CHAPTER 10

ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION

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ACRONYMS AND ABBREVIATIONS

Acronym	Definition
ABWR	Advanced Boiling Water Reactor
ac.	acre
AP1000	Advanced Passive 1000
BMP	best management practices
CDF	confined disposal facility
CO	carbon monoxide
CO_2	carbon dioxide
COL	combined license
CWS	cooling water system
dBA	A-weighted decibels
DOE	U.S. Department of Energy
DRBC	Delaware River Basin Commission
EAB	Exclusion Area Boundary
ER	Environmental Report
ESP	early site permit
°F	degrees Fahrenheit
ft.	feet
ft/sec	feet per sec
GWe	gigawatts electric
gpm	gallons per minute
HCGS	Hope Creek Generating Station
HPO	Historic Preservation Office
hr.	hour
IGCC	integrated gasification combined cycle
kV	kilovolt

Acronym	Definition
kW	kilowatt
kWh	kilowatt-hour
LOS	level of service
Mgy	million gallons per year
mi.	mile
MIT	Massachusetts Institute of Technology
MWe	megawatt electric
MWh	megawatt-hour
NAAQS	National Ambient Air Quality Standard
NEI	National Electric Institute
NESC	National Electrical Safety Code
NJAAQS	New Jersey Ambient Air Quality Standard
NJDEP	New Jersey Department of Environmental Protection
NJPDES	New Jersey Pollutant Discharge Elimination System
NOAA	National Oceanic and Atmospheric Administration
NO_x	nitrogen oxides
NRC	Nuclear Regulatory Commission
NRHP	National Register of Historic Places
OECD	Organization for Economic Co-operation and Development
OSHA	Occupational Safety and Health Administration
PJM	PJM Interconnection, LLC
PM_{10}	particulate matter less than 10 micrometers in diameter

ACRONYMS AND ABBREVIATIONS (CONTINUED)

Acronym	Definition
$PM_{2.5}$	particulate matter less than 2.5 micrometers in diameter
PPE	plant parameter envelope
PSD	Prevention of Significant Deterioration
RSA	relevant service area
RTO	Regional Transmission Organization
SGS	Salem Generating Station
SHPO	State Historic Preservation Office
SIL	significant impact levels
SO_x	sulfur oxides
SWPPP	Stormwater Pollution Prevention Plan
TEDE	total effective dose equivalent
US-APWR	U.S. Advanced Pressurized Water Reactor
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
U.S. EPR	U.S. Evolutionary Power Reactor
USFWS	U.S. Fish and Wildlife Service

CHAPTER 10

ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION

10.0 INTRODUCTION

This chapter presents the potential environmental consequences of constructing and operating a new plant at the PSEG Site. The environmental consequences are evaluated in the following five sections:

- Unavoidable adverse impacts of construction and operations (Section 10.1)
- Irreversible and irretrievable commitments of resources (Section 10.2)
- Relationship between short-term uses and long-term productivity of the human environment (Section 10.3)
- Benefit-cost balance (Section 10.4)
- Cumulative impacts (Section 10.5)

10.1 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS

Unavoidable adverse impacts are predicted adverse environmental impacts that cannot be avoided and for which there are no practical means of further mitigation. This section considers unavoidable adverse impacts from construction and operation of a new plant at the PSEG Site, any potential transmission line and a proposed causeway.

10.1.1 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS OF CONSTRUCTION

Construction impacts are discussed in detail in Chapter 4. Table 4.6-1 describes those impacts and identifies the measures and controls available to reduce or eliminate impacts. As noted in Table 4.6-1, most of the impacts are SMALL, as they are either not detectable or are minor compared to the availability of the affected resources. Table 10.1-1 summarizes construction-related impacts that result in a measurable loss or permanent change in resources, the mitigation and control measures available to reduce those impacts, and the remaining unavoidable adverse impacts after mitigation and control measures are applied. For many of the impacts related to construction activities, the mitigation measures are referred to as best management practices (BMPs). Typically, these mitigation measures are based on the types of activities that are to be performed. The mitigation measures are implemented through permitting requirements, and plans and procedures developed for the construction activities.

Unavoidable adverse impacts from construction of a new plant at the PSEG Site occur mostly in Salem County, New Jersey (NJ), excepting any potential transmission line. If a new 500 kilovolt (kV) transmission line is required, unavoidable adverse impacts occur in Salem County, NJ, and either Kent, New Castle and Sussex counties in Delaware (DE), or New Castle County in DE, Cecil and Harford Counties in Maryland (MD), and York County in Pennsylvania (PA), dependent upon routing.

Unavoidable adverse impacts of the new plant include land use changes on up to 2728 acres (ac.) of land along potential off-site transmission rights-of-way, impacts to three archaeological sites identified as potentially eligible for the National Register of Historic Places (NRHP) along the proposed causeway, impacts to potential submerged archeological resources in areas where dredging is necessary, and effects on up to 229 ac. of wetlands (139 ac. jurisdictional, 90 ac. in licensed disposal facilities that are considered non-jurisdictional) on-site and along the proposed causeway (Table 4.3-3). In addition, the potential off-site transmission rights-of-way cross up to 814 ac. of wetlands (Table 4.3-5) and 1026 ac. of floodplains (Subsection 4.2.1.3.2). Most wetlands and floodplains are unaffected by transmission line construction except in the limited footprints of transmission towers and any necessary access points, but 210 ac. of forested wetlands potentially are converted to non-forested (herbaceous) wetland types by tree clearing. It is not certain that a new transmission line is required, but potential impacts can be mitigated by using BMPs during construction. To the extent possible, the new transmission line will use or be located adjacent to existing rights-of-way.

Impacts to archaeological sites from construction of the proposed causeway will be mitigated through additional Phase II surveys and consultation with the New Jersey Historic Preservation Office (HPO) for identification of appropriate mitigation methods, if required. Consultation with HPO will be conducted during the design phase to determine needs for additional surveys and mitigative measures. Similarly, Phase II surveys and consultations will be conducted for areas subject to disturbance by dredging. Phase I reports for both of these potential impacts have

been reviewed and concurred with by NJ HPO subject to the Phase II survey and consultation requirements after detail design is completed. Wetland losses are mitigated by restoration and enhancement in accordance with U.S. Army Corps of Engineers (USACE), U.S. Fish and Wildlife Service (USFWS), and New Jersey Department of Environmental Protection (NJDEP) requirements. Mitigation measures for decreases in level of service (LOS) on local roads due to construction traffic may include carpooling, staggered shifts, new signals/traffic controls and new turn lanes.

10.1.2 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS OF OPERATIONS

Operational impacts of the new plant at the PSEG Site are discussed in detail in Chapter 5. Table 5.10-1 describes these impacts and identifies measures and controls available to reduce or eliminate adverse impacts. As noted in Table 5.10-1, the operations-related impacts are SMALL, as they are either not detectable or are minor compared to the availability of the affected resource. Table 10.1-2 summarizes operations-related impacts that result in a measurable loss or permanent change in resources, the mitigation and control measures available to reduce these impacts, and the remaining adverse impacts after mitigation and controls measures are applied.

As indicated in Table 10.1-2 most of the adverse impacts are either avoidable or negligible after mitigation and control measures are considered. For example, under low flow conditions in the Delaware River, the potential exists for the surface water consumption by the new plant to exacerbate low flow effects (e.g., salt line movement). However, this consumptive use is a small percent of Delaware River flow at the PSEG Site and its potential effect is mitigated by water releases from PSEG's dedicated water storage allocation at the existing upstream Merrill Creek reservoir. Similarly, operational groundwater use at the PSEG Site (210 gpm) is within the capacity of aquifer and consistent with the current daily and monthly permitted withdrawals. Site water permits and authorizations will be modified to address total PSEG Site demands.

The discharge of non-contact cooling water results in small near-field increases in ambient Delaware River chemical concentrations and temperatures that may impact aquatic biota and Essential Fish Habitat. The discharge is designed to promote rapid mixing and assure that impacts from chemical and thermal discharges are minor. The potential for prolonged exposures of aquatic biota is low as the plume dissipates rapidly, is limited to less than 5 percent of Delaware River width, and within the regulatory heat dissipation area limits. Discharges are controlled in accordance with NJPDES permit and DRBC docket requirements.

The new plant is in compliance with 10 CFR 20, 10 CFR 50, and 40 CFR 190 radiation dose limits. These dose limits are established to protect members of the public from radiation exposure. At nuclear power plants for which an analysis of radiation exposure to biota, other than members of the public, has been made, there have been no cases of exposures that are considered significant in terms of harm to the species or that approach the exposure limits of 40 CFR 190. The Committee on the Biological Effects of Ionizing Radiation (BEIR) concludes that the evidence indicates that no other living organisms have been identified that are likely to be more radiosensitive than humans. Therefore, demonstrating compliance with the regulatory limits of 40 CFR 190 and dose guidelines given by the IAEA provides sufficient assurance that other biota are protected.

While air quality impacts are generally minor, the modeled 24-hour (hr.) particulate matter ($PM_{2.5}$) concentration due to emissions from the auxiliary boiler and cooling towers (during the winter months) exceeds the U.S. Environmental Protection Agency (USEPA) significant impact level (SIL) in some locations, including a small part of the $PM_{2.5}$ non-attainment area in New Castle County, DE. In addition, the modeled 24-hr. $PM_{2.5}$ concentration due to the auxiliary boiler and mechanical draft cooling towers shows a slight exceedance of the applicable National Ambient Air Quality Standard (NAAQS) when combined with available background concentrations in NJ.

PSEG will consult with NJDEP and perform more detailed modeling, as necessary, after a reactor technology is selected and detailed design is completed for the cooling towers and combustion sources (including auxiliary boiler equipment). Applicable emissions rates in effect at the time will be used in detailed equipment design and specification, along with identification of the appropriate engineering and operational controls. The final modeling will demonstrate compliance with the applicable NAAQS, New Jersey Ambient Air Quality Standards (NJAAQS), and Prevention of Significant Deterioration (PSD) increments.

10.1.3 SUMMARY OF ADVERSE ENVIRONMENTAL IMPACTS FROM CONSTRUCTION AND OPERATIONS

Tables 10.1-1 and 10.1-2 indicate that most of the adverse environmental impacts associated with the new plant construction and operation at the PSEG Site are SMALL or reduced to SMALL through the application of mitigation and control measures. The existing Hope Creek Generating Station (HCGS) and Salem Generating Station (SGS) transmission lines have sufficient capacity for the new plant. Interconnection impact studies performed by PJM Interconnect, LLC (PJM) may identify the need for a new off-site transmission line to ensure grid stability. Despite the uncertainty regarding the need for a new line and the other regional transmission projects, the impacts associated with a hypothetical transmission line right-of-way are included for bounding purposes.

Most of the impacts from construction and operation are SMALL due to design features that result in lower levels of impact, BMPs that control and mitigate emissions and discharges to air and water, use of industrial zoned lands that were previously altered or disturbed, and applicable federal and state permitting requirements designed to protect humans and biota. These SMALL impacts generally have no detectable adverse impacts or only minor adverse impacts. MODERATE impacts include wetland losses, transmission impacts to land-use and terrestrial ecology, decreases in LOS on local roads, potential causeway disturbance of historic properties, and the modeled exceedance of the 24-hr. $PM_{2.5}$ NAAQS and SIL. These MODERATE impacts have measurable adverse effects that are offset by mitigation measures that eliminate unavoidable impacts and ensure that any remaining unavoidable impacts are SMALL.

Wetlands impacts are limited to construction of on-site features, the proposed causeway, and any required transmission line, and are offset by restoration and enhancement of off-site wetland areas in accordance with applicable USACE, USFWS, and NJDEP requirements. Restoration and enhancement activities to offset wetland losses reduce the MODERATE impacts to SMALL impacts. However, some short-term wetlands impacts are unavoidable.

Impacts to historic properties along the proposed access causeway and the potential transmission corridor will be mitigated in consultation with the State Historic Preservation Office (SHPO) for NJ, DE, MD, and PA. Any required mitigation reduces the MODERATE impacts to SMALL impacts. If a transmission line is not required, then impacts to historic properties are limited to the proposed causeway and potential visual impacts in DE and NJ.

Changes in land-use resulting from the construction of a potential off-site transmission line, if required, are minimized by using existing transmission line rights-of-way to the extent possible. For lands crossed by transmission lines, current agricultural and other uses may continue, which reduces impacts. If a new transmission line is not required, the MODERATE land use impacts are reduced to SMALL.

Mitigation measures will be employed to address decreases in LOS on local roads resulting from construction-related traffic. Carpooling, staggered shifts, the installation of traffic lights/ controls and construction of additional turn lanes at key intersections will be evaluated to address the impacts. These construction-related LOS mitigation measures also serve to keep LOS impacts from operations-related traffic SMALL.

The new plant may use oil-fired auxiliary boilers to provide plant-related heating during the winter months and steam for plant start-up purposes. Auxiliary boiler operation results in emissions of carbon monoxide (CO), nitrogen oxides (NO_x), sulfur oxides (SO_x), and particulate matter including $PM_{2.5}$. While the impacts of these emissions on final air quality are SMALL, the modeled 24-hr. $PM_{2.5}$ concentration due to auxiliary boiler emissions in combination with the cooling tower emissions exceeds the applicable SIL in some locations, including a small part of the $PM_{2.5}$ non-attainment area in New Castle County, DE. The modeled 24-hr. $PM_{2.5}$ concentration due to the auxiliary boilers and mechanical draft cooling towers shows a slight exceedance of the applicable NAAQS when combined with background concentrations in NJ. After a reactor technology is selected and detailed design is completed for the cooling towers and auxiliary boiler equipment, PSEG will consult with NJDEP and perform more detailed modeling as necessary. Applicable emissions rates in effect at the time will be used in detailed equipment design and specification, along with identification of the appropriate engineering and operational controls. The final modeling will demonstrate that all air quality impacts are SMALL.

The majority of the adverse environmental impacts associated with the new plant construction and operation at the PSEG Site are SMALL or reduced to SMALL through the application of mitigation and control measures. MODERATE impacts include wetland losses, changes in land use, decreases in LOS on local roads, potential disturbance of historic properties, and the modeled exceedance of the 24-hr. $PM_{2.5}$ NAAQS and SIL. These MODERATE impacts have measurable adverse effects that are offset by mitigative measures that eliminate unavoidable impacts and ensure that any remaining unavoidable impacts are SMALL.

Table 10.1-1 (Sheet 1 of 7)
Construction-Related Unavoidable Adverse Environmental Impacts

Element	Adverse Impact	Mitigation Measure	Unavoidable Adverse Environmental Impacts
Land Use	Construction of the new plant and causeway impacts 500 ac. of predominantly disturbed or otherwise degraded land. Impacts include *Phragmites*-dominated wetland, marsh creek channels, farmland, and floodplain.	Construction activities comply with all relevant federal, state, and local regulatory requirements, including BMPs and stormwater management plans to control erosion and runoff. Wetland and marsh creek channel impacts are offset by the wetland restoration program. Causeway impacts are minimized by the use of a structure roadway design including pilings/ piers.	A total of 270 ac. of land is occupied on a long term basis, consisting of 225 ac. on-site and 45 ac. off-site for the proposed causeway. A minor loss of locally important farmland and floodplain occurs.
	Construction of off-site transmission, if required, may result in long term alteration of up to 2728 ac. of current land uses.	BMPs are used to minimize impacts and to the extent possible any new transmission line will use and/or be located adjacent to existing rights-of-way. For lands crossed by transmission lines, continued use of lands for agriculture (and other current uses where possible) reduces impacts.	Conversion of forested land uses and limited loss of agricultural and wetland land uses will result.
	Potential for disturbance to three archaeological sites identified as potentially eligible for NRHP exists during construction of the proposed causeway.	Phase II survey and consultation with the New Jersey Historic Preservation Office (NJ HPO) will identify mitigation, as appropriate.	Unavoidable adverse environmental impacts are not anticipated.
	Potential for impacts to lands that may contain archaeological resources and other historic properties exists during construction of off-site transmission, if required.	Phase I (and where necessary Phase II) surveys will identify archaeological sites during route development. Consultation with States Historic Preservation Offices (SHPOs) will identify mitigation for unavoidable sites, as appropriate.	Minor potential disturbance of previously unidentified archaeological resources may occur.

Table 10.1-1 (Sheet 2 of 7)
Construction-Related Unavoidable Adverse Environmental Impacts

Element	Adverse Impact	Mitigation Measure	Unavoidable Adverse Environmental Impacts
Hydrologic Alterations	Localized alteration in Delaware River flow velocities and patterns due to localized dredging and construction of permanent shoreline structures.	Shoreline structures are designed to include shoreline stabilization that minimizes effects of flow alterations. Dredged area is minimized.	Unavoidable adverse environmental impacts are not anticipated.
	Loss of 152 ac. of floodplain occurs due to filling during construction in on-site and adjacent off-site areas. Potential off-site transmission crosses up to 1026 ac. of floodplain, but only minor losses are anticipated from any required transmission construction.	Specific measures and controls are not needed as impacts are minor in context of available floodplain.	Changes in local flood levels are not anticipated.
	Increase in local runoff to Delaware River from loss of wetlands, artificial ponds, and increase in impervious surfaces is anticipated.	Stormwater Pollution Prevention Plans (SWPPP) provide for the collection of stormwater to temporary storage areas for permitted discharge. Grading design/BMPs are used to direct runoff to storage basins prior to controlled and permitted discharge to the Delaware River.	Minor potential exists for increased runoff to the Delaware River with minor changes to localized flows.
	Loss of marsh creek channels and resultant changes in tidal exchange to limited marsh areas during construction.	Reconnection of isolated marsh creek channels and restoration of marsh creek channels is part of the wetland mitigation program.	Unavoidable adverse environmental impacts are not anticipated.

Table 10.1-1 (Sheet 3 of 7)
Construction-Related Unavoidable Adverse Environmental Impacts

Element	Adverse Impact	Mitigation Measure	Unavoidable Adverse Environmental Impacts
Water Use	Groundwater is supplied from aquifers that provide water for HCGS and SGS. Additional needs of up to nominally 119 gallons per minute (gpm) have been identified, which is available under existing water withdrawal authorizations.	The current site groundwater withdrawal permit limit is adequate to address the new plant needs. Specific measures and controls are not needed as impacts are minor.	Unavoidable adverse environmental impacts are not anticipated.
Water Quality	There are increased suspended solids and potential for pollutant loading due to land disturbance activities, filling of site utilization areas to raise elevation for plant buildings and support facilities, construction of cooling water intake and discharge structures in the Delaware River, dredging of water intake, discharge, and barge access areas, and proposed causeway construction.	BMPs and stormwater management plans will be developed to control erosion and runoff. Grading design includes provisions to manage runoff for controlled and permitted discharge to the Delaware River; and cofferdams and/or silt curtains are used to limit mixing and transport of suspended sediments. Disposal of dredged materials in approved disposal facilities areas.	Some localized impacts to surface water quality due to sediments in runoff may occur.
	There is an increase in the potential for chemical discharges from accidental spills to surface and groundwater.	Spill prevention control plans will be implemented. Construction is limited to shallow aquifers to avoid adverse effects on deeper aquifers used for site and regional potable water. Secondary containments will be used where applicable to prevent and control spills.	Some localized short-term decreases in water quality may occur.

Table 10.1-1 (Sheet 4 of 7)
Construction-Related Unavoidable Adverse Environmental Impacts

Element	Adverse Impact	Mitigation Measure	Unavoidable Adverse Environmental Impacts
Terrestrial Ecology	There are impacts to 229 ac. of wetlands on the PSEG Site and nearby off-site areas. This includes impacts to 139 ac. of jurisdictional wetlands (mostly *Phragmites*-dominated wetlands); and 90 ac. of wetlands in licensed disposal facilities (considered as non-jurisdictional) 20 ac. of coastal wetlands are impacted temporarily during construction of the proposed causeway. Permanent conversion of 210 ac. of forested wetlands to herbaceous types and minor wetland losses are anticipated due to off-site transmission construction, if required.	Wetlands losses are offset by restoration and enhancement per USACE and NJDEP requirements (DE, PA and MD requirements are applicable if off-site transmission construction is required).	There is a temporary loss of wetland function until wetland restoration area(s) are fully functional.
	Fauna displacement, particularly birds and mammals, occurs. Flora in upland areas and some less mobile fauna are impacted.	Construction is generally confined to areas that have been previously disturbed and that are of low biological value. Specific measures and controls are not needed as impacts are minor.	Temporary displacement of fauna and minor loss of flora and less mobile fauna in upland areas are anticipated.
	Important species habitat alteration or elimination and displacement from the off-site transmission corridor may occur due to off-site transmission construction, if required.	Consultations with state and federal agencies when the need for off-site transmission has been established, to minimize potential unavoidable impacts to listed species and define appropriate mitigating measures.	Minor loss of important species habitat may occur.
	There is a potential for bird collisions with man-made structures such as cranes and buildings during construction.	Previous HCGS surveys indicate very low incidence of bird collisions with plant buildings and structures. Specific measures and controls are not needed as impacts are minor.	Minor losses of birds due to collisions with structures may occur.

Table 10.1-1 (Sheet 5 of 7)
Construction-Related Unavoidable Adverse Environmental Impacts

Element	Adverse Impact	Mitigation Measure	Unavoidable Adverse Environmental Impacts
Aquatic Ecology	Elimination of 7265 feet (ft.) of marsh creeks and isolation of 2320 ft. of marsh creeks.	Restoration of marsh creeks is part of the restoration program for jurisdictional wetlands. Isolated marsh creeks will be reconnected, if possible, after construction completion.	Temporary loss of marsh creek habitat occurs until wetland restoration area(s) are fully functional.
	Elimination of 9.5 ac. of coastal wetlands and shallow water areas along shoreline of the Delaware River occurs.	Restoration is included as part of the restoration program for jurisdictional wetlands.	Temporary loss of aquatic habitat occurs until wetland restoration area(s) are fully functional.
	There is an increased potential for release of suspended solids and chemicals from runoff and accidental spills.	Stormwater discharges will meet applicable New Jersey Pollutant Discharge Elimination System (NJPDES) permit requirements. BMPs will be used to minimize erosion and sedimentation based on NJ SWPPP requirements. Spill prevention control plans and remediation per NJDEP requirements will be implemented.	Minor and localized impacts to aquatic biota are anticipated.
	There are impacts to the Delaware River, creeks and wetlands from off-site transmission tower construction, if required, including potential impacts to other surface water resources and sensitive species from land clearing/tower construction.	Ongoing efforts will be made to avoid and minimize impacts to aquatic ecosystems as part of design and permitting process. Consultations with state and federal agencies will be conducted to identify steps necessary to minimize potential unavoidable impacts to listed species as part of off-site transmission line development.	Minor and localized impacts to aquatic biota are anticipated.

Table 10.1-1 (Sheet 6 of 7)
Construction-Related Unavoidable Adverse Environmental Impacts

Element	Adverse Impact	Mitigation Measure	Unavoidable Adverse Environmental Impacts
Socioeconomics	Construction workers, HCGS and SGS employees, and local residents are exposed to elevated levels of dust, noise and exhaust emissions from vehicles.	BMPs for controlling fugitive dust and proper maintenance of construction equipment for controlling emissions are implemented. Major noise-producing construction activities are limited to daytime and evening hours to minimize night time noise impacts. Construction workers are required to wear hearing protection equipment in areas with high noise levels.	Minor physical impacts are limited to on-site workforce. Minor impacts to off-site air quality and noise due to construction traffic are anticipated.
	Construction waste materials require appropriate disposal.	Construction wastes are recycled as practicable, with remaining waste disposed of in approved landfills.	Unavoidable adverse environmental impacts are not anticipated.
	There is a decrease in LOS on local roads due to increased traffic from construction vehicles.	Mitigation may include installation of traffic controls/signals and additional turning lanes to mitigate delays due to increased traffic. Off-site parking/car pooling will be evaluated. The construction workforce will work in three shifts to spread additional construction traffic volume over a 24-hr. period.	Minor delays at intersections in and around Salem City occurs.
	There is an increase in the local population and associated increased demand for local public services, schooling, housing, and land.	Increases in local tax revenues support increased services. Specific measures and controls are not needed as impacts are minor.	Unavoidable adverse environmental impacts are not anticipated.
	Regional/local purchases and tax revenues increase.	Specific measures and controls are not needed as impacts are beneficial.	A small beneficial increase in local tax revenues occurs.

Table 10.1-1 (Sheet 7 of 7)
Construction-Related Unavoidable Adverse Environmental Impacts

Element	Adverse Impact	Mitigation Measure	Unavoidable Adverse Environmental Impacts
Radiation Exposure	The construction workforce is exposed to gaseous and liquid radioactive releases from HCGS and SGS as well as ISFSI dose.	Gaseous and liquid release rates from normal operations are within established regulatory standards and the applicable HCGS and SGS license limits. Dose from existing operations is within regulatory limits at the fence line. Mitigation is not anticipated.	Radioactive releases are below regulatory limits and unavoidable adverse environmental impacts are not anticipated.
Atmospheric and Meteorological	An increase in dust and emissions from construction equipment and construction workforce vehicles occurs.	BMPs are used for controlling fugitive dust. Proper maintenance of construction equipment and vehicles is used to control air emissions.	Minor localized increases in air emissions occur, mostly at and near the PSEG Site. Detectable changes to local meteorology are not anticipated.
Environmental Justice	There is a potential for adverse impacts to low-income and minority populations due to decreased LOS on roadways in Salem City.	Mitigation may include installation of traffic controls/signals and additional turning lanes to mitigate delays due to increased traffic. Off-site parking/car pooling will be evaluated. The construction workforce will work in three shifts to spread additional construction traffic volume over a 24-hr. period.	Impacts to low income and minority populations are not anticipated.

Table 10.1-2 (Sheet 1 of 8)
Operations-Related Unavoidable Adverse Environmental Impacts

Element	Adverse Impact	Mitigation/Control Measure	Unavoidable Adverse Environmental Impacts
Land Use	Low-level radiological wastes are disposed of in the existing permitted repository. Non-radiological wastes are disposed of in existing permitted off-site landfills/facilities.	Specific measures and controls are not needed as impacts are minor and mitigation is not required.	Unavoidable adverse environmental impacts are not anticipated.
	Visual impacts result from cooling towers and off-site transmission lines.	The PSEG Site has an existing cooling tower and is remote from residential and commercial areas. Consultation with NJ and DE Historic Preservation Offices will identify any necessary mitigation. If a new transmission line is needed it will be located within or adjacent to existing transmission line rights-of-way to the extent possible to minimize any impact.	Minor impacts to viewscape occur due to additional cooling tower(s) at the PSEG Site. Visual impacts may exist from a transmission line that may pass through commercial and residential areas or deviate from existing rights-of-way.
	Maximum salt deposition on vegetation is 0.8 lb/ac/mo within 2300 ft. of cooling towers.	Specific measures and controls for salt deposition effects on vegetation productivity are not warranted as salt deposition on local saline-tolerant vegetation is below impact levels.	Unavoidable adverse environmental impacts are not anticipated.
Hydrological and Water Use	The potential exists for low flows in the Delaware River due to surface water consumption by the new plant during drought conditions.	Water consumption during drought periods is offset, as required by Delaware River Basin Commission (DRBC), by water release from PSEG's existing allocation upstream reservoir water storage.	Minor consumptive use of the Delaware River occurs.

Table 10.1-2 (Sheet 2 of 8)
Operations-Related Unavoidable Adverse Environmental Impacts

Element	Adverse Impact	Mitigation/Control Measure	Unavoidable Adverse Environmental Impacts
Hydrological and Water Use, continued	Groundwater withdrawal is 210 gpm under average conditions. Consumptive use of surface water is 26,420 gpm (0.01 percent of Delaware River flow at the PSEG Site).	The additional demand is within the capacity of existing aquifers and within the current daily and monthly permitted withdrawals. Current permits and authorizations will be modified as necessary to meet total PSEG Site demands No mitigation required for consumptive use.	Unavoidable adverse environmental impacts are not anticipated.
	Minor changes in existing/ambient Delaware River flow patterns occurs due to blowdown discharge and water intake structure operation. Periodic maintenance dredging of intake approach area is necessary. Storm water runoff increases.	Use of closed-cycle cooling system results in negligible changes in Delaware River flow patterns that are limited to the immediate area of the discharge and intake structure openings. Stormwater BMPs and design features to collect and control runoff will be implemented.	Localized but negligible changes to Delaware River flow patterns are anticipated.
Water Quality	There are minor impacts to Delaware River water quality due to chemical and thermal discharges from plant, storm water runoff, and periodic maintenance dredging of the intake channel.	Chemical and thermal discharges are limited by the NJPDES and DRBC authorizations and requirements. The discharge design includes provisions for rapid mixing to minimize size of chemical and thermal plumes. BMPs for storm water and dredging to control and limit suspended solids impacts to water quality are implemented.	Minor and localized alteration of water quality is anticipated.

Table 10.1-2 (Sheet 3 of 8)
Operations-Related Unavoidable Adverse Environmental Impacts

Element	Adverse Impact	Mitigation/Control Measure	Unavoidable Adverse Environmental Impacts
Water Quality, continued	There is a potential for impacts to groundwater quality due to accidental spills.	Design assures that accidental spills affect only soils and shallow aquifers that are not used for potable water. BMPs and spill controls and countermeasures are used to limit and contain chemical spills. Any necessary remedial measures are implemented as required by NJDEP.	A minor potential for shallow groundwater water quality impact exists. Impacts are not anticipated to water quality of deeper aquifers used for potable water.
	Potential water quality impacts may occur from maintenance of transmission corridors.	Established PSE&G right-of-way management measures and BMPs are implemented. Herbicides are applied per an integrated pest management plan with provisions to address application near waterways.	Minor, infrequent and short-term decreases in water quality results are due primarily to maintenance vehicles crossing shallow streams in remote locations along off-site transmission line rights-of-way.
Aquatic Ecology	The cooling water intake results in entrainment and impingement of aquatic biota.	The closed cycle cooling system design includes provisions to assure that intake volumes and velocities are in accordance with USEPA 316(b) Phase I facility requirements. Intake monitoring is implemented per NJPDES requirements to demonstrate compliance with USEPA requirements.	There is a minor loss of aquatic biota, predominantly fish and crabs, relative to abundant standing stocks.

Table 10.1-2 (Sheet 4 of 8)
Operations-Related Unavoidable Adverse Environmental Impacts

Element	Adverse Impact	Mitigation/Control Measure	Unavoidable Adverse Environmental Impacts
Aquatic Ecology, continued	The discharge of non-contact cooling water results in near-field increases in ambient Delaware River chemical concentrations and temperatures that may impact aquatic biota.	The discharge is designed to promote rapid mixing and assure that impacts from chemical and thermal plume are minor. The potential for prolonged exposures of aquatic biota is minor as the plume dissipates rapidly and is limited to less than 5 percent of Delaware River width. Discharges are controlled in accordance with the NJPDES permit requirements.	Minor impacts on aquatic biota exposed to the discharge plumes are anticipated.
	Loss of benthic habitat occurs due to bottom scouring at discharge structure.	Rock rip rap, concrete aprons, or other engineering controls are included at the discharge opening to minimize bottom scour.	Some minor losses of benthic habitat occurs in the immediate area of the discharge outfall.
	There may be temporary exposure of aquatic biota to decreases in water quality due to transmission line maintenance activities.	Vegetation height is maintained in accordance with preestablished BMPs and includes mechanical measures where appropriate. Use of herbicides is per an integrated pest management plan and applicable permit/BMP requirements. BMPs are developed to assure maintenance activities are managed in a way to preserve habitat and to protect important species.	Minor, infrequent and short-term exposure of aquatic biota to decreases in water quality may occur.

Table 10.1-2 (Sheet 5 of 8)
Operations-Related Unavoidable Adverse Environmental Impacts

Category	Adverse Impact	Mitigation/Control Measure	Unavoidable Adverse Environmental Impacts
Terrestrial Ecology	Deposition of elevated levels of salt from the cooling towers on salt marsh vegetation occurs. Maximum salt deposition on vegetation is 0.8 lb/ac/mo within 2300 ft. of cooling towers	No specific measures or controls for salt deposition effects on vegetation are necessary or warranted as salt deposition on local saline-tolerant vegetation is below impact levels.	Impacts on vegetation are not anticipated.
	Decreases in productivity of local vegetation due to cooling tower plume fogging and shadowing may occur.	Specific measures and controls are not needed as the impacts are minor and of short duration and infrequent occurrence.	Intermittent minor losses of productivity of vegetation near the cooling tower(s) may occur.
	Elevated noise levels on-site and during transmission line maintenance activities may displace biota.	Noise levels beyond the property boundaries generally will be less than 65 dBA. Noise levels for transmission line maintenance activities are of infrequent, short duration and only cause temporary displacement. Mitigation is not required as impacts are minor.	Noise levels are below regulatory limits at the site boundary and no unavoidable adverse environmental impacts are anticipated.
	Possible exposure of terrestrial fauna to herbicides due to vegetation management practices may occur.	Established PSE&G right-of-way management measures and BMPs will be implemented. Herbicides will be applied per an integrated pest management plan and applicable permit/BMP requirements.	Intermittent and short-term exposure of terrestrial fauna to herbicides may occur.

Table 10.1-2 (Sheet 6 of 8)
Operations-Related Unavoidable Adverse Environmental Impacts

Element	Adverse Impact	Mitigation/Control Measure	Unavoidable Adverse Environmental Impacts
Terrestrial Ecology, continued	Bird collisions with the cooling towers or the transmission lines may occur. There is a potential for electrocution of birds roosting on/near transmission lines.	Previous HCGS surveys indicate low incidence of bird collisions with plant buildings and structures. Specific measures and controls for bird collisions are not needed as impacts are minor. Towers and lines are designed to industry standards to minimize risks of avian contact with energized components.	Occasional bird collisions and contacts occur with cooling towers and transmission lines.
Socioeconomic	Public exposure to increased noise levels due to plant equipment and cooling tower operation is a potential impact.	The nearest residences are almost three miles from the plant, and noise levels at nearest residences are below protective levels for daytime and night time, mitigation is not warranted or necessary.	Unavoidable adverse environmental impacts are not anticipated.
	Public exposure to transmission line noise and potential electric shock.	Noise levels at the edge of rights-of-way and under transmission lines are below NJDEP protective level of 65 dBA, mitigation is not warranted or necessary. Transmission lines are designed to comply with NESC standards to avoid electric shock risks; therefore, no mitigation is necessary.	Unavoidable adverse environmental impacts are not anticipated.
	The cooling tower(s), cooling tower plumes, and new off-site transmission, if required, alter the existing viewscape.	The PSEG Site has an existing cooling tower and is remote from residential and commercial areas. Consultation with NJ HPO and DE SHPO will identify any necessary mitigation. If a new transmission line is needed it will be located within or adjacent to existing transmission line rights-of-way to the extent possible to minimize any required mitigation.	Minor changes in viewscape occur.

Table 10.1-2 (Sheet 7 of 8)
Operations-Related Unavoidable Adverse Environmental Impacts

Element	Adverse Impact	Mitigation/Control Measure	Unavoidable Adverse Environmental Impacts
Socioeconomic, continued	There is an increase in traffic volume on local roads due to operations and refueling outage workforce travel to and from the plant and delivery of goods and services to plant.	Shifts are staggered, and improvements made to mitigate LOS impacts from construction traffic remain in place. These measures serve as mitigation sufficient to handle the smaller operations-related traffic volume.	Minor delays occur at intersections in and around Salem City.
	Emissions of air pollutants from operation of cooling towers and auxiliary boilers/other combustion equipment may affect ambient air quality.	Alignment and consultation with NJDEP provides inputs on final modeling of air emissions. Monitoring of background air quality and measures to mitigate impacts on air quality are evaluated to determine appropriate equipment and operational measures to reduce impacts and assure compliance with NAAQS/ NJAAQS and PSD increments.	A minor localized decrease in air quality during the winter months may occur, but significant deterioration of regional air quality is not anticipated.
	An increase in four-county and regional populations of less than 0.2 percent occurs.	Adequate housing, school capacity, water supply and water treatment capacities exist to accommodate minor population increase; therefore, mitigation is not required.	Unavoidable adverse environmental impacts are not anticipated.
	There are no adverse impacts to tax revenues, because there is an increase in tax revenues to local taxing jurisdictions.	There is an increase in tax revenues collected by county and regional taxing authorities and does not create any adverse impacts. No mitigation is required.	Unavoidable adverse environmental impacts are not anticipated. The increase in tax revenues is beneficial, particularly to Lower Alloways Creek Township and Salem County.
Radiological	Potential doses to the public from releases to air and surface water may occur.	All releases comply with regulatory limits and therefore, mitigation is not required.	Radioactive releases comply with regulatory limits, and unavoidable adverse environmental impacts are not anticipated.

Table 10.1-2 (Sheet 8 of 8)
Operations-Related Unavoidable Adverse Environmental Impacts

Element	Adverse Impact	Mitigation/Control Measure	Unavoidable Adverse Environmental Impacts
Atmospheric and Meteorological	Fogging from cooling tower plume on on-site roads may occur.	Fogging potential is limited to mechanical draft cooling towers, with most fogging occurring within 1000 ft. of the cooling towers. Fogging events are infrequent and short-term. Appropriate lighting and warnings will be posted on-site, and further mitigation is not required.	Infrequent and short-term increase in on-site fogging events may occur.
	Some changes in local climate due to increased precipitation, shadowing, and heat from cooling tower plume may occur.	Mitigation is not required as most detectable effects are limited to the area within 1000 ft. of the cooling towers .	Minor changes to on-site climatic conditions may occur due to cooling tower plume.
Environmental Justice	No adverse impacts on minority or low-income populations have been identified.	Level of impact is comparable for all populations and mitigation is not required.	Impacts to low income and minority populations are not anticipated.

10.2 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

This section describes the expected irreversible and irretrievable environmental resource commitments used in the new plant construction and operation. The term irreversible commitments of resources describes environmental resources that are potentially changed by the new plant construction or operation and that could not be restored at some later time to the resource's state prior to construction or operation. Irretrievable commitments of resources are generally materials that are used for the new plant in such a way that they could not, by practical means, be recycled or restored for other uses.

10.2.1 IRREVERSIBLE ENVIRONMENTAL COMMITMENTS OF RESOURCES

Irreversible environmental resource commitments resulting from the new plant, in addition to the materials used for the nuclear fuel include:

- Groundwater and surface water
- Land
- Aquatic and terrestrial biota
- Releases to air and surface water

10.2.1.1 Groundwater and Surface Water

The new plant requires Delaware River surface water for cooling purposes. Groundwater is used for construction, site potable requirements, and other plant operational needs.

Roughly one-third (26,420 gallons per minute [gpm]) of the surface water used for cooling purposes is consumed and lost to the atmosphere due to evaporation and drift from the cooling towers. Of the surface water lost to the atmosphere, 4756 gpm is considered freshwater (per the DRBC equivalent impact factor as further described in Subsection 5.2.1.2) and the remainder is salt water. The surface water losses to the atmosphere and the groundwater uses for plant operations are considered consumptive, as they are no longer available for other uses. The freshwater portion of the consumptive losses is equal to 0.7 percent of the annual median Delaware River flow at Trenton, NJ, whereas the total consumptive losses are 0.01 percent of the tidal flows at the PSEG Site. Consequently, the consumptive use is not anticipated to have any discernable effect.

Existing aquifers used by the HCGS and SGS plants have sufficient capacity to meet the additional groundwater needs of the new plant. The groundwater withdrawal for operation of the new plant is 210 gpm (Section 5.2.1.3), which equals 110.4 million gallons per year (Mgy). This value bounds the anticipated need of the new plant for groundwater during construction. The cumulative maximum withdrawal for operations, including SGS and HCGS average historic withdrawals (Table 2.3-24) and based on the PPE for the new plant, is 309 Mgy, which is 3 percent above the current SGS and HCGS site permitted annual water withdrawal. After a reactor technology is selected and a final site water balance is developed, PSEG will re-evaluate total site (SGS, HCGS, and new plant) water use against the site water allocation permit limits. The current water withdrawal permits and authorizations will be modified as necessary to include the new plant, or new permit(s) will be obtained. Groundwater use for the new plant, combined with long-term average SGS and HCGS groundwater use, is only slightly above the current site authorization, therefore the impact of additional water use is SMALL.

Previous modeling studies to establish the current annual permitted amount of groundwater withdrawal indicated that the affected aquifers can support withdrawals of more than twice the permitted amount with no adverse impacts (Subsection 4.2.2). In both cases, the impact to the resource is minor relative to available surface water and ground water resources and the impact is SMALL.

10.2.1.2 Land Use

Most of the land use changes associated with the new plant construction and operation are not considered permanent changes. A small number of acres of wetland impacts may be permanent if causeway use continues after decommissioning. The additional land requirements needed for disposal of radioactive and non-radioactive wastes are also considered to be permanently committed to that use. In conjunction with the new plant construction and operation and proposed causeway, 270 ac. of lands on-site are converted from non-industrial to industrial use (Table 4.1-1). A small percentage of up to 2728 ac. of lands off-site may be altered for the life of the plant if a new transmission line is required (Table 4.1-3). Most of the potential transmission impacts are related to the small footprint of the individual towers, or land use that is modified by fill, or where forested lands need to be maintained below a certain height for transmission safety. Potential impacts to wetlands (on-site or off-site) will be mitigated by the development of wetland restoration areas either on-site or in the vicinity of the PSEG Site at replacement ratios in accordance with USACE and NJDEP permit conditions. Consequently, the irreversible and irretrievable effect to wetlands is small. After operations cease and the plant is decommissioned in accordance with NRC requirements, the land that supports the on-site facilities could be returned to other industrial or nonindustrial uses. The land use impacts associated with a new transmission line may be permanent if the transmission line is used by other generating stations after decommissioning.

Permanent on-site land use impacts are not anticipated. Permanent off-site land-use changes are those associated with the additional land required for the disposal of radioactive and non-radioactive wastes during the life of the plant, and wetlands, forested lands and agricultural lands should the causeway and transmission line, if required, continue to be used after plant decommissioning at the PSEG Site.

10.2.1.3 Aquatic and Terrestrial Biota

Long-term irreversible losses of aquatic and terrestrial biota are not anticipated. Construction has a temporary adverse affect on the abundance and distribution of local flora and fauna on the PSEG Site and along the off-site transmission line corridor. Subsequent to the completion of construction, floral and faunal use is expected to recover in areas that are not affected by on-going operations or where land use was not altered (such as reduction in forested canopy height due to transmission line requirements). Losses due to operations are primarily attributable to intake operations and the resultant entrainment and impingement of aquatic biota. These losses are minor compared to available standing stocks, and most of the impacted species have high reproductive outputs. Therefore, losses due to entrainment and impingement are not expected to have a long-term impact on population levels of the affected species.

10.2.1.4 Releases to Air and Surface Water

Radioactivity, air pollutants, and chemicals are released from the new plant during normal operations. Releases can alter air and water quality. Emissions are below established regulatory standards, or are controlled in accordance with permitting requirements and are not expected to adversely affect air and water quality. New Castle County DE is near the PSEG Site and is in non-attainment for 24-hr $PM_{2.5}$, and therefore $PM_{2.5}$ emissions must meet more stringent standards to prevent further degradation of air quality. The new plant uses an auxiliary boiler to provide plant-related heating during the winter months and process steam during plant start-ups. The combined operation of the auxiliary boilers and cooling towers results in increases in CO, NO_x, SO_x, and particulate emissions. While air quality impacts are generally minor, the modeled 24-h $PM_{2.5}$ concentration due to emissions from the auxiliary boiler and cooling towers (during the winter months) exceeds the SIL in some locations, including a small part of the $PM_{2.5}$ non-attainment area in New Castle County, DE. In addition, the modeled 24-hr. $PM_{2.5}$ concentration due to the auxiliary boiler and mechanical draft cooling towers shows a slight exceedance of the applicable NAAQS when combined with available background concentrations in NJ. After a reactor technology is selected and detailed design is completed for the cooling towers and combustion sources (including auxiliary boiler equipment), PSEG will consult with NJDEP and perform more detailed modeling. Applicable emissions rates in effect at the time will be used in detailed equipment design and specification, along with identification of the appropriate engineering and operational controls. The final modeling will demonstrate that the new plant is in compliance with the NAAQS/NJAAQS and PSD increments, to ensure that the air quality impacts are SMALL.

10.2.2 IRRETRIEVABLE COMMITMENTS OF RESOURCES

Irretrievable commitments of resources during new plant construction are generally similar to that of any major, multi-year, construction project. Unlike previous nuclear plant construction, asbestos and other materials considered hazardous are not used, or used sparingly and in accordance with safety regulations and practices. U.S. Department of Energy (DOE) estimates of bulk materials required for construction of a single unit of a GEN III+ unit (advanced reactor designs that include the Advanced Passive 1000 [AP1000], U.S. Advanced Pressurized Water Reactor [US-APWR], Advanced Boiling Water Reactor [ABWR], and U.S. Evolutionary Power Reactor [U.S. EPR]) are listed in Table 10.2-1. The amounts of these materials are typical of other types of power plants (e.g., hydroelectric and coal-fired plants) and other large industrial facilities (e.g., refineries and manufacturing plants) that are constructed throughout the United States. Use of construction materials in the quantities associated with a nuclear power plant, while irretrievable unless they are recycled at decommissioning, have a SMALL impact, with respect to the availability of such resources.

During operations, the main resources that are irreversibly and irretrievably committed are the uranium used as fuel, and the energy required to produce the fuel. The World Nuclear Association studies of supply and demand of uranium indicate that an 80-year supply of uranium is available at current market prices based on known resources (Reference 10.2-4). This could increase to a 200-year supply as market prices rise and other conventional sources of uranium are used. Therefore, the uranium that is used to generate power by the new plant, while irretrievable, has a negligible impact with respect to the long-term availability of uranium worldwide. The assessment that the use of uranium constitutes an irretrievable resource

commitment can change as a result of a national adoption of a closed fuel cycle and spent fuel recycling for reuse in reactors.

The inventories of minerals used in the construction of power plants, as tabulated by the U.S. Census Bureau for 2000, 2007 and 2008, are shown in Table 10.2-2. While aluminum supplies have dropped since 2000 (from 3688 million metric tons in 2000 to 2284 million metric tons in 2006), the supplies during the 2006 to 2008 period have been increasing (2284 million metric tons in 2006 to 2640 million metric tons in 2008). The supply of other minerals has remained reasonably stable since 2000, with only minor fluctuations in availability during 2006 to 2008. The reasonably stable supply of minerals suggests that they will continue to be available for the foreseeable future in response to demand. Another important measure is industry capacity in those sectors that may affect nuclear power plant construction. The data in Table 10.2-3 suggest that most industries have surplus capacity. Over the 2004 to 2008 period, the primary metal, fabricated metal, and electrical equipment manufacturers used only 68 to 76 percent of their capacity. The data appear to indicate that the capacity utilization has been slightly increasing over this period. However, in 2008 the unused industrial capacity was still 24 to 28 percent, indicating that sufficient industrial capacity is available for construction of new plants.

While a given quantity of material consumed during new plant construction and operation at the PSEG Site is irretrievable, except for materials recycled during decommissioning, the impact on their availability is SMALL.

10.2.3 REFERENCES

10.2-1 U.S. Census Bureau, *The 2010 Statistical Abstract: Mining, Mineral Industries*, Website, http://www.census.gov/compendia/statab/cats/forestry_fishing_and_mining/mining_mineral_industries.html, accessed on January 25, 2010.

10.2-2 U.S. Census Bureau, *Survey of Plant Capacity Utilization: 2007 and 2008 Quarterly and 2006 Annual Reports,* Website, http://www.census.gov/manufacturing/capacity/historical_data/index.html, accessed on January 25, 2010.

10.2-3 U.S. Department of Energy, *DOE NP2010 Nuclear Power Plant Construction Infrastructure Assessment,* Report MPR-2776, Revision 0, Washington, DC, October 2005.

10.2-4 World Nuclear Association, *Supply of Uranium-September 2009*, Website: http://www.world-nuclear.org/info/inf75.html, accessed on December 9, 2009.

Table 10.2-1
Estimated Construction Bulk Material Requirements for Constructing Two GEN III+ Units

Construction Bulk Material	Quantities[(a)]
Concrete (cubic yard)	920,000
Reinforcing Steel and Embedded Parts (ton)	92.000
Structural Steel, Miscellaneous Steel and Decking (ton)	50,000
Large Bore Pipe (>2 ½ in.) (ft.)	520,000
Small Bore Pipe (ft.)	860,000
Cable Tray (ft.)	440,000
Conduit (ft.)	2,400,000
Power Cable (ft.)	2,800,000
Control Wire (ft.)	10,800,000
Process and Instrument Tubing (ft.)	1,480,000

Reference 10.2-3.

a) Quantities represent a two unit plant. Reference 10.2-3 quantities are for a single unit and have conservatively been doubled.

Table 10.2-2
United States Inventories for Minerals Used in Construction of Power Plants

Minerals	Inventory in 1000 Metric Tons by Year			
	2000	2006	2007	2008
Aluminum	3688	2284	2554	2640
Copper	1450	1200	1170	1310
Iron Ore	61	53	51	56
Lead	449	419	434	420
Titanium	300	300	300	200
Zinc	796	699	769	794
Portland Cement	84	93	90	85
Masonry Cement	4	5	4	3
Construction Sand and Gravel	1120	1320	1230	1040

Reference 10.2-1.

Table 10.2-3
Percent Capacity Utilization for Manufacturing Industries Relevant to Power Plant Construction, 2004 – 2008

Industry	Year				
	2004	2005	2006	2007	2008
Primary Metal Manufacturing	74	79	73	76	74
Ferrous Metal Foundries	68	72	72	NA	NA
Nonferrous Metal Foundries	60	66	64	NA	NA
Fabricated Metal Products	66	68	70	71	72
Electrical Equipment	69	68	69	76	70

NA = not available
Reference 10.2-2

10.3 RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG TERM PRODUCTIVITY OF THE HUMAN ENVIRONMENT

This Environmental Report (ER) focuses on the analyses and resulting conclusions associated with the environmental impacts from activities during the new plant construction and operation at the PSEG Site. These activities are considered short-term uses for purposes of this section. In this section, the long-term is considered to be initiated with the conclusion of new plant decommissioning at the PSEG Site. This section includes an evaluation of the extent that the short-term uses preclude any options for future long term use of the PSEG Site.

10.3.1 CONSTRUCTION OF NEW PLANT AT THE PSEG SITE AND LONG-TERM PRODUCTIVITY

Section 10.1 summarizes the potential unavoidable adverse environmental impacts of new plant construction and the measures proposed to reduce those impacts. Some SMALL adverse environmental impacts remain after all practical measures to avoid or mitigate the impacts have been taken. However, none of these impacts represent a long-term effect that precludes any options for future use of the PSEG Site.

The acreage disturbed during construction of the new plant, the proposed causeway and any potential transmission is larger than that required for the actual structures and other ancillary facilities because of the need for construction support facilities and laydown, batch plant operations, and parking areas for the construction workforce. Preparation of these on-site areas coupled with noise from construction activities, displace some wildlife and alter existing vegetation. Once the new plant is completed, the areas not needed for plant operations begin to revert to naturalized habitats that provide wildlife use.

Noise emitted by some construction activities increases the ambient noise levels on-site and in adjacent off-site areas. Upon completion of construction activities, noise levels are expected to decrease to the levels similar to those associated with the operation of the existing SGS and HCGS. The workforce is protected from excessive noise levels by adherence to the Occupational Safety and Health Administration (OSHA) requirements within high noise environments. There are no effects on the long-term productivity of the PSEG Site as a result of these impacts.

Construction traffic increases the volume of traffic on local roads and has adverse impacts on the LOS. These LOS impacts are mitigated and traffic volumes on local roads decrease once construction is completed. Consequently, there are no effects on long-term productivity from these impacts.

The new plant construction has beneficial effects on the local area such as new construction-related jobs, local spending by the construction workforce, and payment of taxes within the area and region. As indicated in Subsection 10.4.2, overnight costs for the construction of a 2200 MWe plant at the PSEG Site result in purchases of goods and services of $8.8 to $9.9 billion over a period of approximately 6 years. Based on the SGS and HCGS reported benefits, the multiplier effect from these expenditures result in an estimated additional indirect economic output of $0.88 for each construction dollar spent in the Region of Influence and $1.07 for each construction dollar in the DE-NJ-PA area (Subsection 4.4.2.2.1). This increase in the indirect economic output also results in an estimated 586 additional jobs in the Region of Influence and

4000 jobs in the DE-NJ-PA area. This additional indirect economic output and associated increase in indirect jobs further increase the amount of property taxes and sales taxes paid to state and local taxing jurisdictions to support and improve public and social services. The beneficial impacts from the in-migration of the construction workforce and indirect economic output and employment resulting from construction expenditures to the communities within the region cease once construction is complete. However, the changes that are the result of increased tax revenues continue throughout the operational life of the new plant. Tax revenue-related impacts are beneficial. Construction has a beneficial impact on the short-term economic productivity of the area, particularly in Salem County, NJ. There are potentially minor long-term beneficial impacts.

10.3.2 OPERATION OF NEW PLANT AT THE PSEG SITE AND LONG-TERM PRODUCTIVITY

Section 10.1 summarizes the potential unavoidable adverse environmental impacts of new plant operation and the measures proposed to reduce or eliminate those impacts. Some SMALL adverse environmental impacts could remain after all practical measures to avoid or mitigate them have been taken. However, none of these impacts represent long-term effects that preclude any options for future use of the PSEG Site.

The PSEG Site is located in an area that has been developed with three existing nuclear powered electric generation facilities. Therefore, the new plant operation represents a continuation of the current and planned land use. Once the reactors cease to operate and the plant is decommissioned to NRC standards, the land is available for other industrial or non-industrial uses. If an additional transmission line is required, portions of this line could remain in place and be used by future electric generating stations, thereby, helping to reduce associated land use and other impacts.

The new plant requires cooling water withdrawn from the Delaware River. Some of the water is lost to evaporation, but the losses are minor relative to the available surface water. Consumptive groundwater uses are needed to support plant operations and plant personnel. After the reactor(s) ceases to operate and the plant is decommissioned, consumptive ground and surface water use is no longer required.

The new plant operation will slightly increase air emissions because of intermittent short-term use of diesel generators or combustion turbines for emergency power supply, use of other combustion equipment, winter-use of auxiliary boiler(s) for plant heating or process steam for plant start-up, and continuous use of cooling towers for cooling water heat dissipation. This equipment is operated in accordance with applicable federal, state, and local regulations, and is not expected to result in any long-term decrease in regional air quality. Preliminary modeling shows maximum predicted PM_{10} and $PM_{2.5}$ concentrations exceed SILs in some locations. These are addressed during detailed design and plant equipment selection. Any other mitigative measures are developed in cooperation with NJDEP such that new plant emissions comply with applicable regulatory requirements and are protective of regional air quality. Salt deposition from the cooling towers will not result in any long-term decreases in productivity because deposition rates are low, and because the areas receiving the highest concentrations are salt marsh communities that are tolerant to salt deposition from the Delaware River. Particulate emissions and salt deposition will not affect long-term productivity of flora. Furthermore, the SMALL impacts associated with these activities no longer exist once the plant ceases operation.

Blowdown from the new plant cooling water system is discharged into the Delaware River. This discharge results in a small area that is characterized as having a higher temperature and concentration of heat and chemicals relative to ambient conditions. This discharge is permitted by NJDEP via a NJPDES permit to assure compliance with state and federal regulations that are protective to humans and aquatic biota. Thermal modeling indicates that there is no impact on the balanced indigenous community or the far-field water quality of the Delaware River. After decommissioning, there are no plant-related discharges to the Delaware River. Therefore, there are no long-term impacts to the productive use of the site after decommissioning due to plant discharges.

Impacts due to gaseous and liquid radioactive releases and direct radiation from the operating plant are SMALL and in accordance with state and federal regulations. These releases and direct radiation will not contaminate the PSEG Site or the surrounding land. No radiological releases occur after the new plant ceases operation and is decommissioned. Therefore, radiological impacts have no long-term impact on the productive use of the PSEG Site.

The new plant operation produces long-term socioeconomic changes that continue after the plant has been decommissioned. As indicated by the 2005 to 2008 HCGS and SGS expenditure data in Table 2.5-28, purchases of goods and services for the new plant operation and maintenance are significant. As described in Subsection 5.8.2.2.1, it is estimated that the multiplier effect from these expenditures results in additional indirect economic output of $0.88 for each dollar spent in the Region of Influence and $1.07 for each dollar spent in the DE-NJ-PA area. The increase in the additional indirect economic output could result in an average of 185 additional jobs in the Region of Influence and 1267 jobs in the DE-NJ-PA area. This additional indirect economic output and associated increase in indirect jobs further increases the amount of property taxes and sales taxes paid to state and local taxing jurisdictions to support and improve public and social services. The beneficial impacts from the in-migration of the operations workforce and indirect economic output and employment resulting from operation and maintenance expenditures to the communities within the region cease once decommissioning is complete. The proposed causeway may remain in place if future recreational use of the areas on/near the PSEG Site is desired. Property taxes paid by PSEG to Lower Alloways Creek Township and Salem County may be used to support greater township and county infrastructure and social services during the life of the plant. Infrastructure improvements may remain in place after plant decommissioning. These long-term improvements to the township and county have no long-term impact on the productive use of the PSEG Site.

10.3.3 SUMMARY OF RELATIONSHIP BETWEEN SHORT-TERM USE AND LONG-TERM PRODUCTIVITY

The impacts resulting from the new plant construction and operation at the PSEG Site result in both adverse and beneficial short-term impacts. The principal short-term adverse impacts are SMALL residual impacts (after mitigation measures are implemented) to land use, aquatic biota, local traffic, and air quality. There are no long-term impacts to the environment. The principal short-term benefits are the production of electrical energy, creation of additional jobs, additional tax revenues to taxing jurisdictions, and improvements to local infrastructure and social services. The principal long-term benefit is the continued availability of the improved infrastructure, particularly in Salem County, after plant decommissioning. The short-term

impacts and benefits and long-term benefits do not affect long-term productive use of the PSEG Site.

10.4 BENEFIT-COST BALANCE

10 CFR 51.50, *Environmental report—construction permit, early site permit, or combined license stage*, Section (b)(2) does not require an assessment of benefits and costs at the ESP stage. However, PSEG intends to apply for a combined license (COL) for a new plant at the PSEG Site in the future and prepared this ER with the environmental information needed for a COL application. For this reason, PSEG included this assessment of the benefit-cost balance in this ESPA.

10.4.1 BENEFITS

10.4.1.1 Need for Power

The new plant (assuming the bounding AP1000 design) consists of two units, with each unit generating 1100 megawatts electric (MWe) net, for a total of 2200 MWe. Assuming a conservatively low capacity factor of 85 percent, the 2-unit plant average annual electrical-energy generation is more than 16,000,000 megawatt-hours (MWh). A more reasonable capacity factor of 93 percent results in 18,000,000 MWh of electricity generated annually.

Chapter 8 analyzes the need for power based on annual PJM resource and load forecast data. The Relevant Service Area (RSA) for the new plant is the State of NJ which is part of PJM, the Regional Transmission Organization (RTO) for the area. As the RTO, PJM is responsible for the reliable supply of bulk electricity within the region. Analysis of PJM data indicates that an additional 7900 MWe (Section 8.4) of baseload capacity is required to meet 2021 energy needs.

The new plant provides regional baseload capacity to PJM to meet up to 28 percent of the additional baseload energy needs projected for NJ in 2021. Given the increasing concerns regarding carbon emissions, including CO_2, and associated climate change, the new plant helps PJM meets its baseload capacity needs without increasing carbon emissions for electrical generation.

One of the major benefits of a new plant at the PSEG Site is the supply of up to 2200 MWe of additional electricity to meet projected baseload capacity requirements. This additional baseload capacity:

- Provides up to 28 percent of the projected additional baseload power need in 2021 within NJ
- Reduces the amount of power imported into NJ
- Reduces reliance on oil fueled generation (domestic or foreign supplied) or other fossil fueled generation
- Reduces the potential for transmission congestion
- Lowers locational marginal prices
- Produces electricity with only incidental air emissions for support equipment

10.4.1.2 Energy Alternatives

Chapter 9 analyzes alternatives to meet the baseload power demand other than the proposed new plant, and demonstrates that there are no environmentally preferable alternatives for generating baseload power on the scale provided by the proposed plant.

PSEG's ability to supply affordable electricity to its customers is derived from its use of a diversity of fuels for its power generation facilities, promotion of conservation measures, and effective management of its baseload, intermediate, and peaking facilities. As shown in the energy alternatives analysis in Chapter 9, energy conservation and efficiency measures only partially meet PJM's projected increase in baseload capacity, and demand side management initiatives only impact peak demand.

Wind and solar generation facilities are variable in their output and, even with storage technologies, are unreliable and/or environmentally prohibitive as baseload generators within the RSA. Geothermal, solar, hydropower, and photovoltaic facilities are not viable due to the lack of suitable sites, lack of geothermal resources, or low solar insolation in the region. Hydropower, solar, and oil are less competitive than nuclear because of their greater environmental impact. Plants using fuel cells and photovoltaic cells are not competitive due to limited generation capacity and high development costs. An integrated gasification combined cycle (IGCC) plant is not competitive because this technology has unproven reliability at the scale needed and has high costs. Biomass as a fuel source is not competitive due to its low energy value, which results in larger fuel requirements and higher fuel costs. While biomass in combination with coal or natural gas may increase efficiency and reduce emissions, biomass has higher costs, larger land requirements for producing, collecting, and managing the required biomass, and higher air emissions, making either combination less competitive than nuclear. Only plants using coal and natural gas as fuel sources are considered competitive with a nuclear-fueled plant for baseload capacity.

A detailed analysis of coal and natural gas energy alternatives and systems is provided in Subsection 9.2.3. This analysis indicates that, overall, the proposed new plant is environmentally preferable to an alternative power generating facility fueled by coal or natural gas. Each of these two alternatives or a combination with other alternatives (wind, solar, biomass, etc.) has a much greater environmental impact on air quality and other natural resources than a nuclear power generating facility. Therefore, a power generating facility fueled by coal, natural gas, or a combination of either with other alternatives is not environmentally preferable to the new nuclear plant at the PSEG Site.

10.4.1.3 Benefits of the Proposed Facility

In addition to supporting PJM in meeting projected baseload capacity requirements for the RSA, a new plant at the PSEG Site provides benefits to the local economy, and helps reduce air and carbon emissions.

10.4.1.3.1 Socioeconomic Benefits

Additional important benefits from the new plant construction and operation include economic effects such as increases in:

- Property tax revenues to local taxing jurisdictions
- Purchases of local and regional goods and services
- Local and regional direct and indirect employment

The new plant provides benefits to the local economy in the form of additional property taxes, purchases of goods and services, and jobs. PSEG pays property tax on the 734 ac. it currently owns at the PSEG Site and lands included as part of the Estuary Enhancement Program. As indicated in Subsection 2.5.2, these property taxes ranged from $1.2 to $1.5 million per year for the current site property and $0.25 to $0.31 million per year for the ecosystem restoration properties during 2005-2009. As described in Subsection 2.2.1, the existing PSEG property boundary will be expanded as part of an agreement with the USACE by an additional 85 ac. to accommodate the needs of the new plant. Additional lands may be required to restore wetlands lost during construction of the new plant, the proposed causeway, and any necessary off-site transmission. Site property taxes are expected to increase based on the land area to be acquired. Tax payments are considered a benefit to the taxing entity because they support the development of infrastructure that supports further economic development and growth.

New plant construction and operation is also expected to have an economic multiplier effect in the area. The economic multiplier effect means that for every dollar spent additional indirect economic revenue is generated over the construction and operation period within the Region of Influence. The multiplier effect from the purchase of goods and services for HCGS and SGS construction, operation, and maintenance was an additional $0.88 of economic output for the Region of Influence and additional $1.07 for the three-state area (DE, NJ, and PA) for each dollar spent (Subsection 4.4.2.2.1 and 5.8.2.2.1). The economic multiplier effect is one way of measuring direct and secondary effects. Direct effects reflect expenditures for goods, services, and labor, while secondary effects include subsequent spending in the community. The economic multiplier effect due to the increased spending by this direct and indirect labor force increases economic activity in the region, most noticeably in Cumberland, Gloucester, and Salem counties in NJ and New Castle County in DE.

In 2009, the existing HCGS and SGS had a combined workforce of approximately 1574 employees (Subsection 2.5.1). As stated in Subsection 5.8.2, new plant operation adds an additional 600 direct employees to the on-site workforce. Based on projections derived from the 2006 NEI report, an additional 185 indirect jobs in the Region of Influence and 1267 indirect jobs in the three-state area may be created as a result of the purchases of goods and services in support of the new plant operation and maintenance. Many of these jobs are in the service sector and are expected to be filled by local residents, which strengthens the economy and also lessens additional demands on social service agencies. The new jobs will exist throughout the life of the plant.

10.4.1.3.2 Emission Reduction Benefits

Given concerns regarding climate change and carbon emissions, as well as emissions of SOx, NO_x, and particulates, a new plant at the PSEG Site provides an important environmental benefit by reducing emissions of carbon and other pollutants, when compared to coal-fired and natural gas-fired plants. Table 10.4-1 compares the CO_2, SO_2, NO_x, and particulates from coal, gas and nuclear plants. For the PSEG Site, it is assumed that an oil-fired auxiliary boiler is used for plant heating during the winter months and for process steam during plant start-ups. The PSEG Site emissions noted in Table 10.4-1 are conservative and are expected to be lower once

the boiler type is specified and the fuel is selected. Once the new plant is operational, it produces substantially lower amounts of carbon compared to coal-fired and natural gas-fired generating plants. Even with the conservative PSEG Site emission assumptions, it is clear that the new plant's emissions are a small fraction of those associated with comparably sized coal- and gas-fired power plants. The lower carbon emissions from a new nuclear plant at the PSEG Site is beneficial in light of the increasing global concerns regarding climate change and transition to a carbon-constrained regulatory environment.

10.4.1.3.3 Licensing Certainty

The regulatory scheme used for the existing domestic fleet of nuclear plants, under 10 CFR 50, was a two-step process that resulted in uncertainty regarding cost projections and ultimately in final costs. This was due, in part, to the fact that the industry had to make large capital investments prior to resolving licensing issues. In large, capital-intensive construction projects, interest costs are a significant portion of the project cost. As indicated in Subsection 10.4.2.2, interest charges on overnight capital costs account for a quarter of the levelized cost of electricity from nuclear power plants. Under 10 CFR 50, delays in obtaining an operating license quickly and substantially increased project cost. Design changes had similar effects, whether driven by licensing concerns, backfit requirements, or other factors.

The NRC's 10 CFR 52 licensing process, particularly the issuance of an ESP, provides early resolution of siting, design, and operational issues prior to large investments of financial capital and human resources in new plant design and construction. This process also provides for: early resolution of issues on the environmental impacts of construction and operation of proposed reactors, the ability to bank sites where nuclear plants may be located, and the facilitation of future decisions on whether to build new nuclear plants. This licensing process should reduce project costs by decreasing premiums associated with uncertainty and making licensing and construction scheduling more controllable and reliable.

10.4.2 COSTS

The costs associated with new plant construction and operation are broken down into internal and external costs. Internal costs are those expended by the applicant in support of the construction and operation of a new plant and are generally expressed in monetary values or quantities (materials). External costs are the environmental costs that result from the construction and operation of the new plant, and are expressed in terms of monetary, quantitative, and qualitative values.

10.4.2.1 Internal Costs

This section summarizes estimated internal costs for new plant construction and operation at the PSEG Site. Internal costs include capital costs of the facility, transmission lines, operating costs (staffing, maintenance, and fuel) and decommissioning costs. A number of studies have estimated construction and operation costs for the new generation (GEN III+) of nuclear reactors. These estimated costs vary depending on the assumptions used. Four studies commonly referenced are:

- Organization for Economic Co-operation and Development (OECD) study of projected electricity generating costs (Reference 10.4-5)

- University of Chicago study on the economic future of nuclear power (Reference 10.4-7)

- Updated Massachusetts Institute of Technology (MIT) study on the future of nuclear power (Reference 10.4-2)

- The Keystone Center nuclear power study (Reference 10.4-1)

By conducting a systematic review of nuclear power economics, the studies generated a financial model that estimated the costs of new nuclear plants. To develop that model, the following were considered:

- Factors affecting nuclear power competitiveness, including levelized costs, comparisons with international nuclear costs, capital costs, effects of learning by doing, and financing issues

- An analysis of technologies that could reduce the costs of gas- and coal-fired electricity, future changes in fuel price, and the potential economic impact of greenhouse gas control policies and technologies

- An analysis of several federal financing policy alternatives designed to make nuclear power competitive in the future

A December 2009 NEI study on the cost of new nuclear plants (Reference 10.4-4) summarized findings from a number of studies, including the updated MIT study, and cost data submitted by Florida Power and Light, Progress Energy Florida, and South Carolina Electric and Gas. This study was used as the basis for estimating the internal monetary costs of constructing and operating a new plant at the PSEG Site.

A major consideration in the competitive cost of nuclear power is the offsetting effect of the financial risk premium that resulted from past nuclear industry performance due to construction delays, cost overruns, and plants not being completed. Given the high capital costs for a nuclear plant and the long construction schedule, the higher financial rates of risk premiums contribute to the cost of constructing and operating a new nuclear plant. Until new plants are constructed and financial institutions are satisfied that the perceived risk is not justified, other incentives are required to offset the risk premium. The Energy Act of 2005 provides incentives to promote the construction and operation of new nuclear plants. Based on DOE summary information on the Energy Act of 2005 (Reference 10.4-6), the primary incentives are as follows:

- Loan guarantees up to 80 percent of the cost of construction
- Insurance of up to $500 million on the first two units against delays caused by litigation or the NRC
- Production tax credit of up to 1.8 cents per kWh for the first 6 GWe of new plants

These incentives help lower the financial costs by lowering the amount of developer's equity (as low as 20 percent), ensuring a lower interest rate due to the government guarantee, and helping to offset production costs in the initial eight years of operation. The incentives included in the Energy Act of 2005 may not be available to PSEG, due to DOE COL application schedule

requirements. PSEG anticipates that similar incentives may be available at the time it applies for a COL.

10.4.2.1.1 Monetary – Construction

The phrase commonly used to describe the monetary cost of constructing a nuclear plant is "overnight capital cost." These capital costs are those incurred during construction, when the actual outlays for equipment and construction and engineering are expended as if the plant was constructed overnight, with no interest or escalation factored in. Overnight costs are exclusive of interest and include engineering, procurement, construction costs, owner's costs, and contingencies. The NEI study estimated overnight capital costs ranging from $4000 per kW to $4500 per kW. Many factors account for the range: the specific technology and assumptions regarding the number of like-units built, allocation of first-of-a-kind costs, site location, the degree of modularization in the reactor technology/design, and allowances for contingencies.

10.4.2.1.2 Monetary – Operation

The four studies referenced above show a wide range of operation cost estimates. Operation costs are frequently expressed as levelized cost of electricity, which is the price at the busbar needed to cover operating costs and annualized capital costs. Overnight capital costs account for about one third of the levelized cost, and interest costs on the overnight costs account for another 25 percent (Reference 10.4-7). Factors affecting the range include choices for discount rate, construction duration, plant lifespan, capacity factor, cost of debt and equity and split between debt and equity financing, depreciation time, tax rates, and premium for uncertainty. Estimates include decommissioning but, due to the effect of discounting costs that occur as much as 40 years in the future, decommissioning costs have little effect on the levelized cost.

The NEI study (Reference 10.4-4) estimated that levelized costs of a new nuclear plant range from 7.5 to 8.1 cents per kWh. These costs are based on a merchant nuclear plant with an 80 percent debt/20 percent equity capital structure and support by a federal loan guarantee. PSEG has concluded that levelized costs in the NEI study are the most current available and that the assumptions used to derive the levelized costs are reasonable for a new plant at the PSEG Site. Therefore, PSEG has used levelized costs of 7.5 to 8.1 cents per kWh for a new plant at the PSEG Site.

In addition to nuclear plant costs, the four studies provide coal-fired and gas-fired generation costs for comparison to nuclear generation costs. The updated MIT and OECD studies (References 10.4-2 and 10.4-5) concluded that nuclear operating costs are competitive with coal and gas costs, while the other two studies concluded that nuclear operating costs are higher than coal and gas costs. The recent emphasis on CO_2 emissions and associated concerns regarding climate change are likely to cause significant increases in the cost of coal plants because they will be required to implement measures to reduce CO_2 emissions or pay for CO_2 emissions. The MIT study estimated that the levelized costs for coal-fired and gas-fired plants increases from 6.2 to 8.3 cents per kWh and 6.5 to 7.4 cent per kWh, respectively, due to the costs of eliminating or mitigating carbon emissions. The NEI compared levelized costs for nuclear, coal and gas power plants and found that nuclear (7.5 to 11.6 cent per kWh, depending on financial structure) and coal (7.4 to 11.6 cents per kWh, depending of financial structure and technology) costs are comparable without consideration of CO_2 emissions, while gas costs (5.6 to 9.7 cents per kWh) are less than nuclear. However, when the costs of controlling CO_2

emissions are factored in (2.5 cents per kWh for coal and 1.8 cents per kWh for gas) nuclear levelized costs are competitive with coal and natural gas levelized costs. Because CO_2 emissions from nuclear plants are negligible, they do not incur these additional costs. Therefore, a new nuclear plant at the PSEG Site is among the most competitive means of supplying needed baseload electricity to its customers.

10.4.2.1.3 Tax Payments

As indicated in Section 2.1.1, PSEG currently owns 734 ac. of land and is working with the USACE to acquire an additional 85 ac. of land. PSEG currently pays $1.2 to $1.5 million in property taxes on the 734 ac. to Lower Alloways Creek Township each year (Table 2.5-37). Over $200,000 in property taxes for Estuary Enhancement Program restoration properties are also paid by PSEG each year to various other NJ townships (Table 2.5-37). PSEG will pay property taxes on the additional 85 ac. and any new ecological restoration properties it acquires. Based on the current taxes paid for the 734 ac., the additional 85 ac. results in an increase in property tax payments to Lower Alloways Creek Township.

PSEG pays corporate tax to NJ as a result of revenues generated by the new plant. As indicated in Table 2.5-29, corporate taxes are 9 percent for NJ. Sales/Use tax are also paid to NJ and PA associated with the purchase of goods and services during construction and operation and these range from 6 percent in PA to 7 percent in NJ (Table 2.5-29). Payroll taxes paid by PSEG vary from 0.5 to 5.95 percent for DE, 1.4 to 8.97 for NJ, and 3.07 for PA (Table 2.5-29).

10.4.2.1.4 Land

As indicated in Section 10.4.2.1.3, PSEG is developing an agreement in principle with the USACE for the acquisition of an additional 85 ac. of land. The terms of this acquisition and associated cost are not known at this time. If an additional transmission line is required, up to 2728 ac. (Table 4.1-3) of land rights may be acquired.

10.4.2.1.5 Material Costs

Large quantities of concrete, steel, pipe, cable, conduit, tubing and wire and the various minerals required to produce these bulk construction materials are used during new plant construction and operation at the PSEG Site. According to mineral production inventory data, relevant minerals inventories are reasonably stable and have kept pace with requirements. Data on plant production capacity for those industries producing equipment and materials required for power plant construction are operating well below capacity. Based on the mineral production inventories and surplus plant production capacity, construction of a new plant will not adversely affect the cost of the required construction materials.

10.4.2.2 External Costs

External costs are those environmental costs that remain after mitigation and controls have been taken into account. For new plant construction and operation, these include residual land use, archaeological resource, water use, aquatic biota, and radiological costs.

10.4.2.2.1 Land Use

In conjunction with the construction of the new plant and proposed causeway, 270 ac. of lands (Table 4.1-1) are converted to long-term industrial use. A small percentage of the 2728 ac. of off-site lands (Table 4.1-3) may be altered if a new transmission line is required. Most of the potential transmission impacts are related to the small footprint of the individual towers, or land use that is modified by fill, or where forested lands need to be maintained below a certain height for transmission safety. After the new plant ceases operations and is decommissioned in accordance with NRC requirements, the land that supports the on-site facilities could be returned to other industrial or nonindustrial uses.

10.4.2.2.2 Archaeological Resources

PSEG will conduct Phase I and Phase II surveys, as appropriate, and work closely with the HPOs in DE, MD, NJ, and PA to identify, avoid, or minimize disturbance to archaeological resources along the transmission line rights-of-way, if required. There is a potential that some below-ground archaeological resources are unavoidable and could be lost or disturbed by construction activities.

10.4.2.2.3 Ground and Surface Water Use

New plant operations consume 26,420 gpm of surface water and 210 gpm of groundwater. The surface water consumption is the result of evaporative cooling losses, and the groundwater consumption is due to potable water needs by plant operations and personnel. The freshwater portion of the consumptive losses is 0.7 percent of the annual median Delaware River flow at Trenton, NJ, whereas the total consumptive losses are 0.01 percent of the tidal flows at the PSEG Site.

The groundwater withdrawal for the new plant is 210 gpm, which equals 110.4 Mgy. The cumulative maximum withdrawal for operations, based on SGS and HCGS average historic withdrawals (see Table 2.3-24) and the new plant, is 309 Mgy, which is 3 percent above the current SGS and HCGS site permitted annual water withdrawal. After a reactor technology has been selected and a final site water balance developed, PSEG will reevaluate total site (SGS, HCGS, and new plant) water use against the site water allocation permit limits. The current permits and authorizations will be modified as necessary to include the new plant, or new permit(s) for water withdrawal will be obtained. Groundwater use for the new plant, combined with long-term average SGS and HCGS groundwater use, is only slightly above the current authorization for the site, therefore the impact of additional water use is SMALL.

10.4.2.2.4 Aquatic Biota

The new plant uses a closed-cycle cooling system consistent with EPA requirements. Cooling water make-up requirements are small and the intake is designed to keep flow velocities across the traveling screens less than 0.5 ft./sec. The cooling water system design features minimize aquatic biota losses due to entrainment and impingement. The losses are minor compared to available standing stocks, and are not expected to have a long-term impact on population levels of the affected species.

10.4.2.2.5 Radiological

There are gaseous and liquid radioactive releases and direct radiation from the new plant during normal plant operations. These releases are to the atmosphere and surface water. The operations workforce and public could be exposed to these releases. However, the releases are monitored in accordance with protective state and federal regulations.

10.4.3 SUMMARY

Table 10.4-2 summarizes the benefits and costs of the proposed action. The primary benefits of a new plant include the availability of additional energy to meet projected demands, the avoidance of harmful air pollution emissions, additional tax revenues realized by local taxing jurisdictions, creation of additional jobs, and increased economic output. The primary costs of a new plant include the capital and operating costs, the construction materials consumed, and the environmental impacts remaining after implementation of proposed mitigation measures.

This analysis of the benefits and costs of a new plant at the PSEG Site indicates that:

- Additional electricity is needed in the RSA to meet projected baseload energy requirements
- Other alternatives such as importing electricity, implementation of additional energy conservation measures, or alternative energy sources are not adequate to meet this projected baseload energy need
- Construction of a baseload plant in the RSA is the most cost-effective way of meeting this projected baseload energy need
- Coal, natural gas, and nuclear plants are the most viable options for meeting this projected baseload energy need
- Construction and operation of a nuclear plant is cost competitive with coal-fired and natural gas-fired plants
- Government incentives for advanced nuclear plants reduce the perceived financial risks associated with construction of new plants
- Cost of carbon management at fossil-fueled plants will be high and favors nuclear plants over currently available coal-fired and gas-fired plants
- Construction and operation of the new nuclear plant increases both direct and indirect short-term and long-term employment, as well as increasing long-term direct and indirect economic output locally and within the region
- Construction and operation of the plant provides additional long-term tax revenues to local and state taxing jurisdictions for infrastructure and social services

- Air pollution emissions are an increasing domestic and international concern due to the contribution of greenhouse gases to climate change and overall environmental impacts are less with nuclear than with coal-fired and gas-fired-fired plants

- Use of the existing industrial-zoned site, which already has operating nuclear units, further minimizes environmental impacts

- Design features, BMPs, permitting, controls, and mitigation measures either avoid adverse environmental impacts or reduce impacts to SMALL

- A comparison of benefits and costs indicates that the benefits of a new nuclear plant at the PSEG Site are significantly greater than the economic and environmental costs

- The costs of plant construction and operation are reduced by continuing efforts to avoid and minimize impacts to ecological resources

As described in the previous section, the proposed new plant and associated development result in unavoidable impacts to ecological resources including waters of the United States and state waters. Direct wetland impacts from construction of the new plant and proposed causeway occur within the various site utilization areas (see Table 4.3-3 and Figure 4.3-2). However, PSEG has taken steps to minimize these potential impacts to the extent practicable as part of an overall avoidance and impact minimization strategy. Key elements of this strategy include reducing impacts to on-site wetlands and jurisdictional waters by the site layout configuration identified in Figure 3.1-2. Site utilization efforts minimize impacts to on-site wetlands by preferentially locating the key plant features (power block, cooling towers, etc.) in areas that are highly disturbed and are predominantly within existing licensed waste disposal facilities (i.e., PSEG's on-site desilt basin and the USACE confined disposal facility [CDF]). PSEG has made additional commitments to further avoid and minimize on-site impacts during the design phase by optimizing plant features within designated site utilization areas. Potential effects to the aquatic ecosystem are further minimized by avoiding impacts to marsh creeks within coastal wetlands.

Potential impacts within off-site areas are also minimized. Impacts to wetlands along the proposed causeway are minimized through the use of an elevated road and bridge design, thus reducing the width and magnitude of wetland impact when compared to construction on fill material. Within a 50-ft. width of impact, wetland impacts are limited to losses resulting from construction fill in areas directly affected by pier placement, and to shading effects. For potential off-site transmission, impacts are minimized by the commitment to site the transmission line in or along established rights-of-way to the extent practicable. Furthermore, additional consultations will be made with resource agencies to identify sensitive species of concern, avoid jurisdictional waters including wetlands, and mitigate any unavoidable adverse impacts.

10.4.4 REFERENCES

10.4-1 The Keystone Center, *Nuclear Power Joint Fact-Finding,* Keystone, Colorado, June 2007.

10.4-2 Massachusetts Institute of Technology, *Update of the MIT 2003 The Future of Nuclear Power; An Interdisciplinary MIT Study*, Boston, Massachusetts, 2009.

10.4-3 Not Used

10.4-4 Nuclear Energy Institute, *The Cost of New Generating Capacity in Perspective,* Washington, D.C., December 2009.

10.4-5 Organization for Economic Co-Operation and Development, and International Energy Agency, *Projected Costs of Generating Electricity; 2005 Update,* Website, http://browse.oecdbookshop.org/oecd/pdfs/browseit/6605011E.PDF, accessed December 17, 2009.

10.4-6 U.S. Department of Energy, Energy Policy Act of 2005: New Plant Incentives within the Energy Policy Act of 2005 (EPACT2005), Website, http://www.ne.doe.gov/energypolicyact2005/neEPACT2a.html, accessed January 26, 2010.

10.4-7 The University of Chicago, *The Economic Future of Nuclear Power,* Chicago, Illinois, August 2004.

Table 10.4-1
Comparison of Typical Air Emissions from Coal- and Gas-Fired Power Plants with Preliminary Air Emission from the PSEG Plant

Pollutant	Coal Plant Emissions (tons per year/ 1924 MW)[(a)]	Gas Plant Emissions (tons per year/ 2200 MW)[(a)]	New Nuclear Plant (tons per year/ 2200 MW)[(b)]
Sulfur dioxide	6410	63	230
Nitrogen oxides	5293	528	44
Carbon Dioxide	15,375,434	6,907,756	24,000
Particulates having a diameter of less than 10 microns	982	662	69

a) From Table 9.2-2, based on no CO_2 capture data.
b) From Table 5.8-1, except for CO_2. Emissions are due to the distillate-fueled auxiliary boiler use for heating during the winter months and monthly start-up testing of diesel generators.

Table 10.4-2 (Sheet 1 of 3)
PSEG Site Benefits and Costs Summary

Benefit Category	Description
Electricity Generated	• 16,000,000,000 to 18,000,000,000 kWh
Generating Capacity	• Up to 2200 MWe • Provide up to 28% of the projected increase in baseload demand • Reduce the need to import electricity into NJ • Reduce reliance on fossil fuels including imported oil • Reduce the potential for transmission congestion • Lower locational marginal prices
Fuel Diversity	• Nuclear alternative to coal-fired and gas-fired baseload generation
Emission Reduction	• Avoidance of up to 6410 tons per year of SO_2 • Avoidance of up to 5293 tons per year of NO_x • Avoidance of up to 15.38 million tons per year of CO_2 and associated climate change impacts. • Avoidance of up to 982 tons per year of particulates
Tax Payments	• Increase in current property taxes by an estimated 11 percent which helps support and enhance local public and social services • Purchases related to construction and operation of the plant result in additional sales taxes from direct expenditures and additional sales tax and payroll taxes from indirect expenditures to state and local taxing jurisdictions. These additional direct and indirect taxes help support and enhance state and local public and social services.
Local Economy	• 600 additional direct operations workforce jobs • 4100 construction workforce jobs (634 relocations to Region of Influence) • Additional 586 local and 4000 regional indirect jobs during construction and 185 local and 1265 regional indirect jobs during operation due to multiplier effect • Increase in local and regional direct and indirect economic activity due to construction-related and operations-related purchases of goods and services. An additional $0.88 of indirect economic activity for every dollar of local purchases and $1.07 for every dollar of purchases in the region.
Historic and Archaeological Resources	• Mitigation of identified sites determined to be unavoidable preserves resources and adds to local historic and prehistoric knowledge.
Licensing Certainty	• ESP provides early resolution of environmental issues, facilitation of future decisions on whether to build nuclear power plants.

Table 10.4-2 (Sheet 2 of 3)
PSEG Site Benefits and Costs Summary

Cost Category	Description
Internal Costs	
Construction Cost	• $4000-4500/kW (overnight capital cost).
Operating Costs	• 7.5 to 8.1 cents/kWh (levelized costs) as compared to 10.5 cents per kWh for coal-fired plants and 7.4 to 10.5 cents per kWh for gas-fired plants with CO_2 cost.
Tax Payments	• Corporate income and business taxes must be paid by PSEG to the State of NJ and property taxes to Lower Alloways Creek Township and Salem City. Although sales and payroll taxes associated with income and operation of the plant are not estimated, the tax payments on the current property may increase by an estimated 11 percent.
Land	• Acquisition of an additional 85 acres of land for the new plant and potential property rights for up to an additional 2728 acres for a potential transmission line, if required.
Materials	• Concrete – 920,000 cubic yards • Reinforcing steel and embedded parts – 92,000 tons • Structural steel, misc. steel, and decking – 50,000 tons • Large bore pipe (greater than 2-1/2 inches) – 520,000 ft. • Small bore pipe – 860,000 ft. • Cable tray – 440,000 ft. • Conduit – 2,400,000 ft. • Power cable – 2,800,000 ft. • Control wire – 10,800,000 ft. • Process and instrument tubing – 1,480,000 ft.

Table 10.4-2 (Sheet 3 of 3)
PSEG Site Benefits and Costs Summary

Cost Category	Description
External Costs	
Land Use	• Long-term use of 270 ac. of land on-site and within the proposed causeway. • Long-term use of up to 2728 ac. of land for transmission line rights-of-way, if required.
Archaeological Resources	• Potential disturbance or destruction of unidentified archaeological resources along off-site transmission line and proposed causeway.
Groundwater Use	• Consumptive use of an average of 210 gpm of groundwater from deep aquifers.
Surface Water Use	• Consumptive use of 26,420 gpm of water from Delaware River.
Aquatic Biota	• Minor losses due to entrainment and impingement
Radiological	• Construction worker dose: 18.2 millirem per year (total effective dose equivalent [TEDE]) • Operational worker dose: Less than current 309 person-rem per year (existing operating units plus new plant) • Maximum exposed individual (public) dose: 0.37 millirem/year (total body) during operation of existing units plus new plant • Collective dose to public: 60.1 person-rem per unit per reactor-year (total body) • Population dose risk from severe accident: 1.15E+00 person-rem per reactor-year

10.5 CUMULATIVE IMPACTS

This section discusses cumulative adverse impacts to the region's environment that could result from the new plant's construction and operation. A cumulative impact is defined in Council of Environmental Quality regulations (40 CFR 1508.7) as an "impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions."

To address cumulative impacts, the existing environment in the region surrounding the PSEG Site (Chapter 2) was considered in conjunction with the environmental impacts presented in Chapters 4 and 5 for constructing and operating a new plant at PSEG Site. PSEG is also seeking renewal of its operating licenses for HSGS and SGS for 20 years beyond the current term of 40 years. This section contemplates the renewal of HCGS and SGS operating licenses, and the cumulative impacts of the three plants on the affected environment.

10.5.1 CUMULATIVE IMPACTS FROM CONSTRUCTION

This section discusses the potential cumulative effects of PSEG Site construction activities (including the proposed causeway and potential transmission line) and the construction impacts of other major projects in the region. Past HCGS and SGS construction related impacts are part of the existing baseline conditions at the PSEG Site and are therefore intrinsically integrated as part of the cumulative effects analysis. Cumulative impacts of the new plant and other identified present and reasonably foreseeable future actions are assessed for land use, ecological resources (terrestrial and aquatic ecosystems, sensitive species), water resources (groundwater and surface water use and water quality, surface water hydrology) and the socioeconomic environment, (noise levels, air quality, socioeconomic resources, and environmental justice populations). The sensitivity of cumulative effects analysis is resource based, and an appropriate context of analysis was selected for each of the resources described below.

10.5.1.1 Land Use

PSEG currently owns 734 ac. of lands on the PSEG Site. As described in Subsection 2.2.1, PSEG is pursuing an agreement in principle with the USACE to acquire an additional 85 ac. immediately to the north of HCGS. With the land acquisition, the entire PSEG Site will be 819 ac. (Figure 3.1-2). The specific timing of land acquisition is not currently known and is subject to further PSEG and USACE actions. However, the agreement in principle with the USACE will establish the basis for eventual land acquisition and Exclusion Area Boundary (EAB) control, necessary to support the issuance of a future COL.

Subsequent to the agreement in principle with the USACE, PSEG will develop a lease agreement for the USACE CDF land to the north of the PSEG Site, as depicted on the Site Utilization Plan (see Figure 3.1-2) for the concrete batch plant and temporary construction/ laydown use. At the completion of construction, the leased land will be returned to the USACE, subject to any required long-term EAB control conditions.

The proposed causeway provides additional access to the PSEG Site and impacts 69 ac. of coastal marsh and adjacent uplands (45 ac. permanently and 24 ac. temporarily).

PSEG has identified two off-site transmission corridor alternatives that may be considered in future transmission routing studies in the event a new transmission line is necessary to accommodate grid stability requirement (Subsection 9.4.3). A particular corridor has not been selected, as this is dependent on a variety of factors including the selection of a reactor technology, formal transmission impact studies, and regional transmission planning efforts. These studies are performed at the time of COLA development after a reactor technology has been selected. If required, this transmission line right-of-way includes a total of 2728 ac. of land over a distance of up to 107 mi. Lands crossed by the potential off-site transmission line are influenced by past development patterns and are dominated by agricultural uses (cultivated fields, pastures, etc.), deciduous forests, and estuarine wetland types. In consideration of total acreage of similar lands within the 5-mi. wide macro-corridor within both the 6-mi vicinity and the region (Table 2.4-10), the amount of lands affected by potential off-site transmission is small. If off-site transmission is needed, PSEG will route the new transmission line in or along existing rights-of-way to the extent practicable to minimize land use impacts.

PSEG is not aware of any large projects that may alter or change the predominant land uses in Salem County or the other counties the transmission line corridor crosses. Therefore, cumulative impacts of changing land use are SMALL.

10.5.1.2 Water Resources

New plant construction results in impacts to both surface water and groundwater resources. Potential effects to surface water resources include the loss of perched artificial ponds within PSEG's desilt basin and the USACE CDF, filling of marsh creek channels to support site development, alteration of the shoreline of the Delaware River for barge facility, heavy haul road and intake structure construction, and dredging within the near-shore Delaware River to support barge facility operations and intake and discharge structures (Subsection 4.3.1).

The cumulative effects analysis on water resources is focused on other projects that may affect the Delaware River and Bay and its associated water resources. A project identified in the vicinity of the PSEG Site that entails disturbance of surface water resources is the USACE Main Channel Deepening Project. The resource potentially affected by both actions is the Delaware River. In their Environmental Assessment and Supplemental Environmental Impact Statement, the USACE has indicated that the project does not have a significant impact on the Delaware River. Water quality impacts at the point of dredging and at the CDFs are minimal (Reference 10.5-1). By comparison, the PSEG Site construction activities affect much smaller areas of the Delaware River and have smaller and more localized impacts on flow patterns and water quality than the USACE project. The minor impacts from the PSEG project in conjunction with the USACE channel deepening project are not expected to result in a greater incremental impact on water resources. Therefore, cumulative impacts from the PSEG project to surface water flows and water quality are SMALL.

Construction activities associated with the new plant require some use of groundwater from the same geologic formations as that used by the existing facilities. Surface water will be used for construction. PSEG intends to install two additional production wells to facilitate new plant operations. However, there are no other large groundwater users in the vicinity of the PSEG Site. Therefore, cumulative impacts to groundwater during construction are SMALL.

10.5.1.3 Ecological Resources

New plant construction at the PSEG Site impacts 385 ac. (permanent and temporary uses) of upland and wetland habitats on the site (Table 4.3-1). Much of these lands are characterized as low quality, previously disturbed old field habitats that have become naturalized following the construction of the HCGS and SGS plants. These low quality habitats are often dominated by the invasive common reed (*Phragmites australis*). Construction activities affect wetlands that consist of coastal wetlands (105 ac.), unmapped coastal wetlands (34 ac.), and unmapped coastal wetlands within permitted disposal facilities (90 ac. within PSEG's desilt basin and within the USACE CDF) (Table 4.3-3). A total of 9.5 ac. of coastal riparian zones and open water habitat along the shoreline of the Delaware River are affected by new plant development.

The proposed causeway impacts 41 ac. of wetlands (21 ac. permanent impacts primarily due to shading effects, and 20 ac. temporarily during construction, Table 4.3-3). An off-site transmission line may be developed that affects 2728 ac. of land over a distance of up to 107 mi. Lands crossed by the potential off-site transmission line are influenced by past development patterns and are dominated by agricultural uses (cultivated fields, pastures, etc.), deciduous forests, and estuarine wetland types (Table 4.3-4). Considering the total acreage of similar habitats within the 5-mi. wide macro-corridor in the 6-mi vicinity and the region (Table 2.4-10), the amount of lands affected by potential off-site transmission is small. If off-site transmission is needed, PSEG will route the new transmission line in or along existing rights-of-way to the extent practicable to minimize land cover impacts. Therefore, cumulative impacts to terrestrial ecosystems are SMALL.

The cumulative effects analysis on aquatic ecosystems and wetlands is focused on other projects that may affect the Delaware River and Bay and its associated water resources. Other projects identified in the vicinity of the PSEG Site that entail disturbance of similar resources include the USACE Main Channel Deepening Project and the habitat restoration at Mad Horse Creek Wildlife Management Area funded as a result of the 2004 *Athos I* oil spill on the Delaware River at Paulsboro, NJ (Section 2.8). The channel deepening project affects a stretch of the Delaware Bay and Delaware River extending from the Philadelphia to the mouth of the Delaware Bay. New plant construction impacts on-site water bodies, small marsh creeks, and requires dredging of a 92-ac. area to support barge facility and intake structure operations (Subsection 4.3.2.3). The effects of these activities on water quality and aquatic biota are localized and not contributory to any cumulative effects on the ecosystem of the Delaware River or Estuary. As indicated previously, the PSEG project is not expected to result in any incremental increases in impact to ecological resources affected by the USACE project. Therefore, cumulative impacts of the PSEG project on aquatic ecosystems similarly affected by the main channel deepening are SMALL.

Subsection 2.8.2.5 describes the planned restoration activities within the Mad Horse Creek Wildlife Management Area. The proposed Mad Horse Creek restoration restores nearly 200 ac. of the Mad Horse Creek Wildlife Management Area to address injuries to shoreline and bird resources resulting from the 2004 *Athos I* oil spill. NJDEP and the National Oceanic and Atmospheric Administration (NOAA) are proposing a tidal wetland restoration project that allows construction of *Spartina alterniflora* habitat. Restoration is accomplished through fill material removal to lower the marsh elevation and allow tidal inundation. Unavoidable impacts of new plant construction to wetlands on the PSEG Site and within the vicinity is mitigated by habitat restoration and enhancement, as described in Subsection 4.3.1, using proven experience and

techniques developed by the PSEG Estuary Enhancement Program. Sensitive species that utilize such marsh habitats (bald eagle-foraging only, northern harrier, osprey) are positively affected by the proposed Mad Horse Creek restoration effort and by the proposed mitigation for the new plant (i.e., restoration of low quality marsh habitats). Consequently, cumulative adverse impacts to sensitive species are not expected.

In summary, upland terrestrial habitats of the PSEG Site are generally of low quality and dominated by the invasive strain of *Phragmites.* Impacts to aquatic ecosystems are localized relative to the channel deepening project and small in comparison to the available resources of the Delaware River and Bay. Construction related impacts to wetlands and marsh creeks are mitigated by restoration and enhancement measures. Therefore, PSEG has concluded that the cumulative impacts of new plant construction on ecological resources are SMALL.

10.5.1.4 Socioeconomic Resources

Existing noise levels on the PSEG Site attenuate to background levels near the site boundary. During new plant construction, site and traffic noise levels increase above those now experienced at PSEG Site, but attenuate to acceptable levels prior to reaching off-site residential receptors. The noise emissions return to levels typical of a power generation facility after construction ceases. No other large construction activities are planned in the vicinity that contribute to noise levels of nearby sensitive resources (e.g., residential receptors). Consequently, cumulative effects associated with noise from construction are SMALL.

New plant construction results in increased air emissions from commuter traffic and the operation of construction equipment. Air emission impacts from construction are SMALL, because emissions are controlled at the sources where practicable, emissions are maintained within established regulatory limits designed to minimize impacts, and the distance between the construction site and the public limits off-site exposures. This is the only large construction project currently planned in the vicinity. Therefore, adverse cumulative impacts to air quality are not expected.

The maximum construction workforce for the new plant is 4100 people. Of these workers, 82 percent are expected to reside in the four-county Region of Influence (Salem County, Cumberland County, and Gloucester County in NJ and New Castle County in DE). This workforce could have short-term SMALL impacts to the housing markets, social services, educational facilities, and community support services (fire and police protection, water/wastewater infrastructure). While some large development projects are planned in the Philadelphia area (Section 2.8) no other construction projects of this magnitude have been identified in the four-county Region of Influence. Consequently, cumulative impacts on the physical or social environment due to other large construction workforces are not expected within the 50-mi. region and the Region of Influence.

Potential adverse impacts are not disproportionately concentrated in such a manner as to impact environmental justice populations within the 50-mi. region or the four-county Region of Influence. Transportation improvements mitigate the potential transportation related impacts to environmental justice populations in Salem County. Based on factors including the isolated location of the construction site, the established adequacy of community infrastructure and public services, effective planning procedures, and sufficient tax revenues generated by the construction-related activity, environmental justice populations within Salem County are not

disproportionately affected. No other projects are identified that may affect the same environmental justice populations potentially affected by the new plant. Consequently, cumulative impacts to environmental justice populations are not expected.

No other cumulative impacts due to construction have been identified.

10.5.2 CUMULATIVE IMPACTS OF OPERATIONS

This section discusses the potential cumulative effects of PSEG Site operations activities and other major projects in the region. Cumulative impacts to land use, ecological resources, water resources, the socioeconomic environment, and human health are discussed. The geographic context for each analysis is similar to that given in the previous subsection.

10.5.2.1 Land Use

Anticipated impacts to land use from new plant operation result from the deposition of solids from cooling tower operation, periodic maintenance activities of the cooling water intake structure (desilting of the intake bays, and potentially limited dredging of the intake area to maintain depth), and periodic maintenance of the PSEG Site grounds. Each of these activities is predominantly confined to the PSEG Site and its immediate environs. Consequently, cumulative impacts on site land use are SMALL.

Operational activities in the vicinity of the PSEG Site are associated with maintenance of the proposed causeway and potential off-site transmission lines (vicinity and region). PSE&G's control and management of these rights-of-way preclude construction of residential and industrial features on the transmission corridors. PSEG has not identified any other projects in the vicinity of the PSEG Site that have the potential to alter land use. Therefore, PSEG concludes that cumulative impacts of plant operation on land use in the vicinity are SMALL.

PSEG also considered the potential for cumulative visual impacts due to cooling tower operation. As described in Subsection 5.1.3, the new plant cooling tower is predicted to be visible at a number of sites within the 10-mi. radius that are listed on the National Register of Historic Places. However, because of the large distance of the new plant from known historic sites, and the physical similarity of the new plant cooling towers with the existing HCGS cooling tower, the cumulative impact of the view of the new cooling towers on the viewshed of historic properties is SMALL.

Non-radioactive solid wastes from new plant operation are disposed in permitted landfills. The volume of additional wastes is minimized through waste minimization programs in a manner similar to that at the existing SGS and HCGS. Landfill capacity required by the new plant is small relative to the regional residential and industrial demand. Consequently, cumulative impacts of waste disposal on off-site land use are SMALL.

10.5.2.2 Water Resources

The new plant uses groundwater for some operational systems. The average withdrawal rate for the existing units, combined with the new plant operations slightly exceeds the current site permitted annual withdrawal rate. No other significant current or future users of groundwater in

the vicinity of the PSEG Site have been identified. Therefore, cumulative impacts to groundwater during operation are SMALL.

Operational activities that could impact surface water such as NJPDES permitted discharges are SMALL. Based on computer modeling, blowdown from the new plant cooling towers produces a thermal plume (1.5 degrees Fahrenheit [°F])) that extends up to 300 to 500 ft. downstream and upstream, and has a width of 450 ft. (Subsection 5.2.3). The plume is not large enough to affect the water quality or biota of the river. The new plant discharge is located north of the existing HCGS and SGS discharges and produces a plume that merges with those of the existing plants. As described in Subsection 5.2.3.1.2, the new plant plume is contained within SGS's thermal plume, such that the combined temperatures from the new plant and the existing SGS and HCGS thermal plumes are less than the maximum temperature elsewhere in the SGS thermal plume. Consequently, cumulative thermal impacts of new plant operation are SMALL.

The new plant cooling system withdraws make up water from the Delaware River. PSEG has an allocation of 6695 acre-feet of storage in the Merrill Creek Reservoir that is available to offset freshwater consumptive use during periods of declared drought. The total consumptive losses are 0.01 percent of the tidal flows at the PSEG Site (Subsection 5.2.2.1). No other significant current or future users of surface water in the vicinity of the PSEG Site have been identified. Consequently, the cumulative impacts of water withdrawal on the Delaware River are SMALL.

10.5.2.3 Ecological Resources

Potential cumulative operational impacts of the new plant relate to the operation and maintenance of off-site transmission lines and the impingement and entrainment of aquatic biota from cooling water system (CWS) operation. Potential cumulative impacts from transmission operation include those associated with the operation of the existing HCGS and SGS transmission lines and include the potential for electrocution or physical collision. As discussed in Subsection 5.6.1, appropriate measures are included in transmission line designs to reduce avian power line interaction such that these effects are minimized. PSEG uses BMPs on vegetation within transmission corridors and works in consultation with resource agencies to minimize potential effects to sensitive species. Thus, the potential for cumulative impacts to ecological resources from maintenance and operation of the transmission lines is SMALL.

The new plant CWS is designed as a closed-cycle system consisting of an intake structure that withdraws a small volume of water from the Delaware River, at a through-screen velocity of less than 0.5 ft/sec. As such, the design of the CWS is considered Best Technology Available under the Phase I Clean Water Act 316(b) regulations. As described in Subsection 5.3.1.2, estimated impingement mortality and entrainment rates result in the loss of a relatively small number of aquatic biota relative to the abundance of the standing stocks in the river and bay, and do not adversely affect the stability of the overall community or important species. Regarding the potential impacts from intake operation on aquatic biota, species richness and diversity levels of the fish community in the vicinity of SGS and HCGS are documented in PSEG's NJPDES permit renewal filings as high as, or higher than, they were in the 1970's. Species lists from preoperational studies and current studies are similar, and most of the important species' populations have either remained stable or varied due to regional or coast-wide environmental factors. The on-going HCGS and SGS operation does not result in an impact to the aquatic community that destabilizes resident populations. Therefore, cumulative impacts of the operation of the new plant intake system on aquatic biota are SMALL.

10.5.2.4 Socioeconomic Resources

PSEG has not determined the cooling tower configuration for the new plant. In terms of visual impact, the bounding condition assumes the operation of two natural draft cooling towers that are slightly taller in size and similar in configuration to the HCGS tower. The three cooling towers are visually grouped together so the aesthetics and visual impact is only slightly different from that which currently exists. Cumulative impacts on the viewscape are therefore SMALL.

Cooling tower operation results in localized effects such as ground level fogging, shadowing from the cooling tower and associated plume, and salt deposition on surrounding terrestrial ecosystems. Aside from the existing cooling tower at the HCGS site, there are no other cooling towers located nearby that could contribute to these effects. Because of the distances between the existing HCGS cooling tower and the new plant cooling towers (more than 2000 ft.) the localized effects of cooling tower operation (i.e., less than 1000 ft.) and the salt-tolerance of the adjacent plant communities, the cumulative impacts of cooling tower operation are SMALL.

Air quality impacts do not result from the reactors, but from support equipment and cooling towers. Emissions of criteria pollutants from the new plant are from the emergency diesel generators and/or combustion turbines and the auxiliary boiler(s). The region surrounding the PSEG Site has several large industrial facilities with permitted releases to the air. Areas having air quality as good as, or better than, the NAAQS are designated as attainment areas. Areas having air quality that is worse than the NAAQS are designated as non-attainment areas. Salem County is next to (but not included in) the Philadelphia-Wilmington $PM_{2.5}$ non-attainment area and is located in the Philadelphia-Wilmington-Atlantic City 8-hr. ozone non-attainment area. Based on modeling results, NO_x impacts are in compliance with the NAAQS and PSD increment. However, predicted SO_2 and $PM_{10}/PM_{2.5}$ concentrations indicate that a modeling analysis must be conducted during the PSD permitting phase that includes background concentrations and other sources to demonstrate compliance with the NAAQS and PSD increments. After a reactor technology is selected and detailed design is completed for the cooling towers, emergency power equipment and auxiliary boiler equipment, PSEG will consult with NJDEP and perform more detailed multi-source modeling. Applicable emissions rates in effect at the time will be used in detailed equipment design and specification, along with identification of the appropriate engineering and operational controls. The modeling will demonstrate that the new plant will be in compliance with the NAAQS/NJAAQS and ensure that the cumulative impacts to air quality are SMALL.

Noise from the existing HCGS and SGS is typically indistinguishable from background at the site boundary, and the new plant generates similar levels of noise (primarily associated with cooling tower and intake structure operation). Additional traffic generated noise occurs on the regional roadway network. No other sources of industrial noise occur in the vicinity of the PSEG Site such that the new plant operation results in a cumulatively greater impact on noise pollution. Cumulative impacts from operations-related noise are SMALL.

Socioeconomic impacts, including increased tax revenues to Salem County, are cumulative with socioeconomic changes brought about through the operation of the existing HCGS and SGS plants, and changes due to normal population growth. Up to 600 workers are employed at the new plant to support operations. It is estimated that most of these new employees come from within the 50-mi. region. Some of these employees, as well as most new workers from outside the 50-mi. region, are expected to relocate to localities within the Region of Influence that

provide convenient access to the new PSEG plant. Taxes resulting from the new plant operation (direct payment of corporate taxes and indirect contribution of payroll taxes) are beneficial and offset the additional demands on local community services (education, police, fire protection, water and wastewater, etc.) within the four-county Region of Influence. No other projects that involve in-migration of a large workforce have been identified in the area. Cumulative socioeconomic impacts are therefore SMALL.

10.5.2.5 Human Health

The new plant releases small quantities of radionuclides to the environment. Gaseous effluent activity releases and liquid effluent activity releases are given in Tables 5.4-1 and 5.4-2 respectively. Values for gaseous effluent releases and liquid effluent releases from the new plant are taken from SSAR Tables 1.3-7, and 1.3-8 respectively. These values are multiplied by two to account for the possibility of dual units.

It should be noted that the doses from the new plant are higher than from the existing HCGS and SGS units because doses from the existing units are based on actual site measurements, compared to the conservatively calculated, theoretical doses from the new plant. For 2007, the collective total effective dose equivalent (TEDE) to workers was 118 person-rem at SGS and 191 person-rem at HCGS (Reference 5.4-1). This combines to a total of 309 person-rem. The maximum annual occupational dose from the new plant in combination with that from the existing SGS and HCGS at the PSEG Site is less than the 40 CFR 190 criteria (Table 5.4-10). Overall, the cumulative impacts to workers from occupational radiation doses is SMALL.

The fuel cycle specific to a new plant at the PSEG Site contributes to the cumulative impacts of fuel production, storage and disposal for all nuclear units in the United States. The cumulative impacts of the fuel cycle for the existing reactors are SMALL and the impacts from the addition of two new units do not change that conclusion. Fuel and waste transportation impacts from two new units are SMALL, and do not significantly increase the cumulative impacts of transportation of nuclear reactor fuel and wastes.

10.5.3 CONCLUSION

In conclusion, the impacts from the new plant construction and operation at the PSEG Site do not contribute significantly to existing or future cumulative impacts to the vicinity or the region.

10.5.4 REFERENCES

10.5-1 U.S. Army Corps of Engineers, *Delaware River Main Stem and Channel Deepening Project*, *Environmental Assessment.* Philadelphia, PA*.,* 2009*.*