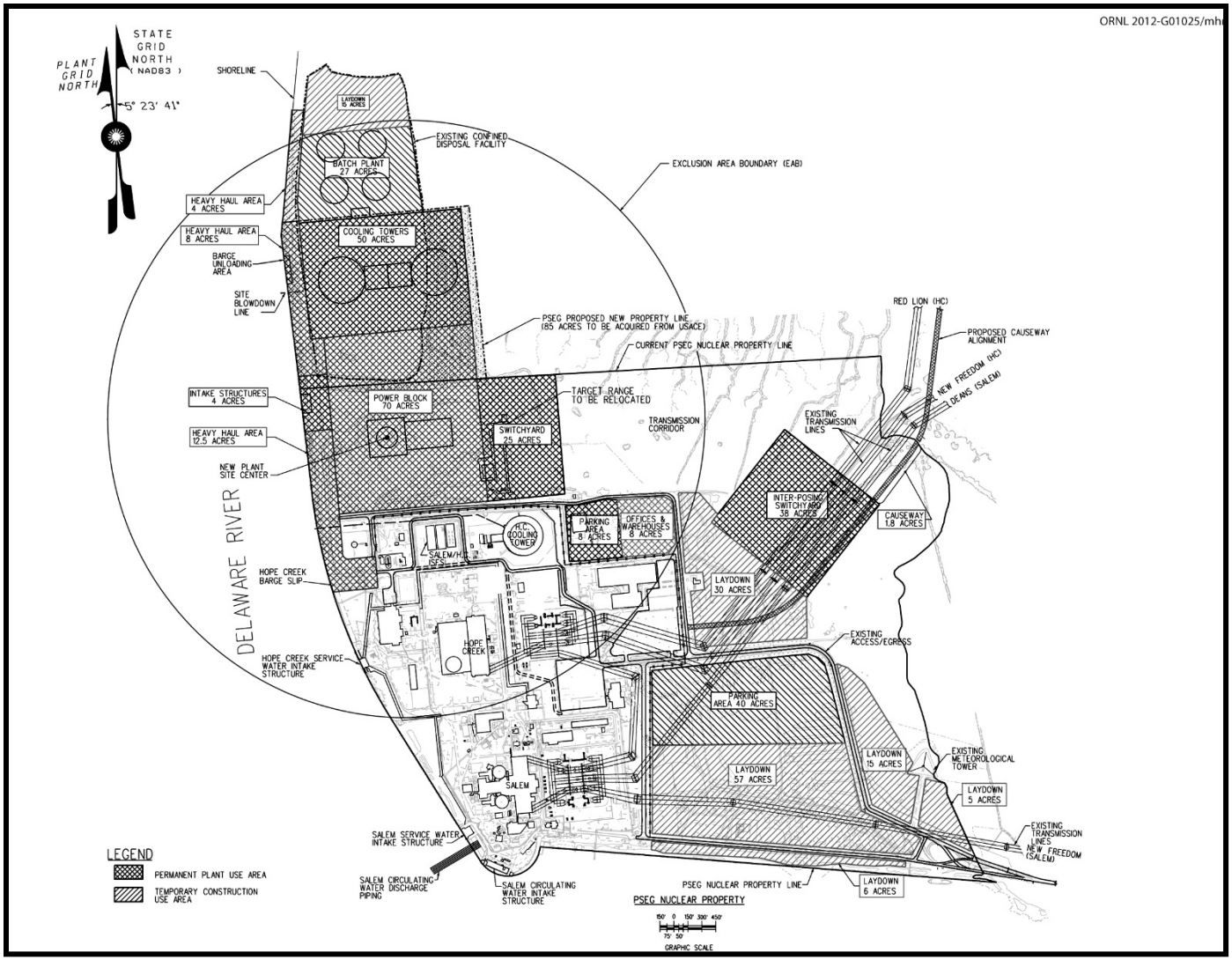

Figure 3. PSEG Site Utilization Plan *(Source: PSEG 2012-TN1489).*

Delaware River Estuary

The Delaware River and Delaware Bay are a part of the larger Delaware Estuary and River Basin that extends from headwaters in New York to the coastal plains near Cape Henlopen in Delaware (PDE 2012-TN2191). The Delaware Bay extends from the confluence of the Delaware River with the Atlantic Ocean from Delaware River Mile (RM) 0 to RM 54 (River Kilometer [RKM] 0 to RKM 86.9). The Delaware River Estuary includes the Delaware Bay and extends up the tidal Delaware River, which is characterized by brackish water between Delaware RM 54 and RM 80 (RKM 86.9 and RKM 128.8) and becomes freshwater at Delaware RM 80 (BBL and Integral 2007-TN2126). The PSEG Site near the mouth of Alloway Creek is at Delaware RM 52 (DRBC 2011-TN2412) and is considered to be in the lower estuary watershed unit of the Delaware River Estuary (PDE 2012-TN2191).

Characterization of the region dates back to pre-Revolutionary War times when shipping and trading at developing ports from the mouth of the Delaware River Estuary to inland Delaware, Pennsylvania, and New Jersey increased use of the watershed (Berger et al. 1994-TN2127). Increasing urbanization and industrialization of the region from 1840 to present day have significantly contributed to the degradation of the watershed with habitat alteration, water diversion, and increased pollution of the Delaware Estuary and River Basin ecosystems because no environmental policies were established until the 1960s and later (Berger et al. 1994-TN2127). According to the most recent status report on the Delaware Estuary and River Basin, the region continues to see some decline in environmental health indicators, such as removal of estuary sediments and increases in nitrogen and contaminant levels. However, environmental conditions such as technology implementation to increase fish passage and restoration of targeted aquatic habitats have improved the aquatic ecology for the watershed (PDE 2012-TN2191). The Delaware River Basin Commission (DRBC) stated in the State of the Delaware River Basin report for 2013 that increases in temperature and salinity are expected with future sea level rise and climate change (DRBC 2013-TN2609). These potential changes are likely to result in movement of populations of more marine and euryhaline species further up the Delaware River Estuary.

The boundary of salinity intrusion in the Delaware River Estuary, also known as the salt line, fluctuates with flow changes. The salt line moves in response to the tides and variations in Delaware River Estuary freshwater discharge. During most of the year, the salt line is located between the Commodore Barry Bridge at Delaware RM 82 and Reedy Island at Delaware RM 54 (DRBC 2008-TN2277). During the drought of record in the 1960s, the salt line moved to its most upstream historically observed location at Delaware RM 102 (DRBC 2008-TN2277). Salinity is an important determinant of biotic distribution in estuaries, and salinity near the PSEG Site varies with river flow. Between 2003 and 2010, surface water salinity measurements near the PSEG Site ranged from 1.8 to 13.3 parts per thousand (ppt) and surface water temperatures ranged from 0.4 to 28.6°C (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571). Salinity measurements taken over a greater number of years between RM 51 and RM 49 report a minimum salinity of 0.1 ppt and a maximum of 17.9 ppt (PSEG 2014-TN3452). For the purposes of EFH habitat assessment, the salinity range will conservatively be estimated between 0 and 18 ppt.

At the PSEG Site on Artificial Island, the estuary is tidal with a net flow to the south. The USACE maintains a dredged navigation channel near the center of the estuary about 6,600 ft (2,000 m) west of the shoreline of the PSEG Site. The navigation channel is

about 40 ft (12 m) deep and 1,300 ft (400 m) wide; however, starting in 2010, the USACE began implementing the Delaware River Main Channel Deepening Project to deepen the existing navigation channel from 40 to 45 ft (USACE 2011-TN2262). On the New Jersey side of the channel, water depths in the open estuary at mean low water are fairly uniform at about 20 ft (6 m). Predominant tides in the area are semi-diurnal, with a period of approximately 12 hours and a mean tidal range of 5.3 ft (1.6 m) at RM 52 (PSEG 2014-TN3452).

The biological communities of the Delaware River Estuary in the area of the PSEG Site are typical of those that exist all along the main reaches of the Delaware Bay system. To mitigate egg and larval fish loss through the cooling system for SGS, PSEG proposed and established an estuary enhancement program (EEP) to restore salt marshes and provide monitoring and other structural enhancements to mitigate losses of aquatic species through impingement and entrainment at SGS (Balletto and Teal 2011-TN2612). The PSEG EEP was established in 1995 as part of New Jersey Pollutant Discharge Elimination System (NJPDES) requirements for SGS and includes an ongoing biological monitoring program in addition to habitat restoration to track the success of the mitigation actions. Because of the biological monitoring surveys that have been conducted in this area of the Delaware River Estuary since the mid-1980s in support of environmental requirements for the construction and operation of SGS and HCGS, an extensive long-term data set exists on the fishery and benthic macroinvertebrate communities of this area.

There is little to no submerged aquatic vegetation observed in the sampling areas near the PSEG Site (PSEG 2014-TN3452). Phytoplankton and zooplankton studies between 1973 and 1976 identified over 100 genera of phytoplankton in the area of the site, with three diatom taxa dominating the phytoplankton community: *Skeletonema costatum*, *Melosira* spp., and *Chaetoceros* spp. (IAI 1980-TN2608). The primary production contributed by the phytoplankton community is highest during the warmer months and lowest during the winter. Because estuarine systems are typically characterized by a shallow euphotic zone and high turbidity, contribution of organic carbon to the base of the food web by phytoplankton production is relatively small compared to that supplied by organic detritus and other primary producers such as benthic algae, periphyton, and submergent and emergent macrophytes (IAI 1980-TN2608). Surveys of zooplankton communities in the Delaware River Estuary near the site have identified over 100 taxa of microzooplankton (IAI 1980-TN2608). Dominant taxa consisted of rotifers and copepods (largely nauplii). Macroinvertebrate plankton samples were composed of 46 taxa (32 arthropods), with the dominant groups being amphipods *Gammarus* spp., the mysid shrimp *Neomysis americana*, larvae of the crabs *Rhithropanopeus harrisii* and *Uca minax*, and the isopod *Chiridotea almyra*. Seasonal variations in total density of zooplankton were not as consistent as that observed for the phytoplankton community and were generally related to short-lived differential abundances of a few dominant taxa (IAI 1980-TN2608).

The Delaware River Estuary is a complex ecosystem with many species playing different roles throughout their lifecycles. Major assemblages of organisms within the estuarine community include plankton, benthic invertebrates, and fish. Detailed descriptions of these assemblages can be found in Section 2.4.2.3 of the EIS for a new nuclear power plant at the PSEG Site.

2.2 Dredging and In-Water Installation Activities

Before initiating any site preparation or development activities, PSEG would be required to obtain the appropriate authorizations regulating alterations to waters of the United States, including ponds and creeks. Building activities that could directly affect EFH include improvements to and use of the HCGS barge slip during site development activities, building the barge storage area and unloading facility, installing the cooling water system intake and discharge structures, and building the proposed causeway (Figures 2 and 3). Aquatic habitats potentially affected include habitats associated with the Delaware River Estuary and the interconnected system of tidal wetlands and marsh creeks primarily north of the PSEG Site. Potential direct impacts on aquatic resources as a result of building activities would involve physical alteration of habitat (e.g., infilling, cofferdam placement, dredging, pile driving) including temporary or permanent removal of associated benthic organisms, sedimentation, changes in hydrological regimes, and changes in water quality. Potential indirect impacts include increased runoff from impervious surfaces and subsequent erosion, as well as sedimentation and isolation of marsh creek segments due to infilling (PSEG 2014-TN3452).

Shoreline installation and site preparation activities would require a stormwater pollution prevention plan (SWPPP), developed as part of the NJPDES stormwater permit, which would describe best management practices (BMPs) to control sedimentation and erosion and provide stormwater management. Shoreline structures would be hardened to protect from shoreline erosion using placement of concrete or riprap (PSEG 2014-TN3452).

Improvements to the HCGS barge slip would include deepening the existing barge slip by another 2 ft to accommodate equipment-carrying barges (Cook 2009-TN2713). An estimated 1,350 yd^3 of dredged material would be removed within the existing HCGS barge slip to allow for additional clearance of barges carrying equipment that can be delivered to the PSEG Site. If the final plant designs indicate modules larger than 54 ft in width are required, the existing 60 ft wide HCGS barge slip may be widened an additional 20 ft along the south side of the barge slip and dredged an additional 2 ft below current barge slip depth. A double row of sheet piling would need to be placed before removal of excess earth by dredging. An estimated 5,800 yd^3 of material would be removed, and the existing riprap at the front end of the slip would be removed and then replaced at the widened river end of the slip (Cook 2009-TN2713).

The new barge storage area and unloading facility would require dredging about 440,000 yd^3 of sediment to lower the river bottom by 4.5 ft over 61 ac (PSEG 2014-TN3452). An additional 0.05 ac of river bottom habitat would be removed for installation of seven 20 ft diameter barge mooring caissons. Installation of a new intake structure would require dredging of about 150,000 yd^3 of sediment to lower the river bottom by 4.5 ft over 31 ac (PSEG 2014-TN3452). Dredging would also be required for installation of a new discharge structure; however, specific details on the amount of material to be dredged for discharge structure placement likely would depend on final design and placement criteria. Dredged material disposal would be either on the site or in another approved upland disposal facility (PSEG 2014-TN3452).

The installation of the barge storage and unloading facilities as well as the intake and discharge structures would result in temporary disturbances to the aquatic habitat in those portions of the Delaware River Estuary. An increase in suspended sediments could occur during dredging activities; however, PSEG would comply with NJDEP and USACE permitting regulations regarding type of dredge used as well as timing and

duration of dredging to avoid sensitive aquatic life stage development or spawning. PSEG also would use appropriate BMPs to minimize sedimentation effects as required for Federal and State permitting. Motile invertebrates, fish, and sea turtles might swim into this portion of the Delaware River Estuary, but they would be able to swim away or likely would avoid the area because of vibratory noise from pile-driving activities. Mobile macroinvertebrates in this area might be able to occupy adjacent habitat in the Delaware River Estuary as the species composition and abundance of the macroinvertebrate community in the Delaware River Estuary near the site are similar to those of benthic communities in adjacent benthic areas of the estuary. Although permanent alteration of at least 92 ac of river bottom habitat would occur, the impacts to aquatic communities in the vicinity are expected to be minimal.

Offsite, an estimated 2,123 linear ft of marsh creek channels would be crossed by the proposed causeway (PSEG 2014-TN3452). Installation of the elevated causeway would require permanent pier placement for support structures. However, PSEG plans to avoid placement in stream channels (PSEG 2014-TN3452). Runoff from disturbed areas would be temporary and controlled through the use of BMPs required for water quality in compliance with Federal and New Jersey permitting, and runoff is not expected to adversely affect Delaware River Estuary surface waters (PSEG 2014-TN3452).

Vessel use during dredging or installation of the in-water structures and transportation of large system components to the PSEG Site may affect the aquatic resources of the Delaware River Estuary, particularly the benthos. The main impacts of using vessels would include turbulence from propellers (prop wash) and accidental spills of materials overboard. Vessels would be used during the installation of the cooling water discharge pipeline and during offloading of materials from barges (PSEG 2014-TN3452). Vessel operation during building or operation activities may cause short-term, localized impacts on aquatic species in the Delaware River Estuary. These impacts should not affect the general resources in the area of the PSEG Site or the region along this coast of the Delaware River Estuary.

2.3 Cooling Water System Description and Operation

Potential effects to managed species, their prey, and their habitats include the impingement of managed species or their prey as juveniles or adults at the facilities' water intake points, entrainment of eggs or larvae of managed species or their prey at the facilities' water intake points, and thermal effects from the discharge of heated water at the facilities' discharge points.

Several factors, such as the type of cooling system, the design and location of the intake structure, and the amount of water withdrawn from the source water body greatly influence the degree to which impingement and entrainment affect aquatic biota. Impingement and entrainment impacts are regulated by the U.S. Environmental Protection Agency or its designees (in this case, NJDEP) under Section 316(b) of the Clean Water Act (33 USC 1251-TN662). Section 316(b) "requires that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact. A new nuclear power plant at the PSEG Site would employ closed-cycle cooling. Depending on the quality of the makeup water, closed-cycle, recirculating cooling water systems can reduce water use by 96 to 98 percent of the amount that the facility would use if it employed a once-through cooling system (66 FR 65256-TN243). This significant reduction in the water withdrawal rate results in a corresponding reduction in impingement and entrainment losses.

The Delaware River Estuary would provide condenser cooling water and service water using closed-cycle cooling technology composed of pumps, a water basin, and wet cooling towers (PSEG 2014-TN3452). The intake structure would be approximately 110 ft by 200 ft to meet bounding requirements of normal and safety-related cooling systems by drawing water directly from the Delaware River Estuary. The intake structure would be located along the east shoreline of the Delaware River Estuary, west of the plant site. This location is 2,800 ft north of the existing HCGS service water intake structure, as shown in Figure 3 (PSEG 2014-TN3452). The forebay for the intake would extend into the river, and the area in front of the intake structure would be dredged to an elevation of -19 ft, 10 inches (in.) North American Vertical Datum (NAVD). It is assumed that the river bottom would be dredged from the shoreline to the -19 ft, 10 in. NAVD river bottom contour on both sides of the intake to provide sufficient depth for the intake water withdrawal. The intake structure design would include a bar rack at the inlet to prevent debris from entering intake bays and would be cleaned mechanically by a trash rake (PSEG 2014-TN3452).

The intake structure bay and intake screens would be sized so that the average intake through-screen flow velocity would be less than 0.5 feet per second (fps), as required by Clean Water Act Section 316(b) Phase I requirements specified in 40 CFR 125.84 (40 CFR 125-TN254). In accordance with these rules, this design value would be subject to conditions of maximum flow (i.e., all pumps in the bay operating at full capacity) to enhance the performance of the debris-filtering system and minimize organism mortality due to impingement and entrainment (PSEG 2014-TN3452). The fish protection system (traveling screens and fish return) would be designed and operated to comply with the NJPDES permit that would be issued for a new plant's cooling system (PSEG 2014-TN3452). Makeup water for the closed-cycle cooling system would be drawn from the Delaware River Estuary at an average rate of 78,196 gallons per minute (gpm; 112.6 million gallons per day [Mgd]), with consumptive use at a rate of 26,420 gpm (38 Mgd) (PSEG 2014-TN3452). In contrast, the adjacent SGS has a once-through cooling system, which takes in considerably more water (3,024 Mgd). Additionally, a new plant's slower intake velocity (<0.5 fps) compared to SGS's intake velocity (roughly 0.9 fps) increases the likelihood that smaller and/or slower fish would be able to escape from the intake area before being impinged.

Impingement

Because of its location on the Delaware River Estuary, a new nuclear power plant at the PSEG Site would impinge a variety of freshwater and marine fish and shellfish. Data from the impingement studies for SGS (once-through cooling) indicate that 50 to 67 finfish species are impinged each year, compared to just under 50 species of finfish impinged at HCGS (closed-cycle cooling) between 1986 and 1987. However, the number of sampling events differed dramatically between the two plants, with only 46 to 48 sampling events at HCGS over the same years (1986–87) as the more than 530 sampling events per year at SGS (VJSA 1988-TN2564; ECS 1989-TN2572). The species composition in the screen samples also varied between SGS and HCGS during the 1986 to 1987 sampling and varied at SGS between the sampling dates in the 1980s and sampling dates since 2003. Table 1 compares important, most abundant and total finfish species, as well as blue crab (*Callinectes sapidus*), impinged at SGS and HCGS between 1986 and 1987 as well as at SGS between 2003 and 2010.

Table 1. Impingement Rate for Important, Most Abundant, and Total Finfish Species and Blue Crab Impinged at SGS and HCGS

		Impingement Rate (number of individuals/10^6 m^3)		
Common Name	**Scientific Name**	**SGS (1986–87)[a]**	**HCGS (1986–87)[a]**	**SGS (2003–10)[b]**
American Eel	*Anguilla rostrata*	7.6	13.4	4.1
Blueback Herring	*Alosa aestivalis*	49.1	5.0[d]	37.2
Alewife	*Alosa pseudoharengus*	7.6	1.1[d]	8.14
Bay Anchovy	*Anchoa mitchilli*	601.9	521.5	115.4[d]
Atlantic Menhaden	*Brevoortia tyrannus*	31.0	3.7[d]	28.9
Atlantic Silverside	*Menidia menidia*	18.6	15.1	46.7[c]
White Perch	*Morone americana*	359.3	27.9[e]	1,066.4[c]
Striped Bass	*Morone saxatilis*	5.3	0.7[d]	78.8[e]
Weakfish	*Cynoscion regalis*	585.4	143.0[c]	486.4
Spot	*Leiostomus xanthurus*	13.8	2.1[d]	16.6
Atlantic Croaker	*Micropogonias undulatus*	109.8	965.4[d]	636.7[d]
Summer Flounder	*Paralichthys dentatus*	13.0	4.7[c]	4.1[c]
Oyster Toadfish	*Opsanus tau*	16.2	38.3[c]	1.8[d]
Northern Pipefish	*Syngnathus fuscus*	2.1	40.6[e]	4.1
Naked Goby	*Gobiosoma bosc*	2.3	303.2[e]	3.3
Hogchoker	*Trinectes maculatus*	636.4	112.2[d]	152.3[c]
Spotted Hake	*Urophycis regia*	58.6	7.0[d]	83.5
Gizzard Shad	*Dorosoma cepedianum*	14.3	1.7[d]	63.0[c]
American Shad	*Alosa sapidissima*	5.5	0.2	12.3[c]
Black Drum	*Pogonias cromis*	2.8	0.8	3.0
Black Sea Bass	*Centropristis striata*	3.0	2.0	0.4
Butterfish	*Peprilus triacanthus*	0.7	ND	0.6
Channel Catfish	*Ictalurus punctatus*	0.9	1.0	8.2[d]
Conger Eel	*Conger oceanicus*	0.1	0.4	0.1
Northern Kingfish	*Menticirrhus saxatilis*	0.2	ND	12.2[e]
Northern Searobin	*Prionotus carolinus*	3.8	1.8	6.0

Table 1 (continued)

Common Name	Scientific Name	Impingement Rate (number of individuals/10^6 m^3)		
		SGS (1986–87)[(a)]	HCGS (1986–87) [(a)]	SGS (2003–10)[(b)]
Scup	*Stenotomus chrysops*	ND	ND	1.4
Silver Hake	*Merluccius bilinearis*	0.4	0.1	0.1
Windowpane Flounder	*Scophthalmus aquosus*	4.7	2.4	5.2
Winter Flounder	*Pseudopleuronectes americanus*	0.3	0.4	1.1
Total finfish density rate[(f)]		2,643.6	2,095.4	3,152.5
Blue Crab	*Callinectes sapidus*	1,542.5	2,450.1	690.4[(c)]
Total finfish and blue crab density rate[(f)]		4,186.1	4,545.5	3,842.9

Note: ND = not detected.
(a) Sources: VJSA 1988-TN2564; ECS 1989-TN2572.
(b) Sources: PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571.
(c) Differs from 1986–87 SGS impingement rate by more than a factor of 2.
(d) Differs from 1986–87 SGS impingement rate by more than a factor of 5.
(e) Differs from 1986–87 SGS impingement rate by more than a factor of 10.
(f) Includes all finfish impinged, not just those listed in table.

The comparison of the SGS 1986–87 impingement data with SGS 2003–10 impingement data shows shifts in specific species abundance. Calculating mean density impinged per volume of water corrects for the difference in number of sampling events as more frequent samples were collected between 2003 and 2010. Interestingly, the total abundance of blue crab, Bay Anchovy (*Anchoa mitchilli*), Summer Flounder (*Paralichthys dentatus*), Oyster Toadfish (*Opsanus tau*), and Hogchoker (*Trinectes maculatus)* diminished by a factor of 2 or more since the 1986–87 sampling events. However, increases in Atlantic Silverside (*Menidia menidia*), White Perch (*Morone americana*), Striped Bass (*Morone saxatilis*), Atlantic Croaker (*Micropogonias undulatus*), American Shad (*Alosa sapidissima*), Channel Catfish (*Ictalurus punctatus*), Northern Kingfish (*Menticirrhus saxatilis*), and Gizzard Shad (*Dorosoma cepedianum*) are evident since the 1986–87 sampling. Of note, impingement data for SGS from 2008 to 2010 (PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571) also were examined and compared with SGS impingement data from 2003 to 2007 (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569) to assess any recent deviation from the previous 2003 to 2007 trend (data not shown in table). Gizzard Shad, Northern Kingfish, Black Drum (*Pogonias cromis*), and Atlantic Menhaden (*Brevoortia tyrannus*) all increased by a factor of 2 in the more recent sampling. However, Blueback Herring (*Alosa aestivalis*), Atlantic Croaker, Butterfish (*Peprilus triacanthus*), Channel Catfish, Scup (*Stenotomus chrysops*), and Spotted Hake

(*Urophycis regia*) were all reduced by a factor of 2 in the more recent sampling. These deviations in annual averages may represent changes to environmental conditions at the larger regional scale, such as climate, seasonal weather extremes, and fishing pressure, and do not appear to reflect any longer term trends in abundance.

Impingement mortality was not reported during the HCGS impingement sampling in 1986 or 1987 (VJSA 1988-TN2564; ECS 1989-TN2572). However, sampling at SGS (1986–87) and (2003–10) reported between 97 percent and 100 percent live, undamaged blue crab, and live condition for greater than 50 percent of the finfish impinged with the exception of White Perch and Atlantic Croaker juveniles between 1986 and 1987 (VJSA 1988-TN2564; ECS 1989-TN2572; PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571).

Historical impingement rates for the aquatic community from SGS (2003 to 2010) and HCGS (1986 to 1987) were used to estimate potential impingement losses associated with the operation of a new nuclear power plant at the PSEG Site (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571; VJSA 1988-TN2564; ECS 1989-TN2572). HCGS is more similar to a new plant at the PSEG Site with a closed-cycle cooling system design, versus the once-through cooling system of SGS. SGS withdraws larger volumes of water from the Delaware River Estuary with a faster through-screen velocity (roughly 0.9 fps), and therefore, SGS would be expected to impinge more fish than the closed-cycle cooling systems of HCGS and a new nuclear power plant at the PSEG Site.

PSEG examined the most recent HCGS impingement data from 1986 and 1987 with same year impingement data for SGS and derived a correction factor by dividing the HCGS data by the SGS data to allow comparison between the two plants and normalize the differences in intake volume and velocity (VJSA 1988-TN2564; ECS 1989-TN2572). Examination of 1986 to 1987 density impingement rates for finfish show a total impingement density average of 2,095.4 organisms per million cubic meters (m^3) total water volume for HCGS and 2,643.6 organisms per million m^3 total water volume for SGS. When combining both finfish and blue crab impingement rates, the total impingement density average is 4,545.5 organisms per million m^3 total water volume for HCGS and 4,189.1 organisms per million m^3 total water volume for SGS. The more recent impingement rates for SGS between 2003 and 2010 report a finfish impingement rate of 3,152.5 organisms per million m^3 total water volume and a combined blue crab and finfish impingement rate of 3,842.9 organisms per million m^3 total water volume. Therefore, a correction factor may not be needed to assess total organism impingement, and PSEG used a conservative approach for assessing potential impingement rates for a new nuclear power plant at the PSEG Site in its environmental report (ER). However, for comparative purposes, PSEG presented in its ER both the conservative assumption and the correction factor for estimating potential impingement rates (PSEG 2014-TN3452).

Sampled total finfish density was moderately lower at HCGS relative to SGS using data sets either from 1986 to 1987 or from 2003 to 2010, possibly because of the lower approach velocities to the HCGS screens. The only commercially important invertebrate vulnerable to substantial impingement by the intake structure of a new nuclear power plant at the PSEG Site is the blue crab. Blue crab densities for impingement samples at SGS were 690.4 per million m^3 total water volume between 2003 and 2010 and 1,542.5 per million m^3 total water volume in 1986 to 1987. At HCGS, blue crabs were

impinged at a mean rate of 2,450.1 per million m^3 total water volume in 1986 to 1987 (see Table 1). It is possible that the rate of impingement at a new nuclear power plant at the PSEG Site for blue crab may be less than in 1986 to 1987 because there was a significant drop in impingement abundance of blue crab at SGS between the sampling dates in the 1980s and the average of 8 years of more recent sampling.

The applicant estimated impingement rates of finfish at a new nuclear power plant at the PSEG Site by multiplying the more recent SGS impingement densities by a correction factor representing the ratio of the total finfish impingement density at HCGS (1986 to 1987) to that of SGS for the same period. Recent examination of these data sets and impingement rates derives the correction factor to be 0.79 (2,095.4/2,643.6). It is reasonable to use the historical HCGS impingement rate correction factor for the estimate of impingement rate at a new plant at the PSEG Site because the intake design velocity for a new plant (less than 0.5 fps) is more comparable to HCGS than to SGS (roughly 0.9 fps). Thus, the estimated total impingement rate of finfish due to operation of a new plant is 2,490.5 per million m^3 total water volume compared to the more recent impingement rate of 3,152.5 per million m^3 total water volume for SGS. White Perch, Atlantic Croaker, and Weakfish (*Cynoscion regalis*) are expected to comprise the majority of the impingement total. The proposed maximum rate of water withdrawal for a new nuclear power plant at the PSEG Site is equivalent to 3.7 percent of the intake flow at SGS (PSEG 2014-TN3452). Assuming a constant withdrawal of 78,196 gpm for a new plant, and using the 79 percent correction factor for finfish impingement, a new plant would result in impingement of an estimated 386,526 fish annually. Using the conservative assumption with no correction factor and a maximum rate of water withdrawal for a new plant of 3.7 percent of the intake flow of SGS, approximately 489,148 fish would be impinged annually at a new plant at the PSEG Site (PSEG 2014-TN3452).

The intake structure for a new plant at the PSEG Site would contain traveling water screens to collect debris and fish. Impinged organic debris and aquatic organisms would be washed from the traveling screens and returned to the Delaware River Estuary. Mixed organic and manmade debris (e.g., wood, plastic) collected from the trash racks would be disposed of offsite. Details about the screen design, screen wash, and fish return system for a new plant are not available, but PSEG has stated in its ER that the screen design would be compliant with EPA 316(b) Phase I requirements specified in 40 CFR 125.84 (40 CFR 125-TN254), similar to screens at HCGS, and would include low-pressure screen washes to safely remove impinged organisms and water-filled fish buckets to improve the survival of screen-washed fish and shellfish until they are transported back to the Delaware River Estuary by the fish return system (PSEG 2014-TN3452).

In terms of numbers, the estimated impingement of most fish species is a small percentage of the commercial and recreational harvests of these species in Delaware and New Jersey as described in EIS Section 2.4.2. Estimated impingement of blue crab, Weakfish, White Perch, and Atlantic Croaker at a new plant at the PSEG Site potentially would have the highest impingement rates. However, it is expected that a large portion of these impinged organisms would survive because of the comparable impingement mortality recorded for SGS with a higher through-screen velocity than would be used for a new plant. Based on the planned low through-screen intake velocity and the use of closed-cycle cooling, the review team concludes that impacts from impingement of aquatic organisms at a new nuclear power plant at the PSEG Site would be minor.

Entrainment

Small, passively drifting, or weakly swimming aquatic organisms that are drawn into the intake and pass through the openings in the traveling screens would be killed by passage through the closed-cycle cooling system. Some entrained organisms are present year-round, such as phytoplankton and many types of zooplankton. These diverse plant and animal species (often referred to as holoplankton) are abundant throughout the Delaware River Estuary and have short generation times, so they can rapidly replace the losses due to entrainment, heat shock, and other stresses. Other entrained organisms, such as the larval stages of fish, crabs, and other bottom-dwelling crustaceans, are present only seasonally near the proposed intake of a new nuclear power plant at the PSEG Site. However, many of these seasonally planktonic organisms (collectively referred to as meroplankton) have longer life spans and generation times, so losses from cooling system effects are not as readily replaced.

The history of entrainment sampling at SGS and analyses of entrainment losses are described in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants–Supplement 45: Regarding Hope Creek Generating Station and Salem Nuclear Generating Station, Units 1 and 2, Final Report* (NRC 2011-TN3131). Most recently, entrainment of fish eggs, larvae, juveniles, and adults in the SGS cooling water system was studied between 2003 and 2010 (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571). Over the 8-year period, between 25 and 38 species were identified each year among the entrained fish (eggs, larvae, small juveniles, and adults). Of these, 92 percent of the entrainment samples were composed of two species: Bay Anchovy (75.3 percent) and Naked Goby (*Gobiosoma bosc*) (16.7 percent). Additional species that comprised over 98 percent of all entrained species included Atlantic Croaker (3.5 percent), Striped Bass (1.4 percent), Weakfish (0.8 percent), Atlantic Menhaden (0.4 percent), and Atlantic Silverside (0.4 percent). Bay Anchovy was the most abundantly entrained species for the egg (99.7 percent) and adult (57 percent) life stages; Naked Goby was the most abundantly entrained larval species (49 percent); and Atlantic Croaker was the most abundantly entrained juvenile species (56 percent) (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571). Seasonal vulnerability to entrainment is species-specific. For example, eggs, larvae, and juveniles of Bay Anchovy were most numerous in entrainment samples in summer months (June and July), whereas Atlantic Croaker juveniles were most abundant in the fall (October and November) (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571). In general, the densities of entrained individuals for most fish species were greatest in the spring and/or summer, corresponding to the spawning periods for these species. Total densities of all fish life stages in the entrainment samples ranged from 54.0/100 m^3 (2003) to 264.2/100 m^3 (2007) and averaged 125.0/100 m^3 (PSEG 2014-TN3452).

PSEG applied estimated annual entrainment rates from SGS directly to calculate entrainment rates for a new nuclear power plant at the PSEG Site. The entrainment rates at SGS were applied to a new plant without a correction factor because entrained organisms are planktonic. Entrainment rates are a function of water withdrawal rates and are not influenced by through-screen velocities. Entrainment rates of holoplankton and meroplankton would be much smaller for a new plant than for SGS because of the smaller volume of water withdrawn by the closed-cycle system at a new plant. Based on

the small volume of water withdrawn for the closed-cycle cooling water system at a new plant at the PSEG Site, the annual entrainment of organisms during operation of the intake system is expected to be minor and average less than 125 organisms per 100 m^3. Bay Anchovy, the likely dominantly entrained species for a new plant at the PSEG Site, is a highly abundant species in the area, with females spawning every 4 to 5 days over the spawning season (Zastrow et al. 1991-TN2670).

Cooling-Water Discharge Impacts

Blowdown from the cooling towers, service water system, and other aqueous waste streams at a new nuclear power plant at the PSEG Site would be combined and discharged to the Delaware River Estuary at an average flow rate of 50,516 gpm (113 cfs) and a velocity of 9.2 fps, as described in EIS Section 5.2.3.1. The submerged 48-in. diameter discharge pipe would be located 8,000 ft north of the SGS discharge pipe and 4,000 ft north of the HCGS discharge pipe. The outlet of the discharge pipe would be 100 ft from the shoreline, 12 ft below mean lower low water and 3 ft above the river bottom (PSEG 2014-TN3452). Relative to the Delaware River Estuary, the discharged water would have an elevated temperature and increased concentration of both natural chemical constituents and chemical contaminants. Because of the tidal nature of the Delaware River Estuary in this area, the direction of the thermal discharge plume would vary with the tidal cycle.

<u>Thermal Impacts</u>

Potential thermal impacts on aquatic organisms could include heat stress, cold shock, and the creation of favorable conditions for invasive species.

As described in EIS Section 5.2.3.1, the portion of the Delaware River Estuary where discharge would occur is located in Zone 5 between Delaware RM 78.8 and RM 48.2. The DRBC temperature-related standards for Zone 5 require that the discharge-induced water temperature increases above the ambient water temperature in the river outside the permitted heat dissipation area (HDA) may not increase by more than 4°F (2.2°C) from September through May and by 1.5°F (0.8°C) from June through August, with a year-round maximum water temperature of 86°F (30°C) (18 CFR Part 410; DRBC 2011-TN2371) (Figure 4). Recent trawling of the Delaware River Estuary zone in the vicinity of SGS and HCGS between 2003 and 2010 has not identified significant shifts in species abundances near the SGS and HCGS discharge areas compared to adjacent zones (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571). The volume of the thermal discharge from a new nuclear power plant at the PSEG Site (50,516 gpm) is only 2.4 percent of that from SGS (about 2,100,000 gpm circulated through the once-through cooling system) (PSEG 2014-TN3452). As discussed in Section 5.2.3.1, the thermal plume of the discharge from a new plant would have a maximum extent of about 700 ft into the river from the discharge location, about 300 ft upstream from the discharge, and about 500 ft downstream from the discharge; would be completely contained within the existing SGS HDA; and would not be expected to impede fish migration.

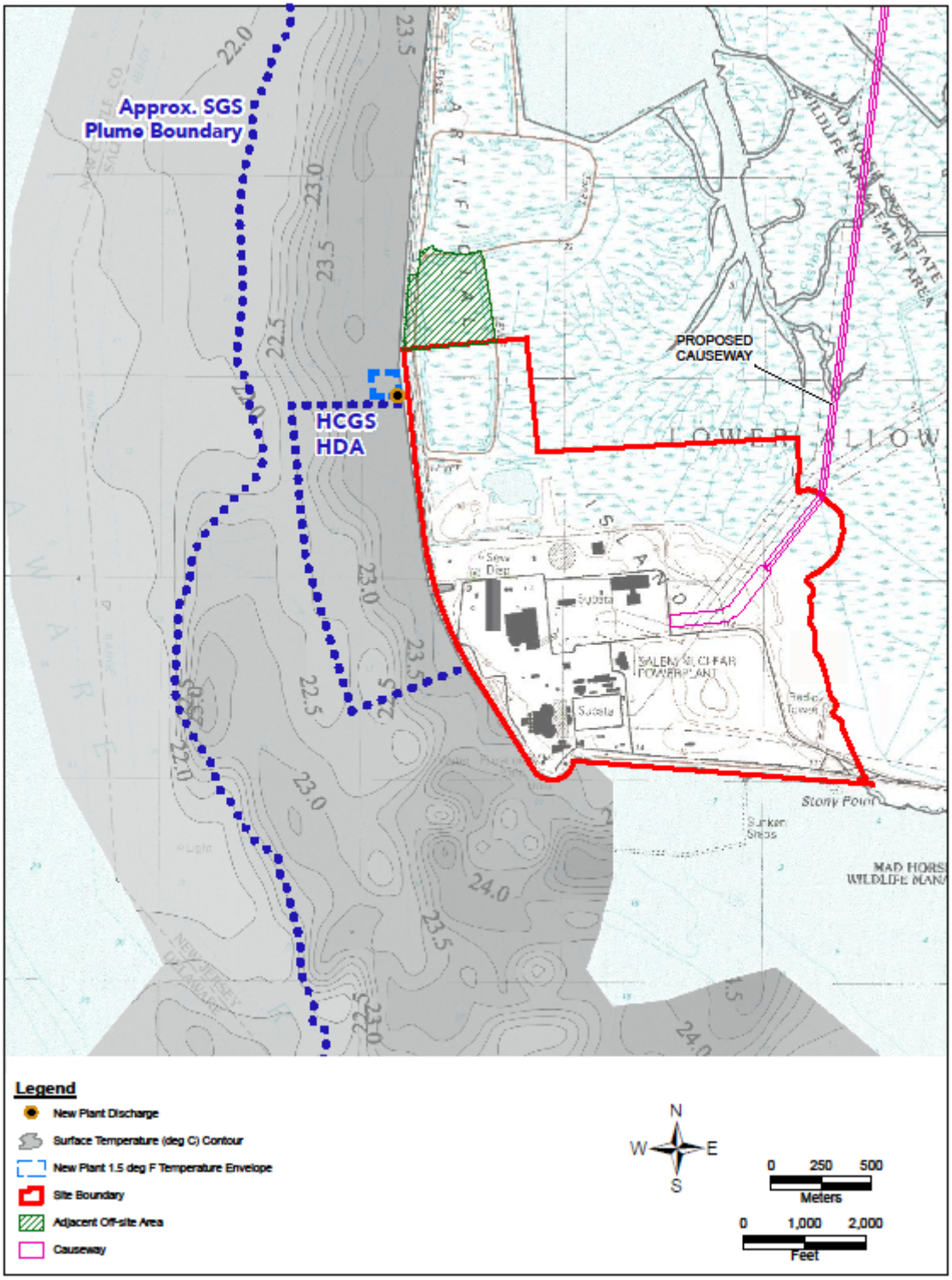

Figure 4. Predicted PSEG Thermal Plume in Relation to HCGS HDA and SGS Plume Boundary Under Flood Tide Conditions
(Source: Modified from PSEG 2014-TN3452).

During flood tide conditions, when the median water temperature exceeds 79.4°F (26.3°C), the review team estimated that a portion of the thermal plume would exceed 86°F (30°C) because of the cumulative effects from SGS, HCGS, and a new plant (3.6°F, 1.5°F, 1.5°F, respectively). However, the combination of high velocity discharge, turbulence in the discharge outlet area, and rapid mixing of the discharge effluent would limit the size of the thermal plume.

A factor related to thermal discharges that may affect aquatic biota is cold shock. Cold shock occurs when aquatic organisms that have been acclimated to warm water are exposed to a sudden temperature decrease. This sometimes occurs when single-unit power plants shut down suddenly in winter or when an unseasonable cold weather event occurs. Cold shock is less likely to occur at a multiple-unit plant because the temperature decrease from shutting down one unit is moderated by the heated discharge from the units that continue to operate. Based on the foregoing, any thermal impacts on the fish populations due to cold shock would be expected to be minor.

Chemical Impacts

As described in EIS Section 3.2.1.2, the cycles of concentration increase the concentration of total dissolved solids and minerals in the blowdown. In addition, the blowdown would contain chemical additives such as biocides and pH-adjusting chemicals to ensure proper functioning of the cooling towers. Predicted concentrations of dissolved chemical constituents in the discharges from the cooling water and other systems are expected to be compliant and controlled by the terms of the NJPDES permit that would be issued for a new plant at the PSEG Site (PSEG 2014-TN3452).

Physical Impacts

Because of the increased temperature and chemical content of the discharged water compared to ambient conditions, the plume is expected to be negatively buoyant (PSEG 2014-TN3452). Due to the high discharge velocity of 9.21 fps, there would be rapid mixing with tidal currents upstream and downstream, with some potential for scouring occurring at the point of discharge. To minimize the scouring potential, PSEG would place riprap or other engineered features near the end of the discharge pipe and reduce the possible interactions of the discharge plume with bottom habitats and bottom-dwelling aquatic organisms (PSEG 2014-TN3452).

Barge Traffic

Use of the HCGS barge slip and the PSEG barge storage and unloading facility area are expected to be infrequent during operation. However, propeller wash may cause localized scouring and sedimentation within the barge slip. Because this area would be previously disturbed during site preparation and used during transport of building materials, it is unlikely that the temporary habitat disruption would have adverse effects on the aquatic communities in the area (PSEG 2014-TN3452). Adjacent, undisturbed habitat is available, and mobile aquatic organisms likely would avoid the barge slip area.

Maintenance Dredging

Dredging may be required to maintain use of the HCGS barge slip and intake channel as well as the barge storage and unloading facility during operation. Seasonal restrictions on activities to minimize effects to sensitive aquatic life stage development or spawning may be required for Federal and State permitting. Any effects to water quality, such as siltation, during these infrequent periods would be temporary and would be managed through the use of BMPs as required by Federal and State permits, and dredged

material disposal would be in approved upland disposal areas (PSEG 2014-TN3452). Mobile organisms in the area would avoid activities involved in dredging and could use adjacent, undisturbed habitat during the temporary disruption.

Stormwater Management

As described in EIS section 5.2.3.1, PSEG would develop an SWPPP to minimize stormwater drainage effects to nearby surface waters. The SWPPP would be required to meet NJPDES stormwater discharge requirements.

3.0 EFH Species Near the Site

3.1 EFH Species Identified for Preliminary Analysis

The 1996 amendments to the MSA (16 USC 1801-TN1061) identified the importance of habitat protection to healthy fisheries. The amendments, known as the Sustainable Fisheries Act of 1996, strengthened the authority of governing agencies to protect and conserve the habitat of marine, estuarine, and anadromous animals. EFH is defined as the waters and substrate necessary for spawning, breeding, feeding, or growth to maturity for managed fishery species. Identifying EFH is an essential component in the development of fishery management plans to evaluate the effects of habitat loss or degradation on fishery stocks and to take actions to mitigate such damage. NMFS considers the estuarine portion of the Delaware River and tidal waters near the PSEG Site to be EFH for 15 species (PNNL 2013-TN2687; NMFS 2013-TN2804), which are listed in Table 2.

The review team compared salinity, water temperatures, and depth in the vicinity of the PSEG Site with EFH requirements for each of the species and life stages that appear in Table 2 to further refine the EFH species with the potential to be adversely affected by the proposed action. The EFH requirements of several of the fish species and life stages are conditions that have been reported in the vicinity of the PSEG Site (see Table 3). For those species whose EFH requirements do not match the local conditions, the review team did not consider these species or life stages further in this EFH assessment. With the exception of the Atlantic Butterfish, the exclusion of certain species and life stages from consideration was based on salinity requirements being too high for the habitat near the PSEG Site. Atlantic Butterfish was excluded based on depth requirements not being met for habitat near the PSEG Site. The remaining species and life stages whose EFH requirements match local conditions appear in Table 4. Accordingly, the remaining species are described in detail in Section 3.2.

Table 2. Species with Designated EFH in the Delaware Bay

Common Name	Scientific Name	Eggs	Larvae	Juveniles	Adults
Atlantic Butterfish	*Peprilus triacanthus*	-	-	X	--
Atlantic Sea Herring	*Clupea harengus*	-	-	X	X
Black Sea Bass	*Centropristis striata*	-	-	X	-
Bluefish	*Pomatomus saltatrix*	-	-	X	X
Clearnose Skate	*Raja eglanteria*	-	-	X	X
Cobia	*Rachycentron canadum*	X	X	X	X
King Mackerel	*Scomberomorus cavalla*	X	X	X	X
Little Skate	*Leucoraja erinacea*	-	-	X	X
Red Hake	*Urophycis chuss*	-	-	-	X
Scup	*Stenotomus chrysops*	-	-	X	-
Spanish Mackerel	*Scomberomorus maculatus*	X	X	X	X
Summer Flounder	*Paralichthys dentatus*	-	-	X	X
Windowpane Flounder	*Scophthalmus aquosus*	X	X	X	X
Winter Flounder	*Pseudopleuronectes americanus*	X	X	X	X
Winter Skate	*Leucoraja ocellata*	-	-	X	X

Notes: X = designated EFH present for species and life stage; - = no designated EFH present for species and life stage.

Sources: NOAA 2006-TN2820; NOAA 2010-TN2821.

Table 3. Habitat Requirements of Identified EFH Species

Species, Life Stage	EFH Requirement			Site Matches EFH Requirements?
	Salinity (ppt)	Temperature (°C)	Depth (m)	
PSEG Site	***0–18***	***0.4–28.6***	***4.4–7.6***	
Atlantic Butterfish				
juveniles	3–37	3–28	10–365	No
Atlantic Sea Herring				
juveniles	26–32	<10	15–135	No
adults	>28	<10	20–130	No
Black Sea Bass				
juveniles	>18	>6	1-38	Yes
Bluefish				
juveniles	23–36	19–24	unspecified	No
adults	>25 ppt	14–16	unspecified	No
Clearnose Skate[(a)]				
juveniles and adults	12–30	6–20	5–23	Yes
Cobia				
all life stages	>25	>20	unspecified	No
King Mackerel				
all life stages	>30	>20	unspecified	No
Little Skate[(b)]				
juveniles and adults	15–32	3–22	4–21	Yes
Red Hake				
adults	33–34	<12	10–130	No
Scup				
juveniles	>15	>7	0–38	Yes
adults	>15	>7	2–185	Yes
Spanish Mackerel				
all life stages	>30	>20	unspecified	No

Table 3 (continued)

Species, Life Stage	EFH Requirement			Site Matches EFH Requirements?
	Salinity (ppt)	Temperature (°C)	Depth (m)	
Summer Flounder				
juveniles	10–30	>11	0.5–5	Yes
adults	unspecified	unspecified	0–25	Yes
Windowpane Flounder				
eggs and larvae	unspecified	<20	<70	Yes
juveniles and adults	5.5–36	<25–26.8	1–100	Yes
Winter Flounder				
eggs	10–30	<10	<5	Yes
larvae	4–30	<15	<6	Yes
juveniles	10–30	<25	1–50	Yes
adults	15–33	<25	1–100	Yes
Winter Skate[c]				
juveniles and adults	15–35	3–17	7–18	Yes

(a) Packer et al. 2003-TN2822.
(b) Packer et al. 2003-TN2823.
(c) Packer et al. 2003-TN2824.

Source: NOAA 2006-TN2820.

Table 4. Species Retained for In-Depth EFH Analysis

Common Name	Scientific Name	Eggs	Larvae	Juveniles	Adults
Black Sea Bass	*Centropristis striata*	-	-	X	-
Clearnose Skate	*Raja eglanteria*	-	-	X	X
Little Skate	*Leucoraja erinacea*	-	-	X	X
Scup	*Stenotomus chrysops*	-	-	X	X
Summer Flounder	*Paralichthys dentatus*	-	-	X	X
Windowpane Flounder	*Scophthalmus aquosus*	X	X	X	X
Winter Flounder	*Pseudopleuronectes americanus*	X	X	X	X
Winter Skate	*Leucoraja ocellata*	-	-	X	X

Notes: X = retained for in-depth analysis in Section 3.2; - = not subjected to in-depth analysis in Section 3.2.

3.2 EFH Species Identified for In-Depth Analysis

3.2.1 Black Sea Bass (*Centropristis striata*)

Species Description

The Black Sea Bass is a member of the Serranidae family and has an unusual life history. Black Sea Bass start out as females with full reproductive capability and then switch to become fertile males sometime around 6 years of age. Adults are found along the continental shelf in habitats characterized by relief structures such as reefs or sunken structures. Juveniles or young-of-year fish prefer more estuarine habitats but are also associated with relief habitat (Drohan et al. 2007-TN2825). Adults overwinter in deep offshore waters and move inshore in the spring. Off coastal New Jersey, spawning occurs between May and June. Females release 191,000 to 369,500 eggs in waters between 20 and 50 m depth in nearshore continental waters (Drohan et al. 2007-TN2825). Both juveniles and adults feed on benthic invertebrates such as crustaceans and squid (MDMF 2006-TN2159).

Status of the Fishery

The Mid-Atlantic Fishery Management Council (MAFMC) and Atlantic States Marine Fisheries Commission (ASMFC) jointly manage the Black Sea Bass under Amendment 13 of the Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan (ASMFC 2013-TN2826).

Black Sea Bass are highly valued by both commercial and recreational fishermen throughout the Mid-Atlantic as a food fish. Commercial harvests of Black Sea Bass in New Jersey and Delaware totaled 293,609 lb and 3,524 lb, respectively, in 2011 (NOAA 2013-TN2174). Recreational harvests in 2011 totaled 1,568,503 individuals in New Jersey and 326,358 in Delaware (NOAA 2013-TN2175). The September 26, 2013, status of the stock report indicated that Black Sea Bass are currently not considered overfished (MAMFC 2013-TN2827).

Trawling, seining, and weir surveys between 2003 and 2010 indicate Black Sea Bass are more commonly abundant in Delaware River waters to the south of the PSEG Site. A single fish was collected in Delaware River waters near the PSEG Site, and none were collected in the marsh creeks near the PSEG Site (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571; PSEG 2013-TN2586).

3.2.2 Clearnose Skate (*Raja eglanteria*)

Species Description

The Clearnose Skate occurs along the eastern Atlantic coast and in the coastal Gulf of Mexico in waters between 9 and 30°C. Clearnose Skates prefer habitat characterized by soft or gravelly substrate between 1 and 30 m depth, although some species have been reported at depths exceeding 100 m (Packer et al. 2003-TN2822). This species moves to inshore waters during the spring and early summer to reproduce and moves to offshore waters during fall and early winter. An oviparous species, females produce egg cases that are deposited in pairs and incubate for an average of 82 days for species occurring north of Cape Hatteras, North Carolina (Packer et al. 2003-TN2822). Females may lay up to 35 pairs of eggs in one breeding season. Clearnose Skates prey on polychaete worms, small crustaceans, squid, and small fishes such as Weakfish, Butterfish, and Scup.

Status of Fishery

The Clearnose Skate is managed as part of the Northeast Skate Complex, although currently this species is not considered to be overfished (Sosebee 2006-TN2828). Skates have been reported in New England fishery landings since the late 1800s and primarily have been fished commercially as bait, although harvest also occurs incidentally as bycatch in other species fished by trawl and gillnets (NOAA 2013-TN2829).

A total of 104 Clearnose Skate were captured during trawling surveys by PSEG between 2003 and 2010 in Delaware River Estuary waters south of the PSEG Site, with no observations from field surveys occurring in the waters near the PSEG Site (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571; PSEG 2013-TN2586).

3.2.3 Little Skate (*Leucoraja erinacea*)

Species Description

The Little Skate is most commonly found in onshore and offshore waters associated with the Mid-Atlantic Bight and Georges Bank in the northeast. Little Skate prefer sandy or gravelly habitat where they can bury themselves during the day (Packer et al. 2003-TN2823). Little Skate juveniles and adults move into nearshore water in the winter and have been reported in Delaware Bay waters between October and May when water temperatures were less than 15°C, with the highest abundances occurring in the lower Delaware Bay near the mouth (Packer et al. 2003-TN2823). Like the Clearnose Skate, Little Skate deposit egg cases during winter months. Little Skate juveniles and adults feed on small crustaceans, amphipods, and polychaete worms (Packer et al. 2003-TN2823).

Status of Fishery

The Little Skate is managed as part of the Northeast Skate Complex, where it is fished commercially along with other skate species for bait and for harvest of skate wings (Packer et al. 2003-TN2823). The Little Skate is not currently considered to be overfished (NEFMC 2012-TN2830). Skates have been reported in New England fishery landings since the late 1800s and primarily have been fished commercially as bait, although harvest also occurs incidentally as bycatch in other species fished by trawl and gillnets (NOAA 2013-TN2829).

A total of 27 Little Skate were captured during trawling surveys by PSEG between 2003 and 2010 in Delaware River Estuary waters south of the PSEG Site, with no observations from field surveys occurring in the waters near the PSEG Site (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571; PSEG 2013-TN2586).

3.2.4 Scup (*Stenotomus chrysops*)

Species Description

The Scup, also known as the Porgy, range along the continental shelf of North America and are most common between Cape Cod, Massachusetts, and Cape Hatteras, North Carolina (MDMF 2006-TN2161). Scup form schools in offshore waters to overwinter and move to inshore habitats characterized by smooth bottom substrate in the spring and summer. Adult Scup spawn annually in inshore waters between May and August in southern New England waters (ASMFC 2013-TN2831). Juvenile and adult scup prefer a variety of intertidal and subtidal habitats characterized by rocky ledges, reefs, sand, shell, and mud bottoms and are commonly found in large estuaries during summer and fall months (ASMFC 2013-TN2831). Adults feed on small crustaceans, mollusks, annelid worms, jellyfish, and sand dollars (MDMF 2006-TN2161).

Status of Fishery

The MAFMC and ASMFC jointly manage the Scup under Amendment 13 of the Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan (ASMFC 2013-TN2826). Scup are fished commercially and recreationally. The commercial harvest totaled 3,726,460 lb in New Jersey and 8 lb in Delaware in 2011 (NOAA 2013-TN2174). Recreational harvests in 2011 totaled 89,882 individuals in New Jersey and 1,258 in Delaware (NOAA 2013-TN2175). The September 26, 2013, status of the stock report indicated that Scup are currently not considered overfished (MAMFC 2013-TN2827).

Trawling, seining, and weir surveys between 2003 and 2010 indicate Scup are not found in Delaware River waters near the PSEG Site but are more abundant to the south of the PSEG Site in Delaware Bay (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571; PSEG 2013-TN2586).

3.2.5 Summer Flounder (*Paralichthys dentatus*)

Species Description

The Summer Flounder ranges along the Atlantic coast from Maine to northern Florida. The Summer Flounder prefers sandy substrate for burrowing but may also use mud or silt substrates found in estuary habitats (Grimes et al. 1989-TN2150). Spawning behaviors are not clearly understood but are assumed to occur sometime between late

fall and early spring in bottom habitats along continental shelf waters (Grimes et al. 1989-TN2150). Summer Flounder eggs are found in pelagic waters between 14 and 17°C, and larvae peak in abundance around November in waters between 9 and 18°C (ASMFC 2013-TN2832). Larvae drift into estuarine habitats where juvenile development takes place. Juveniles and adults prefer estuarine marsh creeks with mud or sandy substrate for burying (ASMFC 2013-TN2832). Adults feed on smaller fish, squids, crustaceans, mollusks, marine worms, and sand dollars (Grimes et al. 1989-TN2150).

Status of Fishery

The MAFMC and ASMFC jointly manage the Summer Flounder under Amendment 13 of the Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan (ASMFC 2013-TN2826). Summer Flounder are considered an excellent food fish and an important species in both recreational and commercial harvests. Commercial harvests in New Jersey and Delaware totaled 2,830,403 lb and 836 lb, respectively, in 2011 (NOAA 2013-TN2174). Recreational harvests in 2011 totaled 9,101,622 individuals in New Jersey and 808,442 in Delaware (NOAA 2013-TN2175). The September 26, 2013, status of the stock report indicated that Summer Flounder are currently not considered overfished (MAMFC 2013-TN2827).

Trawling, seining, and weir surveys between 2003 and 2010 indicate Summer Flounder are found in Delaware River waters near the PSEG Site and have been detected in offsite small and large marsh creeks near the PSEG Site (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571; PSEG 2013-TN2586).

3.2.6 Windowpane Flounder (*Scophthalmus aquosus*)

Species Description

The Windowpane Flounder is found in estuaries, nearshore waters, and waters along the continental shelf of the northwestern Atlantic from the Gulf of St. Lawrence in Canada to northern Florida (Hendrickson 2006-TN2153). Adults prefer muddy or fine-grain sandy substrates in waters and tolerate a wide range of temperatures and salinities—from 23°F to 80.2°F (0°C to 26.8°C) and 5.5 ppt to 36 ppt (Chang et al. 1999-TN2133). Spawning starts in February or March and peaks in May over inner continental shelf waters (Chang et al. 1999-TN2133). Females release pelagic, buoyant eggs that hatch in approximately 8 days. In spring-spawned fish, larvae settle in estuaries and over the continental shelf and then inhabit the polyhaline portions of the estuary throughout the summer. In fall-spawned fish, larvae settle mostly on the shelf. Juveniles migrate from estuaries to coastal waters during autumn, and they overwinter offshore in deeper waters. Adults remain offshore throughout the year and are highly abundant off southern New Jersey (Chang et al. 1999-TN2133).

Juvenile and adult Windowpane have similar food sources, including small crustaceans and fish larvae of hakes and Tomcod (*Microgadus tomcod*), and in turn are preyed upon by a number of species including Spiny Dogfish (*Squalus acanthias*), Thorny Skate (*Amblyraja radiata*), Goosefish (*Lophius americanus*), Atlantic Cod (*Gadus morhua*), Black Sea Bass, Weakfish, and Summer Flounder (Chang et al. 1999-TN2133).

Status of the Fishery

The Windowpane Flounder is managed by the New England Fishery Management Council (NEFMC) as two stocks, the Gulf of Maine/Georges Bank stock and the Southern New England/Mid-Atlantic stock, under its Multispecies Groundfish Fishery

Management Plan (Hendrickson 2006-TN2153). Windowpane Flounder have never been widely or directly targeted as a commercial species but have been harvested in mixed-species fisheries since the 1900s. Landings ranged from 1.1 to 2.0 million lbs (500 to 900 metric tonnes [MT]) per year between 1975 and 1981, increased to a record high of 4.6 million lbs (2,100 MT) in 1985, and have since steadily declined (Hendrickson 2006-TN2153). Although the Windowpane Flounder is not currently a major target of the commercial fishing industry, a total of 11,902 lb were harvested commercially in New Jersey in 2009 (NOAA 2013-TN2174).

Trawling, seining, and weir surveys between 2003 and 2010 indicate adult and juvenile Windowpane Flounder are not commonly found in Delaware River waters near the PSEG Site but were frequently collected in surveys south of the PSEG Site in Delaware Bay (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571; PSEG 2013-TN2586).

3.2.7 Winter Flounder (*Pleuronectes americanus*)

Species Description

The Winter Flounder ranges along the Atlantic coast from Labrador, Canada, to Georgia. Winter Flounder prefer a variety of bottom substrates in inshore bays and estuaries during the winter and migrate to deeper water in the summer (Hendrickson et al. 2006-TN2154). Adult Winter Flounder migrate inshore to bays and estuaries in the fall and early winter to spawn and may remain inshore year-round in areas where temperatures are 59°F (15°C) or lower and where enough food is available (Grimes et al. 1989-TN2150). Eggs adhere to each other to form large clumps on the bottom and are most often found at salinities between 10 and 30 ppt (Buckley 1989-TN2833). Larvae initially are planktonic but become increasingly benthic as they develop (Pereira et al. 1999-TN2834). Juveniles and adults are completely benthic, with juveniles remaining in estuaries for the first year (Grimes et al. 1989-TN2150). Water temperature appears to dictate adult movements; south of Cape Cod, Winter Flounder spend the colder months in inshore and estuarine waters and move farther offshore in the warmer months (Buckley 1989-TN2833). Adult Winter Flounder tolerate salinities from 5 to 35 ppt and prefer waters temperatures from 32°F to 77°F (0°C to 25°C).

Juveniles remain in their natal shallow waters during their first summer and feed on diatoms, small crustaceans, and mollusks. Adults prey on small crustaceans, annelid worms, small mollusks, and fish (Hendrickson et al. 2006-TN2154). Adults and juveniles are an important food source for other predatory fish such as the Striped Bass, Bluefish (*Pomatomus saltatrix*), Goosefish, Spiny Dogfish, other flounders, and birds inhabiting estuarine marshes (Buckley 1989-TN2833).

Status of the Fishery

Winter Flounder, managed by the ASMFC in state waters and by the NEFMC in Federal waters under the Northeast Multispecies Fishery Management Plan, is one of the most important species for commercial and recreational fisheries on the Atlantic coast (Buckley 1989-TN2833). Winter Flounder are generally commercially harvested using otter trawl, but the species is also a popular recreational fish. Winter Flounder in the vicinity of the PSEG Site are part of the Southern New England/Mid-Atlantic Bight Stock. This stock peaked in the mid-1960s with 26 million lbs (12,000 MT) in landings in 1966, declined through the 1970s, peaked again through the 1980s with 24 million lbs (11,000 MT) in landings in 1981, and has since continued to decline (Hendrickson et

al. 2006-TN2154). The Winter Flounder is the most important recreationally caught flounder in inshore waters of the Mid-Atlantic (Grimes et al. 1989-TN2150). The commercial harvest in New Jersey totaled 6,051 lb in 2011 (NOAA 2013-TN2174). The recreational harvest totaled 83,086 individuals in New Jersey in 2007 (NOAA 2013-TN2175).

Trawling, seining, and weir surveys between 2003 and 2010 indicate juvenile and adult Winter Flounder are not found in Delaware River waters near the PSEG Site but were observed in Delaware Bay waters south of the PSEG Site (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571; PSEG 2013-TN2586).

3.2.8 Winter Skate (*Leucoraja ocellata*)

Species Description

The Winter Skate occurs along the eastern Atlantic coast between southern New England waters and coastal North Carolina waters with water temperatures between -1.2 and 19°C. Winter skates prefer habitat characterized by sandy substrate between 1 and 300 m depth (Packer et al. 2003-TN2824). This species moves to inshore waters during the spring and early summer to reproduce and moves to offshore waters during fall and early winter. In the Delaware Bay, adult and juvenile Winter Skate have been observed to prefer higher salinities in the fall and winter and tolerate lower salinities in the spring (Packer et al. 2003-TN2824). Females produce egg cases that are deposited in pairs on sandy substrates, and fully formed juveniles hatch from these egg cases (Packer et al. 2003-TN2824). Winter skates prey on polychaete worms and amphipods and are prey to sharks, other skate species, and gray seals (Packer et al. 2003-TN2824).

Status of Fishery

The Winter Skate is managed as part of the Northeast Skate Complex, where it is fished commercially along with other skate species for bait and for harvest of skate wings for human consumption (Packer et al. 2003-TN2824). The Winter Skate is not currently considered to be overfished (NEFMC 2012-TN2830). Skates have been reported in New England fishery landings since the late 1800s and primarily have been fished commercially as bait, although harvest also occurs incidentally as bycatch in other species fished by trawl and gillnets (NOAA 2013-TN2829).

A total of 28 Winter Skate were captured during trawling surveys by PSEG between 2003 and 2010 in Delaware River Estuary waters south of the PSEG Site, with no observations from field surveys occurring in the waters near the PSEG Site (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571; PSEG 2013-TN2586).

4.0 Potential Adverse Effects to EFH

The provisions of the MSA define an "adverse effect" to EFH as the following (50 CFR 600-TN1342):

> *Adverse effect* means any impact that reduces quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality and/or quantity of EFH. Adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.

The review team has identified the following potential PSEG building and operation activities that may cause adverse effects to EFH:

- Dredging and in-water installation activities
- Impingement
- Entrainment
- Discharge effects (thermal, chemical, and physical)
- Maintenance dredging and barge traffic
- Loss of forage species through activities listed above

In the following sections, each of these issues is addressed for each of the species identified for in-depth analysis in Table 4. Cumulative effects are discussed separately in Section 5.0 below.

4.1 Black Sea Bass

As discussed in Section 3.2.1, the NMFS has designated EFH for juvenile Black Sea Bass within the vicinity of the PSEG Site because of the depth, temperature, and salinity characteristics present to support the juvenile life stage.

In the spring, juvenile Black Sea Bass may forage in more estuarine habitats including the following areas of proposed dredging and in-water installation activities: HCGS barge slip, barge storage and unloading facility, caisson installation area, and intake and discharge structures. Disruption of habitat for foraging in these areas of the Delaware River Estuary is expected to be minor, temporary, and largely mitigable with the use of BMPs required by Federal and State permits to control sedimentation (PSEG 2014-TN3452). Juvenile Black Sea Bass that may be present should be able to use adjacent unaffected habitats.

As described in Section 2.3, a conservative estimate of impingement losses for the closed-cycle cooling operation of PSEG would be approximately 481,479 annually. The majority of these species are expected to be White Perch, Atlantic Croaker, and Weakfish. Entrainment losses are expected to be minor and average less than 125/100 m^3 intake water volume, with the majority of these losses being Bay Anchovy (eggs) and Naked Goby (larvae). Impingement sampling at SGS and HCGS between 1986 and 1987 (VJSA 1988-TN2564; ECS 1989-TN2572), and at SGS between 2003

and 2010 recorded minimal occurrences of Black Sea Bass (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571).

Thermal plume analysis for a new plant at the PSEG Site estimates that ambient water temperature in the estuary outside the NJPDES-permitted HDA may not increase by more than 4°F (2.2°C) from September through May and by 1.5°F (0.8°C) from June through August, with a year-round maximum water temperature of 86°F (30°C) (18 CFR Part 410, DRBC 2011-TN2371). Juvenile Black Sea Bass are generally found in bottom habitats at depths between 1 and 38 m (3 and 125 ft) and could avoid the buoyant thermal plume at the discharge point. As described in Section 2.3, the size of the thermal plume for a new plant would be relatively small and would have a maximum extent of about 700 ft into the river from the discharge location, about 300 ft upstream from the discharge, and about 500 ft downstream from the discharge. Because the horizontal extent of the thermal plume represents only 5.3 percent of the river width at Delaware RM 52, mobile organisms would be able to avoid the localized point of discharge and the heated discharge plume. Aquatic species, including juvenile Black Sea Bass, largely may avoid the immediate vicinity of the discharge outlet because of high velocity and turbulence. Chemical discharge effects are expected to be minimal and comply with the terms of the NJPDES permit that would be issued for a new plant at the PSEG Site (PSEG 2014-TN3452). Disruption of habitat for foraging due to maintenance dredging in the Delaware River Estuary at the PSEG Site is expected to be localized, temporary, and largely mitigable with the use of BMPs required by Federal and State permits to control sedimentation (PSEG 2014-TN3452). Barge traffic effects are expected to be localized and temporary. Juvenile Black Sea Bass that may be present should be able to use adjacent unaffected habitats.

Black Sea Bass juveniles primarily forage on benthic invertebrates, which are not expected to be affected in the long term from dredging and in-water installation activities as described in Section 2.2. In addition, these forage species have not been shown to be affected by operations at the adjacent HCGS and SGS, and therefore operation of a new plant at the PSEG Site would not be expected to reduce the abundance of the benthic invertebrate prey species for Black Sea Bass. Thus, building and operation activities in the vicinity of the PSEG Site would likely have minimal adverse effect on juvenile Black Sea Bass EFH.

4.2 Clearnose Skate

As discussed in Section 3.2.2, NMFS has designated EFH for juvenile and adult Clearnose Skate within the vicinity of the PSEG Site because of the depth, temperature, and salinity characteristics present to support the juvenile and adult life stages.

Juvenile and adult Clearnose Skate may forage within the areas of the cooling water intake and discharge dredging and installation, caisson installation area, HCGS barge slip improvements and dredging, and barge storage and unloading facility dredging and installation. Disruption of habitat for foraging in these areas of the Delaware River Estuary is expected to be minor, temporary, and largely mitigable with the use of BMPs required by Federal and State permits to control sedimentation (PSEG 2014-TN3452). Juvenile and adult Clearnose Skate that may be present should be able to use adjacent unaffected habitats.

As described in Section 2.3, a conservative estimate of impingement losses for the closed-cycle cooling operation of PSEG would be approximately 481,479 annually. The

majority of these species are expected to be White Perch, Atlantic Croaker, and Weakfish. Entrainment losses are expected to be minor and average less than 125/100 m^3, with the majority of these losses being Bay Anchovy (eggs) and Naked Goby (larvae). Impingement sampling at SGS and HCGS between 1986 and 1987 (VJSA 1988-TN2564; ECS 1989-TN2572), and at SGS between 2003 and 2010 recorded no occurrences of juvenile or adult Clearnose Skate (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571).

Thermal plume analysis for a new plant at the PSEG Site estimates that ambient water temperature in the estuary outside the NJPDES-permitted HDA may not increase by more than 4°F (2.2°C) from September through May and by 1.5°F (0.8°C) from June through August, with a year-round maximum water temperature of 86°F (30°C) (18 CFR Part 410, DRBC 2011-TN2371). Juvenile and adult Clearnose Skate are generally found in bottom habitats at depths of 5 to 23 m (16 to 75 ft) and would avoid the buoyant thermal plume at the discharge point. As described in Section 2.3, the size of the thermal plume for a new plant would be relatively small and would have a maximum extent of about 700 ft into the river from the discharge location, about 300 ft upstream from the discharge, and about 500 ft downstream from the discharge. Because the horizontal extent of the thermal plume represents only 5.3 percent of the river width at Delaware RM 52, mobile organisms would be able to avoid the heated discharge plume. Aquatic species, including juvenile and adult Clearnose Skate, may largely avoid the immediate vicinity of the discharge outlet because of high velocity and turbulence. Chemical discharge effects are expected to be minimal, comply by the terms of the NJPDES permit that would be issued for a new plant at the PSEG Site (PSEG 2014-TN3452), and not affect Clearnose Skate EFH for juveniles or adults.

Disruption of habitat for prey species or for foraging because of maintenance dredging in the Delaware River Estuary at the PSEG Site is expected to be localized, temporary, and largely mitigable with the use of BMPs required by Federal and State permits to control sedimentation (PSEG 2014-TN3452). Barge traffic effects are also expected to be localized and temporary.

Clearnose Skate juveniles and adults primarily forage on polychaete worms, small crustaceans, squid, and small fishes such as Weakfish, Butterfish, and Scup. While Butterfish and Scup are not abundant near the PSEG Site, Weakfish are abundant and may be impinged at a rate similar to HCGS, which is roughly 143 individuals per one million m^3 of intake water (see Section 5.3.2.1 of the EIS). However, Weakfish was one of the most abundant species caught in the Delaware River near the PSEG Site between 2003 and 2010 (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571) and would not be expected to decrease significantly with closed-cycle cooling water operation at the PSEG Site. In addition, population abundances of these forage species have not been shown to be adversely affected by operations at the adjacent HCGS and SGS and would therefore not be expected to reduce the abundance of the prey species for Clearnose Skate in the vicinity of the PSEG Site. Therefore, building and operation activities in the vicinity of the PSEG Site likely would have minimal adverse effects on juvenile and adult Clearnose Skate EFH.

4.3 Little Skate

As discussed in Section 3.2.3, NMFS has designated EFH for juvenile and adult Little Skate within the vicinity of the PSEG Site because of the depth, temperature, and salinity characteristics present to support juvenile and adult life stages.

Juvenile and adult Little Skate may forage within the areas of the cooling water intake and discharge dredging and installation, caisson installation area, HCGS barge slip improvements and dredging, and barge storage and unloading facility installation and dredging. Disruption of habitat for foraging in these areas of the Delaware River Estuary is expected to be minor, temporary, and largely mitigable with the use of BMPs to control sedimentation (PSEG 2014-TN3452). Juvenile and adult Little Skate that may be present should be able to use adjacent unaffected habitats.

As described in Section 2.3, a conservative estimate of impingement losses for the closed-cycle cooling operation of PSEG would be approximately 481,479 annually. The majority of these species are expected to be White Perch, Atlantic Croaker, and Weakfish. Entrainment losses are expected to be minor and average less than 125/100 m^3, with the majority of these losses being Bay Anchovy (eggs) and Naked Goby (larvae). Impingement sampling at SGS and HCGS between 1986 and 1987 (VJSA 1988-TN2564; ECS 1989-TN2572), and at SGS between 2003 and 2010 recorded no occurrences of juvenile or adult Little Skate (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571).

Thermal plume analysis for a new plant at the PSEG Site estimates that ambient water temperature in the estuary outside the NJPDES-permitted HDA may not increase by more than 4°F (2.2°C) from September through May and by 1.5°F (0.8°C) from June through August, with a year-round maximum water temperature of 86°F (30°C) (18 CFR Part 410; DRBC 2011-TN2371). Juvenile and adult Little Skate are generally found in bottom habitats at depths of 4 to 21 m (13 to 69 ft) and would avoid the buoyant thermal plume at the discharge point. As described in Section 2.3, the size of the thermal plume for a new plant would be relatively small and would have a maximum extent of about 700 ft into the river from the discharge location, about 300 ft upstream from the discharge, and about 500 ft downstream from the discharge. Because the horizontal extent of the mixing zone under slack tides represents only 5.3 percent of the river width at Delaware RM 52, mobile organisms would be able to avoid the heated discharge plume. Aquatic species, including juvenile and adult Little Skate, may largely avoid these areas because of high velocities and turbulence. Chemical discharge effects are expected to be minimal, comply by the terms of the NJPDES permit that would be issued for a new plant at the PSEG Site (PSEG 2014-TN3452), and not affect Little Skate EFH for juveniles or adults.

Disruption of habitat for foraging because of maintenance dredging in the Delaware River Estuary at the PSEG Site is expected to be localized, temporary, and largely mitigable with the use of BMPs required by Federal and State permits to control sedimentation (PSEG 2014-TN3452). Barge traffic effects are also expected to be localized and temporary.

Little Skate juveniles and adults primarily forage on small crustaceans, amphipods, and polychaete worms, which are not expected to be affected in the long term from dredging and in-water installation activities as described in Section 2.2. In addition, these forage species have not been shown to be affected by operations at the adjacent HCGS and SGS and would therefore not be expected to reduce the abundance of the prey species

for juvenile and adult Little Skate in the vicinity of the PSEG Site. Therefore, building and operation activities in the vicinity of the PSEG Site would likely have no adverse effect on juvenile and adult Little Skate EFH.

4.4 Scup

As discussed in Section 3.2.4, NMFS has designated EFH for juvenile and adult Scup within the vicinity of the PSEG Site because of the depth, temperature, and salinity characteristics present to support the juvenile and adult life stages.

Scup may forage within the areas of the cooling water intake and discharge dredging and installation, caisson installation area, HCGS barge slip improvements and dredging, and barge storage and unloading facility dredging and installation. Disruption of habitat for foraging in these areas of the Delaware River Estuary is expected to be minor, temporary, and largely mitigable with the use of BMPs to control sedimentation (PSEG 2014-TN3452). Juvenile and adult Scup that may be present should be able to use adjacent unaffected habitats.

Scup were not observed in impingement sampling at SGS and HCGS between 1986 and 1987 (VJSA 1988-TN2564; ECS 1989-TN2572) and were detected at low abundance in impingement sampling at SGS between 2003 and 2010 (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571).

Thermal plume analysis for a new plant at the PSEG Site estimates that ambient water temperature in the estuary outside the NJPDES-permitted HDA may not increase by more than 4°F (2.2°C) from September through May and by 1.5°F (0.8°C) from June through August, with a year-round maximum water temperature of 86°F (30°C) (18 CFR Part 410; DRBC 2011-TN2371). Juvenile and adult Scup are generally found over a range of bottom habitats at depths between 0 and 185 m (0 to 607 ft) and would avoid the buoyant thermal plume at the discharge point. As described in Section 2.3, the size of the thermal plume for a new plant would be relatively small and would have a maximum extent of about 700 ft into the river from the discharge location, about 300 ft upstream from the discharge, and about 500 ft downstream from the discharge. Because the horizontal extent of the thermal plume represents only 5.3 percent of the river width at Delaware RM 52, mobile organisms would be able to avoid the heated discharge plume. Aquatic species, including juvenile and adult Scup, may largely avoid these areas because of high velocities and turbulence. Chemical discharge effects are expected to be minimal, comply by the terms of the NJPDES permit that would be issued for a new plant at the PSEG Site (PSEG 2014-TN3452), and are not expected to affect Scup EFH for juveniles or adults.

Disruption of habitat for foraging because of maintenance dredging in the Delaware River Estuary at the PSEG Site is expected to be localized, temporary, and largely mitigable with the use of BMPs required by Federal and State permits to control sedimentation (PSEG 2014-TN3452). Barge traffic effects are also expected to be localized and temporary.

Scup juveniles and adults primarily forage on small crustaceans and mollusks, annelid worms, and jellyfish, which are not expected to be affected in the long term from dredging and in-water installation activities described in Section 2.2. In addition, these forage species have not been shown to be affected by operations at the adjacent HCGS and SGS and would therefore not be expected to reduce the abundance of these prey species for juvenile and adult Scup in the vicinity of the PSEG Site.

Therefore, building and operation activities in the vicinity of the PSEG Site would likely have minimal adverse effects on juvenile and adult Scup EFH.

4.5 Summer Flounder

As discussed in Section 3.2.5, NMFS has designated EFH for juvenile and adult Summer Flounder within the vicinity of the PSEG Site because of the depth, temperature, and salinity characteristics present to support the juvenile and adult life stages. Juvenile and adult Summer Flounder may forage within the areas of the cooling water intake and discharge dredging and installation, caisson installation area, HCGS barge slip improvements and dredging, and barge storage and unloading facility dredging and installation. Disruption of habitat for foraging in these areas of the Delaware River Estuary is expected to be minor, temporary, and largely mitigable with the use of BMPs to control sedimentation (PSEG 2014-TN3452). Juvenile and adult Summer Flounder that may be present should be able to use adjacent unaffected habitats. A total of eight Summer Flounder were collected during bottom trawl surveys near the PSEG Site between 2003 and 2010, with over 300 collected during that same time in the Delaware River Estuary to the south of the site in higher salinity waters (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571).

Summer Flounder were detected in impingement sampling at SGS and HCGS between 1986 and 1987 (VJSA 1988-TN2564; ECS 1989-TN2572) and at SGS between 2003 and 2010 (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571). Between 2003 and 2010, an average of 11.4 larvae and 58.6 juveniles were entrained per year at SGS (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571).

Thermal plume analysis for a new plant at the PSEG Site estimates that ambient water temperature in the estuary outside the NJPDES-permitted HDA may not increase by more than 4°F (2.2°C) from September through May and by 1.5°F (0.8°C) from June through August, with a year-round maximum water temperature of 86°F (30°C) (18 CFR Part 410; DRBC 2011-TN2371). Juvenile and adult Summer Flounder are generally found over a range of bottom habitats at depths between 0 and 25 m (0 and 82 ft) and would avoid the buoyant thermal plume at the discharge point. As described in Section 2.3, the size of the thermal plume for a new plant would be relatively small and would have a maximum extent of about 700 ft into the river from the discharge location, about 300 ft upstream from the discharge, and about 500 ft downstream from the discharge. Because the horizontal extent of the thermal plume represents only 5.3 percent of the river width at Delaware RM 52, mobile organisms would be able to avoid the heated discharge plume. Aquatic species, including juvenile and adult Summer Flounder, may largely avoid these areas because of high velocities and turbulence. Chemical discharge effects are expected to be minimal, comply by the terms of the NJPDES permit that would be issued for a new plant at the PSEG Site (PSEG 2014-TN3452), and not affect Summer Flounder EFH for juveniles or adults.

Disruption of habitat for foraging because of maintenance dredging in the Delaware River Estuary at the PSEG Site is expected to be localized, temporary, and largely mitigable with the use of BMPs required by Federal and State permits to control sedimentation (PSEG 2014-TN3452). Barge traffic effects are also expected to be

localized and temporary. Juvenile and adult Summer Flounder that may be present should be able to use adjacent unaffected habitats.

Summer Flounder juveniles and adults primarily forage on small crustaceans, mollusks, and squid, which are not expected to be affected in the long term from dredging and in-water installation activities as described in Section 2.2. In addition, these forage species have not been shown to be affected by operations at the adjacent HCGS and SGS and would therefore not be expected to reduce the abundance of these prey species for juvenile and adult Summer Flounder in the vicinity of the PSEG Site. Therefore, building and operation activities in the vicinity of the PSEG Site would likely have minimal adverse effects on juvenile and adult Summer Flounder EFH.

4.6 Windowpane Flounder

As discussed in Section 3.2.6, NMFS has designated EFH for Windowpane eggs, larvae, juveniles, and adults within the vicinity of the PSEG Site because of the depth, temperature, and salinity characteristics present to support the occurrence of these life stages.

Windowpane Flounder eggs are present in surface waters over the Atlantic continental shelf beginning in February, with peak abundances occurring in the middle Atlantic between March and October (Chang et al. 1999-TN2133). Following offshore spawning, eggs and larvae may drift into estuarine waters by tidal and wave action. No Windowpane eggs and very few larvae were observed during sampling events between 2003 and 2010 (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571).

Larvae drift along the continental shelf waters or in estuaries and settle to the bottom, and it is possible that a few may settle within the areas of the cooling water intake and discharge dredging and installation, caisson installation area, HCGS barge slip improvements and dredging, and barge storage and unloading facility dredging and installation. Disruption of larval habitat from in-water installation activities or maintenance dredging in the Delaware River Estuary at the PSEG Site is expected to be localized, temporary, and largely mitigable with the use of BMPs required by Federal and State permits to control sedimentation and minimize habitat disruption during spawning and post-spawning development seasons in the spring and early summer (PSEG 2014-TN3452).

Juvenile and adult Windowpane Flounder may forage within the areas of the cooling water intake and discharge dredging and installation, caisson installation area, HCGS barge slip improvements and dredging, and barge storage area and unloading facility dredging and installation. Disruption of habitat for foraging in these areas of the Delaware River Estuary near the PSEG Site during installation and maintenance dredging is expected to be localized, temporary, and largely mitigable with the use of BMPs required by Federal and State permits to control sedimentation (PSEG 2014-TN3452). Barge traffic effects are also expected to be localized and temporary. Juvenile and adult Windowpane Flounder that may be present should be able to use adjacent unaffected habitats.

Two Windowpane Flounder were collected during bottom trawl surveys near the PSEG Site between 2003 and 2010, with over 600 collected during that same time in the Delaware River Estuary to the south of the site in higher salinity waters (PSEG 2004-

TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571).

Windowpane Flounder were detected at low abundance in impingement sampling at SGS and HCGS between 1986 and 1987 (VJSA 1988-TN2564; ECS 1989-TN2572), and at SGS between 2003 and 2010 (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571). No Windowpane eggs were collected from entrainment samples between 2003 and 2010, and an average of 0.9 larvae and 0.25 juveniles were entrained per year at SGS (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571).

Thermal plume analysis for a new plant at the PSEG Site estimates that ambient water temperature in the estuary outside the NJPDES-permitted HDA may not increase by more than 4°F (2.2°C) from September through May and by 1.5°F (0.8°C) from June through August, with a year-round maximum water temperature of 86°F (30°C) (18 CFR Part 410; DRBC 2011-TN2371). Windowpane larvae and juvenile and adult Windowpane Flounder are generally found over a range of bottom habitats at depths between 1 and 100 m (3 and 328 ft) and would avoid the buoyant thermal plume at the discharge point. As described in Section 2.3, the size of the thermal plume for a new plant would be relatively small and would have maximum extent of about 700 ft into the river from the discharge location, about 300 ft upstream from the discharge, and about 500 ft downstream from the discharge. Because the horizontal extent of the thermal plume represents only 2.3 percent of the river width at Delaware RM 52, mobile organisms would be able to avoid the heated discharge plume. Aquatic species, including larval, juvenile, and adult Windowpane Flounder, may largely avoid these areas because of high velocity and turbulence. Chemical discharge effects are expected to be minimal and comply by the terms of the NJPDES permit that would be issued for a new plant at the PSEG Site (PSEG 2014-TN3452), and are not expected to affect Windowpane Flounder EFH for eggs, larvae, juveniles, or adults.

Windowpane Flounder eggs are not known to occur near the PSEG Site and, therefore, there would be no adverse effect to Windowpane egg EFH from building and operating a new plant at the PSEG Site. Windowpane Flounder larvae may occur near the PSEG Site in relatively low abundance and would not be affected in the long term from dredging, in-water installation activities, and maintenance dredging as described in Section 2. Therefore, building and operation activities in the vicinity of the PSEG Site would likely have minimal adverse effects on larval Windowpane Flounder EFH.

Windowpane Flounder juveniles and adults primarily forage on small crustaceans and larval hakes and cods, which are not expected to be affected in the long term from dredging and in-water installation activities as described in Section 2.2. In addition, these forage species have not been shown to be affected by operations at the adjacent HCGS and SGS and would therefore not be expected to reduce the abundance of these prey species for juvenile and adult Windowpane Flounder in the vicinity of the PSEG Site. Therefore, building and operation activities at the PSEG Site would likely have minimal adverse effect on juvenile and adult Windowpane Flounder EFH.

4.7 Winter Flounder

As discussed in Section 3.2.7, NMFS has designated EFH for Winter Flounder eggs, larvae, juveniles, and adults within the vicinity of the PSEG Site because of the depth, temperature, and salinity characteristics present to support the occurrence of these life stages.

Winter Flounder eggs are present in clumps that sink to the bottom and can be found in water depth of less than 5 m (16 ft) between February and June (Buckley 1989-TN2833). No Winter Flounder eggs were observed during sampling events between 2003 and 2010 (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571).

Larvae are initially planktonic but become benthic as they mature, and a small number of Winter Flounder larvae may settle in areas within the area of the cooling water intake and discharge dredging and installation, caisson installation area, and barge slip and new barge facility dredging. Disruption of larval habitat from in-water installation activities or maintenance dredging in the Delaware River Estuary at the PSEG Site is expected to be localized, temporary, and largely mitigable with the use of BMPs required by Federal and State permits to control sedimentation and minimize habitat disruption during spawning and post-spawning development seasons in the spring and early summer (PSEG 2014-TN3452).

Juvenile and adult Winter Flounder may forage within area of the cooling water intake and discharge dredging and installation, caisson installation area, HCGS barge slip improvements and dredging, and barge storage and unloading facility improvements and dredging. Disruption of habitat for foraging in these areas of the Delaware River Estuary is expected to be minor, temporary, and largely mitigable with the use of BMPs required by Federal and State permits to control sedimentation (PSEG 2014-TN3452). Barge traffic effects are also expected to be localized and temporary. Juvenile and adult Winter Flounder that may be present should be able to use adjacent unaffected habitats. No Winter Flounder were collected during bottom trawl surveys near the PSEG Site between 2003 and 2010, while over 50 were collected during that same time in the Delaware River Estuary to the south of the site in higher salinity waters (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571).

Winter Flounder were detected at low abundance in impingement sampling at SGS and HCGS between 1986 and 1987 (VJSA 1988-TN2564; ECS 1989-TN2572) and at SGS between 2003 and 2010 (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571). No Winter Flounder eggs were collected from entrainment samples between 2003 and 2010, and an average of 1.5 larvae and 1.0 juveniles were entrained per year at SGS (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571).

Thermal plume analysis for a new plant at the PSEG Site estimates that ambient water temperature in the estuary outside the NJPDES-permitted HDA may not increase by more than 4°F (2.2°C) from September through May and by 1.5°F (0.8°C) from June through August, with a year-round maximum water temperature of 86°F (30°C) (18 CFR 410-TN3235; DRBC 2011-TN2371). Larval, juvenile, and adult Winter Flounder are generally found over a range of bottom habitats at depths between 1 and 100 m (3 and 328 ft) and

would avoid the buoyant thermal plume at the discharge point. As described in Section 2.3, the size of the thermal plume for a new plant would be relatively small and would have a maximum extent of about 700 ft into the river from the discharge location, about 300 ft upstream from the discharge, and about 500 ft downstream from the discharge. Because the horizontal extent of the thermal plume represents only 5.3 percent of the river width at Delaware RM 52, mobile organisms would be able to avoid the heated discharge plume. Aquatic species, including larval, juvenile, and adult Winter Flounder, largely may avoid these areas because of high velocities and turbulence. Chemical discharge effects are expected to be minimal, comply by the terms of the NJPDES permit that would be issued for a new plant at the PSEG Site (PSEG 2014-TN3452), and not affect Winter Flounder EFH for eggs, larvae, juveniles, or adults.

Winter Flounder eggs are not known to occur near the PSEG Site and therefore, there would be no adverse effect to Winter Flounder egg EFH from building and operating activities at the PSEG Site. Winter Flounder larvae and juveniles feed on diatoms and phytoplankton, while older juveniles and adults primarily forage on small crustaceans, annelid worms, and small mollusks, which are not expected to be affected in the long term from dredging and in-water installation activities as described in Section 2.2. In addition, these forage species have not been shown to be affected by operations at the adjacent HCGS and SGS and would therefore not be expected to reduce the abundance of these prey species for juvenile and adult Windowpane Flounder in the vicinity of the PSEG Site. Therefore, building and operation activities in the vicinity of the PSEG Site would likely have minimal adverse effect on larval, juvenile, and adult Windowpane Flounder EFH.

4.8 Winter Skate

As discussed in Section 3.2.8, NMFS has designated EFH for juvenile and adult Winter Skate within the vicinity of the PSEG Site because of the depth, temperature, and salinity characteristics present to support the juvenile and adult life stages.

Although no Winter Skate were collected near the PSEG Site during trawling and seining surveys between 2003 and 2010 (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571), Winter Skate may still forage within the area of the cooling water intake and discharge dredging and installation, caisson installation area, HCGS barge slip improvements and dredging, and barge storage area and unloading facility improvements and dredging. Disruption of habitat for foraging in these areas of the Delaware River Estuary is expected to be minor, temporary, and largely mitigable with the use of BMPs required for Federal and State permits to control sedimentation (PSEG 2014-TN3452). Barge traffic effects are also expected to be localized and temporary. Juvenile and adult Winter Skate that may be present should be able to use adjacent unaffected habitats.

Winter Skate were not observed in impingement sampling at SGS and HCGS between 1986 and 1987 (VJSA 1988-TN2564; ECS 1989-TN2572) or in impingement sampling at SGS between 2003 and 2010 (PSEG 2004-TN2565; PSEG 2005-TN2566; PSEG 2006-TN2567; PSEG 2007-TN2568; PSEG 2008-TN2569; PSEG 2009-TN2513; PSEG 2010-TN2570; PSEG 2011-TN2571).

Thermal plume analysis for a new plant at the PSEG Site estimates that ambient water temperature in the estuary outside the NJPDES-permitted HDA may not increase by more than 4°F (2.2°C) from September through May and by 1.5°F (0.8°C) from June

through August, with a year-round maximum water temperature of 86°F (30°C) (18 CFR Part 410; DRBC 2011-TN2371). Juvenile and adult Winter Skate are generally found over a range of bottom habitats at depths between 7 and 18 m (23 and 59 ft) and would avoid the buoyant thermal plume at the discharge point. As described in Section 2.3, the size of the thermal plume for a new plant would be relatively small and would have a maximum extent of about 700 ft into the river from the discharge location, about 300 ft upstream from the discharge, and about 500 ft downstream from the discharge. Because the horizontal extent of the thermal plume represents only 5.3 percent of the river width at Delaware RM 52, mobile organisms would be able to avoid the heated discharge plume. Aquatic species, including juvenile and adult Winter Skate, may largely avoid these areas because of high velocity and turbulence. Chemical discharge effects are expected to be minimal, comply by the terms of the NJPDES permit that would be issued for a new plant at the PSEG Site (PSEG 2014-TN3452), and not affect Winter Skate EFH for juveniles or adults.

Winter Skate juveniles and adults primarily forage on polychaete worm and amphipods, which are not expected to be affected in the long term from dredging and in-water installation activities as described in Section 2.2. In addition, these forage species have not been shown to be affected by operations at the adjacent HCGS and SGS and would therefore not be expected to reduce the abundance of these prey species for juvenile and adult Winter Skate in the vicinity of the PSEG Site. Therefore, building and operation activities in the vicinity of the PSEG Site likely would have no adverse effect on juvenile and adult Winter Skate EFH.

5.0 Cumulative Effects to EFH

A wide variety of historical events have affected the Delaware Estuary and River Basin and its resources (Berger et al. 1994-TN2127). As Europeans began settling the estuary region early in the 17th century, agriculture expanded, and the clearing of forest led to erosion. Dredging, diking, and filling gradually altered extensive areas of shoreline and tidal marsh. By the late 1800s, industrialization had altered much of the watershed of the upper estuary, and fisheries were declining because of overfishing as well as pollution from ships, sewers, and industry. By the 1940s, anadromous fish were blocked from migrating upstream to spawn because of a barrier of low oxygen levels in the Philadelphia area. This barrier, combined with small dams on tributaries, nearly destroyed the herring and shad fisheries. A large increase in industrial pollution in the early-to-mid 1900s resulted in the Delaware River near Philadelphia becoming one of the most polluted river reaches in the world. Major improvements in water quality began in the 1960s and continued through the 1980s as a result of State, multi-State, and Federal actions, including the Clean Water Act and the activities of DRBC (PDE 2012-TN2191). The Delaware Estuary and River Basin is the subject of numerous restoration activities and projects under the purview of the Partnership for the Delaware Estuary (PDE), DRBC, and numerous research and academic institutions. In its 2012 annual report, PDE suggested that the overall environmental conditions of the region were fair (PDE 2012-TN2191). Since 2008, some conditions were found to be declining in areas such as sediment removal impairing estuarine habitats and a decline in young-of-year Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*), and some areas were seeing improvements such as a reduction of total organic carbon and an increase in Striped Bass populations (PDE 2012-TN2191).

Other actions in the vicinity that have present and reasonably foreseeable future impacts on the Delaware River Estuary include the continued operation of SGS and HCGS, the

completion of dredging operations for the Delaware River Main Channel Deepening Project by the USACE, and potential construction of a new transmission corridor and transmission line by PJM Interconnection, LLC, for grid stability. Planning and development for the new transmission corridor would avoid or span channelized waterways, perennial streams, and intermittent streams (PSEG 2014-TN3452). New transmission line crossing development would require BMPs to protect water quality and minimize effects to aquatic habitats that may be at risk from clearing activities, runoff, and bank erosion. An estimated 77,088 linear ft of stream habitat (S&L 2010-TN2671) is within the 5-mi-wide macro-corridor for the hypothetical transmission line discussed in EIS Sections 7.1 and 7.3.2. The hypothetical transmission line would cross the Delaware River and would require installation of footings. Placement of footings would result in permanent benthic habitat loss, but this loss would be minimal when compared with available adjacent habitat. Installation activities would be managed through use of BMPs required for Federal and State permitting to minimize siltation and protect adjacent aquatic habitats. PSEG would consult with Federal and State agencies, as required, when an exact route is identified and installation effects to protected species can be assessed directly (PSEG 2014-TN3452).

Water quality in the region may be affected by continued withdrawal and discharge of water to support power generation. There are large commercial and recreational fisheries that harvest fish and invertebrates that make up the ecological community within the Delaware River Estuary. The effects of natural environmental stressors such as climate change and extreme weather events also would affect aquatic communities in the region.

Each of the current and reasonably foreseeable future activities may influence the structure and function of estuarine food webs and result in observable changes to the aquatic resources in the Delaware River Estuary. In most cases, it is not possible to determine quantitatively the impact of individual stressors or groups of stressors on aquatic resources because they affect the region simultaneously, and their effects are cumulative.

5.1 Continued Operation of the SGS Once-Through Cooling System

Based on the assessment presented in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants–Supplement 45 Regarding Hope Creek Generating Station and Salem Nuclear Generating Station, Units 1 and 2 Final Report* (NRC 2011-TN3131), NRC staff concluded that “entrainment, impingement, and thermal discharge impacts on aquatic resources from the operation of SGS Units 1 and 2 collectively have not had a noticeable adverse effect on the balanced indigenous community of the Delaware Estuary.” However, operation of SGS Units 1 and 2 continues to impinge and entrain aquatic species and would contribute, in part, to the cumulative loss of these species in the Delaware River Estuary. Several improvements to the cooling water intake structures have been made to reduce impingement mortality at SGS. Some of these improvements included installation of modified traveling screens, installation of improved screen mesh, and modifications to spray wash nozzle configurations (PSEG 2009-TN2513). Decades of monitoring and survey data for finfish and aquatic invertebrates have been used to assess species density and richness in the vicinity of SGS as directed under NJPDES permits starting in 1994 and subsequent renewals (PSEG 2014-TN3452). Impingement, entrainment, and fish assemblage sampling by trawling and seining are conducted each year, in accordance with NJDPES permit requirements for biological monitoring. The reporting emphasis is on targeted

representative important species that include Blueback Herring, Alewife (*Alosa pseudoharengus*), American Shad, Atlantic Menhaden, Bay Anchovy, Atlantic Silverside, White Perch, Striped Bass, Bluefish, Weakfish, Spot (*Leiostomus xanthurus*), and Atlantic Croaker (PSEG 2014-TN3452). All of these representative important species also are considered either recreationally or commercially important or are ecologically important as forage fish for sustainability of the ecosystem within the Delaware River Estuary. They discussed in more detail in EIS Section 2.4.2.3. Although individual species abundances change year to year, the overall trends in community abundances and diversity show no significant changes (PSEG 2014-TN3452).

5.2 Continued Operation of the HCGS Closed-Cycle Cooling System

HCGS uses closed-cycle cooling and therefore requires substantially less water volume for cooling operations. Accordingly, effects on the aquatic community through impingement, entrainment, and discharge also are expected to be reduced when compared with the once-through cooling system at SGS (NRC 2011-TN3131). Impingement studies at HCGS were performed only in 1986 and 1987 at the commencement of operation for the single unit and showed a reduced overall impingement rate when compared to SGS (see EIS Section 5.3.2). EFH species impinged at HCGS between 1986 and 1987 included Black Sea Bass, Summer Flounder, Windowpane Flounder, and Winter Flounder. Because HCGS was operating concurrently with SGS, the NJPDES permit-directed biological monitoring of the aquatic community through trawling and seining studies also reflected the combined effect of both HCGS and SGS operations. Therefore, the conclusions regarding effect of continued operation of SGS apply also to HCGS in that the overall species diversity and community abundances near the PSEG Site are expected to continue to show no noticeable effects from operations (NRC 2011-TN3131).

5.3 Commercial and Recreational Harvest of Fish and Shellfish

The Delaware River Estuary supports a diverse commercial and recreational fishery for finfish and invertebrates. Losses to the ecosystem from fishery harvest are managed at the Federal and State levels through catch limits, regulations on fishing gear, and seasonal closures. Unintended harvest or mortality is another source of loss through bycatch while targeting a different species. While these activities have the potential to contribute to cumulative effects on aquatic species in the Delaware River Estuary, the direct contribution is difficult to assess because many of these fish populations have life histories that involve a large migratory territory offshore and along the Atlantic coast of the United States, and therefore, effects to populations are difficult to attribute directly to Delaware River Estuary habitat effects.

5.4 Habitat Loss and Restoration

Current and future land use development for industry, agriculture, or other habitat alterations in the Delaware River Estuary watershed may affect water quality. These types of activities also may result in shoreline habitat loss.

Dredging activities from past efforts to maintain navigation in the Delaware River Estuary may have affected estuarine habitats, and planned dredging activities may continue to affect the aquatic ecosystem. Starting in 2010, the USACE began implementing the Delaware River Main Channel Deepening Project to deepen the existing navigation channel from 40 to 45 ft (USACE 2011-TN2262). To deepen the channel, material would be dredged by hydraulic and hopper dredges and placed in USACE CDFs or used

for beneficial reuse purposes (e.g., wetland and beach restoration or habitat creation) in lower Delaware Bay. The USACE estimates that 1,012,428 yd^3 of material were dredged from Reach D of the Delaware River Estuary near Artificial Island and placed in the Federally-owned Artificial Island CDF (USACE 2013-TN2851). When completed, the entire deepening project would remove and dispose of an estimated 16 million yd^3 of sediments from the Delaware River in Philadelphia down to the mouth of the Delaware Bay. The subsequent maintenance dredging would remove an estimated 4,317,000 yd^3 of sediment from the 45-ft-deep channel each year (USACE 2011-TN2262). Maintenance dredging would be carried out as needed, generally over a 2-month period between August and December. As with building in-river components of a new nuclear power plant at the PSEG Site, fish and benthic invertebrates in the Delaware River Estuary would be displaced during the USACE dredging activities but are expected to recolonize the affected areas. The USACE would implement appropriate measures required by Federal and State agencies and organizations to protect aquatic resources, including endangered species (sturgeon and sea turtles), sharks, horseshoe crabs (*Limulus polyphemus*), blue crabs, freshwater mussels, and American Eels (USACE 2011-TN2262). For example, mechanical dredge activities between March 15 and June 30 would be avoided within selected reaches of the project area to prevent sedimentation and turbidity effects on reproduction of Atlantic Sturgeon, Striped Bass, American Shad, and river herring (USACE 2013-TN2851).

While aquatic habitats continue to be affected by natural and anthropogenic activities in the Delaware River Estuary, efforts to restore salt marsh and estuary habitat have met with some success and are expected to continue. For example, ongoing restoration activities within the Mad Horse Creek WMA, which is located 4 mi east of the PSEG Site, would restore nearly 200 ac of the Mad Horse Creek WMA to address injuries to shoreline and bird resources resulting from the 2004 *Athos I* oil spill (NOAA 2008-TN2721). NJDEP and the National Oceanic and Atmospheric Administration (NOAA) proposed a tidal wetland restoration project that would allow development of smooth cordgrass (*Spartina alterniflora*) habitat to improve habitat quality in the area. Restoration would be accomplished through fill material removal to lower the marsh elevation and allow tidal inundation (PSEG 2014-TN3452). As described in EIS Section 4.3.1, unavoidable impacts to wetlands during development of a new nuclear power plant at the PSEG Site and the proposed causeway would be mitigated by habitat restoration and enhancement, using experience and proven techniques developed by the PSEG EEP. Sensitive species that utilize such marsh habitats would be positively affected by the proposed Mad Horse Creek WMA restoration effort and by the proposed mitigation for a new nuclear power plant at the PSEG Site and causeway (i.e., restoration of low quality marsh habitats) (PSEG 2014-TN3452).

5.5 Climate Change

The potential impacts of climate change on aquatic organisms and habitat in the geographic area of interest are not precisely known. In addition to rising sea levels, climate change could lead to regional increases in the frequency and intensity of extreme precipitation events, increases in annual precipitation, and increases in average temperature (GCRP 2014-TN3472). Such changes in climate could alter aquatic community composition on or near the PSEG Site through changes in species diversity, abundance, and distribution. In 2012, Hurricane Sandy created increased storm surge during this event within the Delaware River Estuary and had moderate effects on water quality and coastal habitats within the southernmost portion of the Delaware River Estuary through erosion, sedimentation, and resuspension of contaminants within

sediments (ALS 2012-TN2720). Elevated water temperatures, droughts, and severe weather phenomena could adversely affect or severely reduce aquatic habitat; however, specific predictions on aquatic habitat changes in this region due to climate change are inconclusive at this time. The level of impact resulting from these events would depend on the intensity of the perturbation and the resiliency of the aquatic communities. The DRBC stated in the State of the Delaware River Basin report for 2013 that increases in temperature and salinity are expected with future sea level rise and climate change (DRBC 2013-TN2609). These potential changes are likely to result in movement of populations of more marine and euryhaline species farther up the Delaware River Estuary. For example, in a recent report, hard bottom areas north and south of the Chesapeake and Delaware Canal (upriver of the PSEG site) were identified as having potential as reef sites for the establishment of new oyster beds and were discussed as a future conservation target due to changing climate conditions resulting in increases in salinity farther upriver (PDE 2011-TN2190).

5.6 Summary of Cumulative Impacts

Aquatic resources of the Delaware River Estuary are cumulatively affected to varying degrees by multiple activities and processes that have occurred in the past, are occurring currently, and are likely to occur in the future. The food web and the abundance of important aquatic forage species and other species have been substantially affected by these stressors historically as is described in Section 2.4.2. The impacts of some of these stressors associated with human activities are addressed by management actions (e.g., cooling system operation, regulation of fishing pressure, water quality improvements, and habitat restoration).

Other stressors, such as climate change as well as increased human population and associated development in the Delaware River Basin, cannot be managed directly, and their effects are more difficult to quantify and predict. It is likely, however, that future anthropogenic and natural environmental stressors would cumulatively affect the aquatic community of the Delaware River Estuary so as to noticeably alter important attributes, such as species ranges, populations, diversity, habitats, and ecosystem processes, just as they have in the past. These stressors have modified important attributes of aquatic resources and would continue to exert an influence in the future, potentially destabilizing some of the attributes of the aquatic ecosystem. Based on these observations, the review team concludes that cumulative impacts have been noticeable and destabilizing for some aquatic resources, primarily based on past stressors affecting aquatic resources in the Delaware Estuary and River Basin.

Cumulative impacts on aquatic ecology resources are estimated based on the information provided by PSEG, NMFS, and the review team's independent review. The significant history of the degradation of the Delaware River Estuary has had a noticeable and sometimes destabilizing effect on many aquatic species and communities. Commencement of operations at SGS Units 1 and 2 resulted in significant numbers of aquatic species being entrained and impinged, which led to required restoration of the area through the PSEG EEP as a form of mitigation. In addition, present and reasonably foreseeable future activities such as the continued operation of SGS and HCGS and the completion of dredging operations for the Delaware River Main Channel Deepening Project would continue to have effects on the aquatic resources in the Delaware River Estuary. However, the review team concludes that the incremental contribution of the NRC-authorized activities related to construction and operation of a new nuclear power plant at the PSEG Site would be negligible.

6.0 Conclusions

Conclusions regarding PSEG adverse effects on EFH are addressed in the following sections by species and provided in Table 5. All conclusions are made for the PSEG Site development, operation, and cumulative effects within the region.

6.1 Black Sea Bass

The review team concludes that a new nuclear power plant at the PSEG Site would have minimal adverse effect on Black Sea Bass juvenile EFH. The review team concludes that installation activities and dredging may cause localized disruption to foraging activity in those areas of the Delaware River Estuary. Juvenile Black Sea Bass would be able to forage in adjacent, unaffected habitat during the temporary period of in-water work. In addition, a new plant at the PSEG Site may impinge a small number of juvenile Black Sea Bass each year based on the impingement rates for HCGS, which uses a closed-cycle cooling design similar to that proposed for a new plant at the PSEG Site. However, these impingement losses are minor, and the review team expects that operation of a new plant at the PSEG Site would not affect longer term species abundance in the Delaware River Estuary.

6.2 Clearnose Skate

The review team concludes that a new nuclear power plant at the PSEG Site would have minimal adverse effect on Clearnose Skate juvenile and adult EFH. The review team concludes that installation and dredging activities are not likely to affect juvenile or adult Clearnose Skate as this species has not been collected or reported in the vicinity of the PSEG Site. In addition, intake and discharge operations also are not likely to affect juvenile or adult Clearnose Skate as this species has not been observed in impingement sampling at HCGS and SGS. However, Clearnose Skate juveniles and adults prey on Weakfish, which is expected to be impinged at a new plant at the PSEG Site based on Weakfish impingement rates for the similar closed-cycle cooling system at HCGS. These prey impingement losses are expected to be minor and would not affect longer term Clearnose Skate population abundance in the Delaware River Estuary.

6.3 Little Skate

The review team concludes that a new nuclear power plant at the PSEG Site would have no adverse effect on Little Skate juvenile and adult EFH. The review team concludes that installation and dredging activities for a new plant at the PSEG Site are not likely to affect juvenile or adult Little Skate as this species has not been collected or reported in the vicinity of the PSEG Site. In addition, intake and discharge operations are also not likely to affect juvenile or adult Little Skate as this species has not been observed in impingement sampling at the nearby HCGS and SGS.

6.4 Scup

The review team concludes that a new nuclear power plant at the PSEG Site would have minimal adverse effect on Scup juvenile and adult EFH. The review team concludes that installation activities and dredging may cause localized disruption to foraging activity in those areas of the Delaware River Estuary. Juvenile and adult Scup would be able to forage in adjacent, unaffected habitat during the temporary period of in-water work. In addition, a new plant at the PSEG Site may impinge a small number of juvenile and adult Scup each year based on the impingement rates for HCGS, which uses a closed-cycle

cooling design similar to that proposed for a new plant at the PSEG Site. However, these impingement losses are minor, and the review team expects that operation of a new plant at the PSEG Site would not affect longer term species abundance in the Delaware River Estuary.

6.5 Summer Flounder

The review team concludes that a new nuclear power plant at the PSEG Site would have minimal adverse effect on Summer Flounder juvenile and adult EFH. The review team concludes that installation activities and dredging may cause localized disruption to foraging activity in those areas of the Delaware River Estuary. Juvenile and adult Summer Flounder would be able to forage in adjacent, unaffected habitat during the temporary period of in-water work. Although a small number of Summer Flounder juveniles were entrained at SGS, a new plant at the PSEG Site would use closed-cycle cooling with reduced intake volume and velocity, as opposed to the once-through cooling used at SGS. In addition, a new plant at the PSEG Site may impinge a small number of juvenile and adult Summer Flounder each year based on the impingement rates for HCGS, which uses a closed-cycle cooling design similar to that proposed for a new plant at the PSEG Site. However, these impingement losses are minor, and the review team expects that operation of a new plant at the PSEG Site would not affect longer term species abundance in the Delaware River Estuary.

6.6 Windowpane Flounder

The review team concludes that a new nuclear power plant at the PSEG Site would have no adverse effect on Windowpane Flounder EFH for eggs. The review team concludes that a new plant at the PSEG Site would not entrain Windowpane eggs because they have not been collected or reported in the vicinity of the PSEG Site or from impingement and entrainment sampling at the nearby SGS.

The review team concludes that a new plant at the PSEG Site would have a minimal adverse effect on larval, juvenile, and adult Windowpane Flounder EFH. The review team concludes that installation activities and dredging may cause localized disruption to benthic habitat and juvenile and adult foraging activity in those areas of the Delaware River Estuary. Juvenile and adult Windowpane Flounder would be able to forage in adjacent, unaffected habitat during the temporary period of in-water work.

Although a small number of Windowpane Flounder larvae and juveniles were entrained at SGS, a new plant at the PSEG Site would use closed-cycle cooling with reduced intake volume and velocity, as opposed to the once-through cooling used at SGS. In addition, a new plant at the PSEG Site may impinge a small number of juvenile and adult Windowpane each year based on the impingement rates for HCGS, which uses a closed-cycle cooling design similar to that proposed for a new plant at the PSEG Site. However, these impingement losses are minor, and the review team expects that operation of a new plant at the PSEG Site would not affect longer term species abundance in the Delaware River Estuary.

6.7 Winter Flounder

The review team concludes that a new nuclear power plant at the PSEG Site would have no adverse effect on Winter Flounder EFH for eggs. The review team concludes that a new plant at the PSEG Site would not entrain Winter Flounder eggs because they have not been collected or reported in the vicinity of the PSEG Site or from impingement and entrainment sampling at the nearby SGS.

The review team concludes that a new plant at the PSEG Site would have a minimal adverse effect on larval, juvenile, and adult Winter Flounder EFH. The review team concludes that installation activities and dredging may cause localized disruption to benthic habitat and juvenile and adult foraging activity in those areas of the Delaware River Estuary. Juvenile and adult Winter Flounder would be able to forage in adjacent, unaffected habitat during the temporary period of in-water work.

Although a small number of Winter Flounder larvae and juveniles were entrained at SGS, a new plant at the PSEG Site would use closed-cycle cooling with reduced intake volume and velocity, as opposed to the once-through cooling used at SGS. In addition, a new plant at the PSEG Site may impinge a small number of juvenile and adult Winter Flounder each year based on the impingement rates for HCGS, which uses a closed-cycle cooling design similar to that proposed for a new plant at the PSEG Site. However, these impingement losses are minor, and the review team expects that operation of a new plant at the PSEG Site would not affect longer term species abundance in the Delaware River Estuary.

6.8 Winter Skate

The review team concludes that a new nuclear power plant at the PSEG Site would have no adverse effect on Winter Skate juvenile and adult EFH. The review team concludes that installation and dredging activities for a new plant at the PSEG Site are not likely to affect juvenile or adult Winter Skate as this species has not been collected or reported in the vicinity of the PSEG Site. In addition, intake and discharge operations are also not likely to affect juvenile or adult Winter Skate as this species has not been observed in impingement and entrainment sampling at the nearby HCGS and SGS.

Table 5. Impacts on EFH from Building Activities and Operation of a New Nuclear Power Plant at the PSEG Site

Common Name	Life Stage	EFH Description[a]			Expected Impact
		Salinity (ppt)	Temperature (°C)	Depth (m)	
Black Sea Bass	Juveniles	>18	>6	1–38	Minimal adverse effect. Installation activities and dredging in the Delaware River Estuary may temporarily disrupt foraging activities. Intake operations may impinge a small number of fish
Clearnose Skate	Juveniles and Adults	12–30	6–20	5–23	Minimal adverse effect. Intake operations may impinge a small percentage of prey species
Little Skate	Juveniles and Adults	15–32	3–22	4–21	No adverse effect
Scup	Juveniles	>15	>7	0–38	Minimal adverse effect. Installation activities and dredging in the Delaware River Estuary may temporarily disrupt foraging activities. Intake operations may impinge a small number of fish
	Adults	>15	>7	2–185	
Summer Flounder	Juveniles	10–30	>11	0.5–5	Minimal adverse effect. Installation activities and dredging in the Delaware River Estuary may temporarily disrupt foraging activities. Intake operations may impinge a small number of fish
	Adults	unspecified	unspecified	0–25	
Windowpane Flounder	Eggs	unspecified	<20	<70	No adverse effect
	Larvae	unspecified	<20	<70	Minimal adverse effect. Installation activities and dredging in the Delaware River Estuary may temporarily disrupt habitat
	Juveniles and Adults	5.5–36	<25–26.8	1–100	Minimal adverse effect. Installation activities and dredging in the Delaware River Estuary may temporarily disrupt foraging activities. Intake operations may impinge a small number of fish

Table 5. (continued)

Common Name	Life Stage	EFH Description[a]			Expected Impact
		Salinity (ppt)	Temperature (°C)	Depth (m)	
Winter Flounder	Eggs	10–30	<10	<5	No adverse effect
	Larvae	4–30	<15	<6	Minimal adverse effect. Installation activities and dredging in the Delaware River Estuary may temporarily disrupt habitat
	Juveniles	10–30	<25	1–50	Minimal adverse effect. Installation activities and dredging in the Delaware River Estuary may temporarily disrupt foraging activities. Intake operations may impinge a small number of fish
	Adults	15–33	<25	1–100	
Winter Skate	Juveniles and Adults	15–35	3–17	7–18	No adverse effect

(a) NOAA 2006-TN2820; Packer et al. 2003-TN2822; Packer et al. 2003-TN2823; Packer et al. 2003-TN2824.

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F.3.3. U.S. Fish and Wildlife Service Biological Assessment

Biological Assessment

U.S. Fish and Wildlife Service

PSEG Site
Early Site Permit Application

U.S. Nuclear Regulatory Commission Early Site Permit Application
Docket Number 052-043

Salem County, New Jersey

June 2014

U.S. Nuclear Regulatory Commission
Rockville, Maryland

U.S. Army Corps of Engineers
Philadelphia District

Contents

List of Figures ii
List of Tables ii
Abbreviations/Acronyms iii
1.0 Introduction 1
2.0 Description of Proposed Action 2
2.1 Location and Description 2
2.2 Impacts to Habitats 10
2.3 Noise and Fugitive Dust Impacts 14
2.4 Potential for Wildlife Collisions with Human-made Structures 15
2.5 Cooling System Impacts on Vegetation 15
2.6 Impacts of Artificial Light 18
2.7 Impacts of Increased Vehicle Traffic 18
2.8 Impacts to Shoreline Habitat 19
2.9 Impacts of Transmission Lines 19
3.0 Federally Listed Species Considered 21
3.1 Bog Turtle 21
3.2 Northern Long-eared Bat 22
4.0 Proposed Action Effects Analysis 23
4.1 Habitat Loss 24
4.2 Cooling System Impacts on Vegetation 24
4.3 Wildlife Collisions with Plant Structures 24
4.4 Impacts of Increased Vehicle Traffic 24
4.5 Transmission Lines 24
5.0 Cumulative Effects Analysis 25
5.1 Habitat Loss 25
5.2 Salt Drift, Icing, Fogging, and Increased Precipitation 28
5.3 Climate Change 28
5.4 Summary of Cumulative Impacts 28
6.0 Conclusions and Determination of Effects 29
7.0 References 30

List of Figures

Figure 1. Location of the PSEG Site Within 6-Mile and 50-Mile Radius. 3
Figure 2. PSEG Site with Nearby Water Bodies and Proposed Causeway. 4
Figure 3. PSEG Site Utilization Plan. 5
Figure 4. LMDCT Salt Deposition Rates.....17

List of Tables

Table 1. NJDEP 2002 LULC Cover within the Proposed PSEG Site 7
Table 2. LULC Changes from Building Activities on the PSEG Site.....11
Table 3. Ambient Noise Levels at HCGS and SGS in February 2009.....15

Abbreviations/Acronyms

°F	degrees Fahrenheit
ac	acre(s)
BA	biological assessment
BMPs	best management practice
Btu	British thermal units(s)
CDF	confined disposal facility
CFR	*Code of Federal Regulations*
COL	combined construction permit and operating license
CP	construction permit
CWS	circulating water system
dBA	decibel(s) on the A-weighted scale
EIS	environmental impact statement
EMF	electromagnetic field
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act of 1973, as amended
ESP	early site permit
FR	*Federal Register*
ft	foot or feet
FWS	U. S. Fish and Wildlife Service
GCRP	U.S. Global Change Research Program
GEIS	*Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (NUREG–1437)
gpm	gallon(s) per minute
ha	hectare
HCGS	Hope Creek Generating Station
hr	hour(s)
kg	kilogram(s)
km	kilometer(s)
kV	kilovolt(s)
lb	pound(s)
Leq	equivalent continuous sound level

LMDCT	linear mechanical draft cooling tower
LULC	land use and land cover
MDCT	mechanical draft cooling tower
mi	mile(s)
mo	month(s)
NDCT	natural draft cooling tower
NEPA	National Environmental Policy Act of 1969, as amended
NJDEP	New Jersey Department of Environmental Protection
NJLWD	New Jersey Department of Labor and Workforce Development
NRC	U.S. Nuclear Regulatory Commission
OL	operating license
PPE	plant parameter envelope
PSE&G	Public Service Electric and Gas Company
PSEG	PSEG Power, LLC, and PSEG Nuclear, LLC
ROW	right-of-way
SGS	Salem Generating Station, Units 1 and 2
SWS	service water system
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
WMA	wildlife management area

Biological Assessment of the Potential Effects on Federally Listed/Proposed Listed Endangered or Threatened Species from the Proposed Early Site Permit for the PSEG Site

1.0 Introduction

The U.S. Nuclear Regulatory Commission (NRC) review team is reviewing an application submitted by PSEG Power, LLC, and PSEG Nuclear, LLC (PSEG), for an early site permit (ESP) for a site located adjacent to the existing Hope Creek Generating Station (HCGS) and Salem Generating Station, Units 1 and 2 (SGS), on the eastern shore of the Delaware River Estuary in Lower Alloways Creek Township, Salem County, New Jersey. As part of its review of this ESP application, the NRC is preparing an environmental impact statement (EIS) as required by Title 10 of the *Code of Federal Regulations* (10 CFR) Part 51, the NRC regulations that implement the National Environmental Policy Act of 1969, as amended (NEPA) (42 USC 4321-TN661). The EIS will include an analysis of pertinent environmental issues, including endangered and threatened species and impacts to fish and wildlife. The U.S. Army Corps of Engineers (USACE), Philadelphia District, is a cooperating agency on the EIS.

An ESP is a commission approval of a site or sites for one or more nuclear power facilities. Issuance of an ESP is a process that is separate from the issuance of a construction permit (CP), an operating license (OL), or a combined construction permit and operating license (COL) for such a facility. The ESP application and review process makes it possible to evaluate and resolve safety and environmental issues related to siting before the applicant makes a large commitment of resources. If the ESP is approved, the applicant can “bank” the site for up to 20 years for future reactor siting and can conduct certain site preparation activities enumerated in 10 CFR 50.10(a)(2) (10 CFR 50-TN249). An ESP does not, however, authorize construction and operation of a nuclear power plant. To construct and operate a nuclear power plant, an ESP holder must obtain a CP and an OL, or a COL, which are separate major Federal actions that require their own environmental reviews in accordance with 10 CFR Part 51 (10 CFR 51-TN250).

By letter dated October 26, 2010 (NRC 2010-TN2202), the NRC initiated Endangered Species Act of 1973 (ESA) (16 USC 1531-TN1010) Section 7 consultation with the U. S. Fish and Wildlife Service (FWS) and requested a list of endangered, threatened, candidate, and proposed species as well as designated and proposed critical habitat that may be in the vicinity of the PSEG Site. The NRC received an email response (dated March 20, 2013) from Steve Mars, senior biologist at the FWS New Jersey Field office, which stated, “The activities you [NRC] describe will not likely affect a federal listed species under the jurisdiction of the USFWS” (FWS 2013-TN3364). In a letter to FWS dated December 13, 2013, the NRC requested an update on Federally listed, proposed, and candidate species as well as designated and proposed critical habitat that may be in the vicinity of the PSEG Site and any updates to the initial information to assist with the preparation of the ESA biological assessment (BA) and EIS for the project (NRC 2013-TN3363). NRC had not yet received a response as of the date of the preparation of this BA.

Based on NRC review of electronic sources from the states of Delaware, and New Jersey, one Federally listed turtle species was identified that has the potential to be present in the site vicinity. Additionally, the northern long-eared bat has been proposed for listing as an endangered species. The sensitive joint vetch, swamp pink, and small whorled pogonia species have been documented in the vicinity of the PSEG Site. However, the occurrence of these species and suitable habitat to support them has not been documented or is not known to occur on the PSEG Site or along areas that would be disturbed by building support facilities or a

proposed causeway. Accordingly, this BA focuses on evaluating the potential effects from building and operating a new nuclear power plant at the PSEG Site, adjacent to SGS and HCGS, on the Federally listed turtle species and Federally proposed endangered bat species.

2.0 Description of Proposed Action

PSEG is seeking an ESP for a new nuclear power plant at a site (the PSEG Site) located adjacent to the existing HCGS and SGS. Building activities that could affect onsite and offsite terrestrial and wetland ecosystems include site preparation for installation of the power block, cooling tower, concrete batch plant, intake structure, switchyard, offices and warehouses, heavy haul road, temporary laydown areas, parking areas, and a proposed causeway (PSEG 2014-TN3452).

2.1 Location and Description

Site

The PSEG Site is located on the southern part of Artificial Island in Lower Alloways Creek Township, Salem County, New Jersey. Artificial Island was formed from dredge spoils produced as a result of maintenance dredging of the Delaware River navigation channel by the USACE. The site is approximately 7 mi east of Middletown, Delaware; 7.5 mi southwest of Salem, New Jersey; and 9 mi south of Pennsville, New Jersey (PSEG 2014-TN3452). Figure 1 shows the location of the PSEG Site and the areas within a 6-mi (10-km) radius and a 50-mi (80-km) radius of the facility.

The PSEG Site is located adjacent to HCGS and SGS on the northwestern portion of the existing PSEG property. Figure 2 depicts the proposed PSEG Site in relation to the existing units and nearby water bodies. PSEG owns 734 ac of the PSEG Site and is developing an agreement with the USACE to acquire 85 ac immediately north of the site. Thus, the total proposed PSEG Site would encompass 819 ac (PSEG 2014-TN3452). Figure 3 provides an aerial view of the proposed site layout for a new nuclear power plant at the PSEG Site.

The area within the 6-mi vicinity of the site contains mainly water (Delaware River and Bay), agricultural lands, wetlands, and some forestland. The area also includes numerous parks, wildlife refuges, and preserves such as Mad Horse Creek Wildlife Management Area (WMA) to the east and Abbotts Meadows WMA to the north in New Jersey, and Cedar Swamp WMA to the south and Augustine WMA to the west in Delaware (PSEG 2014-TN3452).

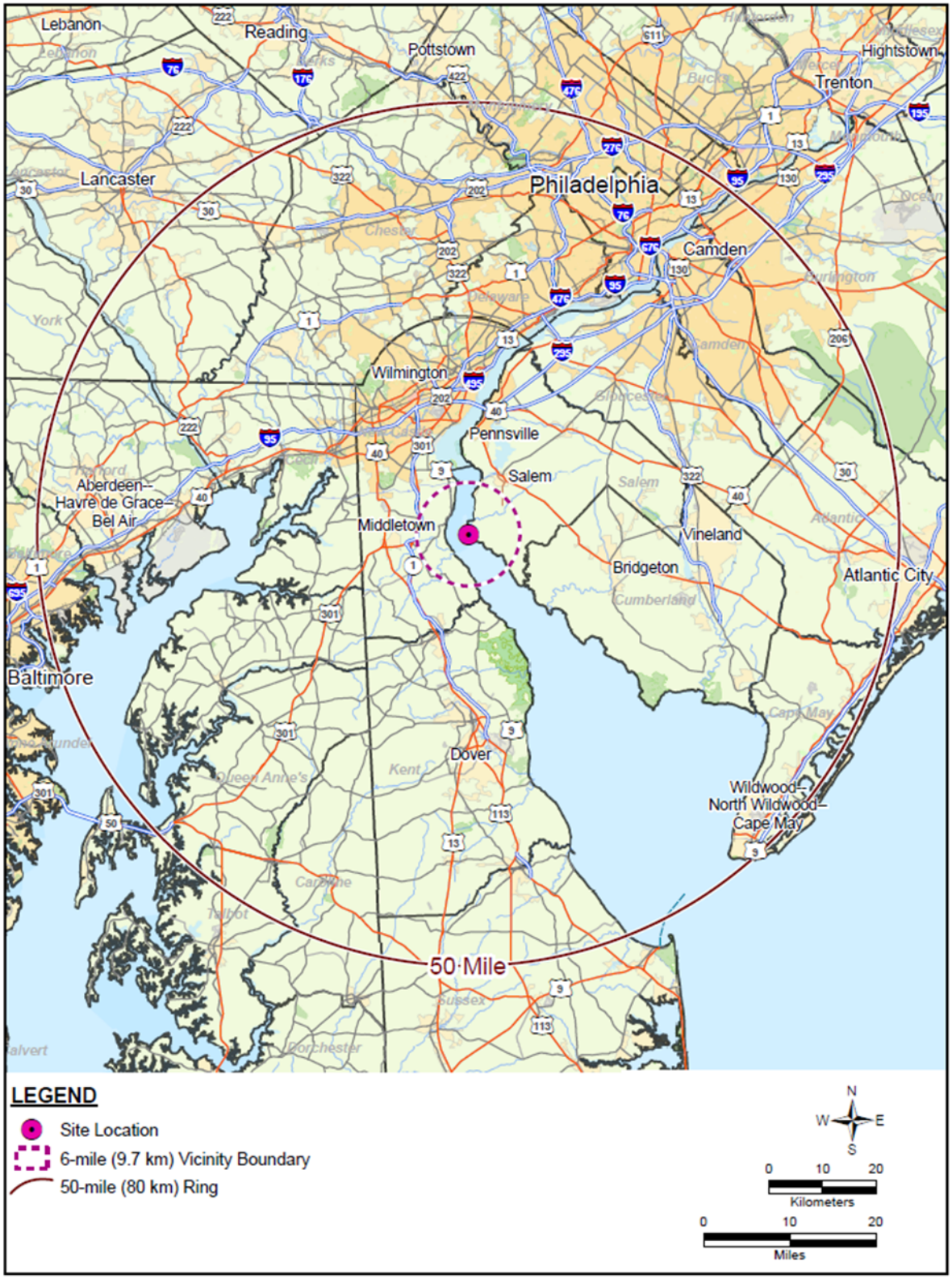

Figure 1. Location of the PSEG Site Within 6-Mile and 50-Mile Radius.
(Source: Modified from PSEG 2014-TN3452).

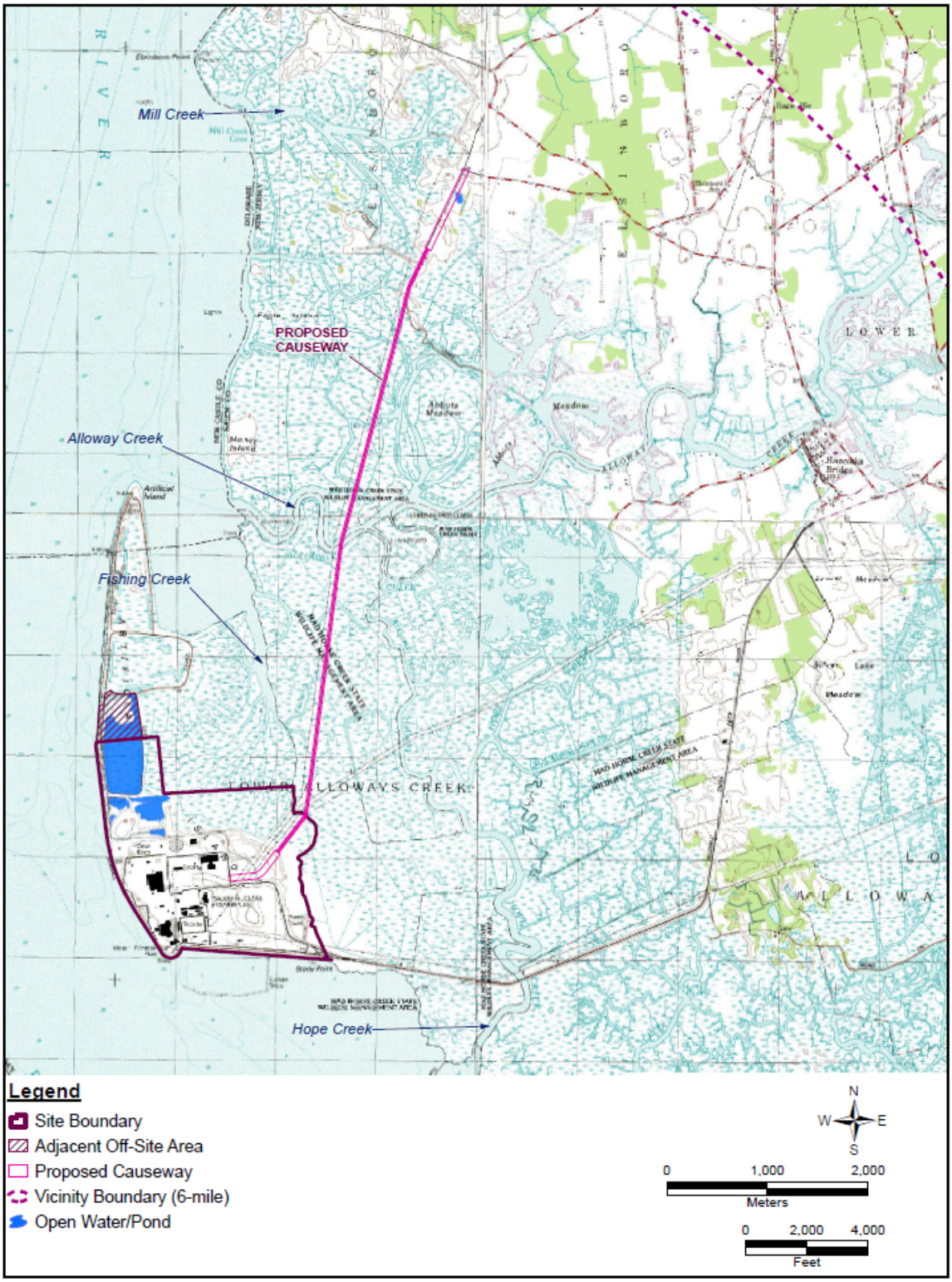

Figure 2. PSEG Site with Nearby Water Bodies and Proposed Causeway.
(Source: Modified from PSEG 2014-TN3452).

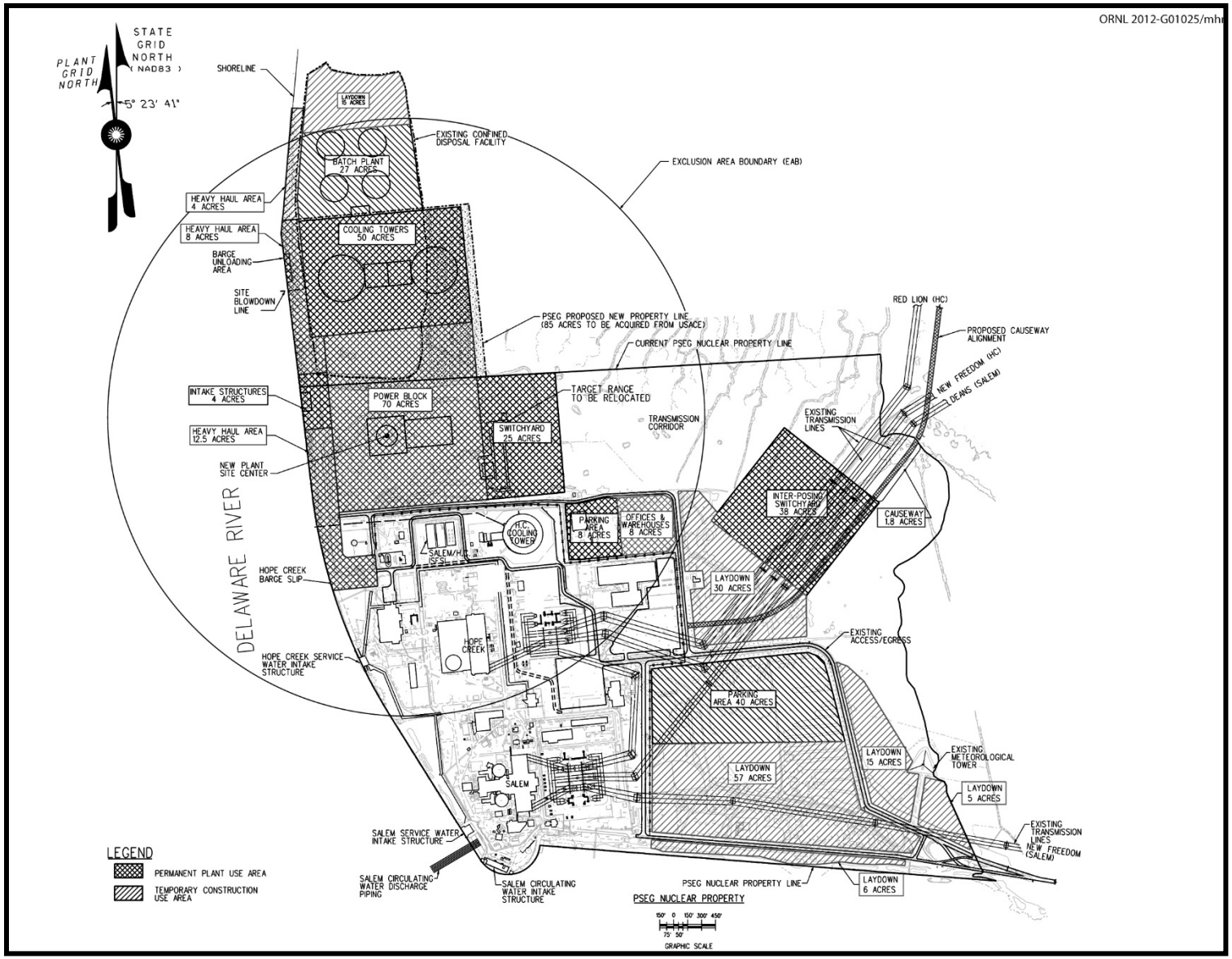

Figure 3. PSEG Site Utilization Plan ***(Source: PSEG 2014-TN3452).***

Vegetation communities were identified from New Jersey Department of Environmental Protection (NJDEP) land use and land cover (LULC) data for the PSEG Site and offsite areas that potentially would be affected by the proposed causeway. Six vegetative cover types were identified and include: urban or built-up land, forestland, water, wetlands, barren land, and managed wetlands. The listed coverage types are common within the Outer Coastal Plain (PSEG 2014-TN3452). Table 1 lists NJDEP 2002 LULC within the proposed PSEG Site.

Urban or Built-up Lands (Developed Land)

Land use in the urban or built-up land category is characterized as having been altered by human activities (NJDEP 2010-TN2887). The majority of these lands on the site are related to power generation of HCGS and SGS and associated structures. The urban or built-up coverage type accounts for 358 ac, or 44 percent, of the PSEG Site. Upland rights-of-way (ROWs) (undeveloped) support shrubby vegetation but are considered under the urban or built-up land category as a result of vegetation maintenance practices (PSEG 2014-TN3452). Also included in this category are two wetland subcategories, wetland ROWs and *Phragmites*-dominated urban area. Wetland ROWs are included in this category because they exhibit hydric soils but, as a result of alterations, may not support vegetation typical of natural wetlands (NJDEP 2010-TN2887). Wetland ROWs account for 23.8 ac, or 3 percent, of the site, and *Phragmites*-dominated urban areas account for 0.5 ac, or less than 1 percent, of the site (PSEG 2014-TN3452). This type of land use provides limited habitat for wildlife use.

Wetlands

The wetlands category includes those areas that are inundated or saturated by surface or ground waters at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. This category does not include wetlands that have been modified for recreation, agriculture, or industry; these are described under specific use categories (NJDEP 2010-TN2887). The wetland category accounts for 284.9 ac, or 35 percent, of the site's total available habitat (PSEG 2014-TN3452). Wetlands influenced by the tidal portions of the Delaware River system and the tidal portions of the watercourses draining into the Atlantic Ocean are categorized as coastal wetlands (NJDEP 2010-TN2887). Coastal wetlands found on the site include saline marshes and *Phragmites*-dominated coastal wetlands. Saltmarsh cordgrass (*Spartina alterniflora*) dominates these wetlands in areas of high salinity. Brackish marshes are co-dominated by big cordgrass (*Spartina cynosuroides*), saltmarsh cordgrass, common reed (*Phragmites australis*), narrowleaf cattail (*Typha angustifolia*), and common threesquare (*Schoenoplectus pungens*). Salt marshes account for 0.2 ac, or less than 1 percent, of the site (PSEG 2014-TN3452). *Phragmites*-dominated coastal wetlands are marsh areas that are dominated by the nonnative invasive *Phragmites australis* (NJDEP 2010-TN2887). *Phragmites*-dominated coastal wetlands are the most common wetland type found on the site and account for 155.6 ac, or 19 percent, of the site's vegetation cover (PSEG 2014-TN3452).

Isolated wetlands and wetlands generally found in non-tidal lowlands influenced by primary, secondary, and tertiary courses and are categorized as interior wetlands (NJDEP 2010-TN2887). Interior wetlands found on the site include deciduous scrub/shrub wetlands, herbaceous wetlands, and *Phragmites*-dominated interior wetlands. There are 4.6 ac of deciduous scrub/shrub wetlands representing less than 1 percent of the total acreage available (PSEG 2014-TN3452). Herbaceous wetlands are characterized as being dominated by herbaceous species associated with lake edges, open flood plains, and abandoned wetlands agricultural fields (NJDEP 2010-TN2887). Herbaceous wetlands account for 5.8 ac, or less than 1 percent, of the total acreage at the PSEG Site (PSEG 2014-TN3452). *Phragmites*-dominated interior wetlands are dominated by the *Phragmites australis* and account for 118.7 ac, or 14.5 percent, of the site's acreage.

Table 1. NJDEP 2002 LULC Cover within the Proposed PSEG Site

NJ LULC Categories	Existing PSEG Property		85-Acre Parcel to be Acquired		PSEG Site Total	
	Area (ac)	Percent	Area (ac)	Percent	Area (ac)	Percent
Urban or Built Up						
Industrial	234.5	31.9%	0.0	0.0%	234.5	28.6%
Transportation/communication/ utilities	8.5	1.2%	0.0	0.0%	8.5	1.0%
Wetlands rights-of-way	23.8	3.2%	0.0	0.0%	23.8	2.9%
Upland rights-of-way (developed)	0.5	0.1%	0.0	0.0%	0.5	0.1%
Upland rights-of-way (undeveloped)	29.5	4.0%	0.0	0.0%	29.5	3.6%
Other Urban or Built-up Land	51.1	7.0%	4.7	5.5%	55.8	6.8%
Phragmites-dominated urban area	0.5	0.1%	0.0	0.0%	0.5	0.1%
Recreational land	4.9	0.7%	0.0	0.0%	4.9	0.6%
Subtotal	**353.3**	**48.1%**	**4.7**	**5.5%**	**358.0**	**43.7%**
Forested Land						
Old field (<25 percent brush covered)	69.4	9.5%	0.0	0.0%	69.4	8.5%
Phragmites-dominated old field	31.9	4.3%	0.0	0.0%	31.9	3.9%
Deciduous brush/shrubland	6.0	0.8%	0.0	0.0%	6.0	0.7%
Subtotal:	**107.3**	**14.6%**	**0.0**	**0.0%**	**107.3**	**13.1%**
Water						
Artificial lakes	14.2	1.9%	26.2	30.8%	40.4	4.9%
Tidal rivers, inland bays, and other tidal waters	3.9	0.5%	1.7	2.0%	5.6	0.7%
Subtotal:	**18.1**	**2.5%**	**27.9**	**32.8%**	**46.0**	**5.6%**
Wetlands						
Saline marsh	0.0	0.0%	0.2	0.2%	0.2	0.0%
Phragmites-dominated coastal wetlands	127.3	17.3%	28.3	33.3%	155.6	19.0%
Deciduous scrub/shrub wetlands	4.6	0.6%	0.0	0.0%	4.6	0.6%
Herbaceous wetlands	5.8	0.8%	0.0	0.0%	5.8	0.7%
Phragmites-dominated interior wetlands	95.0	12.9%	23.7	27.8%	118.7	14.5%
Subtotal:	**232.7**	**31.7%**	**52.2**	**61.3%**	**284.9**	**34.8%**

Table 1 (continued)

NJ LULC Categories	Existing PSEG Property		85-Acre Parcel to be Acquired		PSEG Site Total	
	Area (ac)	Percent	Area (ac)	Percent	Area (ac)	Percent
Barren Land						
Altered lands	14.6	2.0%	0.2	0.2%	14.8	1.8%
Disturbed wetlands (modified)	4.2	0.6%	0.1	0.1%	4.3	0.5%
Subtotal:	**18.8**	**2.6%**	**0.3**	**0.4%**	**19.1**	**2.3%**
Managed Wetlands						
Managed wetland in maintained lawn green space	3.8	0.5%	0.0	0.0%	3.8	0.5%
Subtotal:	**3.8**	**0.5%**	**0.0**	**0.0%**	**3.8**	**0.5%**
Total:	**734.0**	**100.0%**	**85.1**	**100.0%**	**819.1**	**100.0%**

Source: Staff, based on PSEG 2014-TN3281.

Forestland

Old field (<25% brush covered), *Phragmites*-dominated old field and deciduous brush/shrubland identified by NJDEP as occurring on the site are categorized under forested land, brushland/shrubland. Vegetation cover could include early successional species to climax species and are between 0 and 20 ft in height. Old field is also covered in this category and can contain shrubs and grasses (NJDEP 2010-TN2887). Forested land covers over 107.3 ac, or 13 percent, of the site (PSEG 2014-TN3452).

Old field (<25% brushed covered) is predominantly covered by grasses, herbaceous species, tree seedlings, and/or saplings. *Phragmites*-dominated old field contains open fields predominantly covered by *Phragmites australis*. Natural forested areas covered predominantly with deciduous species less than 20 ft in height are classified under deciduous brush/shrubland. This category also can include agricultural lands that have been overgrown with brush (NJDEP 2010-TN2887).

Walking surveys conducted by PSEG in 2009–10 on brushland/scrubland areas indicated that the most common vegetation species were groundsel tree/sea myrtle (*Baccharis halimifolia*), autumn olive (*Elaeagnus umbellata*), multiflora rose (*Rosa multiflora*), Japanese honeysuckle (*Lonicera japonica*), poison ivy (*Toxicodendron radicans*), annual ragweed (*Ambrosia artemisiifolia*), broomsedge (*Andropogon virginicus*), thyme-leaf sandwort (*Arenaria serpyllifolia*), mugwort (*Artemisia vulgaris*), Queen Anne's lace (*Daucus carota*), common spike rush (*Eleocharis palustris*), late boneset (*Eupatorium serotinum*), fescue (*Festuca* sp.), Chinese lespedeza (*Lespedeza cuneata*), yellow sweet clover (*Melilotus officinalis*), blue scorpion grass (*Myosotis stricta*), common reed, plantain (*Plantago virginica*), Canada bluegrass (*Poa compressa*), green foxtail (*Setaria viridis*), Canada goldenrod (*Solidaga altissima*), goldenrod (*Solidago* sp.), and purpletop (*Tridens flavus*) (PSEG 2014-TN3452).

Water

The NJDEP LULC category of water includes all areas within the landmass of New Jersey periodically covered by water (NJDEP 2010-TN2887). This includes the artificial lakes and tidal rivers, inland bays, and other tidal waters found on the proposed PSEG Site. Artificial lakes include water bodies that are 1 ac and larger. Water control structures would be present on these sites. Tidal rivers, inland bays, and other tidal waters include tidal portions of watercourses, enclosed tidal bays, and other tidal water bodies. Land cover categorized as water accounts for approximately 46 ac or 5.6, percent of the site (PSEG 2014-TN3452).

Barren Lands

Barren lands are in non-urban settings and are characterized by thin soil, sand, or rocks (NJDEP 2010-TN2887). These land cover types are often lacking vegetative cover, or the vegetation is sparse. The NJDEP LULC data indicates that two subcategories of barren lands, altered lands and disturbed wetlands, are present at the site. Altered lands are non-urban areas that have been changed by human activities. Disturbed wetlands are formal natural wetlands that have been altered by clearing, grading, leveling, filling, and/or excavating. The soils are hydric but lack vegetation or wetland species. Barren lands represent 19.1 ac, or 2.3 percent, of the site's total acreage (PSEG 2014-TN3452).

Managed Wetlands

Managed wetlands are characterized by hydric soils but do not support typical wetland vegetation (NJDEP 2010-TN2887). Some examples are stormwater swales, golf fairways and recreational fields, and open lawn areas. Managed wetlands account for 3.8 ac, or less than 1 percent, of the site (PSEG 2014-TN3452).

Vicinity

The existing access road and the proposed causeway are included as part of the vicinity. The existing access road extends 3.6 mi east-northeast from the PSEG Site to Alloway Creek Neck Road (PSEG 2014-TN3452). The ROW is 350 ft wide except where it travels through state owned lands, where it is 450 ft wide. Vegetation cover types in the existing access road include 134 ac of agricultural land, 146 ac of wetlands, 50 ac of urban/built-up land, 39 ac of barren land, 6 ac of forestland, and 4 ac of open water (PSEG 2014-TN3452). The total area covered by the existing access road ROW is 379 ac. Dominant species noted along the access road include common reed and cordgrass (PSEG 1982-TN2889). In additional to part of the State of New Jersey, portions of the State of Delaware and the Delaware River also lie within the 6-mi vicinity of the PSEG Site. The NJDEP LULC database would not provide vegetation cover for areas outside of the State of New Jersey. As a result, the U.S. Geological Survey (USGS) LULC database was used to determine the vegetation communities for areas within the 6-mi vicinity of the PSEG Site. The USGS database is composed of nine LULC categories (Anderson et al. 1976-TN2888). Six of these categories are applicable to the PSEG vicinity: urban or built-up land (developed land), agricultural land, forestland, water, wetlands, and barren land (PSEG 2014-TN3452). Urban or built-up land accounts for 939 ac, or 1.2 percent, of the available land use in the vicinity. Agricultural land includes cultivated crops and pasture. Approximately 17,097 ac (23 percent) of the available vegetation cover in the vicinity is agricultural.

Forestland in the vicinity includes deciduous, evergreen, and mixed forests and accounts for approximately 2,653 ac, or less than 4 percent, of the available vegetation cover in the vicinity. As a result of the site's proximity to the Delaware River and Bay, water is the largest available LULC in the vicinity, accounting for approximately 26,837 ac, or nearly 37 percent, of the vicinity. There are approximately 16,555 ac of emergent herbaceous wetlands and 8,979 ac of

woody wetlands in the PSEG Site vicinity. Together the wetlands LULC accounts for nearly 35 percent, making it the second largest vegetation cover type in the vicinity. Barren land makes up nearly 651 ac, or less than 1 percent, of the LULC (PSEG 2014-TN3452).

2.2 Impacts to Habitats

Proposed ground-disturbing activities at the PSEG Site and offsite areas are based on the Site Utilization Plan (Figure 3). Permanent land impacts are depicted as cross hatched, and temporary land impacts are diagonal hatched. Potential areas affected include the power block, cooling tower, concrete batch plant, intake structure, switchyard, offices and warehouses, heavy haul road, temporary laydown areas, parking areas, and the proposed causeway. Preconstruction and construction activities include clearing, grubbing, and grading of the site; installing erosion control measures; building access and haul roads; installing construction security infrastructure; installing temporary utilities and facilities (e.g., storage warehouses, concrete batch plant); preparing the laydown, fabrication, and shop areas; relocating existing facilities within the PSEG Site; staging equipment; and preparation activities associated with power plant construction support. The applicant has not determined the type of reactor to be built on site and is using a plant parameter envelope (PPE) to bound associated construction and preconstruction impacts. The terrestrial ecology impacts represented in this section are based on the PPE, and the actual limits of disturbance (particularly wetlands and jurisdictional streams) may be minimized further during the design phase after a specific reactor technology is selected. PSEG anticipates that once a design is selected, and if the NRC approves a CP or COL, construction and preconstruction activities could take 68 months to complete (PSEG 2014-TN3452).

Preconstruction and construction activities would result in the permanent or temporary disturbance of approximately 385 ac of the PSEG Site and 45 ac of adjacent offsite areas (see Table 2), as well as 69 ac of the habitat in the area of the proposed causeway. The 45 ac offsite area is currently owned by the USACE and is used as a combined disposal facility (CDF) for disposal of dredge materials. In addition, the permitted disposal facility on the PSEG Site is used for disposal of materials dredged from the intake structures of HCGS and SGS. Preconstruction and construction activities that would affect terrestrial habitats include clearing and grubbing, site grading of upland areas, excavation, and filling of various site areas to achieve design grades (PSEG 2014-TN3452).

A total of 228.6 ac of the affected area is considered temporary. This includes 159.9 ac on the site, 45.2 ac on adjacent offsite areas, and land disturbances on 23.5 ac during construction and preconstruction of the proposed causeway (PSEG 2014-TN3452).

Urban or Built-up Land (Developed Land)

Approximately 91 ac, or approximately 26 percent, of urban or built-up land on the proposed PSEG Site would be used during construction and preconstruction activities. Temporary uses would account for almost 45 ac. Permanent use would equal to approximately 47 ac, or approximately 13 percent, of the urban or built-up land use on the site (PSEG 2014-TN3452).

Offsite effects on urban or built-up land also occur in the adjacent offsite areas and the proposed causeway. Construction and preconstruction activities in the adjacent offsite areas would temporarily make use of 2.4 ac of urban or built-up lands. The proposed causeway would permanently use 4.2 ac and temporarily use 1.4 ac of developed lands (PSEG 2014-TN3452).

A total of 271 ac of the affected terrestrial habitat on the PSEG Site and vicinity would be permanently converted to developed land uses containing structures, pavement, or other intensively maintained exterior grounds. There are approximately 939 ac of developed land in

the vicinity and 630,983 ac in the region. The proposed action would add an additional 22 percent of developed land uses to the vicinity and make use of approximately 5 percent of developed lands available. These land areas have limited value for wildlife on the site or in the vicinity (PSEG 2014-TN3452).

Table 2. LULC Changes from Building Activities on the PSEG Site

New Jersey Land Use Category	PSEG Site			Adjacent Offsite Areas[(a)]
	Total Onsite Area (ac)	Permanent Use (ac)	Temporary Use (ac)	Temporary Use (ac)
Urban or Built-Up Land				
Industrial	234.5	26.4	5.1	0.0
Transportation/communication/utilities	8.5	0.0	0.0	0.0
Wetlands right-of-way	23.8	11.7	5.9	0.0
Upland right-of-way developed	0.5	0.0	0.2	0.0
Upland right-of-way undeveloped	29.5	0.0	19.6	0.0
Other Urban or Built-Up Land	55.8	8.1	9.5	2.4
Phragmites-dominated urban area	0.5	0.5	0.0	0.0
Recreation land	4.9	0.0	4.4	0.0
Subtotal:	**358.0**	**46.7**	**44.7**	**2.4**
Forestland				
Old field (<25 percent brush covered)	69.4	2.6	54.3	0.0
Phragmites-dominated old field	31.9	0.1	26.0	0.0
Deciduous brush/shrubland	6.0	6.0	0.0	0.0
Subtotal:	**107.3**	**8.7**	**80.3**	**0.0**
Water				
Artificial lakes	40.4	40.3	0.0	0.0
Tidal rivers, inland bays, and other tidal waters	5.6	2.9	0.3	0.1
Subtotal:	**46.0**	**43.2**	**0.3**	**0.1**
Wetlands				
Saline marsh	0.2	0.1	0.0	0.8
Phragmites-dominated coastal wetlands	155.6	58.3	5.1	2.1
Herbaceous wetlands	5.8	0.9	2.5	0.0
Deciduous scrub/shrub wetlands	4.6	4.6	0.0	0.0
Phragmites-dominated interior wetlands	118.7	44.1	24.2	27.3
Subtotal:	**284.9**	**108.0**	**31.8**	**30.2**
Barren Land				
Altered lands	14.8	14.8	0.0	0.7
Disturbed wetlands (modified)	4.3	4.0	0.1	11.8
Subtotal:	**19.1**	**18.8**	**0.1**	**12.5**
Managed Wetlands				
Managed wetland in maintained lawn green space	3.8	0.0	2.7	0.0
Subtotal:	**3.8**	**0.0**	**2.7**	**0.0**
Total:	**819.1**	**225.4**	**159.9**	**45.2**

(a) Located in the USACE Artificial Island Combined Disposal Facility and includes batch plant, heavy haul road, and construction laydown area.

Source: Modified from PSEG 2014-TN3452.

Forestland

The forestland cover type is mainly present in the southeast portion of the PSEG Site. Scattered old field communities consisting of one or more land cover types also occur sporadically in the north and west portions of the PSEG Site. Construction and preconstruction activities would disturb approximately 89 ac of the available forestland on the site. Permanent use would result in the loss of 8.7 ac of forestland, and 80.3 ac would be temporarily disturbed. The permanent change of land use would result in the loss of approximately 8 percent of the available forestland on the site. The majority of the forestland on the site to be permanently lost is designated as deciduous brush/shrubland habitat (6 ac) and old field (<25 percent brush covered) (2.6 ac) under the NJ LULC system (PSEG 2014-TN3452).

Less than 1 ac of forestland would be disturbed temporarily and 3.5 ac would change permanently with building the proposed causeway. No forestland would be disturbed in adjacent offsite areas during construction and preconstruction activities (PSEG 2014-TN3452).

There is approximately 2,653 ac of forestland available in the 6-mi vicinity of the PSEG Site, and the proposed construction and preconstruction activities would permanently remove less than 1 percent of that available habitat. The effects on forestland from construction and preconstruction activities at the PSEG Site would not result in a noticeable impact to forestland in the vicinity (PSEG 2014-TN3452).

Water

The proposed construction and preconstruction activities would disturb approximately 44 ac of water habitats on the site. Approximately 40 ac of artificial lakes and nearly 3 ac of tidal rivers, inland bays, and other tidal waters would be permanently disturbed. The permanent loss represents approximately 94 percent of the available onsite water habitats. Less than 1 ac would be temporarily disturbed on the site (PSEG 2014-TN3452).

Construction and preconstruction activities on offsite adjacent areas and the proposed causeway would disturb approximately 5 ac of available water habitat in these areas. Temporary disturbances include less than 1 ac in adjacent offsite areas and approximately 2 ac in the causeway. Permanent losses offsite occur only in the proposed causeway area, and losses would be approximately 2 ac (PSEG 2014-TN3452).

There are approximately 26,837 ac of water habitat in the vicinity. The permanent loss of this habitat on the site and in the vicinity represents less than 1 percent of the total available habitat (PSEG 2014-TN3452). The loss of these areas would not have a noticeable effect on the available habitat in the area.

Wetlands

Wetlands and other aquatic habitats are mainly located in the extreme eastern and northern portions of the PSEG Site and represent one of the largest available habitats on the site. The proposed new nuclear power plant would permanently disturb 108 ac of wetlands, including 0.1 ac of saline marsh, 58.3 ac of *Phragmites*-dominated coastal wetlands, 0.9 ac of herbaceous wetlands, 4.6 ac of deciduous scrub/shrub wetlands, and 44.1 ac of *Phragmites*-dominated interior wetlands. There would be 31.8 ac of temporary effects on the site, including 5.1 ac of *Phragmites*-dominated coastal wetlands, 2.5 ac of herbaceous wetlands, and 24.2 ac of *Phragmites*-dominated interior wetlands (PSEG 2014-TN3452).

Offsite effects on wetlands from the construction and preconstruction activities in the offsite adjacent areas and the proposed causeway would total 72.8 ac. A permanent loss of 23 ac would occur in the wetlands associated with the proposed causeway, including losses of 6.1 ac of freshwater tidal marsh, 11.2 ac of *Phragmites*-dominated coastal wetlands, 1.2 ac of

herbaceous wetlands, 0.1 ac of mixed scrub/shrub wetlands (coniferous dominated), and 4.4 ac of *Phragmites*-dominated interior wetlands. A total of 49.8 ac would be disturbed temporarily, including 6.6 ac of freshwater tidal marshes, 13.2 ac of *Phragmites*-dominated coastal wetlands, and 29.2 ac of *Phragmites*-dominated interior wetlands (PSEG 2014-TN3452).

Potential effects on Wetland plant communities may consist of actual direct damage to plants, compaction of wetland soils, and short-term reductions in productivity. The proposed causeway would be designed as an elevated structure to minimize potential effects on plant communities. Permanent effects on wetland plant communities along the causeway would be limited to placement of piers and direct shading. Shading potentially could result in some alteration of plant community makeup under the causeway and a reduction in primary productivity. The building method for the proposed causeway has not yet been determined, but construction work mats are expected to be used within a 50-ft wide easement. Reductions in primary productivity due to causeway development should be minimal overall, considering the large area of adjacent coastal wetlands within the project vicinity (PSEG 2014-TN3452).

A total of 131 ac of wetlands would be lost as a result of construction and preconstruction activities on the PSEG Site and vicinity. This represents less than 1 percent of the 25,534 ac of wetlands available in the vicinity (PSEG 2014-TN3452). Most of these wetlands are dominated by near monocultures of the common reed, a nonnative aggressive invasive plant species that significantly affects Wetland diversity and habitat structure with resultant significant impacts to wildlife habitat quality. However, wetlands are an important habitat, and the alteration of these wetlands would be noticeable.

Barren Land

Approximately 19 ac of onsite barren land would be disturbed from construction and preconstruction activities. This includes permanent impacts of nearly all of the 15 ac of altered lands and 4 ac of disturbed wetlands (modified). Temporary effects on barren land on the site include less than 1 ac of the available disturbed wetlands (modified) (PSEG 2014-TN3452).

Offsite barren land disturbances in the vicinity include approximately 13 ac of temporary effects in the offsite adjacent areas. There are no barren land disturbances expected for the construction and preconstruction activities associated with the proposed causeway (PSEG 2014-TN3452).

Disturbances to barren lands represent approximately 3 percent of the available 651 ac of barren land in the vicinity and less than 1 percent of the 54,164 barren lands available in the region (PSEG 2014-TN3452). Construction and preconstruction effects to barren land would not noticeably affect barren land habitats in the vicinity.

Managed Wetlands

The applicant proposes to temporarily disturb 2.7 ac, or 71 percent, of the available managed wetlands on the proposed PSEG Site. There will be no permanent impacts to managed wetlands, and there are no managed wetlands available in offsite areas or proposed causeway (PSEG 2014-TN3452). This disturbance would not noticeably affect managed wetlands in the vicinity.

Agricultural Lands

Agricultural lands that potentially would be affected by preconstruction and construction include near offsite areas along the proposed causeway route. These agricultural land cover types are located at the north end of the proposed causeway in Elsinboro Township. These plant communities consist of cultivated crops and adventitious weedy species. The proposed causeway would disturb 12.6 ac of agricultural land in the vicinity. The causeway would

permanently disturb 12.4 ac and temporarily disturb 0.2 ac. No permanent or temporary impacts to agricultural lands would result from onsite building activities at the ESP site. The affected agricultural lands represent less than 1 percent of agricultural lands available in the vicinity (PSEG 2014-TN3452). These impacts would not noticeably affect the available agricultural habitats in the vicinity.

2.3 Noise and Fugitive Dust Impacts

Preconstruction and construction activities on the PSEG Site and vicinity that produce noise and fugitive dust likely would displace wildlife into habitat surrounding work areas. Peak noise level associated with preconstruction and construction activities would be 102 A-weighted decibels (dBA) 50 feet away from work areas and would attenuate to 58 dBA 1,500 ft away. Behavioral effects attributed to noise could decrease chances for wildlife survival and successful reproduction. Effects on wildlife can range from nonexistent to serious, depending on the species and the situation (Larkin 1996-TN772). During frequent noise events that exceeded 80 dBA, waterfowl activities demonstrated only minimal responses to individual events with no noticeable disruptions of typical behavior patterns, indicating that avian species quickly accommodated to the noise events (Fleming et al. 2001-TN2419). It is anticipated that general noise levels from preconstruction and construction would dissipate within a short distance to ambient levels well below that which would normally cause a response in wildlife (NRC 2013-TN2654).

Principal noise sources at an operating nuclear power plant include natural draft and mechanical draft cooling towers, transformers, and loudspeakers (NRC 2013-TN2654). The bounding noise level from the proposed new nuclear power plant at the PSEG Site for operational noise emissions is associated with fan-assisted natural draft cooling towers (NDCTs), as presented in the Site Safety Analysis Report in the PSEG ESP application (PSEG 2014-TN3453). The estimated dBA noise emission for this type of cooling tower is 60 dBA at 1,000 feet. Noise measurements recorded on the site demonstrate that existing noise levels attenuate to a maximum of 51.6 dBA (a value typical of ambient low noise environments) near the site boundary (PSEG 2014-TN3452).

Noise from onsite sources associated with the proposed site attenuates with distance. For example, a source with a noise level of 50 dBA at 1,000 ft has a noise level of 44 dBA at 2,000 ft from the source, and a source with a noise level of 60 dBA at 1,000 ft has a dBA of 54 at 2,000 ft. A 2009 baseline ambient noise survey indicates noise from sources at the existing HCGS and SGS facilities attenuates to levels that generally represent background noise values in natural environments (Table 3). This noise level is similar to that measured near the PSEG Site boundary. Noise sources within the adjacent marsh environment include wind, rustling of reeds and grasses (Phragmites), and animal noises (frog calls, bird songs, etc.) (PSEG 2014-TN3452). There are no known Federally listed threatened or endangered terrestrial species within the vicinity of the PSEG Site that potentially could be affected by plant operation noise. In addition, the expected noise level is well below threshold levels that would generally exhibit a response in wildlife populations. Thus, effects of noise from operation of the proposed site are expected to be minimal.

PSEG proposes to suppress fugitive dust on the PSEG Site and offsite preconstruction and construction areas by using water from local stormwater retention ponds (PSEG 2014-TN3452). The impact of fugitive dust to wildlife species would be negligible.

Table 3. Ambient Noise Levels at HCGS and SGS in February 2009

Monitoring Location	Location Specific Attributes	Noise Levels (dBA)	
		Day Leq[(a)]	Night Leq[(a)]
1	Open area 500 ft south of SGS switchyard near Delaware River shoreline	58.9	57.4
2	Open area near meteorological tower	51.6	51.6
3	Open area adjacent to high-use onsite road	54.3	65.6
4	Open area under 500 kV transmission line	53.2	53.6
5	Open area near HCGS cooling tower, small arms firing range, and low-use onsite road	60.9	61.5
6	Open area near Delaware River shoreline	43.4	51.6
7	Open area near material services building, HCGS intake pump house, and Delaware River shoreline	52.0	51.6

(a) Leq is the true equivalent sound level measured over the run time.

Source: PSEG 2014-TN3452.

2.4 Potential for Wildlife Collisions with Human-made Structures

Avian and bat collisions with human-made structures can be attributed to numerous factors related to species characteristics such as flight behavior, age, habitat use, seasonal and diurnal habitats, and environmental characteristics such as weather, topography, land use, and orientation of the structures. This is a particular concern in the area of the PSEG Site because it is in the Atlantic Flyway, a major bird migration route. Additionally, bat hibernacula are known to occur in northern and central portions of Salem County, New Jersey. Bird and bat collisions with construction equipment, such as cranes or new structures, have the potential to occur at the PSEG Site. Studies of avian and bat collisions with elevated construction equipment are lacking. However, surveys conducted in the vicinity of other human-made structures, such as NDCTs and wind turbines, indicate that avian and bat mortalities as a result of collisions could occur. The findings of NUREG–1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), demonstrated that mortalities as a result of avian collisions with existing structures at nuclear power plants are minor and typically occur with structures greater than 300 feet tall (NRC 2013-TN2654). In addition, a study on bat collisions with wind turbine towers indicated that only a small fraction of bats collide with towers, and the collisions weren't sufficient to alter populations (Erickson et al. 2002-TN771). The tallest structure on the PSEG Site is the 512-ft NDCT associated with HCGS (PSEG 2014-TN3452). During a yearlong study from 1985 to 1986, PSEG counted 30 avian mortalities with no Federally or State-listed endangered or threatened species noted (PSEG 1987-TN2893). Therefore, the effects of such collisions during preconstruction and construction at the PSEG Site are expected to be negligible.

2.5 Cooling System Impacts on Vegetation

Operation of cooling systems for a proposed new nuclear power plant at the PSEG Site poses the most significant risk to vegetation. The proposed cooling systems will use a recirculating (closed cycle) cooling water system that includes NDCTs, mechanical draft cooling towers (MDCTs), or fan-assisted cooling towers during normal operations. The circulating water

system (CWS) cooling towers would be the tallest structure on the site at a potential height of 600 ft and would dissipate heat at a rate of 1.508×10^{10} Btu/hour with evaporation losses as high as 25,264 gpm and a drift loss as high as 12 gpm. The service water system (SWS) would provide cooling functions for systems not serviced by the CWS during operation and during cooldown, refueling, and plant startup modes. The shorter SWS cooling towers dissipate heat at a maximum rate of 2,284 gpm and a maximum drift loss of 4 gpm (PSEG 2014-TN3452). Because the effects from the SWS cooling towers would be less significant than the CWS cooling towers, discussion of potential impacts as a result of cooling system operation will be limited to the CWS cooling towers.

Heat from operation of the proposed new nuclear power plant would be transferred to the atmosphere in the form of water vapor and drift from cooling towers. Vapor plumes and drift can affect crops, ornamental vegetation, and native plants, while water losses can affect shoreline habitat. Total dissolved solids found in the vapor and drift have the potential to be deposited onto foliage or soil and cause visible damage (e.g., necrotic tissue and other deformities) and/or chronic effects (e.g., reduced growth and increased susceptibility to disease). NUREG–1555, Section 5.3.3.2, indicates that plants are generally not damaged by salt deposition rates of 1 to 2 kg/ha per month. Salt deposition rates greater than 10 kg/ha per month during the growing season have the potential to cause leaf damage in some vegetation species (NRC 2013-TN2654).

The linear mechanical draft cooling tower (LMDCT) has greater potential for salt drift than other proposed cooling tower structures. Therefore, discussion of salt deposition as a result of cooling tower drift will be limited to the deposition rate of the LMDCT. The results of Seasonal and Annual Cooling Tower Impacts prediction code modeling conducted by PSEG for the proposed site shows that the maximum salt deposition rate during any season is 1.31 kg/ha per month (1.17 lb/ac per month) during the winter. The maximum expected salt deposition rate in any direction is 0.89 kg/ha per month (0.80 lb/ac per month). These salt deposition rates fall within the rate described by NUREG–1555 as generally not damaging to plants (NRC 1996-TN288; NRC 1999-TN289).

Analyses performed by PSEG have shown the cooling tower drift over terrestrial habitats is primarily to the east (within coastal wetlands) (Figure 4) and southeast on the PSEG Site. Most of the plant communities within the salt drift zone that would be exposed to drift from the PSEG cooling towers are salt marsh or brackish marsh ecosystems dominated by species (*Phragmites australis* and *Spartina alterniflora*) with medium to high salinity tolerance. Surveys conducted previously at the PSEG Site did not record any impacts from salt deposition due to drift from the existing HCGS NDCT for any specific plant species. Damage to native vegetation has not occurred at HCGS, which uses brackish water for cooling and represents a comparatively high probability of impact from operation of natural draft towers (NRC 1996-TN288; NRC 1999-TN289; PSEG 2014-TN3452).

Drift deposition also has the potential to damage vegetation through soil salinization. However, soil salinization usually does not occur in areas where rainfall is sufficient to leach salts from the soil profile. In humid environments, effects of drift deposition on soils appear to be transitory, if they can be detected at all (NRC 1996-TN288; NRC 1999-TN289).

Previous evaluations of increased fogging, icing, humidity, and/or precipitation due to cooling tower drift have been conducted for nuclear power plants with cooling towers (natural draft and mechanical draft). No significant impacts were reported as a result of these evaluations (NRC 1996-TN288; NRC 1999-TN289). In addition, based on an analysis conducted for the proposed site, the duration of any fogging and other cooling tower induced precipitation events would be expected to be low (PSEG 2014-TN3452).

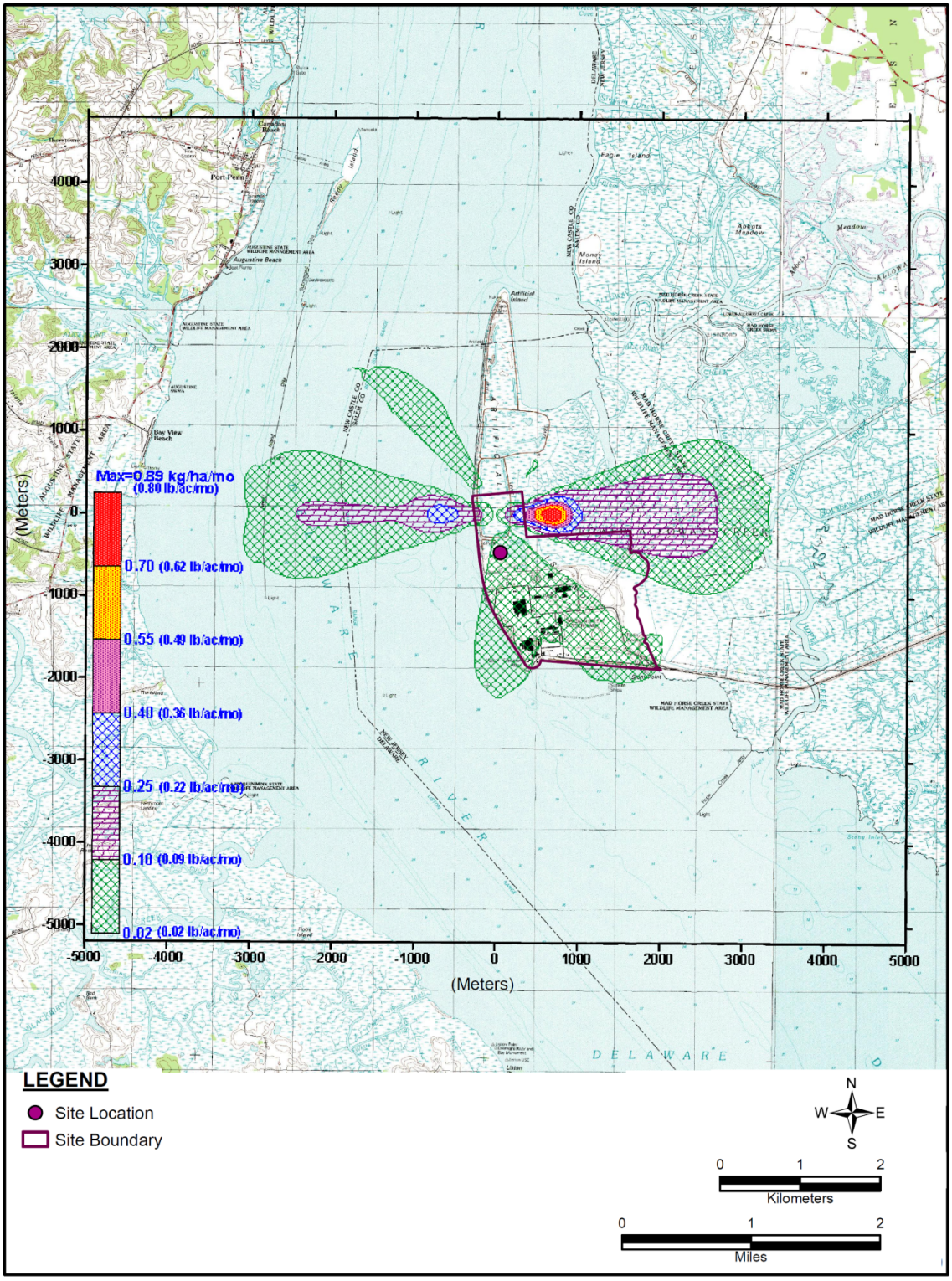

Figure 4. LMDCT Salt Deposition Rates.
(Source: Modified from PSEG 2014-TN3452).

Based on these results, combined with the nature of the local plant communities, the potential effects of proposed site cooling tower operation on surrounding plant communities on the PSEG Site and in the vicinity would be expected to be minimal (NRC 1996-TN288; NRC 1999-TN289).

2.6 Impacts of Artificial Light

Artificial light can affect wildlife by both disorientation and attraction. Night migrating bird species can be impacted when meteorological conditions, such as inclement weather, bring them into close proximity with artificial lighting. Birds may become disoriented and collide with each other or structures, become exhausted, or be taken by predators (Longcore 2004-TN3189). Artificial lighting may affect terrestrial mammal nocturnal predator–prey relationships (Beier 2006-TN2380). Light pollution also may have significant negative impacts on the selection of flight routes by bats (Stone et al. 2009-TN3190). When exposed to artificial light, green frogs were found to exhibit fewer advertisement calls and moved more frequently than they did under ambient light conditions; this could result in potential impacts on recruitment rates, leading to effects on population dynamics (Baker and Richardson 2006-TN2379).

Down shielding of lights to prevent light from being directed into the night sky can help reduce the effect on migratory birds. This means lights can be shielded so that the pattern of illumination is below the horizontal plane of the light fixture. However, this will not prevent potential impacts to other species, such as frogs (Longcore 2004-TN3189).

Additional lighting effects could be lessened by using low sodium lighting. Down shielding, as described above, could be employed to further mitigate certain impacts. Operating experience with HCGS has shown that bird collisions with units have not been a noticeable issue (PSEG 1987-TN2893). It is not expected that the incremental effect of lighting added for the proposed site would increase impacts to noticeable levels, particularly if down shielding and other best management practices (BMPs) were to be employed. With the use of appropriate BMPs, impacts to terrestrial wildlife from the additional lighting at the new PSEG Site are expected to be minimal.

2.7 Impacts of Increased Vehicle Traffic

Increased traffic as a result of operating a new nuclear power plant at the PSEG Site has the potential to increase wildlife mortality caused by vehicle collisions. PSEG estimates that the onsite workforce could increase by 600 employees during normal day-to-day operations and by 1,000 employees during refueling operations (PSEG 2014-TN3452). The increase in workforce population would increase the amount of vehicle traffic on the site and in the vicinity. Local wildlife populations could decline if roadkill rates exceed the rates of reproduction and immigration. However, roadkills occur frequently, and wildlife populations are not significantly affected (Forman and Alexander 1998-TN2250). No individual Federally or State-listed threatened or endangered species were identified that would be adversely affected by vehicle traffic. Therefore, the effect of increased traffic on terrestrial wildlife populations on the site and in the vicinity would be minimal.

The proposed causeway will be constructed on piers to preserve wildlife travel corridors. By allowing wildlife travel below the causeway, this elevated design also will help to minimize the possibility for wildlife–vehicle collisions and wildlife mortality over conventional roadways built on embankments. The elevated design of this structure will also minimize potential impacts to plant communities. Permanent impacts to wetland plant communities along the causeway will be limited to placement of piers and direct shading. Shading could potentially result in some alteration of plant community makeup under the bridge and a reduction in primary productivity

(PSEG 2014-TN3452). However, because the effect will be to a small area relative to the overall plant community, impacts are expected to be minimal.

2.8 Impacts to Shoreline Habitat

Based on the proposed Site Utilization Plan (as shown in Figure 3), the western shoreline of PSEG will be modified with the development of shoreline plant features that include the water intake structure, heavy haul road, and barge facility. In total, 9.5 ac of nearshore water and riparian shoreline will be impacted below the coastal wetland boundary, also known as the New Jersey upper wetland boundary. Based on the Site Utilization Plan, the shoreline will be constructed as a stabilized shoreline (using riprap or other appropriate treatment) (PSEG 2014-TN3452). This will be the condition of the shoreline during the operational phase of the PSEG project.

The already disturbed nature of the shoreline before the proposed stabilization likely provided marginal habitat for most terrestrial species. The main use of these areas would have been some riparian zone/edge birds, as well as waterfowl and other birds on the open water. Open water habitat will remain during the operational stage of the PSEG project (PSEG 2014-TN3452). The riparian zone, on the other hand, will provide little habitat with the establishment of the riprap bank. However, there are large areas of similar shoreline habitat of higher quality in the vicinity of the site. Therefore, it is expected that the shoreline modifications in place during the operational stage of the PSEG project will have a negligible impact on terrestrial wildlife populations.

2.9 Impacts of Transmission Lines

This section addresses potential operational effects of transmission systems on terrestrial resources. This includes the transmission system itself and any ROW associated with the proposed site. The transmission needs for the proposed site include two to three new onsite lines crossing between two proposed switchyards on the PSEG Site. Two potential offsite transmission line routes are being considered by the regional transmission line provider to support grid stability and are discussed as part of cumulative impacts.

Vegetation

The Public Service Electric and Gas Company (PSE&G) is responsible for maintaining the transmission lines and rights-of-way associated with HCGS and SGS in New Jersey and to ensure that important terrestrial habitats and species are protected in accordance with resource agency approved BMPs. Potential effects from operation and maintenance of the new transmission systems are based on established procedures PSE&G uses for existing lines (PSEG 2014-TN3452).

PSE&G transmission lines and rights-of-way are surveyed by air and ground approximately five times a year to ensure the physical and electrical integrity of transmission line supports, hardware, insulators, and conductors are acceptable for safe and reliable service. Climbing inspections of structures are performed approximately every three years, with the frequency dependent on the age of the line (PSEG 2014-TN3452).

PSE&G employs maintenance measures to keep woody vegetation at least 30 ft from conductors wherever transmission lines cross wooded areas. The primary method used for maintenance of the transmission line ROW is mechanical clearing. For areas that contain wetlands, ROW maintenance is typically performed manually in accordance with resource agency approved BMPs. In accordance with an integrated pest management program, herbicides are used to prevent sprouting from fast growing woody vegetation. For any herbicide applications that may be required in or near waterways or wetlands, only herbicides specifically

labeled for use in waterways are used, consistent with U.S. Environmental Protection Agency (EPA) label requirements and NJDEP regulations. Periodic inspections are conducted to ensure that appropriate clearances between tall vegetation and conductors are maintained (PSEG 2014-TN3452).

Important habitats on the PSEG Site are wetlands. It is not anticipated that transmission line ROW maintenance normally required to control woody vegetation will be necessary on the site because the onsite transmission lines run through herbaceous coastal wetlands. These onsite coastal wetlands are disturbed habitats dominated by common reed that does not grow tall enough to interfere with overhead transmission lines. Consequently, onsite transmission line maintenance activities most likely will be restricted to minimal mechanical clearing and/or herbicide application. Therefore, impacts to important terrestrial habitats resulting from the operation and maintenance of onsite transmission line systems are expected to be minimal (PSEG 2014-TN3452).

Saltmarsh cordgrass is the only identified important plant group on the PSEG Site. Saltmarsh cordgrass is essential to the function of the coastal marsh and is an important component of coastal wetlands in marsh restoration sites. Cordgrass has not been observed in onsite areas near the planned transmission lines. Furthermore, the transmission lines are elevated and would not interfere with any future establishment of these plants on the site. Also, as stated above, the need for routine use of herbicides or mechanical clearing as part of any onsite transmission line maintenance activities would be minimal, if required at all. Therefore, impacts to saltmarsh cordgrass associated with the maintenance and operation of the onsite transmission lines are not anticipated (PSEG 2014-TN3452).

Wildlife

Section 4.5.6.2 of the GEIS provides a thorough discussion of bird collisions associated with operating transmission lines. Avian collisions with transmission systems are dependent on site-specific variables such as nesting, foraging, and roosting. Additionally, factors such as line orientation to flight patterns and movements, species composition, and line design are factors in avian collisions. The GEIS determined that bird collisions with transmission lines were more likely to occur with large-bodied species such as raptors, and smaller species such as song birds were more likely to collide with towers (NRC 2013-TN2654).

Threatened and endangered species of large-bodied and small-bodied birds have the potential to be affected where transmission lines pass through areas where these species are concentrated. Several State-listed species have the potential to occur on the PSEG Site or in the vicinity. However, field surveys conducted from 2009 to 2010 did not identify significant concentrations of these species (PSEG 2014-TN3452). Additionally, PSEG's wildlife management practices would be required to comply with the Migratory Bird Treaty Act regarding nest removals and maintenance activities. PSEG includes appropriate measures in the design of transmission lines to reduce the potential for avian collisions. In addition, current design standards for phase-to-phase and phase-to-ground clearances for high transmission voltages are generally considerably greater than wing-to-wing or wing-to-foot spans for even the larger birds. Electrocution is rarely a problem for 500 kV transmission lines (PSEG 2012-TN2389). Therefore, bird mortality resulting from the collisions with transmission line systems on the PSEG Site or in the vicinity is expected to be a small fraction of the total mortality and would not pose as a significant threat to overall populations.

Transmission line ROW management practices have the potential to affect wildlife on the PSEG Site and vicinity. ROW development represents a barrier to larger, more mobile species that require continuous tracts of forested habitat and to smaller, less mobile species that have difficulty crossing disturbed habitat (NRC 2013-TN2654). Much of the proposed transmission

line ROWs on the site have been developed previously or are dominated by common reed (PSEG 2014-TN3452). Because of the vegetation types in the proposed onsite transmission line corridor, PSEG does not expect a need to conduct maintenance activities of the transmission line ROWs. Transmission line ROWs on the PSEG Site are not expected to adversely impact terrestrial wildlife species.

Electromagnetic Fields

Studies have indicated that electromagnetic fields (EMFs) associated with transmission lines could affect flora and fauna (NRC 2013-TN2654). Plant foliage in the vicinity of strong electromagnetic fields (greater than 1,100 kV) has been shown to incur damage to tips of leaves and buds, similar to the stresses that may occur as a result of drought. However, the damage is limited to those plants located close to transmission lines and generally does not interfere with overall growth. Additionally, transmission lines energized at levels less than 765 kV are not expected to affect most terrestrial fauna. The transmission lines that would be constructed for PSEG would operate only at 500 kV (PSEG 2014-TN3452), which is much lower than the 1,100 kV threshold for EMF effects on flora and 765 kV threshold for terrestrial fauna. Therefore, the increased EMF posed by the operation of the proposed transmission lines is expected to have only a minimal impact on terrestrial flora and fauna.

3.0 Federally Listed Species Considered

Based on NRC review of sources from FWS and the states of Delaware and New Jersey, one Federally threatened turtle species and one Federally proposed endangered mammal species were identified with the potential to be present in the site vicinity. These species are the bog turtle (*Gyptemys muhlenbergii*) and northern long-eared bat (*Myotis septentrionalis*). Accordingly, this BA focuses on evaluating the potential effects from building and operating a new nuclear plant at the PSEG Site on the bog turtle and northern long-eared bat.

3.1 Bog Turtle

Species Description

The Federally threatened bog turtle measures up to 4 in. long and is dark brown with distinct orange patches on either side of its head. Its carapace scutes are brown or black and may have a yellow or reddish center, and its plastron is brownish-black. The bog turtle's limbs are brown and may have variable amounts of dark yellow, orange, or red blotching. Male bog turtles have a concave plastron, long thick tail, and long foreclaws. The females have a flat to semi-convex plastron (CWFNJ 2014-TN3288).

Distribution and Habitat

Bog turtles occur in disjointed populations in the eastern United States from New York to northern Georgia. Populations of bog turtles in New Jersey occur in isolated colonies in northern, central, and southern counties including Salem County, New Jersey. The largest populations can be found in the Wallkill River and Paulinskill River watersheds (CWFNJ 2014-TN3288).

Bog turtles inhabit fens, bogs, and wet meadows characterized by mucky, organic soil that remains saturated by groundwater. Plant communities in bog turtle habitat vary in species composition but are almost always dominated by low-growing grasses, sedges, rushes, ferns, scattered cattails, and forbs. Shrub and tree cover is typically low, and physical features of the habitat include spring-derived rivulets; shallow, mucky pools; and abundant sedge or moss-covered hummocks. Bog turtles spend much of their time hiding in cool, soft muck that provides cover and aids in thermoregulation during warm summer months. After emerging from

subterranean hibernacula in the spring, they spend much of that season into early summer basking on hummocks and other areas. Mating occurs primarily in May and June. Females lay their eggs in drier areas of the marsh such as sedge and moss hummocks or rotted tree stumps. The diet of the bog turtle is mainly invertebrates, particularly slugs. They also may feed on carrion, small berries, sedge seeds, young cattail shoots, and duckweed. Once abundant throughout New Jersey, the bog turtle is now restricted to the remaining rural portions of the state, including Sussex, Warren, Hunterdon, and Salem counties. They require large contiguous areas of land for dispersal. Intense land-uses affect bog turtle habitat through direct alteration of wetlands and secondary effects such as stormwater inputs, water table drawdown, and nutrient enrichment (NJDEP 2014-TN3287).

Population Trends and ESA Status

The FWS listed the northern population of the bog turtle on the Federal List of Endangered and Threatened Wildlife under the ESA on November 4, 1997. The bog turtle experienced a 50 percent reduction in range and population from 1976 to 1996. In New Jersey, there were 68 recorded locations where the bog turtle was found in 1978. In 1989, 44 of the recorded New Jersey sites surveyed indicated that the bog turtle was no longer present. In 2000, there were 350 extant sites comprising the entire northern population, which was an increase from the 191 known extant sites reported in 1996. Of those 350 extant sites, 165 known extant sites were located in New Jersey (FWS 2001-TN3315).

The primary threats to bog turtle populations in New Jersey have been habitat loss because of natural succession, habitat fragmentation, and illegal collection. Vegetation succession has a negative effect on bog turtles by eliminating open areas, resulting in the reduction of suitable nesting sites and basking habitat. Important microclimates may also be eliminated and a monoculture created with the infiltration of invasive plant species such as *Phragmites australis*, reed canary grass (*Phalaris arundinacea*), or purple loosestrife (*Lycopodium sabinifolium*). Bog turtle colonies are isolated with habitat fragmentation, which has the potential to result in decreased genetic diversity and to affect the colonization of new sites. Bog turtles also are killed when trying to cross roadways that split wetlands (CWFNJ 2014-TN3288).

The bog turtle was recorded historically for Artificial Island and the vicinity during a study conducted between 1972 and 1978. There were no records for this species in the latest surveys conducted by PSEG in 2009 to 2010. Methods used for surveying reptiles and amphibians on the PSEG Site during 2009 to 2010 included general site reconnaissance and observation, evening anuran (frog) call surveys in the spring, and transect surveys along eight transects also used for bird and mammal surveys. Representative portions of the proposed causeway and areas adjacent to the existing access road were also surveyed qualitatively (PSEG 2014-TN3452).

3.2 Northern Long-eared Bat

Species Description

The northern long-eared bat is a medium size bat species with adults averaging 0.2 to 0.3 ounces. Female bats are slightly larger than their male counterparts. Their average body length is from 3.0 to 3.7 inches long. They are medium to dark brown on their back, ears, and wing membranes and tawny to pale brown on their ventral side. The most distinguishing characteristic of the bat is its long ears, which can extend up to 0.2 inches beyond its muzzle. The ears are pointed and symmetrical with a long tragus (0.4 inches) (78 FR 61046-TN3207).

Distribution and Habitat

The northern long-eared bat's eastern range extends from Maine to the Florida panhandle. However, populations are found in patches and are more common in the northern part of its range than the southern portions. Over 780 hibernacula have been discovered in its range in the United States with only a few individuals in each hibernaculum (78 FR 61046-TN3207).

Hibernacula used by northern long-eared bats are typically large, with large passages, constant cool temperatures, high humidity, and no air currents. Additionally, northern long-eared bats have been seen overwintering in railroad tunnels, storm sewers, and other unexpected retreats. In the summer, northern long-eared bats roost underneath bark or in crevices or cavities of live trees and snags of various tree species. Tree species include black oak (*Quercus velutina*), northern red oak (*Quercus rubra*), silver maple (*Acer saccharinum*), black locust (*Robinia pseudoacacia*), American beech (*Fagus grandifolia*), sugar maple (*Acer saccharum*), sourwood (*Oxydendrum arboreum*), and shortleaf pine (*Pinus echinata*). They also have been observed roosting in or under the eaves of human-made structures such as barns, buildings, sheds, and cabins. Northern long-eared bats are not a long distance migratory species, and movements between summer and winter hibernacula are between 35 mi and 55 mi. Breeding occurs between late July and early October. Home ranges are approximately 46 to 425 ac for females and 161 ac for males. Northern long-eared bats emerge at dusk and fly along hillsides through forest understory, gleaning insects from vegetation. They have a diverse diet of insects, most commonly beetles, moths, and arachnids. Mature forests are an important habitat for the northern long-eared bat's foraging technique (78 FR 61046-TN3207).

Maternity roosts and hibernacula for the northern long-eared bat are known to occur in the following New Jersey counties: Atlantic, Bergen, Burlington, Camden, Hunterdon, Mercer, Morris, Ocean, Passaic, Salem, Somerset, Sussex, and Warren (FWS 2014-TN3208). No surveys were conducted on the PSEG Site for bats species. However, suitable habitat for hibernacula and maternity roosts are limited in the 6-mi vicinity. Important foraging habitat does not exist on the PSEG Site. Northern long-eared bat are known to occur in the northern and central portions of Salem County, New Jersey (78 FR 61046-TN3207).

Population Trends and ESA Status

The northern long-eared bat was proposed for listing under the ESA on December 2, 2013. The northern long-eared bat was most abundant in the eastern portion of its range. It has experienced a severe and rapid decline, estimated at approximately 99 percent since the introduction of white nose disease (first discovered in 2007) in its northeast range. The primary threat to the northern long-eared bat is attributed to white nose disease caused by the fungus *Geomyces destructans.* The threat of white nose disease is expected to increase and continue to extirpate northern long-eared bat populations as it spreads throughout its range (78 FR 61046-TN3207).

4.0 Proposed Action Effects Analysis

This section provides descriptions of potential construction, preconstruction, and operations impacts on the Federally threatened bog turtle and Federally proposed endangered northern long-eared bat. Construction, preconstruction, and operational impacts that potentially could affect these species were evaluated based on habitat presence and life history considerations as well as the type and spatial and temporal nature of the impacts. The primary threats to the Federally listed bog turtle and Federally proposed endangered northern long-eared bat from building and operating a new nuclear power plant on the PSEG Site include habitat reduction, fragmentation, degradation, and the potential for mortality as a result of increased vehicle traffic and collisions with site structures.

4.1 Habitat Loss

Construction and preconstruction activities proposed for the PSEG Site will impact habitats (water and wetlands) that could provide potential habitat for the bog turtle. Although the project will affect approximately 94 percent of the water habitat on the site, over 93 percent of that total consists of artificial lakes that would not be expected to provide adequate habitat for the bog turtle. Furthermore, the majority of the wetland habitat to be disturbed or lost consists of monocultures of the nonnative invasive common reed (*Phragmites australis*). Such monocultures do not provide the important microhabitats required to sustain bog turtles.

Habitat suitable for supporting hibernacula and maternity roost for the northern long-eared bat does not exist on the PSEG Site. Additionally, the PSEG Site does not provide suitable habitat for foraging northern long-eared bats. Therefore, the review team concludes that there will be no effect on the northern long-eared bat as a result of building and operating a new nuclear power plant on the PSEG Site.

4.2 Cooling System Impacts on Vegetation

Potential effects on the bog turtle from the operation of a new nuclear power plant mainly would be associated with water vapor and drift from the cooling tower systems. The main concern would be salt drift and deposition that could affect vegetation in the surrounding area. However, calculated salt deposition rates fall within rates that are generally not damaging to plants. Furthermore, most plants within the salt drift zone for the PSEG Site have medium to high salinity tolerance. The review team has determined that there would be no effect to bog turtle or northern long-eared bat habitat from PSEG Site cooling system operations.

4.3 Wildlife Collisions with Plant Structures

There has been documentation of bat mortality as a result of collisions with human-made structures. However, these collisions do not significantly affect bat populations. Additionally, the PSEG Site does not contain habitat suitable for northern long-eared bat hibernacula, maternity roosts, or foraging. Therefore, bat mortality as a result of collisions with human-made structures is not expected to occur on the PSEG Site.

4.4 Impacts of Increased Vehicle Traffic

Vehicle traffic is expected to increase as a result of building and operating a new nuclear power plant at the PSEG Site. Increased traffic associated with the operations of the new nuclear power plant has the potential to increase wildlife roadkills due to collisions with vehicles, and this is known to be a mortality factor for bog turtles. There could be a decline of bog turtle populations if roadkill rates exceed the rates of reproduction. However, the proposed causeway would be built on piers to limit impacts to wildlife corridors, and the bog turtle population is not expected to be affected by increased traffic on the PSEG Site or vicinity.

4.5 Transmission Lines

The operation and maintenance of onsite transmission lines are not expect to affect the bog turtle or northern-long eared bat. Transmission lines on the PSEG site would disturb some of the coastal wetland areas. Maintenance of transmission lines in this area would not require disturbing the natural vegetation that would grow under the lines. There is a potential for transmission lines to cause bat mortality as a result of collisions with the lines. However, habitat for the northern long-eared bat does not exist on the site, and collisions in the vicinity would not be expected to occur in rates that would result in the decline of migrating bats. Therefore, transmission lines on the PSEG Site would not be expected to affect bog turtles or northern long-eared bats.

5.0 Cumulative Effects Analysis

In addition to impacts from construction, preconstruction, and operation, the following cumulative analysis also considers other past, present, and reasonably foreseeable future projects that could affect the terrestrial and wetland ecological resources also affected by building and operating a new nuclear power plant at the PSEG Site. Direct and indirect impacts to terrestrial and wetland resources resulting from the building and operation of a new nuclear power plant on the PSEG Site and the proposed causeway would be limited to Salem County, New Jersey. However, the cumulative impacts on terrestrial and wetland resources when combined with other actions would extend to areas within the Middle Atlantic Coastal Plains, Northern Piedmont, and Atlantic Coastal Pine Barrens ecoregions. For purposes of this cumulative analysis, the geographic area of interest for terrestrial and wetland resources is defined as the Middle Atlantic Coastal Plains, Northern Piedmont, and Atlantic Coastal Pine Barrens Level III ecoregions within 50 mi of the PSEG Site. This geographic region of interest includes Salem County, New Jersey, and other counties, or portions of counties, in New Jersey, Delaware, Pennsylvania, and Maryland.

5.1 Habitat Loss

The Atlantic Coastal Plains in the geographic region of interest consist of the Middle Atlantic Coastal Plain, Northern Piedmont, and Atlantic Coastal Pine Barrens. The Middle Atlantic Coastal Plain is characterized as nearly flat topography and consists of swampy, marshy, and frequently flooded areas. Upland areas are dominated by loblolly-shortleaf pine forests and lowland, and tidally influenced areas support tidal marshes, swamps, floodplain forests, and pocosins. Marshes are dominated by cord grass and salt-meadow grass. The Northern Piedmont is characterized by irregular plains and low hills. It is dominated by mixed oak, chestnut oak, hemlock-mixed hardwood, and sugar maple-mixed hardwood forests. The Atlantic Coastal Pine Barrens are low undulating part of the Atlantic Coastal Plain. Native habitat in this area consists of pine-oak woodlands, mixed oak and beech-oak forests, salt marshes, swamps, freshwater marshes, and floodplains (Woods et al. 2007-TN3227).

The Atlantic Coastal Plains ecoregion has been altered significantly since the beginning of European settlement in the 1600s as a result of agriculture, silviculture, and urban development. The geographic region of interest includes the same habitat types as those found in the 6-mi vicinity of the site. Habitats within the 6-mi vicinity of the PSEG Site include barren land, developed land, cultivated cropland, pasture hay, deciduous forest, evergreen forest, mixed forest, emergent herbaceous wetland, woody wetland, and open water. However, the overall percentages of each habitat differ when expanding from the 6-mi vicinity to encompass the geographic region of interest. Open water associated with the Delaware River, Delaware Bay, and other open water areas occupies 791,821 ac (15.7 percent) of the area. Emergent herbaceous wetland occupies 199,603 ac (4.0 percent), and woody wetland occupies 279,248 ac (5.5 percent). Agricultural land consisting of cultivated cropland (1,075,101 ac) and pasture hay (774,432 ac) account for 36.8 percent of the land cover. Deciduous forest occupies 1,028,552 ac (20.5 percent) of the habitat in the geographic region of interest.

Developed lands, which include high, medium, low, and open space developed land, occupy 630,983 ac (12.6 percent). Barren lands account for 54,142 ac (1.1 percent) of the land cover. Evergreen and mixed forest habitat accounts for 190,352 ac (3.8 percent) of land cover in the geographic region of interest (PSEG 2014-TN3452).

The USACE created Artificial Island in the early 1900s with the authorization of the Rivers and Harbor Act of 1896. The act authorized the creation of a 30 ft channel from Philadelphia to Delaware Bay and covered 56 miles of proposed channel. The amount of material to be

removed was estimated at 34,953,000 yd^3 of dredge material and 24,000 yd^3 of rock. Six locations, including Baker Shoal and Stony Point Shoal, were evaluated as potential disposal sites. Baker Shoal and Stony Point Shoal were enclosed in 1900 by bulkheads to form a deposit basin now known as Artificial Island (Snyder and Guss 1974-TN2280). Since the development of Artificial Island, several dredging projects have been conducted that have altered the terrestrial and wetland ecology of the region.

Currently, the USACE is in the process of deepening the existing Delaware River Federal Navigation Channel from 40 ft to 45 ft from Philadelphia, Pennsylvania, and Camden, New Jersey, to the mouth of the Delaware River (USACE 2013-TN2665). The cumulative impact contribution to terrestrial and wetland resources associated with the acquisition by PSEG of the 85 ac CDF on Artificial Island will be dependent on potential need for the USACE to develop a new CDF and could add to the overall cumulative impacts for the geographic region of interest. PSEG is in the process of obtaining a separate land exchange agreement with the USACE, Philadelphia District, for the Artificial Island CDF. Any land exchange agreement between the USACE and PSEG would undergo a separate NEPA review and would require PSEG to provide an alternative CDF for USACE-dredged material disposal operations currently available at the Artificial Island CDF. The current CDF on Artificial Island contains low quality terrestrial and wetland habitat, and the addition of a new CDF has the potential of affecting habitat of higher quality. The USACE's Delaware River Main Channel Deepening Project would require a site to dispose of dredge material. The USACE proposes to dispose of dredge material at Fort Mifflin CDF. The USACE determined that the planned impacts are consistent with previous actions and would not result in significant impacts to the affected environment (USACE 2013-TN2665). Similarly, current operations of SGS and HCGS would require a new location for disposing of dredge material, and a disposal site would be needed for dredge material from the barge access area at the PSEG Site. The effects on terrestrial and wetland habitat are expected to be less than, but consistent with, those of the Delaware River Main Channel Deepening Project. Consequently, the review team determined that the cumulative impact on terrestrial and wetland ecology habitats from dredging activities as a result of building and operating a new nuclear power plant at the PSEG Site, in conjunction with past, present, and reasonably foreseeable future dredging activities, is minimal.

Most of the other operational projects in the geographic region of interest have resulted in the reduction, fragmentation, and degradation of terrestrial and wetland habitat in the geographical region of interest. These projects include several fossil fuel energy facilities such as Delaware City Refinery, Deepwater Energy Center, Carneys Point Generating Plant, Pedricktown Combined Cycle Cogeneration Plant, Cumberland County Landfill Gas-to-Energy Plant, Vineland Municipal Electric Utility, Sherman Ave. Energy Center, Carl's Corner Energy Center, and Cumberland Generating Station. Additionally, there are four operating nuclear power plants located in the geographic region of interest that have contributed to adverse cumulative effects to terrestrial and wetland resources: HGS, SGS, Peach Bottom Atomic Power Station, and Limerick Generating Station. The Salem County Solid Waste Landfill also operates in this region. These facilities are expected to have continuing effects on terrestrial and wetland resources in the region of interest during the operational period of a new nuclear power plant at the PSEG Site.

Future residential development and further urbanization of the area would result in the continued increase in fragmentation and loss of habitat. The New Jersey Department of Labor and Workforce Development projected that the population of Salem County would increase by approximately 5 percent between 2010 and 2030. The overall growth of the geographic region of interest is expected to increase as well from 2010 and 2030 (NJLWD 2014-TN3332). Future urbanization in the geographic region of interest could result in further losses of agricultural

lands, wetlands, and forested areas. Urbanization would reduce area in natural vegetation and open space and would decrease connectivity among wetlands, forests, and other wildlife habitat. The loss of habitats as a result of urbanization would result in added pressures to the remaining habitat available for wildlife populations. However, it is not expected that these activities would substantially affect the overall availability of wildlife habitat or travel corridors near the geographic region of interest.

Some of the projects in the geographic region of interest include site redevelopment, including redevelopment resulting from a base realignment and closure for Camp Pedricktown, Shieldalloy site decommissioning, Gateway Business Park, and the Millville Municipal Airport. The Camp Pedricktown redevelopment and Shieldalloy facility are currently developed/disturbed sites. In addition, the Gateway Business Park in Oldmans Township, Salem County, is a light industrial complex consisting of 284 ac. The business park is planning to develop three sites with approximately 25 ac. The site is mostly developed with little terrestrial and wetland habitat available (Matrix Development Group 2008-TN3273). The proposed Millville Municipal Airport improvements would refurbish the apron terminal at the airport. These projects are not expected to further degrade or fragment terrestrial and wetland ecology resources within the geographic region of interest.

The transmission service provider has determined that a new transmission line and ROW are needed to support grid stability in the geographic region of interest. The new transmission line and ROW are not dependent on whether PSEG builds and operates a new nuclear power plant on the PSEG Site. In its environmental report, PSEG conducted a study of a hypothetical 5-mi wide macro-corridor known as the West Macro-Corridor and transmission line ROW that extends 55 mi from the PSEG Site to Peach Bottom Substation in Pennsylvania. The transmission line ROW within the corridor is expected to be 200 ft wide. The development of the transmission line corridor would cause disturbances to over 1,500 ac of land. Habitats that could be affected include barren land, deciduous forests, evergreen forests, mixed forest, agricultural land, woody wetlands, and emergent wetlands (PSEG 2014-TN3452). The corridor would be expected to follow existing ROWs to the extent practicable. However, the exact amounts of terrestrial and wetland habitat that would be affected are not known, and it is expected that the project would cause fragmentation and degradation of these resources. The amount of terrestrial and wetland resources affected by the grid stability line would not be a significant amount of the available terrestrial and wetland resources in the region, but mitigation may be required.

Parks and wildlife management areas located in the region of interest include Supawna Meadows National Wildlife Refuge, Fort Mott State Park, Parvin State Park, and Mad Horse Creek WMA. These areas would not be expected to add cumulative impacts to terrestrial and wetland resources and may be affected by regional development. Habitats available in this region potentially could become overburdened with species fleeing areas being developed. The Supawna Meadows National Wildlife Refuge 35 miles south of Philadelphia, Pennsylvania, in Salem County, New Jersey, is recognized as a wetlands of international importance (FWS 2013-TN2530). The refuge covers approximately 3,000 ac and is an important refuge for migratory birds. Fort Mott State Park in Salem County, New Jersey, is a 124-ac facility and was part of the coastal defense system for the Delaware River (NJDEP 2013-TN2532). It provides open field and shoreline habitats as well as recreational activities such as fishing. Parvin State Park is a 2,092-ac facility on the edge of the Pine Barrens and contains coniferous and deciduous forest, open water, and wetland habitats (NJDEP 2013-TN2531). Parvin State Park allows fishing, hunting, and other recreational activities. The proposed Mad Horse Creek project will restore nearly 200 ac of the WMA to address injuries to the shoreline and bird resources resulting from the 2004 Athos I oil spill. NJDEP and the National Oceanic and

Atmospheric Administration are proposing a tidal wetlands restoration project that allows for the restoration of *Spartina alterniflora* habitat (NOAA 2008-TN2721). Any unavoidable impacts to wetlands resulting from the construction of the new plant on the PSEG Site and vicinity could be further mitigated by this restoration project. Sensitive wildlife species that use marsh habitats (e.g., bald eagle [*Haliaeetus leucocephalus*] for foraging, northern harrier [*Circus cyaneus*], osprey [Pandion haliaetus]) will be positively affected by this restoration effort. These activities also potentially could improve habitat for the bog turtle.

5.2 Salt Drift, Icing, Fogging, and Increased Precipitation

Limerick Generating Station, Peach Bottom Atomic Power Station, and HCGS use cooling towers as part of their cooling system. These cooling systems have the potential to affect terrestrial or wetland resources in the region as a result of salt drift, icing, fogging, and increased precipitation (NRC 2013-TN2654). Peach Bottom Atomic Power Station uses MDCT, and both the Limerick Generating Station and HCGS use NDCT. Salt drift deposition rates are highest with MDCT but are dispersed further with NDCT. However, most of the effects of salt deposition on vegetation would be localized to the towers. No adverse impacts to terrestrial or wetland resources from fogging, icing, and increased precipitation would be expected as a result of operating cooling systems. The effects of salt drift, icing, fogging, and increased precipitation from the proposed new nuclear power plant at the PSEG Site were evaluated and found to have a negligible effect on terrestrial and wetland resources.

5.3 Climate Change

The “Global Climate Change Impacts in the United States” report, provided by the U.S. Global Change Research Program (GCRP), summarizes the projected impacts of future climate changes in the United States. The report divides the United States into nine regions, with the PSEG Site located in the Northeast region. The GCRP climate models for this region project temperatures to rise 2.5 to 4°F in the winter and 1.5 to 3.5°F in the summer over the next several decades. Winters are projected to be much shorter with fewer cold days and more precipitation. Cities that currently experience few days above 100°F each summer would average 20 or more days. Hot summer conditions would come three weeks earlier and last three additional weeks into the fall. Sea level is projected to rise more than the global average, with more frequent severe flooding and heavy downpours. These projected changes potentially could alter wildlife habitat and the composition of wildlife populations. Large-scale shifts in the ranges of wildlife species and the timing of seasons and animal migration that are already occurring are very likely to continue (GCRP 2014-TN3472).

5.4 Summary of Cumulative Impacts

The potential cumulative impacts to terrestrial and wetland resources from the construction and operation of a new nuclear plant on the PSEG Site, in combination with the other activities described above, would noticeably alter terrestrial and wetland resources. These activities will result in the loss or modification of terrestrial habitats and wetlands, which potentially could affect important species that live or migrate through the area. Therefore, the incremental contribution of the building and operation of the new nuclear plant on the PSEG Site to cumulative impacts would be noticeable.

Although the PSEG Site does not contain suitable habitat for the Federally threatened (State-listed) bog turtle and the Federally proposed endangered northern long-eared bat, potential offsite transmission lines along with other actions taken in the geographical area of interest could result in potential impacts to this species.

The extent of potential cumulative impacts on the bog turtle and northern long-eared bat would be dependent upon the extent of BMPs taken with the implementation of the various projects in the geographical area of interest. Mitigation or avoidance of sensitive habitat would be an important factor in determining the extent of potential impacts.

The proposed new transmission lines to support grid stability have the potential to cross approximately 560 ac of freshwater woody and emergent wetlands (PSEG 2014-TN3452). The addition of the new transmission corridor potentially could cross over 14 miles of streams. Additionally, future urbanization could result in some limited losses of wetlands and streams. State and/or Federal regulations would protect wetlands and streams from future ROW development and urbanization. However, the impacts to terrestrial and wetland resources from these activities and a proposed new nuclear power plant at the PSEG Site would be noticeable.

Potential cumulative impacts on terrestrial and wetland resources for the site vicinity would result from loss of vegetation as well as loss and fragmentation of wildlife habitat. Such effects will increase with the continued development of the geographical area of interest, with potential impacts to bog turtle and northern long-eared bat habitat. Overall, when combined with other past, present, and reasonably foreseeable future actions, the cumulative impacts to terrestrial and wetland resources resulting from the building and operation of the new plant on the PSEG Site and the proposed causeway would be noticeable but would not be expected to cause significant overall wildlife species population or ecosystem impacts within the 6-mi vicinity. Because of the presence of extensive similar habitat in the geographic region of interest, potential cumulative impacts on terrestrial and wetland resources within this region would be expected to be minimal.

6.0 Conclusions and Determination of Effects

Construction and preconstruction activities proposed for the PSEG Site will affect habitats (water and wetlands) that could provide potential habitat for the bog turtle. Although the project will impact approximately 94 percent of the water habitat on the site, over 93 percent of that total consists of artificial lakes that would not be expected to provide adequate habitat for the bog turtle. Furthermore, the majority of the wetland habitat to be disturbed or lost consists of monocultures of the nonnative invasive common reed. Such monocultures do not provide the important microhabitats required to sustain bog turtles. Hibernacula, maternity roost, and foraging habitat for the northern long-eared bat do not exist on the PSEG Site, and building activities associated with a new nuclear power plant would have no effect on this species. In addition, PSEG is developing a wetland mitigation plan to compensate for the loss of wetlands and other aquatic resources resulting from the proposed project. This plan would require approval through the Department of the Army permit application submitted to the USACE, Philadelphia District.

Potential impacts to the bog turtle from the operation of the new nuclear power plant would be associated mainly with water vapor and drift from the cooling tower systems. The main concern would be salt drift and deposition that could potentially affect vegetation in the surrounding area. However, calculated salt deposition rates fall within rates that are not generally damaging to plants. Furthermore, most plants within the salt drift zone for the PSEG Site have medium to high salinity tolerance. Increased traffic associated with the operations of the new nuclear power plant has the potential to increase wildlife road kills due to collisions with vehicles, and this is known to be a mortality factor for bog turtles.

Potential impacts to the northern long-eared bat from operation of the new nuclear power plant would be associated mainly with mortality as a result of collisions with human-made structures on the site. However, bat mortality as a result of collisions is not known to affect

overall bat populations. Additionally, northern-long-eared bats are not known to occur on the PSEG Site and suitable habitat does not exist on the site.

The PSEG Site does not appear to provide suitable habitat requirements to sustain the bog turtle or the northern long-eared bat. Therefore, habitat disturbed or lost because of the construction of a new nuclear power plant on the PSEG Site should not affect these species. Furthermore, there are no recent records for the bog turtle on the PSEG Site, FWS previously indicated that this species is not known to occur on or in the vicinity of the HCGS and SGS sites, and recent feedback from the FWS stated that the activities proposed for the site would not likely affect Federally listed species. Therefore, the review team has determined that building and operation activities associated with a new nuclear power plant on the PSEG Site would have no adverse effects on the Federally threatened bog turtle or Federally proposed endangered northern long-eared bat.

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APPENDIX G

SUPPORTING INFORMATION AND DATA: POPULATION PROJECTIONS AND RADIOLOGICAL DOSE ASSESSMENT

APPENDIX G

SUPPORTING INFORMATION AND DATA: POPULATION PROJECTIONS AND RADIOLOGICAL DOSE ASSESSMENT

G.1 Population Projections

Table G-1 provides resident population distribution and projections through the year 2081 for the area within 50 mi of the PSEG Site. Table G-2 provides transient population distribution and projections through the year 2081 for the area within 10 mi of the PSEG Site. PSEG obtained population estimates from various sources, including the U.S. Census Bureau (USCB) (PSEG 2014-TN3453). PSEG used the estimates to develop population projections for the year 2010, the expected first year of operation for the new plant (2021), and 10-year increments over the potential operating life of the new plant (through 2081) (PSEG 2014-TN3453).

Based on USCB 2000 census block data, Table G-1 provides population estimates within the concentric bands from 0 to 1 mi, 1 to 2 mi, 2 to 3 mi, 3 to 4 mi, 4 to 5 mi, 5 to 10 mi, 10 to 20 mi, 20 to 30 mi, 30 to 40 mi, and 40 to 50 mi for each of the 16 directional sectors, with each directional sector consisting of 22.5 degrees. For each segment formed by a distance band and directional sector, the percentage of each census block's land area that fell, either completely or partially, within that segment is calculated using geographic information system (GIS) software ArcMap9.2 (PSEG 2014-TN3453). The equivalent proportion of each census block's population is then assigned to each segment. If portions of two or more census blocks fall within the same segment, the proportional population estimates for each census block are summed to obtain the population estimate for that segment (PSEG 2014-TN3453).

The GIS baseline, which includes the population estimates distributed by segment, is used to develop projections of future populations (Table G-1). The 2010 populations are projected by using USCB growth rates for the 2000 through 2008 period (PSEG 2014-TN3453). From 2010 onward, population growth rates are derived from county population projections developed by the states of Delaware, Maryland, New Jersey, and Pennsylvania (PSEG 2014-TN3453). New Jersey has published population projections out to 2025, while Delaware, Maryland, and Pennsylvania have published population projections out to 2030 (PSEG 2014-TN3453). The county population growth rates derived from these projections are used to extrapolate the baseline 2010 projections out to 2021 and 2031 for appropriate counties within each of the four states. No official published data were found that could be applied beyond the 2031 projections (PSEG 2014-TN3453). Population projections beyond 2031 are based on the county-specific annual growth rate calculated for each county between 2021 and 2031. The county-specific growth rates for this 10-year period are used to obtain the population projections for each successive 10-year period (2041, 2051, 2061, 2071 and 2081) (PSEG 2014-TN3453).

Table G-4. Population/Distance in Miles

Year	Sectors	0–1	1–2	2–3	3–4	4–5	5–10	Total 0–10	10–20	20–30	30–40	40–50	Total 10–50	Total 0–50
2010	N	0	0	0	0	105	224	–	146,379	127,017	180,586	171,958	625,940	626,269
2021	N	0	0	0	0	112	240	352	155,730	134,747	210,005	194,320	694,802	695,154
2031	N	0	0	0	0	120	257	377	162,469	140,863	237,903	214,653	755,888	756,265
2041	N	0	0	0	0	129	275	404	169,510	147,356	269,731	237,612	824,209	824,613
2051	N	0	0	0	0	138	195	433	176,867	154,261	306,050	263,562	900,740	901,173
2061	N	0	0	0	0	148	316	464	184.555	161,618	347,503	292,921	986,597	987,061
2071	N	0	0	0	0	158	338	496	192,589	169,469	394.822	326,165	1,083,045	1,083,541
2081	N	0	0	0	0	170	362	532.2	00.986	177,866	448,847	363,839	1,191,538	1,192,070
2010	NNE	0	0	3	5	31	5,398	5,437	17,013	135,920	883,240	1,003,853	2,040,026	2,045,463
2021	NNE	0	0	3	6	33	5,775	5,817	18,210	141,555	886,469	1,006,508	2,052,742	2,058,559
2031	NNE	0	0	4	6	36	6,186	6,232	19,519	147,943	896,061	1,012,808	2,076,331	2,082,563
2041	NNE	0	0	4	7	38	6,627	6,676	20,924	154,763	906,131	1,019,671	2,101,489	2,108,165
2051	NNE	0	0	4	7	41	7,100	7,152	22,430	162,055	916,696	1,027,119	2,128,300	2,135,452
2061	NNE	0	0	5	8	44	7,606	7,663	24,045	169,864	927,771	1,035,179	2,156,859	2,164,522
2071	NNE	0	0	5	8	47	8,148	8,208	25,777	178,240	939,374	1,043,880	2,187,271	2,195,479
2081	NNE	0	0	5	9	50	8,729	8,793	27,634	187,239	951,522	1,053,252	2,219,647	2,228,440
2010	NE	0	0	1	5	42	3,200	3,248	9,052	79,314	443,708	498,939	1,031,013	1,034,261
2021	NE	0	0	1	6	44	3,423	3,474	9,707	88,435	473,816	525,180	1,097,138	1,100,612
2031	NE	0	0	2	6	48	3,667	3,723	10,425	98,741	503,842	550,506	1,163,514	1,167,237
2041	NE	0	0	2	7	51	3,928	3,988	11,198	110,249	536,375	577,796	1,235,618	1,239,606
2051	NE	0	0	2	7	55	4,209	4,273	12,029	123,099	571,658	607,203	1,313,989	1,318,262
2061	NE	0	0	2	8	59	4,509	4,578	12,924	137,449	609,960	638,891	1,399,224	1,403,802
2071	NE	0	0	2	8	63	4,830	4,903	13,887	153,473	651,580	673,037	1,491,977	1,496,880
2081	NE	0	0	2	9	67	5,174	5,252	14,923	171,366	696,849	709,835	1,592,973	1,598,225
2010	ENE	0	0	12	31	193	1,160	1,396	4,681	39,356	94,959	45,462	184,458	185,854
2021	ENE	0	0	12	33	206	1,240	1,491	5,006	43,441	103,127	49,543	201,117	202,608
2031	ENE	0	0	13	36	221	1,329	1,599	5,353	48,004	111,616	53,473	218,446	220,045
2041	ENE	0	0	14	38	237	1,424	1,713	5,724	53,066	120,923	57,732	237,445	239,158

Table G-1 (continued)

Year	Sectors	0–1	1–2	2–3	3–4	4–5	5–10	Total 0–10	10–20	20–30	30–40	40–50	Total 10–50	Total 0–50
2051	ENE	0	0	15	41	254	1,525	1,835	6,120	58,682	131,133	62,349	258,284	260,119
2061	ENE	0	0	16	44	272	1,634	1,966	6,545	64,915	142,343	67,355	281,158	283,124
2071	ENE	0	0	17	47	291	1,750	2,105	6,999	71,834	154,660	72,783	306,276	308,381
2081	ENE	0	0	19	50	312	1,875	2,256	7,485	79,517	168,204	78,672	333,878	336,134
2010	E	0	0	9	29	26	1,020	1,084	26,614	74,640	23,952	45,739	170,945	172,029
2021	E	0	0	9	31	28	1,091	1,159	28,407	79,806	26,125	50,365	184,703	185,862
2031	E	0	0	10	33	30	1,166	1,239	29,724	83,782	28,230	55,176	196,912	198,151
2041	E	0	0	11	36	32	1,247	1,326	31,103	87,973	30,520	60,446	210,042	211,368
2051	E	0	0	11	38	34	1,333	1,416	32,546	92,392	33,010	66,219	224,167	225,583
2061	E	0	0	12	41	36	1,426	1,515	34,056	97,054	35,721	72,543	239,374	240,889
2071	E	0	0	13	44	39	1,525	1,621	35,637	101,974	38,671	79,472	255,754	257,375
2081	E	0	0	14	47	42	1,631	1,734	37,292	107,168	41,884	87,062	273,406	275,140
2010	ESE	0	0	0	0	3	380	383	20,279	24,928	10,673	21,323	77,203	77,586
2021	ESE	0	0	0	0	3	405	408	21,644	26,606	11,362	22,000	81,612	82,020
2031	ESE	0	0	0	0	3	425	428	22,636	27,825	11,887	22,947	85,295	85,723
2041	ESE	0	0	0	0	3	446	449	23,674	29,100	12,437	23,939	89,150	89,599
2051	ESE	0	0	0	0	3	467	470	24,759	30,434	13,012	24,978	93,183	93,653
2061	ESE	0	0	0	0	4	490	494	25,893	31,829	13,615	26,067	97,404	97,898
2071	ESE	0	0	0	0	4	514	518	27,080	33,288	14,247	27,210	101,825	102,343
2081	ESE	0	0	0	0	4	539	543	28,321	34,813	14,908	28,408	106,450	106,993
2010	SE	0	0	0	0	0	6	6	97	641	40	36,596	37,374	37,380
2021	SE	0	0	0	0	0	6	6	104	684	43	37,592	38,423	38,429
2031	SE	0	0	0	0	0	7	7	108	715	45	39,073	39,941	39,948
2041	SE	0	0	0	0	0	7	7	113	748	47	40,611	41,519	41,526
2051	SE	0	0	0	0	0	7	7	118	782	49	42,211	43,160	43,167
2061	SE	0	0	0	0	0	8	8	124	818	51	43,873	44,866	44,874
2071	SE	0	0	0	0	0	8	8	130	856	53	45,601	46,640	46,648
2081	SE	0	0	0	0	0	9	9	135	895	56	47,396	48,482	48,491

Table G-1 (continued)

Year	Sectors	0–1	1–2	2–3	3–4	4–5	5–10	Total 0–10	10–20	20–30	30–40	40–50	Total 10–50	Total 0–50
2010	SSE	0	0	0	0	0	6	6	152	1539	1304	6981	9976	9982
2021	SSE	0	0	0	0	0	6	6	170	1726	1510	8528	11,934	11,940
2031	SSE	0	0	0	0	0	7	7	182	1847	1659	9750	13,438	13,445
2041	SSE	0	0	0	0	0	7	7	195	1976	1824	11,148	15,143	15,150
2051	SSE	0	0	0	0	0	8	8	209	2115	2007	12,745	17,076	17,084
2061	SSE	0	0	0	0	0	8	8	224	2264	2211	14,572	19,271	19,279
2071	SSE	0	0	0	0	0	9	9	239	2422	2439	16,660	21,760	21,769
2081	SSE	0	0	0	0	0	10	10	256	2592	2693	19,048	24,589	24,599
2010	S	0	0	0	0	4	128	132	13,777	80,752	33,679	21,093	149,301	149,433
2021	S	0	0	0	0	4	139	143	15,453	90,578	38,350	25,476	169,857	170,000
2031	S	0	0	0	0	4	147	151	16,537	96,933	41,554	28,890	183,914	184,065
2041	S	0	0	0	0	4	154	158	17,697	103,733	45,056	32,777	199,263	199,421
2051	S	0	0	0	0	4	163	167	18,938	111,011	48,887	37,202	216,038	216,205
2061	S	0	0	0	0	5	171	176	20,266	118,800	53,084	42,243	234,393	234,569
2071	S	0	0	0	0	5	180	185	21,688	127,135	57,684	47,985	254,492	254,677
2081	S	0	0	0	0	5	190	195	23,209	136,055	62,733	54,529	276,526	276,721
2010	SSW	0	0	0	4	7	612	623	20,410	14,540	11,162	16,338	62,450	63,073
2021	SSW	0	0	0	4	7	651	662	22,708	16,471	13,139	19,344	71,662	72,324
2031	SSW	0	0	0	5	7	677	689	24,202	17,802	14,720	21,791	78,515	79,204
2041	SSW	0	0	0	5	8	705	718	25,798	19,249	16,501	24,564	86,112	86,830
2051	SSW	0	0	0	5	8	734	747	27,501	20,825	18,511	27,709	94,546	95,293
2061	SSW	0	0	0	5	8	764	777	29,319	22,542	20,779	31,274	103,914	104,691
2071	SSW	0	0	0	5	9	795	809	31,260	24,413	23,340	35,319	114,332	115,141
2081	SSW	0	0	0	6	9	828	843	33,333	26,456	26,232	39,908	125,929	126,772
2010	SW	0	0	1	6	8	1,772	1787	4,269	6,256	6,815	11,477	28,817	30,604
2021	SW	0	0	1	7	8	1,885	1,901	4,645	7,170	7,856	13,174	32,845	34,746
2031	SW	0	0	1	7	9	1,962	1,979	4,890	7,878	8,687	14,513	35,968	37,947
2041	SW	0	0	1	7	9	2,042	2,059	5,149	8,661	9,607	15,995	39,412	41,471

Table G-1 (continued)

Year	Sectors	0–1	1–2	2–3	3–4	4–5	5–10	Total 0–10	10–20	20–30	30–40	40–50	Total 10–50	Total 0–50
2051	SW	0	0	1	8	9	2,126	2,144	5,423	9,525	10,627	17,634	43,209	45,353
2061	SW	0	0	2	8	10	2,213	2,233	5,712	10,481	11,757	19,447	47,397	49,630
2071	SW	0	0	2	8	10	2,303	2,323	6,018	11,536	13,010	21,455	52,019	54,342
2081	SW	0	0	2	9	11	2,398	2,420	6,341	12,703	14,398	23,676	57,118	59,538
2010	WSW	0	0	2	16	154	4,262	4,434	3,687	3,722	11,737	28,284	47,430	51,864
2021	WSW	0	0	2	17	163	4,532	4,714	4,303	4,170	13,003	29,950	51,426	56,140
2031	WSW	0	0	2	18	170	4,718	4,908	4,782	4,454	13,760	30,266	53,262	58,170
2041	WSW	0	0	2	19	177	4,911	5,109	5,335	4,764	14,564	30,592	55,255	60,364
2051	WSW	0	0	2	19	184	5,112	5,317	5,975	5,104	15,422	30,928	57,429	62,746
2061	WSW	0	0	2	20	192	5,321	5,535	6,718	5,479	16,335	31,275	59,807	65,342
2071	WSW	0	0	2	21	200	5,539	5,762	7,582	5,893	17,309	31,632	62,416	68,178
2081	WSW	0	0	2	22	208	5,766	5,998	8,588	6,352	18,349	32,002	65,291	71,289
2010	W	0	0	2	134	322	14,199	14,657	6,170	6,108	56,270	198,557	267,105	281,762
2021	W	0	0	2	143	343	15,099	15,587	7,274	7,366	62,969	218,504	296,113	311,700
2031	W	0	0	2	148	357	15,718	16,225	8,181	8,219	64,348	222,304	303,052	319,277
2041	W	0	0	2	154	371	16,361	16,888	9,237	9,218	65,758	226,183	310,396	327,284
2051	W	0	0	2	161	386	17,031	17,580	10,471	10,391	67,198	230,141	318,201	335,781
2061	W	0	0	2	167	402	17,729	18,300	11,913	11,770	68,669	234,180	326,532	344,832
2071	W	0	0	2	174	419	18,455	19,050	13,602	13,391	70,173	238,303	335,469	354,519
2081	W	0	0	3	181	436	19,211	19,831	15,582	15,301	71,710	242,510	345,103	364,934
2010	WNW	0	0	52	162	276	3,906	4,396	26,208	30,162	34,621	26,919	117,910	122,306
2021	WNW	0	0	55	173	293	4,154	4,675	32,151	38,578	41,817	29,726	142,272	146,947
2031	WNW	0	0	57	180	305	4,324	4,866	37,126	45,710	47,031	30,866	160,733	165,599
2041	WNW	0	0	60	187	318	4,501	5,066	42,982	54,163	53,142	32,063	182,350	187,416
2051	WNW	0	0	62	195	331	4,685	5,273	49,881	64,181	60,313	33,321	207,696	212,969
2061	WNW	0	0	64	203	344	4,877	5,488	58,012	76,052	68,738	34,644	237,446	242,934
2071	WNW	0	0	67	211	358	5,077	5,713	67,604	90,120	78,647	36,035	272,406	278,119
2081	WNW	0	0	70	220	373	5,284	5,947	78,925	106,793	90,311	37,500	313,529	319,476

Table G-1 (continued)

Year	Sectors	0–1	1–2	2–3	3–4	4–5	5–10	Total 0–10	10–20	20–30	30–40	40–50	Total 10–50	Total 0–50
2010	NW	0	0	0	121	167	2,625	2,913	104,022	31,899	31,100	46,300	213,321	216,234
2021	NW	0	0	0	129	178	2,791	3,098	113,104	38,686	35,933	49,289	237,012	240,110
2031	NW	0	0	0	134	185	2,906	3,225	119,859	44,703	40,473	51,956	256,991	260,216
2041	NW	0	0	0	140	193	3,025	3,358	127,285	51,704	45,634	54,781	279,404	282,762
2051	NW	0	0	0	145	201	3,148	3,494	135,481	59,853	51,501	57,775	304,610	308,104
2061	NW	0	0	0	151	209	3,277	3,637	144,565	69,343	58,177	60,949	333,034	336,671
2071	NW	0	0	0	157	218	3,412	3,787	154,675	80,401	65,775	64,317	365,168	368,955
2081	NW	0	0	0	164	227	3,551	3,942	165,975	93,291	74,425	67,892	401,583	405,525
2010	NNW	0	0	0	87	27	1,798	1,912	132,354	81,031	83,847	57,711	354,943	356,855
2021	NNW	0	0	0	93	29	1,912	2,034	140,746	91,010	98,845	66,726	397,327	399,361
2031	NNW	0	0	0	97	30	1,990	2,117	146,509	99,795	113,009	75,203	434,516	436,633
2041	NNW	0	0	0	101	31	2071	2,203	152,509	109,665	129,202	84,838	476,214	478,417
2051	NNW	0	0	0	105	33	2,156	2,294	158,754	120,769	147,715	95,795	523,033	525,327
2061	NNW	0	0	0	109	34	2,244	2,387	165,255	133,274	168,881	108,260	575,670	578,057
2071	NNW	0	0	0	114	35	2,336	2,485	172,022	147,374	193,080	122,446	634,922	637,407
2081	NNW	0	0	0	118	37	2,432	2,587	179,067	163,291	220,746	138,597	701701	704,288

Source: PSEG 2014-TN3452.

In addition to the permanent residents within 10 mi of the PSEG Site, there are people that enter this area on a regular basis for employment, education (schools and daycare facilities), recreation (parks, wildlife areas, resorts, beaches, and associated lodging and restaurants), and medical care (hospitals and assisted living centers) (PSEG 2014-TN3453). The transient population data in Table G-2 are based primarily on 2009 surveys conducted by KLD Engineering (PSEG 2014-TN3453). These data assume that transient populations increase at the same rate as resident populations (PSEG 2014-TN3453).

Table G-5. Transient Population Distribution and Projections within 10 Mi of the PSEG Site, 2010 to 2081

Year	Distance in Miles						
	0–1	1–2	2–3	3–4	4–5	5–10	Total 0–10
2010	0	0	0	166	98	12,285	12,549
2021	0	0	0	176	105	13,097	13,378
2031	0	0	0	183	109	13,765	14,057
2041	0	0	0	191	116	14,470	14,777
2051	0	0	0	199	122	15,212	15,533
2061	0	0	0	206	129	15,997	16,332
2071	0	0	0	215	136	16,824	17,175
2081	0	0	0	224	143	17,696	18,063

Source: PSEG 2014-TN3452.

G.2 Supporting Documentation on Radiological Dose Assessment

The U.S. Nuclear Regulatory Commission (NRC) staff reviewed and performed an independent dose assessment of the radiological impacts from normal operation of new and existing nuclear units at the PSEG Site. The results of the assessment are presented in this appendix and are compared to the results from PSEG's assessment found in Section 5.9, Radiological Impacts of Normal Operations. The appendix is divided into four sections: (1) dose estimates to the public from liquid effluents; (2) dose estimates to the public from gaseous effluents; (3) cumulative dose estimates; and (4) dose estimates to the biota from gaseous and liquid effluents.

G.2.1 Dose Estimates to the Public from Liquid Effluents

The NRC staff used the dose assessment approach specified in Regulatory Guide 1.109 (NRC 1977-TN90) and the LADTAP II computer code (Strenge et al. 1986-TN82) to estimate doses to the maximally exposed individual (MEI) and population from the liquid effluent pathway of the proposed Lee Nuclear Station Units 1 and 2. The NRC staff used the projected radioactive effluent release values for the Salem Generating Station, Units 1 and 2 (SGS) and the Hope Creek Generating Station (HCGS) reactors to estimate doses to the MEI and

population from liquid effluent releases from a new nuclear power plant. The NRC staff used the projected radioactive effluents release values from the Site Safety Analysis Report (SSAR) (PSEG 2014-TN3453).

G.2.1.1 Scope

Doses from to the MEI were calculated and compared to regulatory criteria for the following:

- Total Body—Dose was the total for all pathways (i.e., ingestion of aquatic organisms as food and recreational activity on and near the Delaware River) with the highest value for either the adult, teen, child, or infant compared to the 3 mrem per year per reactor design objective in Title 10 of the *Code of Federal Regulations* (CFR), Part 50, Appendix I.

- Organ—Dose was the total for each organ for all pathways (i.e., ingestion of aquatic organisms as food and recreational activity on and near the Delaware River) with the highest value for the adult, teen, child, or infant compared to the 10 mrem per year per reactor design objective specified in 10 CFR Part 50, Appendix I.

The NRC staff reviewed the assumed exposure pathways and the input parameters and values used by PSEG (PSEG 2014-TN3452; PSEG 2014-TN3453) for appropriateness, including references made to the AP1000 (Westinghouse 2011-TN261). Default values from Regulatory Guide 1.109 (NRC 1977-TN90) were used when input parameters were not available. The NRC staff concluded that the assumed exposure pathways were appropriate; drinking water withdrawal from the Delaware River does not occur downstream of the site. In addition, the input parameters and values used by PSEG were generally appropriate.

G.2.1.2 Resources Used

To calculate doses to the public from liquid effluents, the NRC staff used a personal computer version of the LADTAP II code titled NRCDOSE, Version 2.3.15 (CNS 2006-TN102), obtained through the Oak Ridge Radiation Safety Information Computational Center (RSICC) with updates to the user interface obtained directly from Chesapeake Nuclear Services.

G.2.1.3 Input Parameters

Table G-3 provides a listing of the major parameters used in calculating dose to the public from liquid effluent releases during normal operation.

Table G-6. Parameters Used in Calculating Dose to the Public from Liquid Effluent Releases

Nuclide	Annual Release (Ci)		Nuclide	Annual Release (Ci)	
	Single Unit[(a)]	Dual Unit[(b)]		Single Unit[(a)]	Dual Unit[(b)]
H-3	1.66×10^{3}	3.32×10^{3}	Na-24	6.10×10^{-3}	1.22×10^{-2}
P-32	5.68×10^{-4}	1.14×10^{-3}	Cr-51	1.70×10^{-2}	3.40×10^{-2}
Mn-54	2.04×10^{-3}	4.08×10^{-3}	Fe-55	9.46×10^{-3}	1.89×10^{-2}
Mn-56	2.04×10^{-3}	4.08×10^{-3}	Co-58	9.80×10^{-3}	1.96×10^{-2}
Fe-59	2.30×10^{-3}	4.60×10^{-3}	Co-60	1.54×10^{-2}	3.08×10^{-2}
Ni-63	1.70×10^{-3}	3.40×10^{-3}	Cu-64	1.26×10^{-2}	2.52×10^{-2}
Zn-65	4.41×10^{-4}	8.82×10^{-4}	Br-84	2.00×10^{-5}	4.00×10^{-5}
Rb-88	2.80×10^{-2}	5.60×10^{-2}	Sr-89	3.14×10^{-4}	6.28×10^{-4}
Sr-90	2.68×10^{-5}	5.36×10^{-5}	Sr-91	1.25×10^{-3}	2.50×10^{-3}
Y-91	2.35×10^{-4}	4.70×10^{-4}	Y-91m	5.00×10^{-5}	1.00×10^{-4}
Sr-92	4.43×10^{-4}	8.86×10^{-4}	Y-92	1.69×10^{-3}	3.38×10^{-3}
Y-93	1.36×10^{-3}	2.72×10^{-3}	Nb-95	2.00×10^{-3}	4.00×10^{-3}
Zr-95	1.30×10^{-3}	2.60×10^{-3}	Mo-99	2.61×10^{-3}	5.22×10^{-3}
Tc-99m	5.68×10^{-3}	1.14×10^{-2}	Ru-103	4.93×10^{-3}	9.86×10^{-3}
Ru-106	7.35×10^{-2}	1.47×10^{-1}	Ag-110m	1.80×10^{-3}	3.60×10^{-3}
Sb-124	4.30×10^{-4}	8.60×10^{-4}	Te-129	3.10×10^{-4}	6.20×10^{-4}
Te-129m	1.20×10^{-4}	2.40×10^{-4}	I-131	3.40×10^{-2}	6.80×10^{-2}
Te-131	7.60×10^{-5}	1.52×10^{-4}	Te-131m	3.10×10^{-4}	6.20×10^{-4}
I-132	1.93×10^{-3}	3.86×10^{-3}	Te-132	4.80×10^{-4}	9.60×10^{-4}
I-133	3.73×10^{-2}	7.46×10^{-2}	Cs-134	1.20×10^{-2}	2.40×10^{-2}
I-134	8.10×10^{-4}	1.62×10^{-3}	I-135	1.50×10^{-2}	3.00×10^{-2}
Cs-136	2.20×10^{-2}	4.40×10^{-2}	Cs-137	1.80×10^{-2}	3.60×10^{-2}
Cs-138	8.00×10^{-7}	1.60×10^{-6}	Ba-140	5.80×10^{-3}	1.16×10^{-2}
La-140	8.00×10^{-3}	1.60×10^{-2}	Ce-141	2.97×10^{-4}	5.90×10^{-4}
Ce-143	6.10×10^{-4}	1.22×10^{-3}	Pr-143	1.30×10^{-4}	2.60×10^{-4}
Ce-144	5.60×10^{-3}	1.12×10^{-2}	Pr-144	3.16×10^{-3}	6.32×10^{-3}
Nd-147	2.00×10^{-6}	4.00×10^{-6}	W-187	4.60×10^{-4}	9.20×10^{-4}
Np-239	9.49×10^{-3}	1.90×10^{-2}			

Parameter	Staff Value	Comments
Discharge rate	20,000 gal/min 44.56 ft^3/s	Value from ER Table 5.4-3 (PSEG 2014-TN3452)
Source term multiplier	2	To convert single-unit source term to two units.
Site type	Salt water	Discharge to Delaware River
Impoundment Reconcentration Model	None	Value from ER Table 5.4-3 (PSEG 2014-TN3452)
Dilution factors for aquatic food and boating, shoreline, and swimming.	20	ER Table 5.4-3 (PSEG 2014-TN3452)
Transit time to receptor (hr)	0 hr	ER Table 5.4-3 (PSEG 2014-TN3452)

Table G-3 (continued)

Parameter	Staff Value	Comments
Consumption and usage factors for adults, teens, children, and infants	Shoreline usage (hr/yr) 12 (adult) 67 (teen) 14 (child) NA (infant) Boating exposure (hr/yr) 12 (adult) 67 (teen) 14 (child) NA (infant) Fish consumption (kg/yr) 21 (adult) 16 (teen) 6.9 (child) NA (infant)	LADTAP II code default values (NRC 1977-TN90; Strenge et al. 1986-TN82).
50 mi population	8,138,635	ER Table 5.4-3 (PSEG 2014-TN3452)
50 mi sport fishing[(c)]	5.62×10^7	ER Table 5.4-3 (PSEG 2014-TN3452)
50 mi invertebrate ingestion[(c)]	8.14×10^6	ER Table 5.4-3 (PSEG 2014-TN3452)
50 mi shoreline usage[(c)]	3.83×10^8 person-hr/yr	ER Table 5.4-3 (PSEG 2014-TN3452)
50 mi swimming usage[(c)]	7.65×10^7 person-hr/yr	ER Table 5.4-3 (PSEG 2014-TN3452)
50 mi boating usage[(c)]	7.65×10^7 person-hr/yr	ER Table 5.4-3 (PSEG 2014-TN3452)

(a) Single unit is the plant parameter envelope (PPE) bounding value from the Site Safety Analysis Report (SSAR) Table 1.3-8 (PSEG 2014-TN3453) and is included for single unit analysis throughout the section.
(b) Dual unit is the PPE bounding value from the SSAR Table multiplied by the source term multiplier.
(c) Parameter is based on LADTAP II default value.

G.2.1.4 Comparison of Results

The results documented in the PSEG environmental report (ER) (PSEG 2014-TN3452) and Site Safety Analysis Report (SSAR) (PSEG 2014-TN3453) for doses from liquid effluent releases are compared in Table G-4 with the results calculated by the NRC staff. The doses calculated by the NRC staff are in agreement with doses calculated by PSEG. For calculating the population dose from liquid effluents, PSEG used the population distribution for 2036. However, Section 5.4.1 of the NRC's Environmental Standard Review Plan (ESRP) (NRC 1999-TN614) requires use of "projected population for 5 years from the time of the licensing action under consideration." Because the population is increasing, the use of the year 2036 is conservative as long as operations at the site begin before then, so the NRC staff also used the year 2036 for comparisons.

Table G-7. Comparison of Doses to the Public from Liquid Effluent Releases for a New Nuclear Power Plant

Type of Dose	PSEG ER or SSAR[(a)]	NRC Staff Calculation	Percent Difference
Total body (mrem/yr)	0.02 (adult)	0.02 (adult)	0
Organ dose (mrem/yr)	0.18 (adult GI-LLI)	0.18 (adult GI-LLI)	0
Thyroid (mrem/yr)	0.04 (adult)	0.04 (adult)	0
Total body population dose from liquid pathway (person-rem/yr)	45.5	45.5	0

Note: GI-LLI = gastrointestinal lining of lower intestine.
(a) Results from PSEG ER Tables 5.4-4 and 5.4-11 (PSEG 2014-TN3452).

G.2.2 Dose Estimates to the Public from Gaseous Effluents

The NRC staff used the dose assessment approach specified in Regulatory Guide 1.109 (NRC 1977-TN90), and the XOQDOQ and GASPAR II computer code (Sagendorf et. al. 1982-TN280; Strenge et al. 1987-TN83) to estimate doses to the MEI and to the population within an 80-km (50 mi) radius of the PSEG Site from the gaseous effluent pathway for the new nuclear power plant. The NRC staff used the projected radioactive gaseous effluents release values from the SSAR (PSEG 2014-TN3453).

G.2.2.1 Scope

The NRC staff and PSEG calculated the MEI dose at 2.8 mi northwest (NW) of a new nuclear power plant at the PSEG Site. Pathways included were plume, ground, inhalation, and ingestion of locally grown meat, milk, and vegetables. The NRC staff reviewed the parameters and values used by PSEG (PSEG 2014-TN3453) for appropriateness, including references to the AP1000 Design Control Document (Westinghouse 2011-TN261). Default values from Regulatory Guide 1.109 (NRC 1977-TN90) were used when site-specific input parameters were not available. The NRC staff concluded that the assumed exposure pathways and input parameters were appropriate. These pathways and parameters were used by the NRC staff in its independent calculations using GASPAR II.

Joint frequency distribution data of wind speed and wind direction by atmospheric stability class for the proposed site provided in SSAR Table 2.3-27 (PSEG 2014-TN3453) were used as input to the XOQDOQ code (Sagendorf et. al. 1982-TN280) to calculate average atmospheric dispersion factor (χ/Q, the annual average normalized air concentration value[s]) and deposition factor (D/Q, the annual normalized total surface concentration rate[s]) values for routine releases. The NRC staff reviewed the XOQDOQ output files provided by PSEG and concluded they are appropriate for use in dose calculations for the gaseous effluents.

Population doses were calculated for all types of releases (i.e., noble gases, particulates, iodines, H-3, and C-14) using the GASPAR II code for the following: plume immersion; direct radiation from radionuclides deposited on the ground; inhalation; and ingestion of vegetables, milk, and meat.

G.2.2.2 Resources Used

To calculate doses to the public from gaseous effluents, the NRC staff used a personal computer version of the XOQDOQ and GASPAR II codes titled NRCDOSE Version 2.3.15 (CNS 2006-TN102) obtained through the Oak Ridge RSICC with updates to the user interface obtained directly from Chesapeake Nuclear Services.

G.2.2.3 Input Parameters

Table G-5 provides a listing of the major parameters used in calculating dose to the public from gaseous effluent releases during normal operation.

Table G-8. Parameters Used in Calculating Dose to the Public from Gaseous Effluent Releases

Nuclide	Single Unit[(a)]	Dual Unit[(b)]	Nuclide	Single Unit[(a)]	Dual Unit[(b)]
H-3	3.50×10^{2}	7.0×10^{2}	C-14	1.89×10^{1}	3.78×10^{1}
Na-24	4.05×10^{-3}	8.11×10^{-3}	P-32	9.19×10^{-4}	1.84×10^{-3}
Ar-41	3.40×10^{1}	6.80×10^{1}	Cr-51	3.51×10^{-2}	7.03×10^{-2}
Mn-54	5.41×10^{-3}	1.08×10^{-2}	Fe-55	6.49×10^{-3}	1.30×10^{-2}
Mn-56	3.51×10^{-3}	7.03×10^{-3}	Co-57	8.20×10^{-6}	1.64×10^{-5}
Co-58	2.30×10^{-2}	4.60×10^{-2}	Fe-59	8.11×10^{-4}	1.62×10^{-3}
Co-60	1.30×10^{-2}	2.59×10^{-2}	Ni-63	6.49×10^{-6}	1.30×10^{-5}
Cu-64	1.00×10^{-2}	2.00×10^{-2}	Zn-65	1.11×10^{-2}	2.22×10^{-2}
Kr-83m	8.38×10^{-4}	1.68×10^{-3}	Kr-85	4.10×10^{3}	8.20×10^{3}
Kr-85m	1.50×10^{2}	3.00×10^{2}	Kr-87	5.30×10^{1}	1.06×10^{2}
Kr-88	1.80×10^{2}	3.60×10^{2}	Kr-89	2.41×10^{2}	4.81×10^{2}
Rb-89	4.32×10^{-5}	8.65×10^{-5}	Sr-89	5.68×10^{-3}	1.14×10^{-2}
Sr-90	1.20×10^{-3}	2.40×10^{-3}	Y-90	4.59×10^{-5}	9.19×10^{-5}
Sr-91	1.00×10^{-3}	2.00×10^{-3}	Sr-92	7.84×10^{-4}	1.57×10^{-3}
Y-91	2.41×10^{-4}	4.81×10^{-4}	Y-92	6.22×10^{-4}	1.24×10^{-3}
Y-93	1.11×10^{-3}	2.22×10^{-3}	Zr-95	1.59×10^{-3}	3.19×10^{-3}
Nb-95	8.38×10^{-3}	1.68×10^{-2}	Mo-99	5.95×10^{-2}	1.19×10^{-1}
Tc-99m	2.97×10^{-4}	4.38×10^{-4}	Ru-103	3.51×10^{-3}	7.03×10^{-3}
Ru-106	7.80×10^{-5}	1.56×10^{-4}	Ag-110m	2.00×10^{-6}	4.00×10^{-6}
Sb-124	1.81×10^{-4}	3.62×10^{-4}	Sb-125	6.10×10^{-5}	1.22×10^{-4}
Te-129m	2.19×10^{-4}	4.38×10^{-4}	Te-131m	7.57×10^{-5}	1.51×10^{-4}
Te-132	1.89×10^{-5}	3.78×10^{-5}	I-131	2.59×10^{-1}	5.19×10^{-1}
Xe-131m	2.70×10^{3}	5.40×10^{3}	I-132	2.19	4.38
I-133	1.70	3.41	Xe-133	7.20×10^{3}	1.44×10^{4}
Xe-133m	1.70×10^{2}	3.40×10^{2}	Cs-134	6.22×10^{-3}	1.24×10^{-2}
I-134	3.78	7.57	I-135	2.41	4.81
Xe-135	1.20×10^{3}	2.40×10^{3}	Xe-135m	4.05×10^{2}	8.11×10^{2}
Cs-136	5.95×10^{-4}	1.19×10^{-3}	Cs-137	9.46×10^{-3}	1.89×10^{-2}

Table G-5 (continued)

Nuclide	Single Unit[(a)]	Dual Unit[(b)]	Nuclide	Single Unit[(a)]	Dual Unit[(b)]
Xe-137	5.14×10^{2}	1.03×10^{3}	Cs-138	1.70×10^{-4}	3.41×10^{-4}
Xe-138	4.32×102	8.65×102	Ba-140	2.70×10-2	5.41×10-2
La-140	1.81×10-3	3.62×10-3	Ce-141	9.19×10-3	1.84×10-2
Ce-144	1.89×10-5	3.78×10-5	W-187	1.89×10-4	3.78×10-4
Np-239	1.19×10-2	2.38×10-2			

Parameter	Staff Value	Comments
Wind speed and direction	SSAR Table 2.3-72 (PSEG 2014-TN3453)	Site-specific data for 3-yr period 2006–2008
Atmospheric dispersion coefficients	SSAR Table 2.3-35 (PSEG 2014-TN3453)	Site-specific data
Ground deposition coefficient	SSAR Table 2.3-36 (PSEG 2014-TN3453)	Site-specific data
Annual milk production within 50 mi radius of site	3.26×10^{9} L/yr	Site-specific data from ER Table 5.4-7 (PSEG 2014-TN3452)
Annual vegetable production within 50 mi radius of site	5.65×10^{9} kg/yr	Site-specific data from ER Table 5.4-7 (PSEG 2014-TN3452)
Annual meat production within 50 mi radius of site	8.95×10^{8} kg/yr	Site-specific data from ER Table 5.4-7 (PSEG 2014-TN3452)
Receptor locations and dispersion coefficients		Site specific values ER Table 5.4-5 (PSEG 2014-TN3452)

MEI Location	Atmospheric Dispersion Coefficient χ/Q (s m^{-3})			D/Q (m^{-2})
	No Decay/ Undepleted	2.26-Day Half-life/ Undepleted	8-day Half-life/ Depleted	
Nearest Meat Animal, 4.9 mi NW	1.1×10^{-7}	1.1×10^{-7}	8.2×10^{-8}	3.5×10^{-10}
Nearest Milk-Producing Animals (Cow/Goat), 4.9 mi NW	1.1×10^{-7}	1.1×10^{-7}	8.2×10^{-8}	3.5×10^{-10}
Nearest Residence, 2.8 mi NW	2.4×10^{-7}	2.4×10^{-7}	1.9×10^{-7}	9.6×10^{-10}
Nearest Vegetable Garden, 4.9 mi NW	1.1×10^{-7}	1.1×10^{-7}	8.2×10^{-8}	3.5×10^{-10}
Nearest Site Boundary, 0.24 mi ENE	1.0×10^{-5}	1.0×10^{-5}	9.5×10^{-6}	4.1×10^{-8}

Consumption factors

	Maximum consumption factors; ER Table 5.4-6 (PSEG 2014-TN3452)			
	Adult	Teen	Child	Infant
Milk (L/yr)	310	400	330	330
Meat (kg/yr)	110	65	41	0
Vegetables(kg/yr)				
Leafy	64	42	26	0
Other	520	630	520	0

Table G-5 (continued)

Parameter	Staff Value	Comments
Fraction of year leafy vegetables are grown	1.0	Site-specific value SSAR Table 11.3-2 (PSEG 2014-TN3453)
Fraction of year milk cows are on pasture	1.0	Site-specific value SSAR Table 11.3-2 (PSEG 2014-TN3453)
Fraction of MEI's vegetable intake from own garden	0.76	Site-specific value SSAR Table 11.3-2 (PSEG 2014-TN3453)
Fraction of year beef cattle on pasture	1.0	Site-specific value SSAR Table 11.3-2 (PSEG 2014-TN3453)

(a) Single unit is the PPE bounding value from the SSAR Table 1.3-7 (PSEG 2014-TN3453) and is included for single unit analysis throughout the section.
(b) Dual unit is the PPE bounding value from the SSAR Table multiplied by the source term multiplier.

G.2.2.4 Comparison of Doses to the Public from Gaseous Effluent Releases

The NRC staff compared results documented in the SSAR and in PSEG's responses to requests for information (PSEG 2014-TN3453) about doses from noble gases at the site boundary and the exclusion area boundary with the results calculated by the NRC staff. The doses calculated by the NRC staff confirmed the doses calculated by PSEG.

The NRC staff compared its estimates of doses to the MEI calculated by PSEG. Doses to the MEI estimated by PSEG were calculated by summing doses from the maximum locations of each exposure pathway. The doses calculated by the NRC staff confirmed the doses calculated by PSEG.

G.2.2.5 Comparison of Results—Population Doses

The NRC staff performed a comparison of the PSEG population-dose estimates taken from Table 5.4-12 of the ER (PSEG 2014-TN3452) with the staff estimates. The staff's independent calculation for population dose yielded results that were comparable to the PSEG SSAR estimates (PSEG 2014-TN3453) for a new nuclear power plant. For calculating the population dose from gaseous effluents, the population distribution used by PSEG and the NRC staff was for year 2056. However, ESRP Section 5.4.1 (NRC 1999-TN614) requires use of "projected population for 5 years from the time of the licensing action under consideration." Assuming the combined construction permit and operating license action occurs in year 2010, adding 5 years yields year 2015. Because the population is increasing, the use of the year 2056 is more conservative than required by the rule and has been used herein. The NRC staff estimates confirmed the estimates by PSEG (PSEG 2014-TN3452) to two significant digits.

G.2.3 Cumulative and Population Dose Estimates

Based on parameters shown for the liquid and gaseous pathways, Table G-3 and Table G-5, respectively, the NRC staff compared the results documented in the ER (PSEG 2014-TN3452) for cumulative dose estimates to the MEI with those calculated by the NRC staff. Cumulative dose estimates include doses from all pathways (i.e., direct exposure, liquid effluents, and

gaseous effluents) for a new nuclear power plant at the PSEG Site, as well as the existing SGS and HCGS units. These cumulative dose estimates were calculated for comparison to the dose standards of 40 CFR Part 190. The NRC staff's calculations for cumulative dose confirmed the PSEG estimates (PSEG 2014-TN3452) and are shown in Table G-6.

Table G-9. Comparison of Cumulative Doses to the MEI

Dose	PSEG[(a,b,c)]	NRC Estimates	Percent Difference
Whole body (adult liquid + child gaseous, mrem/yr)	2.94	2.94	0
Thyroid dose (adult liquid + infant gaseous, mrem/yr)	6.86	6.86	0
Dose to other organ (adult liquid GI-LLI + child gaseous bone, mrem/yr)	3.97	3.97	0

(a) *Source:* PSEG 2014-TN3452.
(b) Doses from direct radiation were from a single unit Advanced Boiling Water Reactor (ABWR) configuration. The direct doses from the other reactor technology configurations are less than the ABWR.
(c) Sum of doses from liquid effluent, gaseous effluent, and direct radiation.

G.2.4 Dose Estimates to the Nonhuman Biota from Liquid and Gaseous Effluents

The NRC staff performed confirmatory calculations of the doses to biota from liquid and gaseous effluents using the LADTAP II and GASPAR II. The NRC staff used a personal computer version of the LADTAP II code and GASPAR II code titled NRCDOSE Version 2.3.15 (CNS 2006-TN102) obtained through the Oak Ridge RSICC.

G.2.4.1 Liquid Effluent Pathways

The NRC estimated doses to biota from liquid effluents using fish, invertebrates, and algae as surrogate aquatic biota species. Muskrats, raccoons, herons, and ducks are used as surrogate terrestrial biota species. The NRC staff recognizes the LADTAP II computer program as an appropriate method for calculating dose to the aquatic biota and for calculating the liquid pathway contribution to terrestrial biota. Most of the LADTAP II input parameters are specified in Section G.2.1.3. The NRC staff's dose analysis confirmed the liquid pathway doses to biota estimated by PSEG.

G.2.4.2 Gaseous Effluent Pathways

The NRC staff assessed doses to terrestrial biota from the gaseous effluent pathway based on the results of the GASPAR II calculations for human doses discussed in Section G.2.2. Again, muskrats, raccoons, herons, and ducks are used as surrogate terrestrial biota species. The NRC staff assessed the doses at the site boundary (0.24 mi ENE) to achieve a reasonable estimate of the doses to terrestrial biota that might live on the PSEG Site. It was assumed that doses for raccoons and ducks were equivalent to adult human doses for inhalation, vegetation ingestion, and the plume. The dose from ground exposure was doubled. The doubling of doses from ground deposition reflects the closer proximity of these organisms to the ground. Muskrats and herons do not consume terrestrial vegetation, so that pathway was not included for these

organisms. The NRC staff's dose assessment confirmed the gaseous pathway doses to biota estimated by PSEG as shown in Table 5-19 in Volume 1 of this EIS.

G.3 References

CNS (Chesapeake Nuclear Services, Inc.). 2006. *NRCDose for Windows, Suite of NRC's Dose Modeling Codes for Reactor Radioactive Effluents.* Annapolis, Maryland. Available at http://www.chesnuc.com/docs/NRCDose%20Datasheet.pdf. TN102.

NRC (U.S. Nuclear Regulatory Commission). 1977. *Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I*. Regulatory Guide 1.109, Revision 1, Washington, D.C. Accession No. ML003740384. TN90.

NRC (U.S. Nuclear Regulatory Commission). 1999. *Environmental Standard Review Plan-Standard Review Plans for Environmental Reviews for Nuclear Power Plants: Environmental Standard Review Plan*. Volumes 1 and 2, NUREG-1555, Washington, D.C. Accession Nos. ML003702134 and ML003701937. TN614.

PSEG (PSEG Power LLC and PSEG Nuclear LLC). 2014. *PSEG Site Early Site Permit Application,* Part 2; "Site Safety Analysis Report." Revision 3, Newark, New Jersey. Accession No. ML14093A922. TN3453.

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Strenge, D.L., R.A. Peloquin, and G. Whelan. 1986. *LADTAP II—Technical Reference and User Guide*. NUREG/CR-4013, Pacific Northwest National Laboratory, Richland, Washington. Accession No. ML14098A069. TN82.

Strenge, D.L., T.J. Bander, and J.K. Soldat. 1987. *GASPAR II—Technical Reference and User Guide*. NUREG/CR-4653, Pacific Northwest National Laboratory, Richland, Washington. Accession No. ML14098A066. TN83.

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APPENDIX H

LIST OF AUTHORIZATIONS, PERMITS, AND CERTIFICATIONS

APPENDIX H

LIST OF AUTHORIZATIONS, PERMITS, AND CERTIFICATIONS

Table H-1 contains a list of the environmental-related authorizations, permits, and certifications potentially required by Federal, State, regional, local, and affected Native American tribal agencies related to site preparation, construction, and operation of a new nuclear power plant at the PSEG Nuclear LLC (PSEG) Site. Table H-1 has been adapted from Table 1.3-2 of the Environmental Report submitted to the U.S. Nuclear Regulatory Commission by the applicant (PSEG 2014-TN3452).

References

PSEG (PSEG Power LLC and PSEG Nuclear LLC). 2013. *PSEG Site Early Site Permit Application;* Part 3, "Environmental Report." Revision 2, Newark, New Jersey. Accession No. ML14093B256. TN3452.

Table H-1. Authorizations, Permits, and Certifications Required for Preconstruction, Construction, and Operation Activities[(a)]

Agency	Authority	Requirement	Activity Covered/Comments
U.S. Nuclear Regulatory Commission (NRC)	Atomic Energy and Energy Reorganization Acts 10 CFR Part 52 Subpart C or 10 CFR 50.10(e)(1)	ESP and combined construction permit and operating license (COL) or Limited Work authorization, in addition to applicable By-Product License, Source Material License, and Special Nuclear Material License	Site Licensing, including safety-related construction activities and operation of a nuclear power facility
Federal Aviation Administration	Federal Aviation Act 49 USC 1501; 14 CFR 77	Construction Notice	Notice of erection of structures greater than 200 ft high that potentially may impact air navigation
U.S. Department of Transportation	Hazardous Material Transportation Act 40 CFR 107 Subpart G	Certificate of Registration	Transportation of hazardous materials
U.S. Army Corps of Engineers	Federal Clean Water Act 33 CFR 330	Section 404 Permit	Disturbance, crossing, or filling-in of wetland areas or navigable waters from site (barge slip modification, maintenance dredging, intake/discharge structures, and proposed causeway construction)
	Rivers and Harbors Act 33 USC 403	Section 10 Permit	Construction and maintenance of intake, discharge, and barge structures in navigable waters of Delaware River
U.S. Coast Guard	Ports and Waterways Safety Act 33 USC 1221, et seq.	Private Aids to Navigation Permit	Construction of discharge pipeline in navigable waters of the Delaware River
	Rivers and Harbors Act 33 USC 401	Section 9 Permit	Construction of bridge over navigable waterway (Alloway Creek)
U.S. Environmental Protection Agency (EPA)	Resource Conservation and Recovery Act, Section 3010	Acknowledgement of Notification of Hazardous Waste Activity	Hazardous Waste Generation
	EPA Facility Response Plan (40 CFR 9 and 112), and the EPA Hazardous Waste Contingency Plan	Facility Response Plan Approval	Spill/Discharge Response Program

Table H-1 (continued)

Agency	Authority	Requirement	Activity Covered/Comments
	Spill Prevention, Control, and Countermeasures (SPCC) rule (40 CFR 112), Appendix F, Sections 1.2.1 and 1.2.2	SPCC Plan	Spill/Discharge Prevention Plan
U.S. Fish and Wildlife Service	Migratory Bird Treaty Act 16 USC 703 et seq.	Federal Depredation Permit	Potential impacts to protected species or their nests from construction of the proposed causeway
	Endangered Species Act Section 7 (16 USC 1536)	Incidental Take Permit	Possession and disposition of potential impinged or stranded species (turtles, shortnose sturgeon)
Delaware River Basin Commission	Delaware River Basin Compact, Section 3.8; Resolution No. 71-4	Water Withdrawal Docket	Additional Delaware River water required for cooling purposes
		Water Withdrawal Docket	Additional groundwater required for a new plant and existing permit modifications
		Water Use Contract	A water use contract may be required for the new plant
		Approval of Wells	New wells required for the new plant
		Oxygen Demand Wasteload Allocations	Allocation for first stage oxygen demand discharge to Delaware River Estuary
	Delaware River Basin Compact, Section 3.8	Industrial Waste Treatment Facility	Waste treatment required for a new plant
Salem County Soil Conservation District	Soil Erosion and Sediment Control (SESC) Act, SESC Act, Chapter 251 NJAC 2:90	Soil Erosion and Sediment Control Plan Approval	SESC Plan approval required for earth disturbance greater than 5,000 ft^2
Lower Alloways Creek Township	Code of Lower Alloways Creek Township, Chapter 156 (Land Development), Section 5.07B2	Site Plan Approval	Planning Board and/or Zoning Board of Adjustment approval of the development of the site in compliance with township ordinances
		Construction Permits	Construction of the new plant facilities in compliance with township ordinances

Table H-1 (continued)

Agency	Authority	Requirement	Activity Covered/Comments
Salem County	Salem County Planning Board	Site Plan Approval	Construction of the new plant facilities in compliance with county ordinances if county facilities or drainage are impacted
New Jersey Department of Community Affairs	New Jersey State Uniform Construction Code Act, NJAC 5:23	Construction Permits	Construction of the new plant facilities in compliance with State of New Jersey construction codes
New Jersey Department of Environmental Protection	Federal Clean Water Act (33 USC 1251 et seq.), NJSA Water Pollution Control Act 58:10A et seq. and NJAC 7:14A et seq.	New Jersey Pollutant Discharge Elimination System (NJPDES) Permit for stormwater discharges associated with construction activities greater than 5 ac	Construction/operation of stormwater control measures (detention basins, etc.)
		NJPDES Permit for Dewatering Activities	Construction dewatering
		Section 401 Certification, NJPDES Permit	Compliance with federal and state water quality standards, discharges to waters of the state because of construction of the new plant, proposed causeway, switchyards, and on-site transmission lines
	Sewage Infrastructure Improvement Act NJAC 7:14A-22	Treatment Works Approval	Construction and operation of a treatment system for construction dewatering
		Treatment Works Approval	Modification and operation of an existing permanent treatment system for plant wastewater
	Water Quality Management Planning, NJAC 7:15	Water Quality Management Plan Amendment	New discharges or expansion of existing discharges require an amendment
	Federal Clean Water Act (33 USC 1251 et seq.), NJSA Water Pollution Control Act 58:10A et seq. and NJAC 7:14A et seq.	NJPDES Permit for plant operation activities	Cooling water, service water, and runoff discharge from plant operations
	Water Supply Management Act, NJSA 58:1A-1 et seq.	Temporary Dewatering Permit	Required for construction dewatering where dewatering rate exceeds 100,000 gpd for 31 consecutive days in a year

Table H-1 (continued)

Agency	Authority	Requirement	Activity Covered/Comments
		Well Drilling Permit	For construction dewatering wells, permanent water supply wells, and closure of abandoned wells
		Water Allocation Permit	Current permit requires modification to allow additional groundwater use for new plant
New Jersey Department of Environmental Protection (continued)	Coastal Area Facility Review Act (CAFRA), NJSA 13:19-1, 13:9B-1 and 13:1D-1	CAFRA Permit[(b)]	Property required for construction of the new plant is in New Jersey coastal zone Portions of the new plant site, proposed causeway, switchyards, and on-site transmission lines may be located in freshwater wetlands and transitional areas
	Flood Hazard Area Control Act, NJSA 58:16A-50 et seq.	Flood Hazard Control Permit	Construction within a flood hazard area (100-yr floodplain)
	New Jersey Freshwater Wetlands Protection Act, NJAC 7:7A	Freshwater Wetland Permit	Portions of the new plant site, proposed causeway, switchyards, and on-site transmission lines may be located in freshwater wetlands and transitional areas
	New Jersey Wetlands Act, NJSA 13:9A	Coastal Wetlands Permit	Portions of new plant site, proposed causeway, and on-site transmission lines constructed in areas designated as coastal wetlands
	Waterfront Development Act, NJSA 12:5-1, 13:19-1, 13:9B-1, and 13:1D-1	Waterfront Development Permit	Required for any activity occurring below mean high water line (dredging/construction)
	Tidelands Act NJSA 12:3	Grant, Lease, or License	Portions of new plant site, proposed causeway, or on-site transmission lines may be constructed in lands subject to tidelands claims
	Solid Waste Management Act, NJSA 13:1 E-1	Beneficial Use Certificate of Authority	Re-use of excavated materials
	Federal Clean Air Act, 42 USC 7401	Title V Operating Permit; Prevention of Significant Deterioration Preconstruction Permit	Discharge of air pollutants from cooling tower(s), emergency generators, auxiliary boiler(s), and ancillary equipment

Table H-1 (continued)

Agency	Authority	Requirement	Activity Covered/Comments
	NJAC, Title 7, Chapter 1E (NJAC 7:1E-1 et seq.)	Discharge Prevention, Containment, and Countermeasure (DPCC) Plan and Discharge Cleanup and Removal Plan	DPCC/Discharge Cleanup and Removal Program: DPCC Plan, Discharge Cleanup and Removal Plan, SPCC Plan, Hazardous Waste Contingency Plan, and Stormwater Pollution Prevention Plan (SWPPP)
South Carolina Department of Health and Environmental Control—Division of Waste Management	South Carolina Radioactive Waste Transportation and Disposal Act (Act No. 429)	South Carolina Radioactive Waste Transport Permit	Transportation of radioactive waste into the State of South Carolina
State of Tennessee Department of Environment and Conservation Division of Radiological Health	Tennessee Department of Environment and Conservation, Rule 1200-2-10.32	Tennessee Radioactive Waste License- for-Delivery	Transportation of radioactive waste into the State of Tennessee

Notes: NJSA = New Jersey Statutes Annotated; USC = United States Code.
(a) None of the authorizations were applied for at the time of the ESP application, except for the New Jersey Coastal Consistency Determination, which was filed concurrently with the submittal of the ESP.
(b) Includes State Planning Commission action to modify state plan to update the heavy industry–transportation–utility node based on revised PSEG property boundary.

APPENDIX I

PSEG SITE CHARACTERISTICS AND PLANT PARAMETER ENVELOPE VALUES

APPENDIX I

PSEG SITE CHARACTERISTICS AND PLANT PARAMETER ENVELOPE VALUES

The specific early site permit (ESP) site characteristics and plant parameter envelope (PPE) values used in this document are from Chapter 3 of the Environmental Report (PSEG 2014-TN3452) and Tables 1.3-1 and 2.0-1 of the Site Safety Analysis Report (PSEG 2014-TN3453) unless otherwise specified. The review team used these characteristics and values in its independent evaluation of the environmental impacts of the proposed new plant. In some cases, as noted, the review team substituted values based on its own analysis. The ESP site characteristics and PPE values used in the review team's evaluation are presented in Table I-1 and Table I-2, respectively.

References

PSEG (PSEG Power LLC and PSEG Nuclear LLC). 2014. *PSEG Site Early Site Permit Application,* Part 2; "Site Safety Analysis Report." Revision 3, Newark, New Jersey. Accession No. ML14093B256. TN3452.

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Table I-1. PSEG Site Characteristics

Site Characteristic		PSEG Power, LLC, and PSEG Nuclear, LLC (PSEG) Site Value	Site Safety Analysis Report (SSAR) Section	Definition
Geography and Demography				
Exclusion Area Boundary (EAB)		The EAB is a circle at least 600 m (1,968 ft) from the edge of the power block area in all directions	2.1.1.2	The area surrounding the reactor(s), in which the reactor licensee has the authority to determine all activities, including exclusion or removal of personnel and property from the area
Low Population Zone		The area falling within a 5-mi radius circle from the PSEG Site's new plant site center	2.1.3.4	The area immediately surrounding the exclusion area that contains residents
Population Center Distance		14.8 mi (Wilmington, DE)	2.1.3.5	The distance from the reactor to the nearest boundary of a densely populated center containing more than about 25,000 residents
Identification of Potential Hazards in Site Vicinity				
External Hazards on Plant Structures, Systems, or Components		Refer to SSAR Section 2.2.3	2.2.3	Identification and evaluation of potential accident situations in the vicinity of the plant
Meteorology				
Ambient Air Temperature and Humidity				
Maximum Dry-Bulb Temperature (DBT)	2% annual exceedance	88°F (DBT) 73°F (MCWB)	Table 2.3-14	The ambient DBT (and mean coincident wet-bulb temperature [MCWB]) that will be exceeded 2% of the time annually
	1% annual exceedance	90°F (DBT) 75°F (MCWB)	Table 2.3-14	The ambient DBT (and MCWB) that will be exceeded 1% of the time annually
	0.4% annual exceedance	93°F (DBT) 76°F (MCWB)	Table 2.3-14	The ambient DBT (and MCWB) that will be exceeded 0.4% of the time annually
	0% annual exceedance (record)	108°F (DBT) 79°F (MCWB)	2.3.1.7	The highest recorded ambient DBT and MCWB

Table I-1 (continued)

Site Characteristic		PSEG Power, LLC, and PSEG Nuclear, LLC (PSEG) Site Value	Site Safety Analysis Report (SSAR) Section	Definition
	100-year return period	105.9°F (DBT) 82.4°F (MCWB)	2.3.1.7; Table 2.3-13	The ambient DBT (and MCWB) that has a 1% annual probability of being exceeded (100-year mean recurrence interval)
Minimum DBT	99% annual exceedance	14°F	Table 2.3-14	The ambient DBT below which DBTs will fall 1% of the time annually
	99.6% annual exceedance	10°F	Table 2.3-14	The ambient DBT below which DBTs will fall 0.4% of the time annually
	100% annual exceedance (record)	-15°F	2.3.1.7	Lowest recorded DBT
	100-year return period	-18.7°F	Table 2.3-13	The ambient DBT for which a 1% annual probability of a lower DBT exists (100-year mean recurrence interval)
Maximum Wet-Bulb Temperature (WBT)	1.0% annual exceedance	77°F	Table 2.3-14	The ambient WBT that will be exceeded 1.0% of the time annually
	0.4% annual exceedance	79°F	Table 2.3-14	The ambient WBT that will be exceeded 0.4% of the time annually
	0% annual exceedance (record)	86.2°F	Table 2.3-13	Highest recorded WBT
	100-year return period	87.4°F	Table 2.3-13	The ambient WBT that has a 1% annual probability of being exceeded (100-year mean recurrence interval)

Table I-1 (continued)

Site Characteristic	PSEG Power, LLC, and PSEG Nuclear, LLC (PSEG) Site Value	Site Safety Analysis Report (SSAR) Section	Definition
Ultimate Heat Sink (UHS) Ambient Air Temperature and Humidity			
Meteorological conditions resulting in the minimum water cooling during any 1 day	82.69°F (WBT) 87.12°F (DBT)	2.3.1.6	Historic worst 1-day daily average WBT and coincident DBT
Meteorological conditions resulting in the minimum water cooling during any consecutive 5 days	78.02°F (WBT) 83.47°F (DBT)	2.3.1.6	Historic worst 5-day daily average WBT and coincident DBT
Meteorological conditions resulting in the maximum evaporation and drip loss during any consecutive 30 days	75.87°F (WBT) 82.65°F (DBT)	2.3.1.6	Historic worst 30-day daily average WBT and coincident DBT
Basic Wind Speed			
3-Second Gust	117.7 mph	2.3.1.5.1	The nominal 3-s gust wind speeds in miles per hour at 33 ft above ground associated with a 100-year return period
Importance Factors	1.15	2.3.1.5.1	Multiplication factor applied to basic wind speed used to assess wind impacts to structures
Hurricane			
Hurricane Wind Speed	159 mph	2.3.1.5.3	Maximum nominal 3-s gust wind speed at 33 ft above ground over open terrain having a probability of exceedance of 10^{-7} per year
Tornado			
Maximum Wind Speed	200 mph	Table 2.3-5	Maximum wind speed resulting from the passage of a tornado having a probability of occurrence of 10^{-7} per year

Table I-1 (continued)

Site Characteristic	PSEG Power, LLC, and PSEG Nuclear, LLC (PSEG) Site Value	Site Safety Analysis Report (SSAR) Section	Definition
Maximum Translational Speed	40 mph	Table 2.3-5	Translation component of the maximum tornado wind speed
Maximum Rotational Speed	160 mph	Table 2.3-5	Rotation component of the maximum tornado wind speed
Radius of Maximum Rotational Speed	150 ft	Table 2.3-5	Distance from the center of the tornado at which the maximum rotational wind speed occurs
Maximum Pressure Drop	0.9 psi	Table 2.3-5	Decrease in ambient pressure from normal atmospheric pressure resulting from passage of the tornado
Rate of Pressure Drop	0.4 psi/s	Table 2.3-5	Rate of pressure drop resulting from the passage of the tornado
Winter Precipitation			
100-year Snowpack	24 lb/ft^2	2.3.1.5.4	The weight of the 100-year return period snowpack (to be used in determining normal precipitation loads for roofs)
48-hr Probable Maximum Winter Precipitation	21 in. of water	2.3.1.5.4	Probable maximum precipitation during the winter months (to be used in conjunction with the 100-year snowpack in determining extreme winter precipitation loads for roofs)
Normal Winter Precipitation Event	24 lb/ft^2	2.3.1.5.4	The highest ground-level weight (in lb/ft^2) among: (1) the 100-year return period snowpack; (2) the historical maximum snowpack; (3) the 100-year return period two-day snowfall event; or (4) the historical maximum two-day snowfall event in the site region (to be used in determining the precipitation loads for roofs)

Table I-1 (continued)

Site Characteristic	PSEG Power, LLC, and PSEG Nuclear, LLC (PSEG) Site Value	Site Safety Analysis Report (SSAR) Section	Definition
Extreme Frozen Winter Precipitation Event	20.51 lb/ft^2	2.3.1.5.4	The highest of: (1) the 100-year return period two-day snowfall event; and (2) the historical maximum snowfall event in the site region (to be used in determining the precipitation loads for roofs)
Short-Term (Accident Release) Atmospheric Dispersion			
0–2 hr χ/Q (atmospheric dispersion factor) (EAB)	4.71×10^{-4} s/m^3	Table 2.3-30	The 0–2 hour atmospheric dispersion factor to be used to estimate dose consequences of accidental airborne releases at the EAB
0–8 hr χ/Q (low population zone [LPZ])	8.47×10^{-6} s/m^3	Table 2.3-30	The 0–8 hour atmospheric dispersion factor to be used to estimate dose consequences of accidental airborne releases at the LPZ
8–24 hr χ/Q (LPZ)	5.50×10^{-6} s/m^3	Table 2.3-30	The 8–24 hour atmospheric dispersion factor to be used to estimate dose consequences of accidental airborne releases at the LPZ
1–4 day χ/Q (LPZ)	2.15×10^{-6} s/m^3	Table 2.3-30	The 1–4 day atmospheric dispersion factor to be used to estimate dose consequences of accidental airborne releases at the LPZ
4-30 day χ/Q (LPZ)	5.60×10^{-7} s/m^3	Table 2.3-30	The 4–30 day atmospheric dispersion factor to be used to estimate dose consequences of accidental airborne releases at the LPZ
Long-Term (Normal Release) Atmospheric Dispersion			
Annual Average Undepleted/No Decay χ/Q Value at Site Boundary, east-northeast, 0.24 mi	1.00×10^{-5} s/m^3	Table 2.3-34	The maximum annual average site boundary undepleted/no decay χ/Q value for use in determining gaseous pathway doses to the maximally exposed individual

Table I-1 (continued)

Site Characteristic	PSEG Power, LLC, and PSEG Nuclear, LLC (PSEG) Site Value	Site Safety Analysis Report (SSAR) Section	Definition
Annual Average Undepleted/ 2.26-Day Decay χ/Q Value at Site Boundary, east-northeast, 0.24 mi	1.00×10^{-5} s/m^3	Table 2.3-34	The maximum annual average site boundary undepleted/2.26-day decay χ/Q value for use in determining gaseous pathway doses to the maximally exposed individual
Annual Average Depleted/ 8.00-Day Decay χ/Q Value at Site Boundary, east-northeast, 0.24 mi	9.50×10^{-6} s/m^3	Table 2.3-34	The maximum annual average site boundary depleted/8.00-day decay χ/Q value for use in determining gaseous pathway doses to the maximally exposed individual
Annual Average Relative Deposition Factor (D/Q) Value at Site Boundary, east-northeast, 0.24 mi	4.10×10^{-8} 1/m^2	Table 2.3-34	The maximum annual average site boundary relative D/Q value for use in determining gaseous pathway doses to the maximally exposed individual
Annual Average Undepleted/No Decay χ/Q Value at Nearest Resident, northwest, 2.8 mi	2.40×10^{-7} s/m^3	Table 2.3-34	The maximum annual average resident undepleted/no decay χ/Q value for use in determining gaseous pathway doses to the maximally exposed individual
Annual Average Undepleted/ 2.26-day Decay χ/Q Value at Nearest Resident, northwest, 2.8 mi	2.40×10^{-7} s/m^3	Table 2.3-34	The maximum annual average resident undepleted/2.26-day decay χ/Q value for use in determining gaseous pathway doses to the maximally exposed individual
Annual Average Depleted/8.00-day Decay χ/Q Value at Nearest Resident, northwest, 2.8 mi	1.90×10^{-7} s/m^3	Table 2.3-34	The maximum annual average resident depleted/8.00-day decay χ/Q value for use in determining gaseous pathway doses to the maximally exposed individual
Annual Average D/Q Value at Nearest Resident, northwest, 2.8 mi	9.60×10^{-10} 1/m^2	Table 2.3-34	The maximum annual average resident D/Q value for use in determining gaseous pathway doses to the maximally exposed individual

Table I-1 (continued)

Site Characteristic	PSEG Power, LLC, and PSEG Nuclear, LLC (PSEG) Site Value	Site Safety Analysis Report (SSAR) Section	Definition
Annual Average Undepleted/No Decay χ/Q Value at Nearest Farm, northwest, 4.9 mi	1.10×10^{-7} s/m^3	Table 2.3-34	The maximum annual average farm undepleted/no decay χ/Q value for use in determining gaseous pathway doses to the maximally exposed individual
Annual Average Undepleted/2.26-day Decay χ/Q Value at Nearest Farm, northwest, 4.9 mi	1.10×10^{-7} s/m^3	Table 2.3-34	The maximum annual average farm undepleted/2.26-day decay χ/Q value for use in determining gaseous pathway doses to the maximally exposed individual
Annual Average Depleted/8.00-day Decay χ/Q Value at Nearest Farm, northwest, 4.9 mi	8.20×10^{-8} s/m^3	Table 2.3-34	The maximum annual average farm depleted/8.00-day decay χ/Q value for use in determining gaseous pathway doses to the maximally exposed individual
Annual Average D/Q Value at Nearest Farm, northwest, 4.9 mi	3.50×10^{-10} 1/m^2	Table 2.3-34	The maximum annual average farm D/Q value for use in determining gaseous pathway doses to the maximally exposed individual
Hydrology			
Proposed Facility Boundaries	SSAR Figure 1.2-3 presents the proposed facility boundary	1.2	PSEG Site boundary map
Maximum Groundwater	10 ft North American Vertical Datum (NAVD)	2.4.12.5	The maximum elevation of groundwater at the PSEG Site
Maximum Stillwater Flood Elevation	26.9 ft NAVD	Table 2.4.5-1	The stillwater elevation, without accounting for wind-induced waves, that the water surface reaches during a flood event
Wave Run-Up	7.9 ft	Table 2.4.5-1	The height of water reached by wind-induced waves running up on the site
Combined Effects Maximum Flood Elevation	35.9 ft NAVD	Table 2.4.5-1	The water surface elevation at the point in time where the combination of the still water level and wave run-up is at its maximum

Table I-1 (continued)

Site Characteristic	PSEG Power, LLC, and PSEG Nuclear, LLC (PSEG) Site Value	Site Safety Analysis Report (SSAR) Section	Definition
Local Intense Precipitation	18.4 in./hr	Table 2.4.2-5	The depth of probable maximum precipitation for duration of 1 hr on a 1-mi^2 drainage area. The surface water drainage system should be designed for a flood produced by the local intense precipitation
Frazil, Surface, or Anchor Ice	The PSEG Site has the potential for frazil and surface ice	2.4.7.1	Potential for accumulated ice formation in a turbulent flow condition
Minimum River Water Surface Elevation	-15.9 ft NAVD for less than 6 hr	2.4.11.7	The river surface water elevation and duration for which the low water level conditions exist at the PSEG Site
Site Grade	36.9 ft NAVD	2.4.10	Finished plant grade for the power block area on the PSEG Site
Maximum Ice Thickness	17.8 in.	2.4.11.3.3	Maximum potential ice thickness on the Delaware River at the PSEG Site
Hydraulic Conductivity	Table 2.4.12-9	2.4.12	Groundwater flow rate per unit hydraulic gradient
Hydraulic Gradient	Tables 2.4.12-7 and 2.4.12-8	2.4.12	Slope of groundwater surface under unconfined conditions or slope of hydraulic pressure head under confined conditions
Geology, Seismology, and Geotechnical Engineering			
Basic Geological and Seismic Information			
Capable Tectonic Structures	No capable tectonic structures within the site region	2.5.1	The presence of a fault or structure capable of producing both tectonic surface deformation and earthquakes

Table I-1 (continued)

Site Characteristic	PSEG Power, LLC, and PSEG Nuclear, LLC (PSEG) Site Value	Site Safety Analysis Report (SSAR) Section	Definition
Vibratory Ground Motion			
Ground Motion Response Spectra (Site Safe Shutdown Earthquake)	SSAR Figure 2.5.2-54	2.5.2	Site specific response spectra
Stability of Subsurface Materials and Foundations			
Liquefaction	Soils below the competent layer are not susceptible to liquefaction	2.5.4.8	Liquefaction potential for the subsurface soils at a site
Minimum Ultimate Bearing Capacity	420,000 lb/ft^2	2.5.4.10	Load bearing capacity of the competent soil layer supporting the loads exerted by plant structures without soil failure
Minimum Shear Wave Velocity	1,613 ft/sec	Table 2.5.4.7-3	The minimum propagation velocity of shear waves through the foundation materials

Table I-2. Plant Parameter Envelope (PPE) Values

Item	Design Parameter	Site Safety Analysis Report (SSAR) Section	Description and References
Structure Height	234 ft	Table 1.3-1	The height from finished grade to the top of the tallest power block structures, excluding cooling towers
Structure Foundation Embedment	39 ft to 84.3 ft	Table 1.3-1	The depth from finished grade to the bottom of the basemat for the most deeply embedded power block structure
Normal Plant Heat Sink			
• **Condenser**			
Max Inlet Temp Condenser	91°F	Table 1.3-1	Design assumption for the maximum acceptable circulating water temperature at the inlet to the condenser
Condenser Heat Rejection	1.508×10^{10} Btu/hr	Table 1.3-1	Design value for the waste heat rejected to the circulating water system (CWS) across the condensers
Maximum Cooling Water Flow Rate Across Condenser	1,200,000 gpm	Table 1.3-1	Design value for the maximum flow rate of the CWS through the condenser tubes
Maximum Cooling Water Temperature Rise Across Condenser	25.2°F	Table 1.3-1	Design value for the maximum temperature differential across the condenser
• **Mechanical Draft Cooling Towers (MDCT)—CWS**			
Acreage	50 ac	Table 1.3-1	The land required for cooling towers, including support facilities
Approach Temperature	14.4°F	Table 1.3-1	The difference between the cold water temperature and the ambient wet-bulb temperature (WBT)
Blowdown Constituents and Concentrations	Various (see SSAR Table 1.3-2)	Table 1.3-2	The maximum expected concentrations for anticipated constituents in the CWS blowdown to the receiving water body

Table I-2 (continued)

Item	Design Parameter	Site Safety Analysis Report (SSAR) Section	Description and References
Blowdown Flow Rate (Normal)	50,516 gpm	Table 1.3-1	The normal flow rate of the blowdown stream from the CWS to the receiving water body for closed system designs during normal operations
Blowdown Temperature (Normal)	91°F	Table 1.3-1	The maximum expected blowdown temperature at the point of discharge to the receiving water body during normal operations
Cycles of Concentration	1.5	Table 1.3-1	The ratio of total dissolved solids in the CWS blowdown to the total dissolved solids in the makeup water
Evaporation Rate (Normal)	25,264 gpm	Table 1.3-1	The expected 1% exceedance design rate at which water is lost by evaporation from the CWS during normal operations
Makeup Flow Rate (Normal)	75,792 gpm	Table 1.3-1	The expected rate of removal of water from a natural source to replace water losses from a closed CWS during normal operations
Noise	58 dBA at 1,000 ft	Table 1.3-1	The maximum expected sound level produced by operation of cooling towers, measured in feet from the noise source
Cooling Tower Temperature Range (Normal)	25.2°F	Table 1.3-1	The temperature difference between the cooling water entering and leaving the towers during normal operations
Cooling Water Flow Rate (Normal)	1,200,000 gpm	Table 1.3-1	The total cooling water flow rate through the condenser/heat exchangers during normal operations
Heat Rejection Rate (Normal)	1.508×10^{10} Btu/hr	Table 1.3-1	The expected heat rejection rate to a receiving water body during normal operations

Table I-2 (continued)

Item	Design Parameter	Site Safety Analysis Report (SSAR) Section	Description and References
Drift	12 gpm	Table 1.3-1	Rate of water lost from the tower as liquid droplets entrained in the vapor exhaust air stream
Exhaust Stack Exit Velocity	1,730 fpm	Table 1.3-1	The exit velocity of water vapor through the cooling tower exhaust stack
Exhaust Stack Exit Diameter	68 cells at 31.6 ft each	Table 1.3-1	The diameter of the cooling tower exhaust stack
Exhaust Stack Height	46 ft	Table 1.3-1	The vertical height above finished grade of cooling towers associated with the CWS
• **Natural Draft Cooling Towers (NDCTs)—CWS**			
Acreage	50 ac	Table 1.3-1	The land required for cooling towers, including support facilities
Approach Temperature	14.4°F	Table 1.3-1	The difference between the cold water temperature and the ambient WBT
Blowdown Constituents and Concentrations	Various (see SSAR Table 1.3-2)	Table 1.3-2	The maximum expected concentrations for anticipated constituents in the CWS blowdown to the receiving water body
Blowdown Flow Rate (Normal)	50,516 gpm	Table 1.3-1	The normal flow rate of the blowdown stream from the CWS to the receiving water body for closed system designs during normal operations
Blowdown Temperature (Normal)	91°F	Table 1.3-1	The maximum expected blowdown temperature at the point of discharge to the receiving water body during normal operations
Cycles of Concentration	1.5	Table 1.3-1	The ratio of total dissolved solids in the CWS blowdown to the total dissolved solids in the makeup water

Table I-2 (continued)

Item	Design Parameter	Site Safety Analysis Report (SSAR) Section	Description and References
Evaporation Rate (Normal)	25,264 gpm	Table 1.3-1	The expected 1% exceedance design rate at which water is lost by evaporation from the CWS during normal operations
Makeup Flow Rate (Normal)	75,792 gpm	Table 1.3-1	The expected rate of removal of water from a natural source to replace water losses from a closed CWS during normal operations
Noise	50 dBA at 1,000 ft	Table 1.3-1	The maximum expected sound level produced by operation of cooling towers, measured in feet from the noise source
Cooling Tower Temperature Range (Normal)	25.2°F	Table 1.3-1	The temperature difference between the cooling water entering and leaving the towers during normal operations
Cooling Water Flow Rate (Normal)	1,200,000 gpm	Table 1.3-1	The total cooling water flow rate through the condenser/heat exchangers during normal operations
Heat Rejection Rate (Normal)	1.508×10^{10} Btu/hr	Table 1.3-1	The expected heat rejection rate to a receiving water body during normal operations
Drift	12 gpm	Table 1.3-1	Rate of water lost from the tower as liquid droplets entrained in the vapor exhaust air stream
Exhaust Stack Exit Velocity	995 fpm	Table 1.3-1	The exit velocity of water vapor through the cooling tower exhaust stack
Exhaust Stack Exit Diameter	242 ft	Table 1.3-1	The diameter of the cooling tower exhaust stack
Exhaust Stack Height	590 ft	Table 1.3-1	The vertical height above finished grade of cooling towers associated with the CWS
• **Fan Assisted NDCT—CWS**			
Acreage	50 ac	Table 1.3-1	The land required for cooling towers, including support facilities

Table I-2 (continued)

Item	Design Parameter	Site Safety Analysis Report (SSAR) Section	Description and References
Approach Temperature	14.4°F	Table 1.3-1	The difference between the cold water temperature and the ambient WBT
Blowdown Constituents and Concentrations	Various (see SSAR Table 1.3-2)	Table 1.3-2	The maximum expected concentrations for anticipated constituents in the CWS blowdown to the receiving water body
Blowdown Flow Rate (Normal)	50,516 gpm	Table 1.3-1	The normal flow rate of the blowdown stream from the CWS to the receiving water body for closed system designs during normal operations
Evaporation Rate (Normal)	25,264 gpm	Table 1.3-1	The expected 1% exceedance design rate at which water is lost by evaporation from the CWS during normal operations
Blowdown Temperature (Normal)	91°F	Table 1.3-1	The maximum expected blowdown temperature at the point of discharge to the receiving water body during normal operations
Cycles of Concentration	1.5	Table 1.3-1	The ratio of total dissolved solids in the CWS blowdown to the total dissolved solids in the makeup water
Makeup Flow Rate (Normal)	75,792 gpm	Table 1.3-1	The expected rate of removal of water from a natural source to replace water losses from a closed CWS during normal operations
Noise	60 dBA at 1,000 ft	Table 1.3-1	The maximum expected sound level produced by operation of cooling towers, measured in feet from the noise source
Cooling Tower Temperature Range (Normal)	25.2°F	Table 1.3-1	The temperature difference between the cooling water entering and leaving the towers during normal operations

Table I-2 (continued)

Item	Design Parameter	Site Safety Analysis Report (SSAR) Section	Description and References
Cooling Water Flow Rate (Normal)	1,200,000 gpm	Table 1.3-1	The total cooling water flow rate through the condenser/heat exchangers during normal operations
Heat Rejection Rate (Normal)	1.508×10^{10} Btu/hr	Table 1.3-1	The expected heat rejection rate to a receiving water body during normal operations
Drift	12 gpm	Table 1.3-1	Rate of water lost from the tower as liquid droplets entrained in the vapor exhaust air stream
Exhaust Stack Exit Velocity	902 fpm	Table 1.3-1	The exit velocity of water vapor through the cooling tower exhaust stack
Exhaust Stack Exit Diameter	255 ft	Table 1.3-1	The diameter of the cooling tower exhaust stack
Exhaust Stack Height	224 ft	Table 1.3-1	The vertical height above finished grade of cooling towers associated with the CWS
UHS			
• **Heat Exchangers**			
Maximum Inlet Temperature to Component Cooling Water (CCW) Heat Exchanger	95°F	Table 1.3-1	The maximum temperature of safety-related service water at the inlet of the UHS component cooling water heat exchanger
CCW Heat Exchanger Duty	2.06×10^8 Btu/hr (Normal) 4.72×10^8 Btu/hr (Peak)	Table 1.3-1	The heat transferred to the safety-related service water system for rejection to the environment in UHS heat removal devices
• **UHS Cooling Towers**			
Blowdown Constituents and Concentrations	Various (see SSAR Table 1.3-2)	Table 1.3-2	The maximum expected concentrations for anticipated constituents in the UHS blowdown to the receiving water body

Table I-2 (continued)

Item	Design Parameter	Site Safety Analysis Report (SSAR) Section	Description and References
Blowdown Flow Rate (Normal)	1,140 gpm	Table 1.3-1	The maximum flow rate of the blowdown stream from the UHS system to the receiving water body for closed system designs during normal operations
Blowdown Flow Rate (Accident)	2,280 gpm	Table 1.3-1	The maximum flow rate of the blowdown stream from the UHS system to the receiving water body for closed system designs during accident conditions
Blowdown Temperature (Normal)	< 95°F	Table 1.3-1	The maximum expected UHS blowdown temperature at the point of discharge to the receiving water body during normal operations
Blowdown Temperature (Accident)	95°F	Table 1.3-1	The maximum expected UHS blowdown temperature at the point of discharge to the receiving water body during accident conditions
Cycles of Concentration	2	Table 1.3-1	The ratio of total dissolved solids in the UHS system blowdown to the total dissolved solids in the makeup water streams
Evaporation Rate (Normal)	1,142 gpm	Table 1.3-1	The maximum rate at which water is lost by evaporation from the UHS system during normal operations
Evaporation Rate (Accident)	2,284 gpm	Table 1.3-1	The maximum rate at which water is lost by evaporation from the UHS system during accident conditions
Cooling Tower Deck Height	63 ft	Table 1.3-1	The height of the cooling tower deck above grade
Exhaust Stack Height	35 ft	Table 1.3-1	The height of the exhaust stacks above the deck

Table I-2 (continued)

Item	Design Parameter	Site Safety Analysis Report (SSAR) Section	Description and References
Makeup Flow Rate (Normal)	2,404 gpm	Table 1.3-1	The maximum rate of removal of water from a natural source to replace water losses from the UHS system during normal operations
Makeup Flow Rate (Accident)	4,808 gpm	Table 1.3-1	The maximum rate of removal of water from a natural source to replace water losses from the UHS system during accident conditions
Noise	57 dBA at 200 ft	Table 1.3-1	The maximum expected sound level produced by operation of mechanical draft UHS cooling towers, measured in feet from the noise source
Cooling Water Flow Rate (Normal)	26,125 gpm	Table 1.3-1	The total cooling water flow rate through the UHS system during normal operations
Cooling Water Flow Rate (Shutdown/Accident)	52,250 gpm	Table 1.3-1	The total cooling water flow rate through the UHS system during shutdown/accident conditions
Heat Rejection Rate (Normal)	2.06×10^8 Btu/hr	Table 1.3-1	The maximum expected heat rejection rate to the atmosphere during normal operations
Heat Rejection Rate (Accident)	3.95×10^8 Btu/hr	Table 1.3-1	The maximum expected heat rejection rate to the atmosphere during accident conditions
Stored Water Volume	30,600,000 gal	Table 1.3-1	The quantity of water stored in the UHS impoundments
Drift	2 gpm	Table 1.3-1	Rate of water lost from the tower as liquid droplets entrained in the vapor exhaust air stream

Table I-2 (continued)

Item	Design Parameter	Site Safety Analysis Report (SSAR) Section	Description and References
Potable/Sanitary Water System			
• **Discharge to Site Water Bodies**			
Flow Rate (Normal)	93 gpm	Table 1.3-1	The expected effluent flow rate from the potable and sanitary water systems to the receiving water body
Flow Rate (Maximum)	93 gpm	Table 1.3-1	The maximum effluent flow rate from the potable and sanitary water systems to the receiving water body
• **Raw Water Requirements**			
Maximum Use	216 gpm	Table 1.3-1	The maximum short-term rate of withdrawal from the water source for the potable and sanitary waste water systems
Monthly Average Use	93 gpm	Table 1.3-1	The average rate of withdrawal from the water source for the potable and sanitary waste water systems
Demineralized Water System			
• **Discharge to Site Water Bodies**			
Flow Rate	27 gpm	Table 1.3-1	The expected (and maximum) effluent flow rate from the demineralized system to the receiving water body
• **Raw Water Requirements**			
Maximum Use	107 gpm	Table 1.3-1	The maximum short-term rate of withdrawal from the water source for the demineralized water system
Monthly Average Use	107 gpm	Table 1.3-1	The average rate of withdrawal from the water source for the demineralized water system

Table I-2 (continued)

Item	Design Parameter	Site Safety Analysis Report (SSAR) Section	Description and References
Fire Protection System			
• **Raw Water Requirements**			
Maximum Use	625 gpm	Table 1.3-1	The maximum short-term rate of withdrawal from the water source for the fire protection water system
Monthly Average Use	5 gpm	Table 1.3-1	The average rate of withdrawal from the water source for the fire protection water system
Miscellaneous Drain			
• **Discharge to Site Water Bodies**			
Flow Rate (Expected)	39 gpm	Table 1.3-1	The expected effluent flow rate from miscellaneous drains to the receiving water body
Flow Rate (Maximum)	55 gpm	Table 1.3-1	The maximum effluent flow rate from miscellaneous drains to the receiving water body
• **Raw Water Requirements**			
Maximum Use	5 gpm	Table 1.3-1	The maximum short-term rate of withdrawal from the water source for miscellaneous activities, such as floor washing
Monthly Average Use	5 gpm	Table 1.3-1	The average rate of withdrawal from the water source for miscellaneous activities, such as floor washing
Unit Vent/Airborne Effluent Release Point			
• **Release Point**			
Elevation (Normal)	Ground level	Table 1.3-1	The elevation above finished grade of the release point for routine operational releases

Table I-2 (continued)

Item	Design Parameter	Site Safety Analysis Report (SSAR) Section	Description and References
Elevation (Post Accident)	Ground level	Table 1.3-1	The elevation above finished grade of the release point for accident sequence releases
• **Source Term**			
Gaseous (Normal)	Various (see SSAR Table 1.3-7)	Table 1.3-7	The expected single unit annual activity, by isotope, contained in routine plant airborne effluent streams
Gaseous (Post-Accident)	Various (see SSAR Section 15.3)	Section 15.3	The activity, by isotope, contained in post-accident airborne effluent streams
Tritium	Various (see SSAR Table 1.3-7)	Table 1.3-7	The expected single unit annual activity of tritium contained in routine plant airborne effluent streams
Liquid Radwaste System			
• **Release Point**			
Flow Rate	11 gpm	Table 1.3-1	The discharge flow rate of potentially radioactive liquid effluent streams from plant systems to the receiving water body
Minimum Blowdown Rate	20,000 gpm	Table 1.3-1	Minimum flow rate of the effluent stream discharging potentially radioactive liquid effluent to the receiving water body during normal operations
• **Source Term**			
Liquid	Various (see SSAR Table 1.3-8)	Table 1.3-8	The annual activity, by isotope, contained in routine plant liquid effluent streams
Tritium	Various (see SSAR Table 1.3-8)	Table 1.3-8	The annual activity of tritium contained in routine plant liquid effluent streams

Table I-2 (continued)

Item	Design Parameter	Site Safety Analysis Report (SSAR) Section	Description and References
Solid Radwaste System			
• **Solid Radwaste**			
Activity	Various (see SSAR Table 1.3-3)	Table 1.3-3	The expected single unit annual activity, by isotope, contained in solid radioactive wastes generated during routine plant operations
Principal Radionuclides	Various (see SSAR Table 1.3-3)	Table 1.3-3	The principal radionuclides contained in solid radioactive wastes generated during routine plant operations.
Volume	16,721.5 ft^3/yr	Table 1.3-1	The expected volume of solid radioactive wastes generated during routine plant operations
Auxiliary Boiler System			
Exhaust Elevation	150 ft	Table 1.3-1	The height above finished plant grade at which the flue gas effluents are released to the environment
Flue Gas Effluents	Various (see SSAR Table 1.3-4)	Table 1.3-4	The expected combustion products and anticipated quantities released to the environment due to operation of the auxiliary boilers
Fuel Type	No. 2 Fuel Oil	Table 1.3-1	The type of fuel required for proper operation of the auxiliary boilers
Heat Input Rate (Btu/hr)	1.56×10^8 Btu/hr	Table 1.3-1	The average heat input rate (fuel consumption rate)
Onsite/Offsite Electrical Power System			
Switchyard Acreage	63 ac	Table 1.3-1	The land usage required for the high voltage switchyard used to connect the plant to the transmission grid

Table I-2 (continued)

Item	Design Parameter	Site Safety Analysis Report (SSAR) Section	Description and References
Standby Power System			
• **Diesel**			
Diesel Capacity (kW)	10,130 kW/unit (emergency diesel generator [EDG]) 5,000 kW/unit (station blackout [SBO] diesel generator)	Table 1.3-1	The total generating capacity of the diesel generating system
Diesel Exhaust Elevation	50 ft	Table 1.3-1	The elevation above finished grade of the release point for standby diesel exhaust releases
Diesel Flue Gas Effluents	Various (see SSAR Table 1.3-5)	Table 1.3-5	The expected combustion products and anticipated quantities released to the environment due to operation of the emergency standby diesel generators
Diesel Noise	55 dBA at 1,000 ft	Table 1.3-1	The maximum expected sound level produced by operation of diesel generators, measured in feet from the noise source
Diesel Fuel Type	No. 2	Table 1.3-1	The type of diesel fuel required for proper operation of the diesel generator
Exhaust Stack Diameter	68 in.	Table 1.3-1	The nominal diameter of the exhaust stack
Flue Gas Flow Rate	68,960 actual cubic feet per minute (acfm)	Table 1.3-1	The maximum flue gas flow rate exiting the exhaust stack
Flue Gas Temperature	665°F	Table 1.3-1	The temperature of the flue gas exiting the exhaust stack
Number of Units	EDG—4 SBO—2	Table 1.3-1	The number of generator units
Diesel Usage	150 hr/yr per unit (EDG) 100 hr/yr per unit (SBO)	Table 1.3-1	The expected duration of usage for each diesel
Heat Input Rate (Btu/hr)	77,384,160 Btu/hr	Table 1.3-1	The average heat input rate (fuel consumption rate)

Table I-2 (continued)

Item	Design Parameter	Site Safety Analysis Report (SSAR) Section	Description and References
• **Gas Turbine**		Table 1.3-1	
Gas Turbine Capacity (kW)	26,000 kW	Table 1.3-1	The total generating capacity of the gas turbine generating system
Gas Turbine Exhaust Elevation	50 ft	Table 1.3-1	The elevation above finished grade of the release point for standby gas turbine exhaust releases
Gas Turbine Flue Gas Effluents	Various (see SSAR Table 1.3-6)	Table 1.3-6	The expected combustion products and anticipated quantities released to the environment due to operation of the standby gas turbine generators
Gas Turbine Noise	64.3 dBA at 1,000 ft	Table 1.3-1	The maximum expected sound level produced by operation of gas turbine generators, measured in feet from the noise source
Gas Turbine Fuel Type	Diesel oil	Table 1.3-1	The type of fuel required for proper operation of the gas turbines
Exhaust Stack Diameter	59.1 in.	Table 1.3-1	The nominal diameter of the exhaust stack
Flue Gas Flow Rate	128,899 acfm	Table 1.3-1	The maximum flue gas flow rate exiting the exhaust stack
Flue Gas Temperature	940°F	Table 1.3-1	The temperature of the flue gas exiting the exhaust stack
Number of Units	4 (Class 1E); 2 (Non-Class 1E)	Table 1.3-1	The number of generator units
Gas Turbine Usage	48 hr/yr	Table 1.3-1	The expected duration of usage for each gas turbine
Heat Input Rate (Btu/hr)	71,513,906 Btu/hr	Table 1.3-1	The average heat input rate (fuel consumption rate)

Table I-2 (continued)

Item	Design Parameter	Site Safety Analysis Report (SSAR) Section	Description and References
Plant Characteristics			
• **Permanent Acreage**			
Parking Lots	8 ac	Table 1.3-1	The land area required to provide space for parking lots
Permanent Support Facilities	8 ac	Table 1.3-1	The land area required to provide space for permanent support facilities
Power Block	70 ac	Table 1.3-1	The land area required to provide space for power block facilities. Power block is defined as all structures, systems, and components that perform a direct function in the production, transport, or storage of heat energy, electrical energy, or radioactive wastes. Also included are structures, systems, and components that monitor, control, protect, or otherwise support the above equipment
Other Areas	26.4 ac	Table 1.3-1	The land area required to provide space for plant facilities not included above in the categories of parking lots, permanent support facilities, and power block
• **Megawatts Thermal (MW[t])**	4,614 MW(t) (single unit); 6,830 MW(t) (dual unit)	Table 1.3-1	The thermal power generated by the nuclear steam supply system
• **Megawatts Electric (MW[e]) (net)**	1,350 to 1,600 MW(e) (single unit) 2,200 MW(e) (dual unit)	Table 1.3-1	The nominal electric output to the electrical grid. This value does not include the plant's house loads
• **Plant Design Life**	60 yr	Table 1.3-1	The operational life for which the plant is designed

Table I-2 (continued)

Item	Design Parameter	Site Safety Analysis Report (SSAR) Section	Description and References
• **Plant Population**			
Operation	600 people	Table 1.3-1	The number of people required to operate the plant
Refueling/Major Maintenance	1,000 people	Table 1.3-1	The additional number of temporary staff required to conduct refueling and major maintenance activities
• **Station Capacity Factor**	85 to 96.3%	Table 1.3-1	The percentage of time that a plant is capable of providing power to the grid. Values within this range are conservatively applied as necessary in the ER analyses
• **Plant Operating Cycle**	18 or 24 mo	Table 1.3-1	The normal plant operating cycle length
Construction			
• **Acreage**			
Laydown Area	128 ac	Table 1.3-1	The land area required to provide space for the construction laydown area
Temporary Construction Facilities	77 ac	Table 1.3-1	The land area required to provide space for temporary construction support facilities
• **Noise**	102 dBA at 50 ft	Table 1.3-1	The maximum expected sound level due to construction activities, measured in feet from the noise source
• **Construction Population**	3,950–4,100 people	Table 1.3-1	The number of onsite workers for construction of the new plant
Miscellaneous Parameters			
• **Maximum Fuel Enrichment**	5 wt %	Table 1.3-1	Concentration of ^{235}U in the fuel
• **Maximum Average Assembly Burnup**	54,200 MWd/MTU	Table 1.3-1	Maximum assembly average burnup at end of assembly life
• **Peak Fuel Rod Burnup**	62,000 MWd/MTU	Table 1.3-1	Peak fuel rod exposure at end of life
• **Rated Thermal Power**	4,590 MW(t) (single unit); 6,800 MW(t) (dual unit)	Table 1.3-1	Maximum core thermal power

Table I-2 (continued)

Item	Design Parameter	Site Safety Analysis Report (SSAR) Section	Description and References
• **Liquid-Containing Tank Failure Radionuclide Concentrations**	Various (see SSAR Table 1.3-9)	Table 1.3-9	The concentrations of radionuclides and associated tank volumes for the analysis of liquid-containing tank failure

APPENDIX J

PSEG REPRESENTATIONS AND ASSUMPTIONS

APPENDIX J

PSEG REPRESENTATIONS AND ASSUMPTIONS

If an early site permit (ESP) for the PSEG Site is issued and an applicant references that ESP in a subsequent application for a construction permit (CP) or a combined construction permit and operating license (COL), the applicant would have to demonstrate that the design selected for the site falls within the bounds of the Nuclear Regulatory Commission's (NRC's) ESP analysis in this environmental impact statement (EIS). With regard to the environmental impacts associated with construction and operation of a new nuclear power plant at the PSEG Site, PSEG made a number of representations in its application. As listed in this appendix, the staff used these representations and staff-developed assumptions in assessing the environmental impacts associated with construction and operation of a new nuclear power plant. As such, fulfillment of these representations and assumptions provides part of the basis for the final impact assessment. Should a CP or COL applicant reference the ESP, and the staff ultimately determines that a representation or assumption has not been satisfied at the CP/COL stage, that information would be considered new and potentially significant, and the affected impact area could be subject to re-examination.

Table J-1 references PSEG's representations and the NRC staff's assumptions in this EIS about design (Appendix I, the plant parameter envelope); authorizations, permits, and certifications (Appendix H); and mitigation (Sections 4.11 and 5.12). Table J-2 contains references to representations and assumptions organized by technical area, without repeating the information in Table J-1.

Within the Environmental Report (ER) (PSEG 2014-TN3452), PSEG provides:

(1) representations to address certain issues in the design, construction, and operation of the facility;

(2) representations of planned compliance with current laws, regulations, and requirements;

(3) representations of future activities and actions that it would take should it receive an ESP and decide to apply for a COL for the PSEG Site; and

(4) representations of PSEG's estimates of future activities and actions of others and the likely environmental impacts of those activities and actions that would be expected should PSEG decide to apply for a CP or COL.

The following tables are meant to aid the staff and the applicant in the event this EIS is referenced in a CP or COL application. The tables are not meant to replace the analyses in the EIS.

Table J-1. Appendix I, Appendix H, Section 4.11, and Section 5.12 Assumptions and Commitments

Area	Representation/Assumption
Site Characteristics	An applicant referencing this EIS will demonstrate its application is bounded by the site characteristics contained in Table I-1
Plant Parameter Envelope (PPE) Values	An applicant referencing this EIS will demonstrate its application is bounded by the PPE values contained and referenced in Table I-2
Authorizations and Permits	An applicant referencing this EIS will provide the status of the authorizations and permits specified in Appendix H
Mitigation of Construction Impacts	An applicant referencing this EIS will address whether its application contains the mitigation measures contained in Section 4.11
Mitigation of Operational Impacts	An applicant referencing this EIS will address whether its application contains the mitigation measures contained in Section 5.12
New and Significant Information	An applicant referencing this EIS will provide, in its application, in accordance with 10 CFR 51.50(c)(1), any new information that could affect the technical basis or conclusions for determination of an impact level in the EIS

Table J-2. Assumptions by Technical Area Not Covered in Table J-1

Technical Area	Representations/Assumptions	Source
Land Use—PSEG Site		
	The PSEG Site is located immediately north of and partially within the existing site of PSEG's Salem Generating Station (SGS) and Hope Creek Generating Station (HCGS)	ER Section 3.1
	The PSEG Site construction footprint is shown in Figure 3.1-2 in the Environmental Report	ER Figure 3.1-2
	The PSEG Site would total 819 ac. Of this total, 734 ac is within PSEG's existing SGS/HCGS site, and 85 ac is within the U.S. Army Corps of Engineers' (USACE's) existing Artificial Island Confined Disposal Facility (CDF). PSEG would obtain the 85 ac through a land exchange with the USACE. Also, during plant construction, PSEG would temporarily lease from the USACE 45 ac of the Artificial Island CDF as the location of the concrete batch plant and a construction laydown area	ER Section 2.2.1.1
	An estimated 302 ac of the existing 734-ac SGS/HCGS site would be affected by the construction of a new nuclear power plant	ER Figure 3.1-2
	Permanent facilities and structures (primarily the power block area, cooling tower area, and intake structures and their associated pipelines) for a new nuclear power plant would occupy approximately 225.4 ac, and temporary facilities would occupy approximately 205.1 ac	ER Table 4.1-1
	Of the approximately 430.5 ac estimated for the construction of a new nuclear power plant, almost all of the acreage overlaps areas that previously have been altered by activities associated with the construction or operation of the SGS/HCGS site or the Artificial Island CDF	ER Figure 3.1-2
	The size of the existing barge slip facility would be increased for use during the construction and operation of a new nuclear power plant. The increased size would require dredging approximately 61 ac in the Delaware River. Dredging to a depth of 4.5 ft would result in the removal of approximately 440,000 yd^3 of soil	ER Section 4.2.1.1.4
	Land use and land cover (LULC) types and acreages associated with the PSEG Site are described in the ER	ER Sections 2.2 and 4.1
	No significant agricultural, crops, or dairy production are or will be located at or immediately adjacent to the PSEG Site	ER Section 2.2
	No mining activities would be possible at the PSEG Site	ER Section 2.2
	Salt drift from any cooling tower design would be localized and well below NRC guidance thresholds	ER Section 5.3.3.3.1

Table J-2 (continued)

Technical Area	Representations/Assumptions	Source
	A new switchyard would be constructed for use with a new nuclear power plant at the PSEG Site	ER Section 3.7.1
	Potential areas for borrow pits have been identified at several locations in New Jersey, Pennsylvania, and Maryland; however, the extent of land required has not been determined	ER Section 4.1.1; Request for Additional Information (RAI) Response Env-02 (Land Use)
	Potential areas for the temporary storage of earthwork and excavation spoils have been identified on the site; however, the extent of land required has not been determined. The excavated material would be managed with the appropriate erosion and sediment control measures, and best management practices (BMPs) would be used as necessary for these storage areas	ER Section 4.1.1
	Development of a new plant would result in some building inside the existing 100-year flood plain on the PSEG Site. The estimated filling of 152 ac of onsite and offsite 100-year flood plain could change the flood carrying capacity of the flood plain	EIS Section 4.2.1
Land Use—Causeway Corridor and Offsite Areas		
	PSEG has not provided a specific design for the proposed causeway. This EIS assesses the environmental impacts of a “pilings and span” causeway design	EIS Section 2.2.3.
	LULC types and acreages associated with the proposed causeway and the four alternative sites, as well as in the vicinity and the region of the PSEG Site and the alternative sites, are described in the ER	ER Sections 2.2, 4.1, and 9.3.
	Permanent disturbance related to the proposed causeway would be approximately 45.5 ac, and temporary disturbance would be approximately 23.5 ac	ER Table 4.1-2
	PSEG would obtain releases on lands preserved as County Preserved Farmlands and/or protected under Deeds of Conservation Restriction along the proposed causeway and at alternative sites 4-1, 7-1, and 7-3	ER Section 4.1.2; Response to RAI Env-02 (Land Use); EIS Sections 4.1.2, 9.3.2.1, 9.3.3.1, and 9.3.5.1

Table J-2 (continued)

Technical Area	Representations/Assumptions	Source
Water Use and Quality		
	Stormwater runoff from the area filled (ponds and marsh creeks) would be collected in engineered detention basins and would be released to the Delaware River in a controlled manner	EIS Section 4.2
	The altered shoreline would be protected from erosion using placement of concrete or riprap	EIS Section 4.2
	The material dredged from the Delaware River would be disposed of on the site or at another approved upland disposal site	EIS Section 4.2
	Vertical low permeability barriers would be used to reduce horizontal groundwater flow into the excavation during dewatering operations. Water withdrawn from open surface excavations would be pumped to an onsite settling basin before discharge through a permitted New Jersey Pollutant Discharge Elimination System (NJPDES) outfall	EIS Section 4.2
	To support construction of a new nuclear power plant, an additional 119 gpm (average) of groundwater would be pumped from two new production wells located within the Potomac-Raritan-Magothy (PRM) aquifer system	EIS Section 4.2
	The Vincentown aquifer is not used as a source of potable water near the site	EIS Section 4.2
	Groundwater levels would be monitored in existing shallow wells to confirm that the HCGS and SGS facilities are not adversely affected by dewatering and to evaluate any changes in water quality to the alluvium and Vincentown aquifers. Monitoring of the Wenonah-Mount Laurel and PRM aquifers required by the HCGS and SGS water allocation permit would continue during preconstruction and construction activities, providing data on groundwater heads and salinity in these aquifers	EIS Section 4.2
	The Delaware River would be used to supply makeup water for a new plant's circulating water system. Biocides would be injected to control biofouling in the circulating water system and its associated piping. Additional chemicals would be added in the cooling tower basins to control scaling, corrosion, and solids deposition	EIS Section 5.2
	Consumptive use of Delaware River water would be a small percentage of the river flow, even under drought conditions	EIS Section 5.2

Table J-2 (continued)

Technical Area	Representations/Assumptions	Source
	If the reactor technology selected for the PSEG Site requires surface water withdrawals from the Delaware River that would cause the currently permitted PSEG allocation in the Merrill Creek reservoir to fall short, PSEG would revise the consumptive water use allocations of other plants it owns or would acquire additional storage from the existing rights of other Merrill Creek co-owners	EIS Section 5.2
	The average groundwater withdrawal rate for operations would be 210 gpm, and larger maximum withdrawal rates would be temporary, as they would occur only during abnormal conditions	EIS Section 5.2
	The nearest offsite groundwater users are located approximately 3 mi from the PSEG Site	EIS Section 5.2
	A new nuclear power plant at the PSEG Site would have a blowdown discharge to the Delaware River upstream of and similar to that of the HCGS discharge, with similar thermal impacts to water quality	EIS Section 5.2
	To minimize potential scour, the river bottom near the outlet of the discharge pipe would be armored with riprap or other engineered features	EIS Section 5.2
	Dredging of the intake channel and the barge canal area would be infrequent, and any sediment disturbed would quickly settle upon cessation of the activities	EIS Section 5.2
	The site grade would contain engineered fill with a low permeability to limit the risk of groundwater contamination from accidental releases to the land surface	EIS Section 5.2
	A monitoring plan would be developed for the final selected plant design to monitor potential impacts of plant operations on the groundwater	EIS Section 5.2
	When the reactor technology is selected, the existing New Jersey Department of Environmental Protection (NJDEP) groundwater withdrawal permit may be modified to account for a new nuclear power plant, or a new permit with a different withdrawal rate may be obtained	EIS Section 7.2
Terrestrial Ecology		
	Habitat and vegetative cover acreage associated with construction areas are described in the PSEG response to RAI No. Env-02	RAI Env-02 (Land Use); EIS Section 4.1.1
	No important species as described in NUREG–1555 currently live on the site or are likely to, and except for a few small, potential wetlands, no important habitats are present on the site	ER Section 2.4.1

Table J-2 (continued)

Technical Area	Representations/Assumptions	Source
	An updated description would be provided of the important terrestrial biota in the vicinity of the site before or during the CP or COL stage. These descriptions will be consistent with Chapter 2.4.2 in NUREG–1555	EIS Section 2.4.1.3
	A biological assessment (BA) documenting the potential impacts on the Federally listed threatened and endangered plant and wildlife species is provided in Appendix F. Assume an updated review of Federally listed species would be performed before or during the CP or COL stage to determine if preparation of a new BA is necessary	EIS Appendix F
	The approximately 500-ac construction site includes approximately 99 ac of urban or built-up lands, 13 ac of agricultural lands, 93 ac of forestland, 48 ac of water, 213 ac of wetlands, 31 ac of barren land, and 3 ac of managed wetlands	EIS Section 4.3.1.2
	The disturbance along the shoreline of the Delaware River at the location of the new cooling water intake, discharge pipeline, and barge unloading areas would be approximately 9.5 ac of coastal wetland and shallow open water	ER Section 4.2.1.1.4
	Based on the results of the evaluation performed for this ESP application, the guidance provided in NUREG–1555, and the results of the Cooling Tower Drift Program performed for the existing Salem and Hope Creek facilities, no adverse impact to the surrounding vegetation from salt deposition because of the operation of the cooling towers for a new nuclear power plant is anticipate	ER Section 5.3.3.2.4
	A BA documenting the potential impacts on the Federally listed threatened and endangered terrestrial species within the vicinity of the proposed action site is provided in Appendix F. Assume an updated review of Federally listed species would be performed before or during the CP or COL stage to determine if preparation of a new BA is necessary	EIS Appendix F
	Erosion control devices would be installed around the construction site to prevent sediment from affecting surrounding wetlands	ER Section 4.3.1.1
	Wetlands mitigation measures would be completed for jurisdiction wetlands that could be affected by the building and operating of a new nuclear power plant at the PSEG Site as described in Section 4.3.1.4 of the EIS	ER Section 4.3.1.6.2
	After construction, temporary impacts would be restored to natural cover types	ER Section 4.3.1.6.1
	Construction work mats would be used in wetland areas along the proposed causeway	ER Section 4.3.1.1.2

Table J-2 (continued)

Technical Area	Representations/Assumptions	Source
	BMPs would be used during construction to reduce artificial nighttime illumination	ER Section 4.3.1.2
Aquatic Ecology		
	Onsite and offsite descriptions of aquatic resources for the PSEG Site, consistent with NUREG–1555, are provided in Sections 2.4.2.1 and 2.4.2.2, respectively. Updated descriptions would be provided before or during the CP or COL stage	EIS Sections 2.4.2.1 and 2.4.2.2
	Important aquatic species are discussed in Section 2.4.2.3 of the EIS. Assume an updated review and discussion of important aquatic species would be performed	EIS Section 2.4.2.3
	A BA documenting the potential impacts on the Federally listed threatened and endangered aquatic species and an essential fish habitat (EFH) assessment documenting potential impacts on EFH and relevant commercially, Federally managed species and their prey within the vicinity of the proposed action site are provided in Appendix F. Assume an updated review of Federally listed species and designated EFH would be performed before or during the CP or COL stage to determine if preparation of a new BA and/or EFH assessment is necessary	EIS Appendix F
	Building activities that could directly affect onsite and offsite aquatic ecosystems include site preparation for installation of plant structures, cooling towers, switchyard, and temporary laydown area; improvements to the HCGS barge slip; building the barge storage area and unloading facility; installing the cooling water system intake and discharge structures; and building the proposed causeway. Shoreline installation and site preparation activities would require a stormwater pollution prevention plan, developed as part of the NJPDES stormwater permit, which would describe BMPs to control sedimentation and erosion and provide stormwater management. Dredging and in-water building activities (e.g., pile-driving, caisson installation, in-filling) would comply with the terms and conditions (e.g., dredging methodology, seasonal restrictions, dredged material disposal requirements) included in the Department of the Army permit issued by the USACE and the NJDEP State 401 water-quality certification	EIS Section 4.3.2
	The location, design, construction, and capacity of the cooling water intake structure reflects the best technology available for minimizing environmental impacts and would be compliant with EPA 316(b) Phase I requirements (40 CFR 125-TN254). For example, the new plant at the PSEG Site would have a closed cycle cooling system and traveling intake screens with a through-mesh velocity of less than 0.5 ft/s. The intake structure would be would be located flush with the east shoreline of the Delaware River Estuary	EIS Section 5.3.2.1

Table J-2 (continued)

Technical Area	Representations/Assumptions	Source
Socioeconomics		
	General growth of the regional economy and population would occur within the times and in the locations projected in the ER. Baseline data from the 2010 Census were used in the analyses of potential impacts. Projections are based on information from the State of New Jersey and Delaware Population Consortium	ER Section 2.5.1
	State and local governments would continue to expand and upgrade infrastructure and public services to meet general population growth	EIS Sections 4.4 and 5.4
	Site preparation and construction activities would continue for approximately 6 years and would employ as many as 4,100 construction workers. PSEG would employ 600 operations workers	EIS Sections 4.4.2 and 5.4.2; ER Sections 4.4.2.1 and 5.8.2.1
	The in-migrating building and operations work force would be distributed geographically in a manner similar to the existing SGS and HCGS workforce	ER Sections 4.4.2.2 and 5.8.2; EIS Sections 4.4.2 and 5.4.2
	Although noise would not cause adverse offsite impacts, a noise study would be performed as part of the final selection of the cooling systems for any new nuclear power plant, and the results would be described in the CP or COL application	ER Section 5.8.1.2
	Assumed 2.68 persons household size for in-migrating workers	EIS Sections 4.4.2 and 5.8.2
	Assumed largest MW(e) reactor type in PPE (two-unit AP1000). Assumed $4,490.61 per kW(e) for cost of reactors. Used the Bureau of Economic Analysis' Regional Input-Output Modeling System II multipliers for indirect workforce	EIS Sections 4.4.3.1 and 5.4.3.1
	Assumed construction worker annual income of $52,200 and operations worker income of $95,869. Delaware state income tax of 1,001 + 5.55% per worker and assumed a tax rate of 6.279 percent, which is average of 1.4–8.97 income tax rates for New Jersey. Assumed sales tax rate of 7 percent in New Jersey and 6 percent in Pennsylvania. Delaware has no sales tax rate. Assumed 9 percent New Jersey corporate income tax rate and Salem County's $1.207 per hundred dollars of assessed value property tax	EIS Sections 4.4.3.2 and 5.4.3.2

Table J-2 (continued)

Technical Area	Representations/Assumptions	Source
	Based traffic assumptions from PSEG traffic impact analysis. Traffic impact analysis assumed peak construction workforce, full HCGS/SGS workforce, and an outage workforce all at once	EIS Sections 4.4.4.1 and 5.4.4.1; ER Sections 4.4.1.5 and 5.8.1.2
	Aesthetic impacts assume 590 ft tall natural draft cooling towers (NDCTs), associated plumes, two reactor buildings, and the elevated causeway	EIS Sections 4.4.1.6 and 5.4.1.6
	Water and wastewater services assume 100 gpd and 75 gpd, respectively	EIS Sections 4.4.4.4 and 5.4.4.4
Environmental Justice		
	Baseline data from 2010 Census were used in the analyses of potential impacts. Minority and low income populations will continue to exist in the same proportions and locations as populations increase	EIS Section 2.6
Historic and Cultural Resources		
	The area of potential effect evaluated in the ESP EIS bounds the area of potential effect for the combined license application	EIS Section 4.6
	PSEG would implement the necessary administrative steps to notify the New Jersey Historic Preservation Officer and or the applicable Tribal Historic Preservation Officer in the event of any unanticipated discovery of an historic resource	EIS Section 4.6
Meteorology and Air Quality		
	Specific dust-control measures to control fugitive dust during construction would be identified in a dust control plan, or similar document, prepared before construction. These mitigation measures could include any or all of the measures identified in Section 4.7.1 of this EIS	ER Section 4.4.1.3; EIS Section 4.7.1
	Meteorological data for the PSEG Site are presented in the Site Safety Analysis Report (SSAR). The data from 2006 to 2008 are assumed to be representative	SSAR Section 2.3.2.2
	Air emissions from the PSEG Site would be bounded by those listed in EIS Sections 4.7, 5.7, 6.1.3, 6.3, and 7.6. Greenhouse gas emissions would be bounded by those in Appendix K over the lifecycle of the facility	Various

Table J-2 (continued)

Technical Area	Representations/Assumptions	Source
	Auxiliary boilers and diesel generators are assumed to be required for a new nuclear power plant, and these devices would release permitted pollutants to the air. The ER describes the annual estimated emissions, and these emissions have been considered in EIS Table 5-13	EIS Section 5.7
	A general conformity applicability analysis per 40 CFR Part 93, Subpart B, will be performed at the COL stage because Salem County and nearby New Castle County are in nonattainment of 8-hr ozone and 8-hr ozone and $PM_{2.5}$, respectively. The operations emissions inventory in EIS Table 5-13 indicates that the emissions expected for volatile organic compounds, an ozone precursor, are above the *de minimis* limits in 40 CFR 93.153(b)(1). A $PM_{2.5}$ emissions inventory is not currently provided in the ER and will be needed at the COL stage.	EIS Section 5.7
	The normal heat sink that would be used to dissipate heat from the turbine cycle for a new nuclear power plant would use cooling towers to reject that heat directly into the atmosphere	
	Water droplets drifting from the cooling towers would have the same concentration of dissolved solids and suspended solids as the water in the cooling tower basin. The water in the cooling tower is assumed to have solid concentrations about twice that of the Delaware River, the source of the cooling water makeup	ER Section 5.3.3.2.4
	Cooling towers would have drift eliminators that are comparable in effectiveness to the drift eliminators in current-generation cooling towers	ER Section 5.3.3.1.1
	The distance between the proposed cooling towers and the existing cooling towers would be about 3,200 ft. The maximum salt deposition rate from all linear mechanical draft cooling towers (LMDCTs) combined was estimated as 0.80 lb/ac per month and would occur at a distance of 2,300 ft east of the towers. The maximum salt deposition rate from all NDCTs combined was estimated as 0.021 lb/ac per month, occurring between 4,265 and 7,546 ft north of the towers	ER Section 5.3.3.2.4; RAI Response Env-08S
	The Seasonal and Annual Cooling Tower Impact (SACTI) model predicts that the majority of fogging due to operation of the LMDCTs would be confined to within about 0.5 mi (800 m) to the northwest of the towers with occasional fogging (maximum 7 hr/yr) up to about 0.7 mi (1,100 m) to the east–southeast of the towers (this area is mostly within the property boundary of the site). Fogging is not a concern for NDCTs because of their considerably greater release height, and the SACTI does not calculate fogging for NDCTs as such. Therefore, it is predicted that the operation of the cooling towers would result in limited increased fogging at the site	RAI Response Env-08S

Table J-2 (continued)

Technical Area	Representations/Assumptions	Source
	The meteorological monitoring program would continue throughout the construction and operational phases of the project. The monitoring program would be a continuation of the ongoing meteorological monitoring program for the SGS and HCGS sites.	ER Sections 4.4.1.3, 4.4.1.1.1.1, and 6.4
Human Health		
	Radioactive waste management systems would be designed to minimize releases from reactor operations to values as low as reasonably achievable. These systems would be designed and maintained to meet the requirements of 10 CFR 20 and Appendix I in 10 CFR 50	ER Section 3.5
	Nonradioactive solid wastes are addressed by local regulation under “truck-and-haul” permitting. Hazardous wastes are handled by permitted contractors and are addressed on the site in compliance with Federal regulations	ER Section 3.6.3.3
	The expected single unit annual activities by isotope contained in the airborne effluent, liquid effluent, and solid radioactive waste streams generated during routine plant operations are based on the configuration of the four reactor designs designated in the ER and SSAR at the time of this EIS	SSAR Section 1.3; ER Section 5.4.1
	The exposure pathways considered and the analytical methods used to estimate doses to the maximally exposed individual (MEI) and to the population surrounding a new nuclear power plant are based on NRC Regulatory Guide 1.109, *Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50*, Appendix I (Rev.1, October 1977) (RG 1.109) and NRC Regulatory Guide 1.111, *Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors* (Revision 1, July 1977) (RG 1.111)	SSAR Chapter 11; ER Section 5.4.1
	ER Table 5.4-9 estimates the single-unit total body and organ doses to the MEI from liquid effluents and gaseous releases from potentially up to two new nuclear units for analytical endpoints prescribed in 10 CFR Part 50, Appendix I	ER Section 5.4.3
	The estimated annual doses from all pathways are summarized in ER Table 5.4-10. ER Table 5.4-10 compares these doses to the public dose criteria in 40 CFR Part 190. PSEG states by meeting the requirements of 40 CFR Part 190, they also meet the requirements of 10 CFR 20.1301	ER Section 5.4.3

Table J-2 (continued)

Technical Area	Representations/Assumptions	Source
	The calculated construction worker doses are based on available dose rate measurements and calculations. It is possible that these dose rates would increase in the future as site conditions change. However, the site would be monitored continually during the construction period, and appropriate actions would be taken as necessary to ensure that the construction workers are protected from radiation	ER Section 4.5.4.4
	The construction worker dose from independent spent fuel storage installation direct radiation is within the bounds of evaluation in the EIS, which depends on the specific cask loading during the construction period	EIS Section 4.9
	The new nuclear power plant would release liquid effluents to the Delaware River via the cooling water discharge stream	ER Section 5.4.1.1; EIS Sections 5.9.1 and G.2.1
	The structure of the site radiological environmental management program (REMP) would be based on the necessary components of the monitoring program established for the existing units, which encompasses the entire SGS/HCGS site and would be expanded to include radiological environmental monitoring for a new nuclear power plant. This expanded REMP would continue to be in accordance with the existing units' Technical Specifications/Offsite Dose Calculation Manual (ODCM) and is described in Section 11.6 in the Salem Updated Final Safety Analysis Report. It would be implemented through the existing units' ODCM via administrative and technical procedures	ER Section 6.2.1; EIS Section 5.9.6
	The short-term noise levels associated with construction activities could be as high as 102 dBA at a distance of 50 ft; however, these noise levels would not extend beyond the boundaries of the PSEG Site	ER Section 4.4.1.2
	The noise levels from cooling tower operations and diesel generators are anticipated to be approximately 60 dBA at a distance of 1,000 ft	ER Section 5.8.1.3
Transportation		
	Unirradiated fuel assemblies would be shipped to the PSEG Site by truck only shortly before they would be needed	ER Section 5.7.2; EIS Section 6.2.1
	Radioactive waste and spent fuel would be shipped from the PSEG Site by truck only. The number of radioactive waste shipments was based on 2.34 m^3/shipment. The number of spent fuel shipments was based on 0.5 MTU/shipment	ER Section 5.7.2; EIS Section 6.2.3

Table J-2 (continued)

Technical Area	Representations/Assumptions	Source
	The transportation impact analysis used information from INEEL (2003) to estimate the unirradiated and spent fuel shipping cask capacities	EIS Section 6.2.2
	Doubling the estimated number of truck shipments to account for empty return shipments would result in a number of shipments well below the one-shipment-per-day condition	ER Section 5.7.2; EIS Section 6.2.3
	The new nuclear power plant would have storage capacity exceeding that needed to accommodate five-year cooling of irradiated fuel before transport offsite	ER Section 5.7.2; EIS Section 6.2.2
	The transportation impact analysis for advanced reactor spent fuel shipments assumed the radiation dose rate emitted from the shipments is at the maximum allowed by Federal regulations	EIS Section 6.2.2
	It was assumed that shipping casks for advanced reactor spent fuel would provide equivalent mechanical and thermal protection of the spent fuel cargo (relative to the current light water reactor [LWR] spent fuel shipping cask designs)	EIS Section 6.2.2
	For this assessment, release fractions for current generation LWR fuels were used to approximate the impacts from advanced reactor spent fuel shipments. This essentially assumes that the behavior of fuel materials and containment systems (e.g., cladding, fuel coatings) is similar to that of the current generation LWR fuel under applied mechanical and thermal conditions	EIS Section 6.2.2
	The proposed geologic repository at Yucca Mountain was used as a surrogate destination for spent fuel shipments	ER Sections 5.7.2 and 7.4; EIS Section 6.2.2
	It was assumed that for unirradiated fuel, irradiated fuel, and radioactive waste, no shipments would be made by barge or rail	ER Sections 5.7.2 and 7.4; EIS Section 6.2
	It was assumed that shipments of spent nuclear fuel would be directly to a geologic repository. Shipment of spent nuclear fuel to an interim storage facility followed by shipment to a geologic repository was not analyzed	ER Sections 5.7.2 and 7.4; EIS Section 6.2
Decommissioning		
	Impacts from decommissioning new reactor unit(s) designs are bounded by those in NUREG–0586, Supplement 1	EIS Section 6.3

Table J-2 (continued)

Technical Area	Representations/Assumptions	Source
Nuclear Fuel Cycle and Fuel Storage		
	All of the LWR technologies considered have a design storage capacity for spent fuel pools that far exceeds that needed to accommodate 5-year cooling	ER Section 3.8.2
	After a sufficient decay period, the fuel will be removed from the pool and packaged in spent fuel shipping/storage casks, licensed in accordance with 10 CFR 72, Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High-Level Waste, and Reactor-Related Greater than Class C Waste, and transferred either to an independent spent fuel storage installation facility on-site or an off-site disposal facility.	ER Section 3.8.2
Waste Management		
	PSEG's existing pollution prevention and waste minimization program would apply to the new nuclear power plant	ER Section 5.5.3
	PSEG generates small quantities of hazardous wastes and is classified as a small-quantity generator. PSEG maintains a waste minimization plan for hazardous wastes, and all hazardous waste activities are performed in compliance with State and Federal regulations. PSEG's existing waste management procedures address the minimization of impacts in the unlikely event of a hazardous waste spill	ER Section 5.5.1
	Non-radioactive resins and sludges would be disposed of in a permitted industrial landfill. Universal wastes, scrap metal, and used oil and antifreeze would be managed for recycling or recovery. Office wastes and aluminum cans would be recycled locally. Putrescible wastes would be disposed of in an offsite permitted disposal facility. PSEG practices pollution prevention, including waste minimization. Solid wastes generated by the construction and operation of a new nuclear power plant would be handled in the same manner as current wastes are handled	ER Section 5.5.1.2
	PSEG would also develop and implement contingency plans, emergency preparedness plans, and spill prevention procedures similar to the procedures and plans for the existing units that would be implemented in the event of a waste spill. Personnel who are designated to handle waste or to respond to waste emergency spills would receive appropriate training to enable them to perform their work properly and safely	ER Section 5.5.2.3

Table J-2 (continued)

Technical Area	Representations/Assumptions	Source
Accidents		
	The exclusion area boundary is greater than 0.5 mi in all directions from the footprint of the new nuclear power plant. No major roads, public buildings, or residences are located within the exclusion area	ER Section 2.5.1; EIS Section 3.1
	Population growth in the vicinity of the PSEG Site would not alter the population distribution in the region	ER Section 2.5.1; EIS Section 2.5.1
	Impacts relating to postulated accidents determined by the applicant were based on earlier versions of the respective Design Certification/Control Documents (DCDs) for the Advanced Boiling Water Reactor, Advanced Passive 1000 (pressurized water) reactor, U.S. Advanced Pressurized Water Reactor, and U.S. Evolutionary Power Reactor designs. However, the staff conclusions were based on the latest versions of each DCD available at the time of the staff's review	ER Sections 7.1 and 7.2; EIS Section 5.11
	External events are a design-specific issue; therefore, they were not addressed in the PSEG ESP application. For a COL application, 10 CFR 52.79(a)(46) requires that the application includes a description of the PRA. The submitted PRA should follow Regulatory Guide 1.206, "Combined License Applications for Nuclear Power Plants," with a Level 1 and Level 2 PRA that includes internal and external events and addresses all plant operating modes. The scope should be sufficient to enable the applicant to utilize it as discussed in Section C.I.19.2. The scope of the PRA may need to be expanded if it supports other risk-informed applications. The environmental review at the COL stage relies upon the risk analysis and PRA performed for the safety review (i.e., Chapter 19 of the FSAR). Additionally, NUREG–0800, Standard Review Plan," also states the following: The applicant's analyses should be comprehensive in scope, and address all applicable internal and external events and all plant operating modes. Since some aspects of the applicant's approach may involve non-PRA techniques to address specific events (e.g., PRA-based seismic margins), the PRA staff review should ensure that the scope of the applicant's analyses is appropriate for their identified uses and applications, which may involve a scope, level of detail, and/or technical adequacy for the affected areas that is greater than that needed for a COL application	ER Section 7.2; EIS Section 5.11.2
Need for Power		
	In the need-for-power analysis, PSEG has identified the relevant service area (RSA) as the entire State of New Jersey	ER Sections 8.0 and 8.1

Table J-2 (continued)

Technical Area	Representations/Assumptions	Source
	PSEG has identified the need for an additional baseload generation in the State of New Jersey (i.e., within the RSA) which will be partially met by up to 2200 MW(e) from project no later than 2021	ER Section 8.4; EIS Chapter 8
Energy Alternatives		
	The analysis of energy alternatives for this ESP application assumes that PSEG's desired net electrical output for the new nuclear power plant is 2,200 MW(e) at a capacity factor of 90%	ER Sections 1.2.3 and 9.2.2.1
System Design Alternatives		
	PSEG considered any of three designs (i.e., MDCTs, NDCTs, and fan-assisted NDCTs) as options for its heat dissipation system. If one of these is chosen, it should be compared to the other two designs to determine if either of the other two designs is environmentally preferable to the chosen design	ER Section 9.4.1; EIS Section 9.4.1
Cumulative Impacts		
	The proposed nearby projects and activities that could have a cumulative effect upon the construction or operation of a new nuclear power plant at the PSEG Site are those identified in EIS Sections 2.12 and 7.0	ER Sections 2.8.1 and 2.8.2; RAI Response No. Env-14; EIS Section 7.0
Transmission Lines		
	Assumed the existing transmission lines have sufficient capacity to carry the total output of the existing SGS and HCGS units and a new nuclear power plant. A system study (load flow and grid stability) modeling these lines with the new plant's power contribution would need to be performed to confirm this assumption, if and when PSEG decided to proceed with the development of a new nuclear power plant at the site through the submittal of a COL application	EIS Section 3.2.2.2

References

40 CFR Part 125. 2007. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 125, "Criteria and Standards for the National Pollutant Discharge Elimination System." Washington, D.C. TN254.

PSEG (PSEG Power LLC and PSEG Nuclear LLC). 2014. *PSEG Site Early Site Permit Application;* Part 3, "Environmental Report." Revision 3, Newark, New Jersey. Accession No. ML14093B256. TN3452.

APPENDIX K

GREENHOUSE GAS FOOTPRINT ESTIMATES FOR A REFERENCE 1,000-MW(E) LIGHT WATER REACTOR (LWR)

APPENDIX K

GREENHOUSE GAS FOOTPRINT ESTIMATES FOR A REFERENCE 1,000-MW(E) LIGHT WATER REACTOR (LWR)

The review team has estimated the greenhouse gas (GHG) footprint of various activities associated with nuclear power plants. These activities include building, operating, and decommissioning a nuclear power plant. The estimates include direct emissions from the nuclear facility and indirect emissions from workforce transportation and the fuel cycle.

Preconstruction/construction equipment estimates listed in Table K-1 are based on hours of equipment use estimated for a single nuclear power plant at a site requiring a moderate amount of terrain modification (UniStar 2007-TN1564).

Preconstruction/construction equipment carbon monoxide (CO) emission estimates were derived from the hours of equipment use, and carbon dioxide (CO_2) emissions were then estimated from the CO emissions using a scaling factor of 172 tons of CO_2 per ton of CO. The scaling factor is based on the ratio of CO_2 to CO emission factors for diesel fuel industrial engines as reported in Table 3.3-1 of AP-42 (EPA 2012-TN2647). A CO_2 to total GHG equivalency factor of 0.991 is used to account for the emissions from other GHGs, such as methane (CH_4) and nitrous oxide (N_2O). The equivalency factor is based on non-road/construction equipment (Chapman et al. 2012-TN2644). Equipment emissions estimates for decommissioning are assumed to be one half of those for preconstruction/construction. Data on equipment emissions for decommissioning are not available; the one-half factor is based on the assumption that decommissioning would involve less earth moving and hauling of material, as well as fewer labor hours, when compared with preconstruction/construction.

Table K-1. GHG Emissions from Equipment Used in Preconstruction/Construction and Decommissioning (MT CO_2 equivalent [CO_2e])

Equipment	Preconstruction/Construction Total[(a)]	Decommissioning Total[(b)]
Earthwork and Dewatering	12,000	6,000
Batch Plant Operations	3,400	1,700
Concrete	5,400	2,700
Lifting and Rigging	5,600	2,800
Shop Fabrication	1,000	500
Warehouse Operations	1,400	700
Equipment Maintenance	10,000	5,000
TOTAL[(c)]	39,000	19,000

(a) Based on hours of equipment usage over a 7-yr period.
(b) Based on equipment usage over a 10-yr period.
(c) Results are rounded.

Table K-2 lists the review team's estimates of the CO_2 equivalent (CO_2e) emissions associated with workforce transportation. Workforce estimates for new plant preconstruction/construction are conservatively based on estimates in various combined license applications (Chapman et al. 2012-TN2644), and the operational and decommissioning workforce estimates are based on Supplement 1 to NUREG–0586 (NRC 2002-TN665). The table lists the assumptions used to estimate total miles traveled by each workforce and the factors used to convert total miles to metric tons (MT) CO_2e. The workers are assumed to travel in gasoline-powered passenger vehicles (cars, trucks, vans, and sport utility vehicles) that get an average of 21.6 mi per gallon of gasoline (FHWA 2012-TN2645). Conversion from gallons of gasoline burned to CO_2e is based on EPA emission factors (EPA 2012-TN2643).

Table K-2. Workforce GHG Footprint Estimates

	Preconstruction/ Construction Workforce	Operational Workforce	Decommissioning Workforce	SAFSTOR Workforce
Commuting Trips (round trips per day)	1,000	550	200	40
Commute Distance (miles per round trip)	40	40	40	40
Commuting Days (days per year)	365	365	250	365
Duration (years)	7	40	10	40
Total Distance Traveled (miles)[a]	102,000,000	321,000,000	20,000,000	23,000,000
Average Vehicle Fuel Efficiency[b] (miles per gallon)	21.6	21.6	21.6	21.6
Total Fuel Burned[a] (gallons)	4,700,000	14,900,000	900,000	1,100,000
CO_2 emitted per gallon[c] (MT CO_2)	0.00892	0.00892	0.00892	0.00892
Total CO_2 emitted[a] (MT CO_2)	42,000	133,000	8,000	10,000
CO_2 equivalency factor[c] (MT CO_2/MT CO_2e)	0.977	0.977	0.977	0.977
Total GHG Emitted[a] (MT CO_2e)	43,000	136,000	8,000	10,000

(a) Results are rounded.
(b) *Source:* FHWA 2012-TN2645.
(c) *Source:* EPA 2012-TN2643.

10 CFR 51.51(a) (10 CFR 51-TN250) states that every environmental report prepared for the combined license stage of a light-water-cooled nuclear power reactor shall take Table S-3 from 10 CFR 51.51(b) (10 CFR 51-TN250) as the basis for evaluating the contribution of the environmental effects of the uranium fuel cycle in licensing the nuclear power reactor. 10 CFR 51.51(a) (10 CFR 51-TN250) further states that Table S-3 shall be included in the environmental

report and may be supplemented by a discussion of the environmental significance of the data set forth in the table as weighted in the analysis for the proposed facility.

Table S-3 does not provide an estimate of GHG emissions associated with the uranium fuel cycle; it only addresses pollutants that were of concern when the table was promulgated in the 1980s. However, Table S-3 states that 323,000 MWh is the assumed annual electric energy use for the reference 1,000 MW(e) nuclear power plant and that this 323,000 MWh of annual electric energy is assumed to be generated by a 45 MW(e) coal-fired power plant burning 118,000 MT of coal. Table S-3 also assumes that approximately 135,000,000 standard cubic feet (scf) of natural gas is required per year to generate process heat for certain portions of the uranium fuel cycle. The review team estimates that burning 118,000 MT of coal and 135,000,000 scf of natural gas per year results in approximately 253,000 MT of CO_2e being emitted into the atmosphere per year because of the uranium fuel cycle (Harvey 2013-TN2646).

The review team estimated GHG emissions related to plant operations from a typical usage of various onsite diesel generators (UniStar 2007-TN1564). Carbon monoxide emission estimates were derived assuming an average of 600 hr of emergency diesel generator operation per year (four generators, each operating 150 hr/year) and 200 hr of station blackout diesel generator operation per year (two generators, each operating 100 hr/year). A scaling factor of 172 was then applied to convert the CO emissions to CO_2 emissions, and a CO_2 to total GHG equivalency factor of 0.991 was used to account for the emissions from other GHGs such as methane (CH_4) and nitrous oxide (N_2O).

Given the various sources of GHG emissions discussed above, the review team estimates the total lifecycle GHG footprint for a reference 1,000 MW(e) nuclear power plant with an 80 percent capacity factor to be about 10,500,000 MT. The components of the footprint are summarized in Table K-3. The uranium fuel cycle component of the footprint dominates all other components. It is directly related to power generated. As a result, it is reasonable to use reactor power to scale the footprint to larger reactors.

The IPCC released a special report on renewable energy sources and climate change mitigation in 2012 (IPCC 2012-TN2648). Annex II of the IPCC report includes an assessment of previously published works on lifecycle GHG emissions from various electric generation technologies, including nuclear energy. The IPCC report included in its assessment only material that passes certain screening criteria for quality and relevance. The IPCC screening yielded 125 estimates of nuclear energy lifecycle GHG emissions from 32 separate references. The IPCC-screened estimates of the lifecycle GHG emissions associated with nuclear energy, as shown in Table A.II.4 of the report, ranged more than two orders of magnitude, from 1 to 220 grams (g) of CO_2e per kWh, with 25th percentile, 50th percentile, and 75th percentile values of 8 g CO_2e/kWh, 16 g CO_2e/kWh, and 45 g CO_2e/kWh, respectively. The range of the IPCC estimates is due, in part, to assumptions regarding the type of enrichment technology employed, how the electricity used for enrichment is generated, the grade of mined uranium ore, the degree of processing and enrichment required, and the assumed operating lifetime of a nuclear power plant.

The review team's lifecycle GHG estimate of approximately 10,500,000 MT CO_2e for the reference 1,000 MW(e) nuclear plant is equal to about 37.5 g CO_2e/kWh, which places the review team estimate between the 50th and 75th percentile values of the IPCC estimates in Table A.II.4 of the report.

In closing, the review team considers the footprint estimated in Table K-3 to be appropriately conservative. The GHG emissions estimates for the dominant component (uranium fuel cycle) are based on 30-year-old enrichment technology, assuming that the energy required for enrichment is provided by coal-fired generation. Different assumptions related to the source of energy used for enrichment or the enrichment technology that would be just as reasonable could lead to a significantly reduced footprint.

Table K-3. Nuclear Power Plant Lifetime GHG Footprint

Source	Activity Duration (yr)	Total Emissions (MT CO_2[eq])
Preconstruction/construction Equipment	7	39,000
Preconstruction/construction Workforce	7	43,000
Plant Operations	40	181,000
Operations Workforce	40	136,000
Uranium Fuel Cycle	40	10,100,000
Decommissioning Equipment	10	19,000
Decommissioning Workforce	10	8,000
SAFSTOR Workforce	40	10,000
TOTAL[(a)]		10,500,000

(a) Results are rounded

Emissions estimates presented in this EIS have been scaled to values that are appropriate for the proposed project. The uranium fuel cycle emissions have been scaled by reactor power and plant capacity factor using the scaling factor determined in Chapter 6 and by the number of reactors to be built. Plant operations emissions have been adjusted to represent the number of large GHG emissions sources (diesel generators, boilers, etc.) associated with the project. The workforce emissions estimates have been scaled to account for differences in workforce numbers and commuting distance. Finally, equipment emissions estimates have been scaled by estimated equipment usage. As can be seen in Table K-3, only the scaling of the uranium fuel-cycle emissions estimates makes a significant difference in the total carbon footprint of the project.

References

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