Oyster Creek Generating Station

Applicant's Environmental Report - Operating License Renewal Stage

AmerGen℠
An Exelon Company

Applicant's Environmental Report – Operating License Renewal Stage Oyster Creek Generating Station

AmerGen

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ACRONYMS AND ABBREVIATIONS

AADT	Annual Average Daily Traffic
BTU	British Thermal Unit
°C	degrees Celsius
CAFRA	Coastal Area Facility Review Act
CCMP	[Barnegat Bay] Comprehensive Conservation and Management Plan
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CMP	[Pinelands] Comprehensive Management Plan
CWA	Clean Water Act
DoD	[U.S.] Department of Defense
DSM	Demand-side management
ESA	Endangered Species Act
°F	degrees Fahrenheit
FES	Final Environmental Statement
fps	Feet per second
FRPP	Forked River Power Plant
FSAR	Final Safety Analysis Report
FWS	[U.S.] Fish and Wildlife Service
GE	General Electric
GEIS	Generic Environmental Impact Statement for License Renewal of Nuclear Plants
gpm	gallons per minute
GW	groundwater
HRSG	heat recovery steam generator
IPA	Integrated Plant Assessment
ISFSI	Independent Spent Fuel Storage Installation
Kwh	Kilowatt hours
LOS	Level of Service
MAFB	McGuire Air Force Base
MGD	Million gallons per day
MM	million
MSA	Metropolitan Statistical Area
MUA	Municipal Utilities Authority
MW	megawatt
MWe	megawatts-electric
NAAQS	National Ambient Air Quality Standards
NAES	Naval Air Engineering Station
NESC	National Electrical Safety Code
NJAC	New Jersey Administrative Code

NJBPU	New Jersey Board of Public Utilities
NJDEP	New Jersey Department of Environmental Protection
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
OCGS	Oyster Creek Generating Station
PJM	Pennsylvania, New Jersey, Maryland [power pool]
PM_{10}	particulates with diameters less than 10 microns
ppt	parts per thousand
SAMA	Severe Accident Mitigation Alternatives
SCR	Selective catalytic reduction
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SMITTR	surveillance, monitoring, inspections, testing, trending, and recordkeeping
SO_2	sulfur dioxide
SO_x	sulfur oxides
SW	surface water
TSP	total suspended particulates
USAEC	U.S. Atomic Energy Commission
USCB	U.S. Census Bureau
USEPA	U.S. Environmental Protection Agency
USNRC	U.S. Nuclear Regulatory Commission
WMA	Wildlife Management Area

Chapter 1

Introduction

1.1 Purpose of and Need for Action

The U.S. Nuclear Regulatory Commission (NRC) licenses the operation of domestic nuclear power plants in accordance with the Atomic Energy Act of 1954, as amended, and NRC implementing regulations. AmerGen Energy Company LLC. (AmerGen) operates the Oyster Creek Generating Station (OCGS), pursuant to NRC Operating License DPR-16. The license will expire on April 9, 2009. AmerGen has prepared this environmental report in conjunction with its application to NRC to renew the OCGS operating license, as provided by the following NRC regulations:

> Title 10, Energy, Code of Federal Regulations (CFR), Part 54, Requirements for Renewal of Operating Licenses for Nuclear Power Plants, Section 54.23, Contents of Application-Environmental Information (10 CFR 54.23) and
>
> Title 10, Energy, CFR, Part 51, Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions, Section 51.53, Postconstruction Environmental Reports, Subsection 51.53(c), Operating License Renewal Stage [10 CFR 51.53(c)].

NRC has defined the purpose and need for the proposed action, the renewal of the operating license for nuclear power plants such as OCGS, as follows:

> "...The purpose and need for the proposed action (renewal of an operating license) is to provide an option that allows for power generation capability beyond the term of a current nuclear power plant operating license to meet future system generating needs, as such needs may be determined by State, utility, and, where authorized, Federal (other than NRC) decision makers." (USNRC 1996a)

The renewed operating license would allow an additional 20 years of plant operation beyond the current OCGS licensed operating period of 40 years.

1.2 Environmental Report Scope and Methodology

NRC regulations for domestic licensing of nuclear power plants require environmental review of applications to renew operating licenses. The NRC regulation 10 CFR 51.53(c) requires that an applicant for license renewal submit with its application a separate document entitled Applicant's Environmental Report - Operating License Renewal Stage. In determining what information to include in the OCGS Environmental Report, AmerGen has relied on NRC regulations and the following supporting documents that provide additional insight into the regulatory requirements:

- NRC supplemental information in the Federal Register (USNRC 1996a, 1996b, 1996c, and 1999a)
- Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) (USNRC 1996d and 1999b)
- Regulatory Analysis for Amendments to Regulations for the Environmental Review for Renewal of Nuclear Power Plant Operating Licenses (USNRC 1996e)
- Public Comments on the Proposed 10 CFR Part 51 Rule for Renewal of Nuclear Power Plant Operating Licenses and Supporting Documents: Review of Concerns and NRC Staff Response (USNRC 1996f)

AmerGen has prepared Table 1-1 to verify compliance with regulatory requirements. Table 1-1 indicates where the environmental report responds to each requirement of 10 CFR 51.53(c). In addition, each responsive section is prefaced by a boxed quote of the regulatory language and applicable supporting document language.

1.3 Oyster Creek Generating Station Licensee and Ownership

AmerGen is the NRC licensee for OCGS and will submit the OCGS license renewal application to the NRC. AmerGen is a wholly owned subsidiary of Exelon Corporation (Exelon 2002), a diversified energy services company representing more than 20 percent of the U.S. nuclear industry's power capacity (Exelon 2004). When AmerGen bought OCGS from GPU in August, 2000, Amergen was a joint venture between Exelon Corporation and British Energy. Exelon acquired British Energy's interest in 2002.

Table 1-1. Environmental Report Responses to License Renewal Environmental Regulatory Requirements.

Regulatory Requirement		Responsive Environmental Report Section(s)
10 CFR 51.53(c)(1)		Entire Document
10 CFR 51.53(c)(2), Sentences 1 and 2	3.0	Proposed Action
10 CFR 51.53(c)(2), Sentence 3	7.2.2	Environmental Impacts of Alternatives
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(1)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(2)	6.3	Unavoidable Adverse Impacts
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(3)	7.0	Alternatives to the Proposed Action
	8.0	Comparison of Environmental Impacts of License Renewal with the Alternatives
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(4)	6.5	Short-Term Use Versus Long-Term Productivity of the Environment
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(5)	6.4	Irreversible and Irretrievable Resource Commitments
10 CFR 51.53(c)(2) and 10 CFR 51.45(c)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
	6.2	Mitigation
	7.2.2	Environmental Impacts of Alternatives
	8.0	Comparison of Environmental Impacts of License Renewal with the Alternatives
10 CFR 51.53(c)(2) and 10 CFR 51.45(d)	9.0	Status of Compliance
10 CFR 51.53(c)(2) and 10 CFR 51.45(e)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
	6.3	Unavoidable Adverse Impacts
10 CFR 51.53(c)(3)(ii)(A)	4.1	Water Use Conflicts (Plants with Cooling Ponds or Cooling Towers Using Makeup Water from a Small River with Low Flow)
	4.6	Groundwater Use Conflicts (Plants Using Cooling Towers or Cooling Ponds and Withdrawing Makeup Water from a Small River)
10 CFR 51.53(c)(3)(ii)(B)	4.2	Entrainment of Fish and Shellfish in Early Life Stages
	4.3	Impingement of Fish and Shellfish
	4.4	Heat Shock
10 CFR 51.53(c)(3)(ii)(C)	4.5	Groundwater Use Conflicts (Plants Using >100 gpm of Groundwater)
	4.7	Groundwater Use Conflicts (Plants Using Ranney Wells)
10 CFR 51.53(c)(3)(ii)(D)	4.8	Degradation of Groundwater Quality
10 CFR 51.53(c)(3)(ii)(E)	4.9	Impacts of Refurbishment on Terrestrial Resources
	4.10	Threatened or Endangered Species
10 CFR 51.53(c)(3)(ii)(F)	4.11	Air Quality During Refurbishment (Non-Attainment Areas)

Table 1-1. Environmental Report Responses to License Renewal Environmental Regulatory Requirements (Continued).

Regulatory Requirement	Responsive Environmental Report Section(s)	
10 CFR 51.53(c)(3)(ii)(G)	4.12	Microbiological Organisms
10 CFR 51.53(c)(3)(ii)(H)	4.13	Electric Shock from Transmission-Line-Induced Currents
10 CFR 51.53(c)(3)(ii)(I)	4.14	Housing Impacts
	4.15	Public Utilities: Public Water Supply Availability
	4.16	Education Impacts from Refurbishment
	4.17	Offsite Land Use
10 CFR 51.53(c)(3)(ii)(J)	4.18	Transportation
10 CFR 51.53(c)(3)(ii)(K)	4.19	Historic and Archaeological Resources
10 CFR 51.53(c)(3)(ii)(L)	4.20	Severe Accident Mitigation Alternatives
10 CFR 51.53(c)(3)(iii)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
10 CFR 51.53(c)(3)(iv)	6.2	Mitigation
	5.0	Assessment of New and Significant Information
10 CFR 51, Appendix B, Table B-1, Footnote 6	2.6.2	Minority and Low-Income Populations

1.4 References

Note to reader: Hard copies of cited web pages are available in AmerGen files. Some sites, for example the census data, cannot be accessed through their given URLs. The only way to access these pages is to follow queries on previous web pages. The complete URLs used by AmerGen have been given for these pages, even though they may not be directly accessible.

Exelon. 2002. Oyster Creek Generating Station. Available at: http://www.exeloncorp.com/generation/nuclear/gn_oyster.shtml. Accessed June 30, 2004.

Exelon. 2004. Oyster Creek Generating Station. Available at: http://www.oystercreeklr.com/home.html. Accessed June 30, 2004.

USNRC (U.S. Nuclear Regulatory Commission). 1996a. "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses." *Federal Register*. Vol. 61, No. 109. June 5.

USNRC (U.S. Nuclear Regulatory Commission). 1996b. "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses; Correction." *Federal Register*. Vol. 61, No. 147. July 30.

USNRC (U.S. Nuclear Regulatory Commission). 1996c. "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses." *Federal Register*. Vol. 61, No. 244. December 18.

USNRC (U.S. Nuclear Regulatory Commission). 1996d. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. Volumes 1 and 2. NUREG-1437. Washington, DC. May.

USNRC (U.S. Nuclear Regulatory Commission). 1996e. *Regulatory Analysis for Amendments to Regulations for the Environmental Review for Renewal of Nuclear Power Plant Operating Licenses*. NUREG-1440. Washington, DC. May.

USNRC (U.S. Nuclear Regulatory Commission). 1996f. *Public Comments on the Proposed 10 CFR Part 51 Rule for Renewal of Nuclear Power Plant Operating Licenses and Supporting Documents: Review of Concerns and NRC Staff Response*. Volumes 1 and 2. NUREG-1529. Washington, DC. May.

USNRC (U.S. Nuclear Regulatory Commission). 1999a. "Changes to Requirements for Environmental Review for Renewal of Nuclear Power Plant Operating Licenses; Final Rule." *Federal Register*. Vol. 64, No. 171. September 3.

USNRC (U.S. Nuclear Regulatory Commission). 1999b. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS)*. Section 6.3, "Transportation" and Table 9-1, "Summary of findings on NEPA issues for license renewal of nuclear power plants." NUREG-1437. Volume 1, Addendum 1. Washington, DC. August.

Chapter 2

Site and Environmental Interfaces

2.1 Location and Features

The information in this section comes from the Oyster Creek Nuclear Generating Station Final Safety Analysis Report (AmerGen 2003) and the 1972 Environmental Report (Jersey Central Power & Light Company 1972) unless noted otherwise.

Oyster Creek Generating Station (OCGS) is located in Lacey Township in Ocean County, New Jersey. The nearest major metropolitan areas to OCGS include Newark, New Jersey, approximately 60 miles to the north; Atlantic City, New Jersey, approximately 35 miles to the south; and Philadelphia, Pennsylvania, approximately 60 miles west of the OCGS site. Figures 2-1 and 2-2 are the 50-mile and 6-mile vicinity maps, respectively.

The Station is situated on approximately 800 acres of land (AmerGen 2003, Table 1.2-1) in the coastal pine barrens of New Jersey approximately 9 miles south of Toms River, New Jersey. The property is adjacent to Barnegat Bay and is bisected by U.S. Highway 9, and bounded by the South Branch of the Forked River and the manmade intake canal on the north, and Oyster Creek and the manmade discharge canal on the south.

Figure 2-3 shows the OCGS site boundary. The physical plant is located on approximately 150 acres west of U.S. Highway 9. OCGS is a single boiling water reactor with a maximum power level of 1930 MW (thermal) and an expected ultimate electrical capability of 640 MW net. The remaining approximately 650 acres is east of U.S. Highway 9 and is an old cattle farm (the former Finninger Farm). The old fields are undergoing succession and vegetation ranges from native grasses to pines and small oaks, typical of coastal New Jersey. A dredge spoil basin for sediment removed from Oyster Creek and Forked River is located in this portion of the site.

An emergency fire pond is located southwest of the Station, on the southern edge of the FirstEnergy property. The emergency fire pond is owned by FirstEnergy and maintained by AmerGen.

OCGS is within the Pinelands National Reserve. The surrounding terrain is naturally flat. The area immediately surrounding the plant is a mix of vacant lands, agricultural lands and woodlands. The region within 40 miles of the site has very little industry; in fact, only about 25 percent of the land in the surrounding area is developed. Development within the Pinelands National Reserve is strictly controlled.

The Barnegat Bay region is well known as a summer resort area thus the population of the area surrounding the site increases during the summer months.

Section 3.1 describes key features of OCGS, including reactor and containment systems, cooling water system, and transmission system.

2.2 Aquatic Ecological Communities

Oyster Creek Generating Station was built approximately two miles inland from Barnegat Bay, on high ground lying between two streams, the South Branch of the Forked River (to the north) and Oyster Creek (to the south). Jersey Central Power and Light Company dredged a semi-circular canal between the two streams (see Figure 2-3) to create a horseshoe-shaped cooling water system that consists of the lower reaches of the South Branch of the Forked River, the dredged canal, and the lower reaches of Oyster Creek. Figure 3-1 shows the cooling system configuration and the direction of cooling water flow. Water is withdrawn from Barnegat Bay via the intake canal (South Branch of Forked River and manmade intake canal), circulated through the plant's condensers, and returned to the Bay via the discharge canal (manmade discharge canal and Oyster Creek). A complete description of the circulating water (condenser cooling) system may be found in Section 3.1.2.

Barnegat Bay Physical-Chemical Characteristics

Barnegat Bay is a shallow, lagoon-type estuary located along the central New Jersey coast (Figure 2-2). The Bay extends from Point Pleasant in the north to Manahawkin Causeway in the south, a distance of about 30 miles (USAEC 1974). The Bay has an average depth of 5 feet and a maximum depth of 20 feet. The deepest areas are found along the Intracoastal Waterway, a narrow navigation channel that loosely follows the western shoreline of the Bay. The Bay has a surface area of approximately 65 square miles and a volume of 9.5 billion cubic feet (USAEC 1974).

A pair of barrier islands, Island Beach and Long Beach Island, with north-south orientations separate Barnegat Bay from the Atlantic Ocean (Figure 2-2). Water moves between Barnegat Bay and the Atlantic Ocean via Barnegat Inlet, which separates Island Beach and Long Beach Island. The northern part of the Bay also receives brackish water from the lower Manasquan River via the Bay Head-Manasquan Canal (also known as the Point Pleasant Canal) while the southern part of the Bay communicates freely with Manahawkin Bay.

The U.S. Army Corps of Engineers made a number of modifications to Barnegat Inlet between 1987 and 1991 in an attempt to stabilize the Inlet's navigation channel (Seabergh et al. 1998). A new 4,270-foot-long south jetty was built parallel to the existing north jetty. The existing navigation channel was straightened and deepened to allow water to move more freely in and out of the Bay. After the Inlet was modified, spring tidal prisms (volume of water moving through the inlet in a tidal cycle) increased substantially, returning values to approximating those seen in the 1930s and early 1940s (Seabergh et al. 1998).

Barnegat Bay has a small bay tide range (0.3 to 0.7 foot) compared to the mean ocean tide (4.25 feet) (Seabergh et al. 1998). This is due to the large size of the Bay relative to the inlet's cross-sectional area at its narrowest point, a circumstance that creates asymmetries in flood and ebb tide flows. Flood flow predominates during spring tides accompanied by inability to fully drain during ebb flow (due to the limited discharge capacity of the channel). This creates a net storage in the Bay until the transition from spring to neap tide occurs, when there is a net outflow.

Salinities range from 12 parts per thousand (ppt) in the northern end of Barnegat Bay to 32 ppt at its southern end (USAEC 1974). Salinities in the area of Oyster Creek range from 19 to 30 parts ppt and average around 25 ppt (Chizmadia et al. 1984). Freshwater enters the estuary primarily along the western (mainland) shore from surface runoff and groundwater seepage. A number

of streams that drain the New Jersey Pine Barrens flow into the Bay along its western margin. Of these streams, Toms River and Cedar Creek have the greatest freshwater flow. Smaller streams flowing into the Bay include (from north to south) the Metedeconk River, Forked River, Oyster Creek, and Manahawkin Creek.

Ambient water temperatures in Barnegat Bay range from 29.5°F (-1.4°C) in winter to 82.5°F (28°C) in summer (Chizmadia et al. 1984). Because the Bay is shallow, it is subject to rapid temperature change; temperatures may change as much as 4°F over a 24-hour period. Deeper portions of the Bay may show thermal stratification, but coastal winds and wave action tend to keep the system well mixed. Temperature inversions occasionally occur at the mouths of streams draining the mainland, as cool, freshwater from these streams flows over warmer, saline Bay water (USAEC 1974; Chizmadia et al. 1984).

Because of the shallowness of the Bay, wind action strongly affects its circulation. The predominant wind direction during the summer is from the south (south-southwest), with wind stress producing a general flow of water to the north (Chizmadia et al. 1984). Winds are mainly from the west (west-northwest) in winter, and water flows generally eastward and southward during this season. A tendency toward two-layered circulation exists in areas deeper than 5 feet, although complete vertical mixing occurs periodically. Local water movements in the estuary are complex because of the interaction of wind, tides, hydraulic head produced by runoff and groundwater seepage, density differences due to salinity and temperature gradients, and the bathymetry of the bay.

The barrier islands restrict water circulation, thereby affecting tides, salinities, and sediment deposition in the Bay. Because of restricted circulation, nutrient inputs from urban stormwater and sewage treatment plants tend to remain in the Bay. This has, in the past, produced elevated levels of nitrogen compounds and other nutrients that can stimulate growth of algae. In the last several decades, as development has intensified along the western shore of Barnegat Bay, heavy algae blooms have become more common in summer, while submerged aquatic vegetation has become less abundant. Temporal and spatial shifts in submerged aquatic vegetation in Barnegat Bay are likely the result of naturally-occurring cycles (e.g., periodic disease outbreaks), but anthropogenic activities such as dredging and nutrient loading may also have an effect (BBNEP 2001).

Barnegat Bay Aquatic Communities

The most comprehensive source of information on the aquatic communities of Barnegat Bay is a monograph entitled *Ecology of Barnegat Bay* (Kennish and Lutz, eds.), published in 1984. A collaborative effort, it contains the results of research and monitoring studies carried out by Jersey Central Power and Light Company and GPU Nuclear Corporation (previous owners of OCGS) biologists, university researchers, New Jersey state resource agency biologists, national laboratory (Battelle Columbus) scientists, and consultants. Although some of this information must be viewed in light of physical (modification of Barnegat Inlet) and biological (increasing eutrophication) changes in Barnegat Bay since 1984, it remains an invaluable document and is the basis for the description of aquatic biota that follows.

Algae and macrophytes

The bottom vegetation of Barnegat Bay varies throughout the estuary because of differences in substrate, depth, salinity, water quality, and local currents. In general, the benthic macroflora is dominated by the vascular plant *Zostera marina* (eelgrass) and several species of macroalgae (*Ulva lactuca*, *Codium fragile*, *Gracilaria tikvahiae*, and *Ceramium fastigiatum*) (Loveland et al.

1984). Beds of eelgrass are most common along the mainland shore and shallows east of the Intracoastal Waterway. Most macroalgae are unattached forms, drifting throughout the shallow portions of the Bay.

Phytoplankton

Barnegat Bay contains more than 180 species of phytoplankton, with diatoms and dinoflagellates the numerically dominant groups (Mountford 1984). Phytoplankton biomass peaks during the late winter-early spring diatom bloom or later, in summer, depending on weather and nutrient availability. Zooplankton grazing terminates the diatom bloom in the spring. *Skeletonema costatum*, a relatively unimportant species during the bloom, becomes the dominant phytoplankton as temperatures rise in the spring. Phytoplankton numbers peak in the summer, and are lower in fall and winter. Smaller forms (ultraplankton and nanoplankton) are especially numerous in summer.

Brown tide blooms, caused by the rapid growth of the micro-alga *Aureococcus anophagefferens*, were first observed along the coast of the northeastern U.S. in 1985 in Narragansett Bay (Rhode Island) and Peconic Bay (New York) (Gastrich et al. 2003). Brown tide blooms were first documented in Barnegat Bay in 1995.

The New Jersey Department of Environmental Protection (NJDEP) monitoring over the 2000-2002 period showed brown tide species were present at all sampling stations and that Category 3 blooms (the most severe) covered significant portions of the lower Barnegat Bay-Little Egg Harbor area (Gastrich et al. 2003). Extended drought conditions with correspondingly low freshwater inputs occurred over this period, and likely contributed to the blooms. In 2003, a year with lower average temperatures and salinities, the number of brown tide blooms was substantially reduced: only one station (in Tuckerton Bay) had “elevated” brown tide blooms (NJDEP 2004a).

Zooplankton

Copepods are the most important microzooplankton (< 500 micrometers long) in Barnegat Bay (Kennish 1984). Common species include *Acartia hudsonica*, *Acartia tonsa*, and *Oithona colcarva*. Important macrozooplankton (> 500 micrometers long) in the estuary include *Rathkea octopunctata*, *Neomysis americana*, *Crangon septemspinosa*, *Neopanope texana*, *Jassa falcata*, *Sagitta* spp., and *Sarsia* spp. (Kennish 1984).

In general, abundance of zooplankton of Barnegat Bay tracks abundance of phytoplankton. Greatest zooplankton densities occur in the spring, after the winter-spring diatom blooms, and in summer. Similarly, shorter-term fluctuations in zooplankton numbers appear to be correlated with increases and decreases in phytoplankton numbers.

Benthic Fauna

A total of 216 species of benthic macroinvertebrates were found at three study sites during early years (1969-1973) of OCGS operation (Loveland and Vouglitois 1984). Over this period, there was a general trend of decreasing density and increasing diversity (species richness). Patterns of dominance changed very little, with numerically dominant species in 1969 ranking among dominant species in 1973. Suspension and filter feeders numerically dominated collections in 1969, while deposit feeders dominated in subsequent years of study.

Shellfish

Barnegat Bay historically supported two recreationally and commercially important shellfish species, the hard clam (*Mercenaria mercenaria*) and the blue crab (*Callinectes sapidus*). Abundance and biomass of

Mercenaria in the Bay decreased steadily in the 1960s and 1970s. The decline in standing stocks was attributed to lower recruitment (Kennish et al. 1984). The decline in recruitment, coupled with closure of some shellfish beds due to high levels of bacteria and reduced fishing effort, combined to reduce commercial harvest of this species.

Blue crabs are concentrated along the eastern shore of the Bay, where they are typically found in areas with dense aquatic vegetation. The blue crab population of Barnegat Bay is dominated by recruitment-size (less than 59 mm) and growth-size (60 to 119 mm) crabs, suggesting that the estuary is an important nursery area for this species (Kennish et al. 1984).

The blue crab occurs in Barnegat Bay year-round, but is most active in the summer months. It is an important component of the recreational fishery, making up more than 50 percent of the annual catch (Kennish et al. 1984).

Finfish

Barnegat Bay supports a diverse assemblage of fishes typical of mid-Atlantic estuaries. Biologists collected 107 fish species representing 57 families in Barnegat Bay over a three-year period in the 1970s (Tatham et al. 1984). Resident fishes (20 species), those found year-round within the estuary, made up 31 percent (by number) of all fish collected in the study. Common, recreationally-important, and commercially-important resident species included inland silversides (*Menidia beryllina*), Atlantic silversides (*M. menidia*), mummichog (*Fundulus heteroclitus*), and winter flounder (*Pseudopleuronectes americanus*). Warm-water migrants, those present from April through November, were a diverse (34 species) and abundant (65 percent of all fish collected) group. They included bay anchovy (*Anchoa mitchilli*), Atlantic menhaden (*Brevoortia tyrannus*), spot (*Leiostomus xanthurus*), and weakfish (*Cynoscion regalis*). Most warm-water migrants collected were young of the year or juveniles using the Bay as a nursery area. Individuals of some species, such as bay anchovy and Atlantic menhaden, were also collected in winter months. Cool-water migrants (12 species, 3 percent of all fish collected) were present from November through April and were usually absent in other months. Most were young herring (Clupeidae; 4 species) and cods (Gadidae; 3 species). Some adult alewife (*Alosa pseudoharengus*) and blueback herring (*A. aestivalis*) were also collected, and made spawning runs into some tributary streams.

Strays from the open ocean and freshwater streams flowing into Barnegat Bay were the most diverse group (42 species), but made up a relatively small percentage of all fish collected (1 percent). Most marine strays were immature fish and were collected in summer. Most freshwater strays were collected after periods of heavy rainfall.

The Barnegat Bay fish community tends to be dominated numerically by small, schooling species such as the bay anchovy and Atlantic silversides. Tatham et al. (1984) sampled an array of stations in western Barnegat Bay over a three-year period using a variety of gear (seines, gill nets, trawls) in an attempt to characterize the fish community potentially affected by OCGS operations. In this study, more than 90 percent of the catch comprised 10 species: bay anchovy, Atlantic silverside, fourspine stickleback (*Apeltes quadracus*), spot, winter flounder, inland silverside, northern pipefish (*Sygnathus fuscus*), mummichog, bluefish (*Pomatomus saltatrix*), and oyster toadfish (*Opsanus tau*). Although there may be large fluctuations in absolute abundance (i.e., measures of density or catch per unit effort) of these common species, patterns of species composition and relative abundance tend to be stable (Kennish 1984).

Commercial and Recreational Fisheries

At the time *Ecology of Barnegat Bay* (Kennish and Lutz, eds.) was published, three finfish (American eel [*Anguilla rostrata*], white perch [*Morone americana*], and winter flounder) and two shellfish (blue crab and hard clam) were sought by commercial fishermen. Annual landings of commercially-important species were variable, reflecting normal year-to-year fluctuations in year-class strength, weather, demand, and fishing effort.

Until the 1980s, the hard clam was the most economically important species sought by commercial fishermen in Barnegat Bay. Landings of hard clams peaked in the 1950s, exceeding 300 metric tons per year, and declined steadily thereafter (Kennish 1984). From 1965-1977, approximately one sixth of hard clams harvested in New Jersey were from Barnegat Bay.

Blue crab, bluefish, and winter flounder made up more than 80 percent of the annual Barnegat Bay recreational catch in the 1970s (Kennish 1984). Blue crab was by far the most important species, comprising 65 percent or more of the annual recreational harvest. Finfish catches were dominated by bluefish, winter flounder, spot, summer flounder (*Paralichthys dentatus*), and weakfish. Bluefish, summer flounder, and weakfish are caught mostly in late summer and fall; spot and winter flounder are caught mostly in the spring.

Barnegat Bay from 1987 to Present

In response to growing concerns about the impact of development on Barnegat Bay, the New Jersey Legislature passed the Barnegat Bay Study Act (P.L. 1987 – Chapter 397) in 1987 requiring a study of the nature and extent of these impacts (BBNEP 2002). The Act created the Barnegat Bay Study Group and mandated a study of the Bay and its watershed. The study produced three reports: Profile of the Barnegat Bay (1990), Management Recommendations for the Barnegat Bay (1990), and A Watershed Management Plan for the Barnegat Bay (1995). After the release of the third and final report, the Barnegat Bay Watershed Association (now called the Barnegat Bay Watershed and Estuary Foundation) was formed and the Governor of New Jersey petitioned the United States Environmental Protection Agency (EPA) to add Barnegat Bay to the National Estuary Program. The EPA accepted Barnegat Bay into the program in July 1995.

The Barnegat Bay Estuary Program Characterization Report, released in January 2001, indicated that the priority problems in the estuary were:

- Water supply and water quality, including the issues of contaminated stormwater and runoff, nutrient loading, pathogen contamination, groundwater contaminations, and future water supply deficits;
- Habitat loss and alteration;
- Fisheries decline; and
- Human activities and competing uses.

The BBEP Characterization Report notes that estuarine organisms are adversely affected by OCGS chemical and thermal discharges, impingement, and entrainment but concludes that impacts are generally limited to near-field areas (i.e., intake canal and Forked River, discharge canal and Oyster Creek) and “continued operation of the OCNGS will not threaten the protection and propagation of balanced, indigenous (aquatic) populations in Barnegat Bay” (BBNEP 2001, Chapter 9).

The Barnegat Bay Comprehensive Conservation and Management Plan (CCMP), completed in May 2002, laid out an approach for restoring the Barnegat Bay

ecosystem that was keyed to these priorities.

The Barnegat Bay Estuary Program and its cooperating agencies have already had several successes:

- the volume of polluted stormwater entering the Bay has decreased, the result of improvements in stormwater management in the watershed

- bacterial contamination in the Bay is decreasing, the result of New Jersey's Clean Vessel Program and the Bay's designation as a "No Discharge Zone"

In addition, populations of several popular sportfish in the Bay appear to be recovering or expanding, the result of regional fisheries management initiatives and the rise of a conservation ("catch and release") ethic. Anecdotal information suggests that Barnegat Bay finfish populations are generally healthy and fishing for several species (e.g., striped bass, weakfish, bluefish) is excellent (Flyfishing Connection 1999; Fishing and Hunting News 2004; Haughey 2004; Honachefsky 2004).

The National Marine Fisheries Service (NMFS) maintains records on recreational landings of important species, including many of the species sought by anglers in Barnegat Bay. These data are organized by region (e.g., north Atlantic, mid-Atlantic, south-Atlantic) and by state, but are not available by watershed or waterbody. Most of the species in question range up and down the mid-Atlantic coast and use Barnegat Bay seasonally; therefore, data for the state of New Jersey are assumed to reflect the state of Barnegat Bay populations.

The NMFS data indicate that striped bass landings in New Jersey reached an all time low in the 1980s, but have exceeded 1,000,000 fish in every year since 1999 (NMFS 2005). In 2004, an estimated 1,760,506 striped bass weighing more than 4.6 million pounds were landed in New Jersey. These data, along with widely circulated stories by anglers and outdoor writers, indicate that striped bass fishing along the New Jersey shore and in Barnegat Bay is as good today as it was in the 1960s and 1970s, if not better.

Other species sought by anglers in Barnegat Bay include bluefish, weakfish, and summer flounder. Based on New Jersey recreational landings, bluefish numbers in recent years have been consistently high, more than 3,000,000 fish per year over the 2000 through 2004 period (NMFS 2005). In 2004 an estimated 4,151,920 bluefish weighing 3.3 million pounds were landed by N.J. fishermen. In the 1990s, bluefish landings ranged from 1,217,527 (1993) to 3,557,337 (1991) fish per year. These high bluefish landings are consistent with angler and outdoor writer reports of excellent fishing in Barnegat Bay. Based on anecdotal information, fishing for weakfish is excellent in Barnegat Bay. Data on weakfish landings in New Jersey, however, suggest that weakfish numbers peaked over the 1995-1996 period and have generally declined over the 1997-2004 period (NMFS 2005). Summer flounder landings have been high since 1990, ranging from 3 million to 13 million fish per year (NMFS 2005). No clearcut trend in landings are apparent. In 2004, an estimated 8.8 million summer flounder were landed by recreational fishermen (NMFS 2004).

The species that may be slowest to rebound is the hard clam, which declined in abundance in the 1960s and 1970s due to persistent recruitment failures that reduced standing stocks (Kennish 1984). This reduction in recruitment may have been related to water quality degradation in the Bay, but a variety of other factors (e.g., temperature or salinity changes, shellfish parasites and diseases, or changes in predator-prey interactions) could have affected reproductive success and survival of the young. The hard clam faces an

additional challenge to recovery in that blue crab populations are flourishing. Blue crabs feed heavily on hard clams, particularly young clams, and can decimate hard clam populations under certain circumstances.

2.3 Groundwater Resources

OCGS is located in the Atlantic Coastal Plain approximately two miles west of Barnegat Bay. The State of New Jersey has designated two Water Supply Critical Areas, where excessive water use poses a significant threat to the long-term integrity of a water supply source (NJDEP 2004b). OCGS is located in the southern portion of Water Supply Critical Area 1. Critical Area 1 was established in 1985 by the New Jersey Water Supply Administration. The Water Supply Administration regulates all ground and surface water diversions in excess of 100,000 gallons per day. The Critical Area 1 management zone affects the major aquifers (deep aquifers) in the area and was necessary because over-pumping introduced saltwater into the deep aquifers. These include the Englishtown, the Upper and Lower Potomac-Raritan-Magothy, and the Wenonah-Mount Laurel (NJDEP 2004b). Restrictions on with-drawals from the aquifers began in 1989 and resulted in an increase in shallow aquifer and surface water use (USGS 2003). Since the designation and resulting 40 to 50 percent reduction of groundwater pumping from the deep aquifers, groundwater levels have begun to rebound (USGS 2001). Most drinking water in Ocean County is supplied by groundwater (USEPA 2004a).

The shallowest significant aquifer in the vicinity of the site, the Kirkwood-Cohansey, comprises the Sand and the Kirkwood formations. The Kirkwood-Cohansey aquifer is generally under water-table conditions. The aquifer system is composed of fine- to coarse-grained pebbly sand with local clay bedding and can exceed 350 feet in thickness. Production can vary from 500 to 1,000 gallons per minute (gpm) with yields of 1,500 gpm possible. Brackish and salty water may occur in coastal areas (USGS 2001).

The next deeper aquifer is the confined Atlantic City Sand, comprised of medium to coarse sand, gravel, and shell fragments. This unit varies in thickness from 100 to 150 feet. Water quality is suitable for most purposes with production yields of 600 to 800 gpm and the possibility of 1,000 gpm (USGS 2001).

The Wenonah-Mount Laurel aquifer underlies the Atlantic City Sand. The Wenonah-Mount Laurel aquifer is confined and consists of very fine to coarse glauconitic sand and shell layers. Aquifer thickness can vary from 60 to 120 feet with production ranging from 50 to 250 gpm with capabilities of 500 gpm possible. Water quality is suitable for most purposes (USGS 2001).

The next deeper aquifer is the Englishtown aquifer. The Englishtown aquifer consists of fine- to medium-grained sand with local clay beds. This confined aquifer generally ranges between 60 and 140 feet in thickness and has excellent water quality with production ranging from 300 to 500 gpm with 1,000 gpm possible (USGS 2001).

The Potomac-Raritan-Magothy aquifer system underlies the Englishtown aquifer. In the vicinity of the site the upper and lower units of the Potomac-Raritan-Magothy are combined. The aquifer consists of alternating layers of sand, gravel, silt, and clay. This confined aquifer is highly productive (2,000 gpm or more), extends throughout the Coastal Plain, and attains a thickness of 4,100 feet. Salty water increases with depth and in the downdip direction. The unit has high local iron concentrations (USGS 2001).

2.4 Critical and Important Terrestrial Habitats

The OCGS property (Figure 2-3) consists of the OCGS site, which lies west of Highway 9, and the former Finninger Farm, which lies east of Highway 9. The tract of land west of Highway 9, the OCGS site, includes the powerblock area, support facilities, roads, parking lots, an Independent Spent Fuel Storage Installation (ISFSI) and some undeveloped buffer areas. It totals approximately 150 acres. The tract of land east of US Route 9, the former Finninger Farm, is largely undeveloped and is maintained as a natural area. It comprises approximately 650 acres of old fields, abandoned orchards, forests, wetlands, and marshlands. The two parcels of land total approximately 800 acres.

The OCGS site contains a largely-undeveloped buffer strip of approximately 60 acres that lies parallel to US Route 9. This 60-acre parcel was the subject of a threatened and endangered habitat assessment in the spring and summer of 2004 that is discussed in more detail in Section 2.5. A small area of emergent/ scrub-shrub and forested wetlands lies in the southern part of this tract, adjacent to the discharge canal. This area appeared to provide suitable habitat for the state-listed pine barrens treefrog, but none was detected in field surveys that involved both active (playing taped calls to elicit a response) and passive listening for singing males.

The parcel east of US Route 9, the former Finninger Farm, is a largely undeveloped 650-acre tract that provides a mix of terrestrial and wetland habitats and supports a variety of wildlife. The property, formerly a cattle farm, was purchased by Jersey Central Power & Light Company in 1966. The property has been used by Jersey Central Power & Light and AmerGen since that time for disposal of material dredged from the OCGS intake and discharge canals. AmerGen has also placed monitoring equipment on the Finninger Farm property as a routine part of its ongoing radiological monitoring programs. Otherwise, the property functions as a undeveloped buffer area. The area is posted, gated, and patrolled by security to discourage trespassing.

Jersey Central Power & Light commissioned a study of the Finninger Farm property in 1995 in order to identify the most appropriate long-term use of the property. The study included a Natural Resources Inventory to aid in future planning efforts. The National Resources Inventory mapping determined that 10 percent of the property was covered with surface water, and the rest of the property was forested (25 percent) or abandoned farmland (65 percent). The eastern one-third of the site consisted of drained coastal wetlands that had been invaded by the giant reed (*Phragmites australis*). This species, which forms dense, monotypical stands in disturbed wetland sites, is regarded as a nuisance by some land managers because of its tendency to exclude wetland plants that provide more benefits to wildlife.

Jersey Central Power & Light Company, which operated OCGS for approximately 30 years, built a single 230-kilovolt transmission line to connect the plant to the regional transmission system (see Figure 2-2). This line originates at a substation west of the plant's powerblock area, runs northwest for approximately 1.5 miles, crossing the Garden State Parkway, then turns north to run approximately 9.5 miles to the Manitou Substation at Toms River. For most of its length, the line parallels the Garden State Parkway. Most of the land crossed by the line is pine forest, but the line also crosses a number of streams (three branches of Forked River, Huckleberry Branch, Deep Hollow Branch, Cedar Creek, Factory Branch, and Jakes Branch) and associated wetlands, as well as bogs, ponds, and agricultural areas.

The OCGS-to-Manitou line skirts the irregular eastern boundary of the Forked River Mountain Wildlife Management Area (WMA) for approximately 1.0 mile before crossing its northeastern corner. An approximately 1.5 mile-long segment of the corridor actually lies within the WMA. Further north, for approximately 1.0 mile of its length, the transmission corridor crosses Double Trouble State Park. The 11.0 mile-long transmission corridor does not cross any other wildlife management areas, wildlife refuges, state parks, or national parks.

OCGS property and the associated Oyster Creek-to-Manitou 230 kV transmission line lie on the northeastern edge of the New Jersey Pine Barrens or "Pinelands," a sparsely populated and mostly forested area of more than a million acres in southern New Jersey. Although parts of the Pine Barrens are composed almost entirely of stunted pines, it is a more varied eco-region than the name implies, and is actually composed of a mosaic of mixed pine-hardwood forests, hardwoods forests with few pines, and wetlands, most notably Atlantic white cedar bogs (Sutton and Sutton 1992). The plant communities of a given area of the Pine Barrens are determined by topography, soil type, soil fertility, depth of water table, and the frequency and intensity of local wildfires. In 1978, the U.S. Congress established the Pinelands National Reserve and called upon the State of New Jersey to create a planning agency to preserve, protect, and enhance the Reserve's unique natural and cultural resources (New Jersey Pinelands Commission undated). In 1979, the New Jersey State Legislature enacted the Pinelands Protection Act and created the New Jersey Pinelands Commission, which was charged with the development and implementation of the Comprehensive Management Plan for the Pinelands. This Management Plan spells out the type, amount and location of growth that can be accommodated while ensuring that the Pinelands remain protected. Proposals for development in the Pinelands must be submitted formally, as applications to the Commission, to ensure that the natural and cultural resources of the Pinelands are not adversely affected. The OCGS-to-Manitou transmission line was built prior to the enactment of the Pinelands Protection Act, and thus was not subject to its provisions.

The largely undeveloped Finninger Farm property provides habitat for terrestrial species. Ninety-nine bird species, including uncommon breeding "grassland" birds (those normally found in grasslands, pasturelands, and savannahs) were observed on this tract in surveys conducted in 1991 (Radis and Sutton 1991). Eleven amphibian and reptile species and 12 mammal species were observed during the 1991 survey.

Based on a review of species with designated critical habitat (FWS 2004), no critical habitat lies in the area of the OCGS property or is crossed by the OCGS-to-Manitou transmission line. The federally-threatened piping plover (*Charadrius melodus*) nests along the New Jersey shore and may be observed in Ocean County in spring, summer, and early fall (FWS 1996). There is no critical habitat for this species in New Jersey (Federal Register Volume 66, Number 132, July 10, 2001).

2.5 Threatened or Endangered Species

OCGS lies two miles inland from Barnegat Bay in east-central Ocean County, New Jersey (see Figure 2-2). Jersey Central Power & Light Company, which operated OCGS for approximately 30 years, built a single 230- kV transmission line to connect the plant to the regional transmission system (see Figure 2-2). This line runs approximately 11 miles from the OCGS 230 kV Substation to the Manitou Substation near Toms River. The Station and the OCGS-to-Manitou Line lie entirely in Ocean County. Table 2-1 lists state- and federally-protected species recorded from Ocean County, New Jersey, based on the New Jersey Heritage Program's database (NJDEP 2001). Most of these species have not been observed on the OCGS property, but could (particularly in the case of shorebirds and birds of prey) move through the property during seasonal migrations.

In 1991, the Izaak Walton League of America commissioned wildlife surveys at eight Ocean County sites, all adjacent to Barnegat Bay (Radis and Sutton 1991). One of the sites was the former Finninger Farm property, then owned by Jersey Central Power & Light Company. No rare, threatened, or endangered amphibians, reptiles, or mammals were observed during the 1991 surveys. Several uncommon avian species, including four currently listed by the State of New Jersey, were observed: the grasshopper sparrow (*Ammodramus savannarum*), the American bittern (*Botaurus lentiginosus*), the Northern harrier (*Circus cyaneus*), and the osprey (*Pandion haliaetus*) (Radis and Sutton 1991). Table 2-1 provides the status of each in New Jersey.

The recently-completed "Threatened and Endangered Species Habitat Impact Assessment for Oyster Creek Generating Station National Security Upgrades" is the most up-to-date source of information on threatened and endangered species at the Oyster Creek site. This assessment was conducted in 2004 in support of proposed national security upgrades at OCGS, and focuses on the undeveloped part of the site that lies between the facilities on the west and US Route 9 on the east. This threatened and endangered species assessment included a review of New Jersey Department of Environmental Protection Natural Heritage Program records of sensitive species in the project area, a review of the Heritage Program's maps of threatened and endangered species habitat and occurrences, a review of the Heritage Program's Grid Map of rare plants and ecological communities, a review of vernal habitat maps provided by Rutgers University and NJDEP, and field surveys. In addition, a formal request was made to the Natural Heritage Program regarding the possible presence of sensitive species and habitats in the vicinity of the site. The Natural Heritage Program response, dated May 11, 2004 (Lord 2004), provides the basis for much of the discussion that follows.

Based on a review of the Natural Heritage Database and Landscape Project records, Lord (2004) reported that the following state-listed animal species occur in the vicinity of the OCGS site: barred owl (*Strix varia*), Cooper's hawk (*Accipter cooperii*), Northern pine snake (*Pituophis m. melanoleucus*), pine barrens treefrog (*Hyla andersoni*), and wood turtle (*Clemmys insculpta*). Table 2-1 provides the state and federal status of each of these species.

AmerGen conducted an on-the-ground reconnaissance of the undeveloped area potentially affected by the security upgrades in May 2004 to ensure that no listed species would be affected by the proposed action. Based on an examination of site conditions (including soils, plant communities, topography, existing barriers to animal movement, possible sources of disturbance), AmerGen concluded that barred owls, Cooper's hawks, Northern pine

snakes, and wood turtles were unlikely to occur in the project area. Because potential habitat for the Pine Barrens treefrog was present, they conducted more focused surveys for this species. None were observed and none were detected vocalizing, despite conditions that were ideal (warm, humid nights in June, a peak period for male singing). Treefrogs were heard calling at a control site several miles from OCGS.

The Natural Heritage Database and Landscape Project habitat mapping also indicated that foraging habitat for two additional state listed animal species, the black skimmer (*Rhynchops niger*) and the black-crowned night heron (*Nycticorax nycticorax*) lay within ¼ mile of the site (Lord 2004).

The New Jersey Natural Heritage Program letter of May 11, 2004 also indicated that four rare wetland plants "may" occur in the immediate vicinity of the site (Lord 2004). Two of the four plants were state-listed, the Pine Barren boneset (*Eupatorium resinosum*) and the New Jersey rush (*Juncus caesariensis*). The Pine Barren boneset is a perennial herb that is found in bogs, wetlands, and pine barrens savannas in the Coastal Plain of New Jersey and the Carolinas (CPC undated; Radford et al. 1973). The New Jersey rush is a grass-like perennial that is found in the Coastal Plain of New Jersey, Maryland, Virginia, and North Carolina (Schuyler 1990; Environment Canada 2003).

Prior to 1992, no special-status marine species were observed or captured in the OCGS cooling canals. However, between June 1992 and July 1994, nine sea turtles were impinged on the OCGS intake trash rack (NMFS 2001). The increase in the number of sea turtles observed in Barnegat Bay and the number of sea turtles impinged at OCGS has been attributed to the U.S. Army Corps of Engineers' modification of Barnegat Inlet. This modification of the Inlet, completed in 1991, created a deeper channel that sea turtles use to move into Barnegat Bay from the open waters of the Atlantic Ocean. It also followed the implementation in 1987 (full implementation in 1989) of federal regulations requiring U.S. shrimp trawlers to use Turtle Exclusion Devices that substantially reduced fishing-related mortality of sea turtles in south Atlantic and Gulf coastal waters.

In November 1993, NRC requested a formal consultation with the NMFS regarding possible impacts of OCGS on listed sea turtles, a request that was followed by a Biological Assessment in January 1995. The NMFS issued a Biological Opinion on the effects of OCGS on loggerhead, green, and Kemp's ridley sea turtles in September 1995 that concluded the operation of OCGS might adversely affect these three species but was not likely to jeopardize their continued existence. The accompanying Incidental Take Statement permitted the annual take of 10 loggerhead (*Caretta caretta*; no more than 3 lethal), 3 Kemp's ridley (*Lepidochelys kempi*; no more than 1 lethal), and 2 green (*Chelonia mydas*; no more than 1 lethal) sea turtles. This Incidental Take Allowance extended for five years, to September 21, 2000.

On September 18, 2000, NRC requested reinitiation of formal consultation and submitted an updated Biological Assessment. After requesting and subsequently receiving supplemental information, the NMFS issued its Biological Opinion in July 2001. The Biological Opinion concluded that:

"…the proposed action (continued operation of OCGS) may adversely affect but is not likely to jeopardize the continued existence of endangered Kemp's ridley, green, or threatened loggerhead sea turtles. No critical habitat has been designated in the action area; therefore, none will be affected." (NMFS 2001, pg. 31).

The Biological Opinion also noted that "…the action being considered in this

Opinion is not expected to affect leatherback (*Dermochelys coriacea*) or hawksbill (*Eretmochelys imbricata*) sea turtles, which are listed as endangered under the ESA [Endangered Species Act]."

The Incidental Take Statement accompanying the July 2001 Biological Opinion authorized the annual take of 5 loggerhead (no more than 2 lethal), 4 Kemp's ridley (no more than 3 lethal), and 2 green (no more than 1 lethal) sea turtles during the continued operation of OCGS. The Biological Opinion included Reasonable and Prudent Measures that must be implemented at OCGS to minimize impacts to sea turtles as well as a list of Terms and Conditions that implement the Reasonable and Prudent Measures. These non-discretionary Terms and Conditions include requirements for regular inspections of the intake trash racks in summer and fall; requirements for capturing, handling, resuscitating, and treating injured sea turtles; requirements for recording and reporting sightings and strandings; requirements for necropsies of dead turtles; and reporting requirements, including an annual report to NMFS on incidental takes (NMFS 2001, pp. 33-34).

On August 7, 2004, OCGS recorded the fifth incidental take of a Kemp's ridley, thus exceeding the station's incidental take limit. On August 26, 2004, the NRC requested of NMFS a reinitiation of Endangered Species Act Section 7 consultation on sea turtles at OCGS (Kuo 2004). On March 29, 2005 NRC submitted a Biological Assessment to NMFS (Adams accession no. ML050900162). The consultation is ongoing and NMFS expects to issue its Biological Opinion no later than September 10, 2005.

No other federally- or state-listed threatened or endangered species is known to occur at OCGS or along the OCGS-to-Manitou transmission corridor.

2.6 Demography

The GEIS presents a population characterization method that is based on two factors: "sparseness" and "proximity" (USNRC 1996, Section C.1.4).

2.6.1 REGIONAL DEMOGRAPHY

"Sparseness" measures population density and city size within 20 miles of a site and categorizes the demographic information as follows:

Demographic Categories Based on Sparseness

		Category
Most sparse	1.	Less than 40 persons per square mile and no community with 25,000 or more persons within 20 miles
	2.	40 to 60 persons per square mile and no community with 25,000 or more persons within 20 miles
	3.	60 to 120 persons per square mile or less than 60 persons per square mile with at least one community with 25,000 or more persons within 20 miles
Least sparse	4.	Greater than or equal to 120 persons per square mile within 20 miles

Source: USNRC 1996.

Proximity" measures population density and city size within 50 miles and categorizes the demographic information as follows:

Demographic Categories Based on Proximity

		Category
Not in close proximity	1.	No city with 100,000 or more persons and less than 50 persons per square mile within 50 miles
	2.	No city with 100,000 or more persons and between 50 and 190 persons per square mile within 50 miles
	3.	One or more cities with 100,000 or more persons and less than 190 persons per square mile within 50 miles
In close proximity	4.	Greater than or equal to 190 persons per square mile within 50 miles

Source: USNRC 1996.

The GEIS then uses the following matrix to rank the population category as low, medium, or high.

GEIS Sparseness and Proximity Matrix

Sparseness	Proximity 1	Proximity 2	Proximity 3	Proximity 4
1	1.1	1.2	1.3	1.4
2	2.1	2.2	2.3	2.4
3	3.1	3.2	3.3	3.4
4	4.1	4.2	4.3	4.4

Low Population Area | Medium Population Area | High Population Area

Source: USNRC 1996, pg. C-159.

AmerGen used 2000 census data from the U.S. Census Bureau (USCB) (USCB 2003a, 2003b, 2004) and geographic information system software (ArcView®) to determine most demographic characteristics in the OCGS vicinity. As derived from 2000 USCB information, 434,476 people live within 20 miles of OCGS (USCB 2003b; Figure 2-4). Applying the GEIS sparseness measures, OCGS has a population density of 610 persons per square mile within 20 miles and falls into the least sparse category, Category 4 (greater than or equal to 120 persons per square mile within 20 miles).

As estimated from 2000 USCB information, 4,243,462 people live within 50 miles of OCGS (USCB 2003b; Figure 2-4). This equates to a population density of 1,132 persons per square mile. Applying the GEIS proximity measures, OCGS is classified as Category 4 (greater than or equal to 190 persons per square mile within 50 miles). According to the GEIS sparseness and proximity matrix, the OCGS ranks of sparseness Category 4 and proximity Category 4, result in the conclusion that OCGS is located in a high population area.

All or parts of 16 counties, Toms River, Atlantic City, Camden, Trenton, NJ and Philadelphia, PA are located within 50 miles of OGCS (Figure 2-1).

Because more than 80 percent of employees at OCGS reside in Ocean County, New Jersey, it is the county with the greatest potential to be socioeconomically affected by the proposed action (see Section 3.4). Ocean County's population is increasing at a faster rate than the New Jersey population. From 1970 to 2000, New Jersey's average annual population growth rate was 0.6 percent (USCB 1995 and WNJPIN Undated), while Ocean County increased by 4.8 percent (USCB 1995 and WNJPIN Undated). Most of this growth occurred between 1970 and 1990. Since 1990 the growth rate had slowed considerably, and is projected to remain low throughout the license renewal term (Table 2-2). Ocean County remains the fastest growing county in New Jersey (WNJPIN Undated).

Table 2-2 estimates populations and annual growth rates for Ocean County, New Jersey, through the license renewal term. Between the years 2000 and 2030, the population of Ocean County is projected to

increase at an average annual rate of 1.7 percent (WNJPIN Undated). The population of New Jersey is projected to grow at an average annual rate of 0.7 percent (WNJPIN Undated).

Because of its location on the Atlantic Ocean, Ocean County has a summer influx of tourists. The Barnegat Bay region of New Jersey is a well-known summer resort area, attracting visitors from the Middle Atlantic. It is estimated that the population in the area surrounding the OCGS site can increase by 30 to 60 percent during the summer months.

2.6.2 MINORITY AND LOW-INCOME POPULATIONS

NRC performed environmental justice analyses for previous license renewal applications and concluded that a 50-mile radius could reasonably be expected to encompass minority and low-income populations that could be affected by plant operations. For purposes of its environmental justice analyses, the NRC has determined the state is the appropriate environmental impact area for comparative analysis. AmerGen has adopted this approach for identifying minority and low-income populations that could be affected by renewal of the OCGS operating license.

AmerGen used ArcView® geographic information system software to combine USCB TIGER line data with USCB 2000 census data to determine the minority characteristics by block group (a block group is a subdivision of a census tract).

2.6.2.1 Minority Populations

The NRC "Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues" defines a "minority" population as: American Indian or Alaskan Native; Asian; Native Hawaiian or other Pacific Islander; Black races; all other single minorities; multi-racial; and Hispanic ethnicity (USNRC 2001, Appendix D). The guidance indicates that a minority population exists if either of the following two conditions exists:

1. The minority population in the census block group or environmental impact site exceeds 50 percent.

2. The minority population percentage of the environmental impact area is significantly greater (typically at least 20 percentage points) than the minority population percentage in the geographic area chosen for comparative analysis.

NRC guidance calls for use of the most recent USCB decennial census data. AmerGen used 2000 census data (USCB 2003a, 2003b, 2004) to determine the percentage of the total population in New Jersey, New York, and Pennsylvania of each minority category, and in identifying minority populations within 50 miles of OCGS.

AmerGen included an entire block group if any part of its area lay within 50 miles of OCGS. The 50-mile radius includes 3,326 block groups (Table 2-3). AmerGen divided USCB population numbers for each minority population within each block group by the total population of that block group to obtain the percent of the block group's population represented by each minority. For each of the 3,326 block groups within 50 miles of OCGS, AmerGen calculated the percent of the population in each minority category and compared the result to the corresponding geographic area's minority threshold percentages to determine whether minority populations exist. AmerGen defines the geographic area for OCGS as all of New Jersey when the block group is in New Jersey, all of New York when the block group is in New York, and all of Pennsylvania when the block group is in Pennsylvania.

USCB data (USCB 2003b) (Table 2-3) for New Jersey characterizes 0.1 percent of the

state as American Indian or Alaskan Native, 5.7 percent Asian, 0.0 percent Native Hawaiian or other Pacific Islander, 13 percent Black races, 0.2 percent all other single minorities, 1.6 percent multi-racial, 34 percent aggregate of minority races, and 13.3 percent Hispanic ethnicity. USCB data (USCB 2003b) for New York characterizes 0.3 percent of the state as American Indian or Alaskan Native, 5.5 percent Asian, 0.0 percent Native Hawaiian or other Pacific Islander, 14.8 percent Black races, 0.4 percent all other single minorities, 1.9 percent multi-racial, 38 percent aggregate of minority races, and 15.1 percent Hispanic ethnicity. USCB data (USCB 2003b) for Pennsylvania characterizes 0.1 percent of the state as American Indian or Alaskan Native, 1.7 percent Asian, 0.0 percent Native Hawaiian or other Pacific Islander, 9.8 percent Black races, 0.1 percent all other single minorities, 0.9 percent multi-racial, 15.9 percent aggregate of minority races, and 3.2 percent Hispanic ethnicity. In this analysis, Hispanic ethnicity is considered independent of race. For example, Hispanics who consider themselves Black are include in both the Black and Hispanic ethnicity analyses.

Table 2-3 presents the numbers of block groups in each county in the 50-mile radius that exceed the threshold for minority populations. Based on the "more than 20 percent" or the "exceeds 50 percent" criteria, no block groups within 50 miles have American Indian or Alaska Native, Native Hawaiian or Pacific Islander, or "other single minority" populations. Figures 2-5 through 2-9 locate the minority block groups within the 50-mile radius.

Forty-seven census blocks within the 50-mile radius have Asian populations that exceed the state average by 20 percent or more (Figure 2-5). Of those 47 block groups, 5 have Asian populations of 50 percent or more.

Three hundred forty-four census blocks within the 50-mile radius have Black Races populations that exceed the state average by 20 percent or more (Figure 2-6). Of those 344 block groups, 206 have Black Races populations of 50 percent or more.

One census block within the 50-mile radius has a multi-racial minority population that exceeds the state average by 20 percent or more (Figure 2-7).

Five hundred ninety-four census blocks within the 50-mile radius have aggregate minority populations that exceed the state average by 20 percent or more (Figure 2-8). Of those 594 block groups, 527 have aggregate minority populations of 50 percent or more.

One hundred ninety-one census blocks within the 50-mile radius have Hispanic ethnicity populations that exceed the state average by 20 percent or more (Figure 2-9). Of those 191 block groups, 87 have Hispanic ethnicity populations of 50 percent or more.

2.6.2.2 Low-Income Populations

NRC guidance defines low-income based on statistical poverty thresholds (USNRC 2001, Appendix D). AmerGen divided USCB low-income households in each census block group by the total households for that block group to obtain the percentage of low-income households per block group. USCB data (USCB 2004) characterize 8.5 percent of New Jersey, 14.6 percent of New York, and 11.0 percent of Pennsylvania households as low-income households. A low-income population is considered to be present if:

1. The low-income population in the census block group or the environmental impact site exceeds 50 percent.

2. The percentage of households below the poverty level in an environmental impact area is significantly greater (typically at least 20 percentage points) than the low-income population percentage in the geographic area chosen for comparative analysis.

Table 2-3 identifies the low-income block groups in the region of interest. Figure 2-10 locates the low-income block groups.

One hundred fifty-two census blocks within the 50-mile radius have low-income households that exceed the state average by 20 percent or more. Of these 152 block groups, 27 have 50 percent or more low-income households.

2.7 Taxes

OCGS pays annual property taxes to Ocean and Lacey Townships in Ocean County. The majority of the annual OCGS tax payment is paid to Lacey Township, so the focus of this analysis will be on Lacey Township. In recent years, the OCGS payment to Ocean Township has ranged between $11,000 and $13,000, annually. OCGS payments to Lacey Township ranged from $1.6 million to $1.8 million annually over the same period (Table 2-4).

From 2001 through 2003, Lacey Township collected between $36 and $45 million annually in total property tax revenues (see Table 2-4). Each year the Township forwards a percentage of these revenues to Ocean County and the Lacey Township School District to meet operating budgets. From 2001 to 2003, Lacey Township distributed between $9.7 and $10.6 million annually to Ocean County. (Ocean County's property tax revenues for 2003 were approximately $250 million). For the same period, the Township distributed between $24.1 and $30.8 million annually to the Lacey Township School District. The remainder of the Township's property tax revenues is reserved for the Township operating budget. The Township operating budget includes funding for township operations, fire protection services, public works, ambulance services, police forces, and township road maintenance. Libraries and hospitals are funded through the County.

For the years 2001 through 2003, OCGS's property taxes have represented 4.1 to 4.9 percent of Lacey Township's total property tax revenues (Table 2-4).

On January 28, 1999, the New Jersey Assembly and Senate passed the "Electric Discount and Energy Competition Act." The Act initiated the phasing in of electric industry deregulation in New Jersey. As a result, many tax-related changes have taken place, including changes in property tax assessment valuation methodologies for electric power stations. Stations are now assessed using fair market value instead of net book value methodologies. These changes could affect OCGS's future tax payments to Ocean and Lacey Townships. AmerGen is appealing the current assessment and plans to negotiate a graduated reduction in payments to minimize the financial disruption to the Townships caused by a sudden decrease in revenues.

2.8 Land Use Planning

This section focuses on Ocean County and one of the County's municipalities, Lacey Township, because the majority of the permanent OCGS workforce lives in Ocean County, and Lacey Township is the primary recipient of OCGS property tax payments. Ocean County is the fastest growing county in New Jersey. From 1970 to 2000, Ocean County's population increased 4.8 percent. To accommodate this growth, regional and local planning officials have shared goals of encouraging expansion and development in areas where public facilities, such as water and sewer systems, have been planned, and discouraging incompatible land use mixes in contiguous areas and strip development.

The New Jersey Pinelands

The New Jersey Pinelands (or Pine Barrens) contain over a million acres of pine-oak forests, streams and rivers, farms, crossroad hamlets, and small towns stretched across southern New Jersey. In 1976, in response to mounting environmental concerns, the New Jersey Legislature, along with Congress, enacted legislation protecting the Pinelands of New Jersey from unnecessary and unwarranted development pressure. In 1979, New Jersey enacted the Pinelands Protection Act which requires that county and municipal master plans and land use ordinances be brought into conformance with the Pinelands Comprehensive Management Plan (CMP) developed by the New Jersey Pinelands Commission, a Pinelands oversight committee (Township of Lacey 1991).

The protected Pinelands constitute nearly one quarter of the state, located roughly in the southeastern quadrant. All or portions of seven counties and 52 municipalities in New Jersey are located within the Pinelands Area (Township of Lacey 1991).

The CMP identifies five regions for growth. Each region can be developed at densities appropriate to the carrying capacity of the land. The Pinelands region, one of the five regions, is divided into three subregions: the Pinelands Preservation Area and the Pinelands Protection Area, both located west of the Garden State Parkway; and the Pinelands National Reserve, east of the Parkway. Each of these subregions has various restrictions on development (Township of Lacey 1991).

Lacey Township

Lacey Township covers 98.5 square miles of land area; 14.7 percent of which is water (USCB 2000). Seventy-three square miles of Lacey Township is within the protected New Jersey Pinelands. The entire area of Lacey Township west of the Garden State Parkway (42,469 acres) comprises approximately 30,632 acres of Preservation Area (most restrictive) and 11,837 acres of Protection Area (less restrictive). The Protection Area is further divided into Forest Area (10,874 acres) and Rural Development (963 acres) (Township of Lacey 1991).

The area of Lacey Township east of the Garden State Parkway is in the Pinelands National Reserve which is defined in the National Parks and Recreation Act of 1978. Although the Pinelands CMP was prepared for the entire National Reserve, the actual regulatory authority of the Pinelands Commission is limited to the area west of the Garden State Parkway in Lacey Township (Township of Lacey 1991). With few exceptions, development of areas east of the Garden State Parkway is guided by the Township of Lacey and Ocean County Master Plans (Township of Lacey 1991).

In 1991, Lacey Township had adequate services and infrastructure to support its population and planners recognized that the Township would continue to grow. The Township of Lacey Master Plan addresses that the Township will have to provide adequate services and infrastructure to

meet future demand (Township of Lacey 1991).

Growth in Lacey Township is guided by five goals (Township of Lacey 1991):

1. Maintain the existing quality of life of Lacey Township residents.

2. Provide contiguous land areas and compatibility among users so as to protect sensitive natural areas, resources, and wildlife for future generations.

3. Encourage residential development at appropriate densities while providing for aesthetic and economic diversities.

4. Situate new development in locations which maintain the attractive character of Lacey Township.

5. Encourage the continued maintenance of all navigable waterways.

2.9 Social Services and Public Facilities

2.9.1 PUBLIC WATER SUPPLY

Because OCGS is located in Lacey Township (in Ocean County) and most of the OCGS employees reside in Ocean County, the discussion of public water supply systems will be limited to Ocean County. OCGS provides bottled water for drinking. Two onsite groundwater wells (see Section 3.1.2) provide water for reactor make-up, potable and non-potable domestic uses, and the sanitation system.

Ocean County

Groundwater is the source for the major water suppliers in Ocean County (Table 2-5). Section 2.3 describes the local groundwater aquifers in the area of Ocean County.

2.9.2 TRANSPORTATION

Road access to OCGS is via US Route 9, a two-lane paved road with a northeast-southwest orientation. To the west, the Garden State Parkway runs parallel to US Route 9. These two roads are intersected by Lacey Road (Ocean County Route 614), a two-lane paved road north of OCGS, and Warren Grove Road (Ocean County Route 532), a two-lane paved road south of OCGS. (See Figure 2-2). Employees traveling from the north or northwest of OCGS will use the Garden State Parkway, Lacey Road, and US Route 9 to reach the station. Employees traveling from the south or southwest of OCGS will use the Garden State Parkway, Warren Grove Road, and US Route 9 to reach the station. Employees traveling from the northeast will use New Jersey 37 and US 9 and employees traveling from the southeast will use New Jersey 72 and US 9. When nearing OCGS, all employees must use US Route 9.

In determining the significance levels of transportation impacts for license renewal, the NRC uses the Transportation Research Board's level of service (LOS) definitions (USNRC 1996). LOS is a quantitative measure describing operational conditions within a traffic stream and their perception by motorists.

Limited data are available for US Route 9 from north of the plant to its intersection with NJ 166 in Beachwood. Along this section of Route 9, traffic on the roadway is below capacity (LOS of A, B, or C), although some intersections at certain times of day are operating above capacity (LOS F) (NJDOT undated).

Table 2-6 lists roadways in the vicinity of OCGS annual average number of vehicles per day, as determined by the New Jersey Department of Transportation.

2.10 Meteorology and Air Quality

Meteorological information, as it relates to analysis of severe accidents, is included in Appendix F.

EPA has established National Ambient Air Quality Standards (NAAQS) for six common pollutants: nitrogen dioxide, sulfur dioxide, carbon monoxide, lead, ozone, and particulate matter with aerodynamic diameters of 10 microns or less (PM_{10}). The EPA has designated all areas of the United States as having air quality better ("attainment") or worse ("non-attainment") than the NAAQS.

Ocean County is in attainment for all air quality standards with the exception of the 1-hour ozone NAAQS (USEPA 2004b) and the new 8-hour ozone NAAQS.

In July 1997, EPA issued final rules establishing a new 8-hour ground-level ozone standard and a standard for particulate matter with a nominal size of less than 2.5 microns ($PM_{2.5}$). After several years of litigation, the $PM_{2.5}$ and 8-hour ground-level ozone standards have been upheld.

On April 15, 2004, the EPA Administrator implemented designations, classifications, and boundaries for areas of the country with respect to the 8-hour ground-level ozone NAAQS in accordance with the requirements of the Clean Air Act (69 FR 23857). Ocean County, New Jersey was included in the non-attainment area of "Philadelphia-Wilmington, Atlantic City, PA-DE-MD-NJ". This non-attainment area was classified as "moderate" and the maximum attainment dates extends through June 2010 (USEPA 2004c). Designations under the 1-hour ozone NAAQS will be revoked one year from the effective date of the 8-hour ozone NAAQS designations.

On December 17, 2004, the EPA Administrator announced final designations, classifications, and boundaries for areas of the country with respect to the $PM_{2.5}$ NAAQS. Ocean County, New Jersey was designated as an unclassifiable/attainment area under the new $PM_{2.5}$ standards. Designations under the $PM_{2.5}$ NAAQS became effective on April 5, 2005 (70 FR 944).

2.11 Historic and Archaeological Resources

Area History in Brief

Aboriginal people migrated to New Jersey approximately 15,000 years ago. Three major cultural traditions dominated the prehistory of New Jersey and the Middle Atlantic Coastal Plain: the Paleo-Indian Tradition (15,000 to 10,000 years ago); the Archaic Tradition (10,000 to 3,000 years ago); and the Woodland Tradition (3,000 years ago to European contact) (BBNEP 2001).

When the first European explorers and settlers came to the area now known as New Jersey, they found the Late Woodland period people, who lived in the lower half of "Lenapehoking" (The Land of the Lenape) and called themselves "Lenape," meaning "common" or "ordinary" people. The Lenape were divided into three groups: the Unalachtigo, "the people who lived near the ocean," Unami, "the people down the river," and Unalimi or Minisink, "the people of the stony country" (BBNEP 2001).

There are many theories as to who was the first non-native person to see the shores of North America, dating back to the Vikings. According to historical sources, the first recorded European to sight land in Ocean County was Henry Hudson in 1609, although there is written evidence that Giovanni da Verrazano made contact with the Lenape in 1524, 85 years before Henry Hudson sailed the New Jersey coast (BBNEP 2001).

When the European immigrants arrived in the mid-1600's and early 1700's, they settled first along the coastal bays and inlets of the Hudson, Hackensack, Passaic and Raritan River valleys in northern New Jersey, as well as the Delaware River valley and inner coastal plain south of Trenton. The area between the Delaware and the Atlantic Ocean in the southern part of the outer coastal plain was still "unsettled" in 1765 (BBNEP 2001). This vast area, eventually called the "Pine Barrens," was used largely for lumbering and hunting, and later for the resources that produced the colonial industries (BBNEP 2001).

From the 17th through the 20th centuries, European settlers engaged in a number of vocations and avocations in the New Jersey pine barrens, such as, hunting, fishing, lumbering, shipbuilding, bog iron manufacture, charcoal manufacture, cranberry and blueberry cultivation, salt hay and eelgrass harvesting, Sphagnum moss harvesting, mineral extraction (silica), salt harvesting, and tourism. A number of these industries no longer exist for various reasons, including resource depletion. Today, healthcare, tourism and the marine industry are three of the largest sectors of the economy in Ocean County (BBNEP 2001).

Maritime History

Ocean County has a long maritime history. The earliest commercial activities were connected to shipbuilding, and included whaling and fishing. Toms River and Tuckerton were important privateering ports during the Revolutionary War. Boat building in the Barnegat Bay area has continued through the 19th, 20th, and 21st Centuries (BBNEP 2001).

Initial Operation

The Final Environmental Statement (FES) for operation of OCGS listed 47 important historic landmarks in Ocean County (USAEC 1974). Two of the landmarks were National Historic Register sites: Hangar Number 1 at the Lakehurst Naval Air Station, twenty miles north-northwest of OCGS, and Barnegat Lighthouse, six miles southeast. In the FES, the U. S. Atomic Energy Commission (AEC) reported that "[t]he site includes no historic places. The

station and transmission lines do not intrude upon or otherwise affect the setting and significance of any historic place. In addition, the Curator of Cultural History of the New Jersey State Museum found no evidence of archaeological sites within the station property bounded by the South Branch Forked River, the Parkway, and the Bay. The Historic Sites Office of the New Jersey Department of Environmental Protection confirmed that there are no National Register or State Register sites in the area and that no historical or architectural structures are impaired" (USAEC 1974). No additional studies were done as a direct result of this suggestion, however, as late as 1997 state and county historic preservation offices were contacted prior to dredging the initake canal. This resulted in an updated database of archaeological/historic sites of interest but did not identify any archaeological sites on OCGS property.

Current Status

As of 2002, the National Register of Historic Places listed 27 locations in Ocean County, New Jersey (U.S. Department of the Interior 2004). Of these 27 locations, 5 fall within a 6 mile radius of OCGS (Figure 2-2). Table 2-7 lists the five National Register of Historic Places sites within the 6-mile radius of OCGS. The Historic Preservation Office of the NJDEP lists approximately 100-110 additional sites, including maritime vessels, of historical significance within Ocean County (NJDEP 2004d).

2.12 Known or Reasonably Forseeable Projects in Site Vicinity

Forked River Power Plant

The Forked River Power Plant (FRPP) is adjacent to OCGS property. The FRPP is a two unit simple cycle dual-fired (gas and oil) power plant with 66 MW(e) net capacity. It is owned by Jersey Central Power and Light, a subsidiary of FirstEnergy, an Ohio utility, and used for peaking demand periods of operation (DOE 2000). FRPP can also provide emergency offsite power to OCGS in the unlikely event of a Station Blackout Event (loss of offsite power and failure of the emergency diesel generators to start).

Department of Defense Facilities

Approximately 15 miles northwest of OCGS is Naval Air Engineering Station (NAES) Lakehurst (also known as NAVAIR Lakehurst), the northeast's largest naval aviation installation and home to the Naval Air Warfare Center Aircraft Division, as well as fourteen joint and interagency commands (NAES Undated). It occupies 7,430 government-owned acres in the million-acre Pinelands National Reserve in central New Jersey. The New Jersey Wildlife and Game Refuge bounds the base to the north and the Manchester Fish and Wildlife Preserve to the south. On its western boundary, it abuts Fort Dix and McGuire Air Force Base (MAFB) to form a contiguous 42,000-acre Department of Defense facility (NAES Undated).

Fort Dix is a major training and mobilization center for the Army Reserve and National Guard. Fort Dix consists of 31,065 acres of land, of which 13,765 acres are range and impact areas and 14,000 are classified as contiguous maneuver area. The remainder of the installation is the cantonment area. Fort Dix training areas are bordered by the Lebanon State Forest (26,000 acres), NAES, and selected Wildlife Management Areas (34,900 acres) (Fort Dix 2002).

McGuire Air Force Base (MAFB) is located in Wrightstown, New Jersey, approximately 20 miles from OCGS. MAFB is an active facility that occupies 3,536 acres within the Pinelands National Reserve. The primary mission of MAFB is to provide massive, rapid-response airlift capabilities for military forces in combat. McGuire's operations include military transport, aircraft maintenance, refueling, and storage (USEPA Undated).

Permitted Dischargers to Water

In its "Envirofacts Warehouse" online database, EPA identifies permitted dischargers to water. A search in Ocean County revealed 195 facilities that discharge to the waters of the United States. Of the 195 facilities that discharge to the waters of the United States, many discharge to Barnegat Bay or to rivers that flow into Barnegat Bay, including the Forked River (USEPA 2004d). Detailed information concerning these facilities may be accessed through EPA's "Envirofacts Warehouse".

Table 2-1. Endangered and Threatened Species that Could Occur at or Near OCGS or Along the Associated OCGS-Manitou Transmission Line.

Scientific Name	Common Name	Federal Status[a]	State Status[a]
Mammals			
Lynx rufus	Bobcat	-	E
Birds			
Accipiter cooperii	Cooper's hawk	-	T
Ammodramus savannarum	Grasshopper sparrow	-	T
Bartramia longicauda	Upland sandpiper	-	E
Botaurus lentiginosus	American bittern	-	E
Calidris canutus	Red knot	-	T
Charadrius melodus	Piping plover	T	E
Circus cyaneus	Northern harrier	-	E
Cistothorus platensis	Sedge wren	-	E
Falco peregrinus	Peregrine falcon	-	E
Haliaeetus leucocephalus	Bald eagle	T	E
Laterallus jamaicensis	Black rail	-	T
Melanerpes erythrocephalus	Red-headed woodpecker	-	T
Nyctanassa violacea	Yellow-crowned night-heron	-	T
Nycticorax nycticorax	Black-crowned night-heron	-	T
Pandion haliaetus	Osprey	-	T
Podilymbus podiceps	Pied-billed grebe	-	E
Pooecetes gramineus	Vesper sparrow	-	E
Rynchops niger	Black skimmer	-	E
Sterna antillarum	Least tern	-	E
Sterna dougallii dougallii	Roseate tern	E	E
Strix varia	Barred owl	-	T
Reptiles and Amphibians			
Ambystoma tigrinum tigrinum	Eastern tiger salamander	-	E
Clemmys insculpta	Wood turtle	-	T
Clemmys muhlenbergii	Bog turtle	T	T
Crotalus horridus horridus	Timber rattlesnake		E
Elaphe guttata guttata	Corn snake	-	E
Hyla andersoni	Pine barrens treefrog	-	E
Hyla chrysoscelis	Cope's gray treefrog	-	E
Pituophis melanoleucus	Northern pine snake	-	T
Caretta caretta	Loggerhead sea turtle	T	E
Lepidochelys kempi	Kemp's ridley	E	E
Dermochelys coriacea	Atlantic leatherback turtle	E	E
Eretmochelys imbricate	Atlantic hawksbill turtle	E	E
Chelonia mydas	Atlantic green turtle	T	E
Invertebrates			
Cicindela dorsalis dorsalis	Northeastern beach tiger beetle	T	E
Nicrophorus americanus	American burying beetle	E	E

Table 2-1. Endangered and Threatened Species that Could Occur at or Near OCGS or Along the Associated OCGS-Manitou Transmission Line (Continued).

Scientific Name	Common Name	Federal Status[a]	State Status[a]
Plants			
Amaranthus pumilus	Seabeach amaranth	T	E
Aster radula	Low rough aster	-	E
Cacalia atriplicifolia	Pale Indian plantain	-	E
Cardamine longii	Long's bittercress	-	E
Cirsium virginianum	Virginia thistle	-	E
Clitoria mariana	Butterfly-pea	-	E
Corema conradii	Broom crowberry	-	E
Desmodium pauciflorum	Few-flower tick-trefoil	-	E
Eleocharis tortilis	Twisted spike-rush	-	E
Eriophorum tenellum	Rough cotton-grass	-	E
Eupatorium resinosum	Pine Barren boneset	-	E
Fraxinus profunda	Pumpkin ash	-	E
Galactia volubilis	Downy milk-pea	-	E
Glaux maritima	Sea-milkwort	-	E
Gnaphalium helleri	Small everlasting	-	E
Helonias bullata	Swamp-pink	T	E
Hottonia inflata	Featherfoil	-	E
Jeffersonia diphylla	Twinleaf	-	E
Juncus caesariensis	New Jersey rush	-	E
Juncus torreyi	Torrey's rush	-	E
Limosella subulata	Awl-leaf mudwort	-	E
Linum intercursum	Sandplain flax	-	E
Luzula acuminate	Hairy wood-rush	-	E
Melanthium virginicum	Virginia bunchflower	-	E
Myriophyllum tenellum	Slender water-milfoil	-	E
Myriophyllum verticillatum	Whorled water-milfoil	-	E
Narthecium americanum	Bog asphodel	C	E
Oenothera humifusa	Sea-beach evening-primrose	-	E
Onosmodium virginianum	Virginia false-gromwell	-	E
Plantago pusilla	Dwarf plantain	-	E
Polygonum glaucum	Sea-beach knotweed	-	E
Prunus angustifolia	Chickasaw plum	-	E
Ranunculus cymbalaria	Seaside buttercup	-	E
Rhododendron atlanticum	Dwarf azalea	-	E
Rhynchospora globularis	Coarse grass-like beaked-rush	-	E
Rhynchospora knieskernii	Knieskern's beaked-rush	T	E

Table 2-1. Endangered and Threatened Species that Could Occur at or Near OCGS or Along the Associated OCGS-Manitou Transmission Line (Continued).

Scientific Name	Common Name	Federal Status[a]	State Status[a]
Rhynchospora microcephala	Small-head beaked-rush	-	E
Schwalbea americana	Chaffseed	E	E
Scirpus longii	Long's woolgrass	-	E
Scirpus maritimus	Saltmarsh bulrush	-	E
Spiranthes laciniata	Lace-lip ladies'-tresses	-	E
Stylisma pickeringii var	Pickering's morning glory	-	E
Tridens flavus var chapmanii	Chapman's redtop	-	E
Triglochin maritima	Seaside arrow-grass	-	E
Utricularia biflora	Two-flower bladderwort	-	E
Utricularia minor	Lesser bladderwort	-	E
Uvularia puberula var nitida	Pine Barren bellwort	-	E
Verbena simplex	Narrow-leaf vervain	-	E
Xyris fimbriata	Fringed yellow-eyed-grass	-	E
Zigadenus leimanthides	Death-camus	-	E

a. E = Endangered; T = Threatened; C = Candidate; - = Not listed.
Source: NJDEP NHP 2001.

Table 2-2. Estimated Populations and Annual Growth Rates in Ocean County, New Jersey from 1980 to 2030.

Year	Number	Annual Percent Increase
1970[a]	208,470	--
1980[a]	346,038	6.6
1990[a]	433,203	2.5
2000[b]	510,916	1.8
2010[b]	593,300	1.6
2020[b]	677,000	1.4
2030	777,703	1.5

a. USCB 1995.
b. WNJPIN Undated.

Table 2-3. Minority and Low-Income Population Census Blocks within 50-Mile Radius of OCGS.

County	State	FIPS No.	Total Block Groups Within 50 Miles	Minority Population Block Groups within 50 Miles								Low-Income Block Groups Within 50 Miles	2000 Population Adjusted for Area Within 50 Miles
				American Indian or Alaskan Native	Asian	Native Hawaiian or Other Pacific Islander	Black Races	All Other Single Minorities	Multi-Racial Minorities	Aggregate of Minority Races	Hispanic Ethnicity		
Bucks	Pennsylvania	42017	232	0	2	0	9	0	0	13	2	1	325180.1
Montgomery	Pennsylvania	42091	12	0	0	0	0	0	0	0	0	0	7099.7
Philadelphia	Pennsylvania	42101	458	0	3	0	30	0	0	121	45	50	449486.2
Richmond	New York	36085	33	0	1	0	0	0	0	1	0	0	44115.3
Somerset	New Jersey	34035	25	0	0	0	9	0	0	11	0	0	48221.1
Middlesex	New Jersey	34023	382	0	33	0	8	0	1	87	50	16	475385
Mercer	New Jersey	34021	237	0	3	0	65	0	0	77	19	20	347717.9
Monmouth	New Jersey	34025	529	0	2	0	52	0	0	60	9	19	615301
Burlington	New Jersey	34005	295	0	0	0	41	0	0	40	0	3	423394
Camden	New Jersey	34007	407	0	0	0	84	0	0	106	38	47	508110.7
Gloucester	New Jersey	34015	136	0	0	0	12	0	0	7	0	3	159862
Salem	New Jersey	34033	3	0	0	0	0	0	0	0	0	0	399.5
Ocean	New Jersey	34029	342	0	0	0	1	0	0	6	3	6	510916
Cumberland	New Jersey	34011	38	0	0	0	1	0	0	14	11	2	46918.3
Atlantic	New Jersey	34001	177	0	3	0	32	0	0	51	14	12	252552
Cape May	New Jersey	34009	20	0	0	0	0	0	0	0	0	0	28803.8
Totals			3326		47		344		1	594	191	179	4,243,462.6
Counties completely within 50-mile radius													

Block groups where minorities or low-income populations exceed 50 percent

County	State	FIPS No.	Total Block Groups Within 50 Miles	Minority Population Block Groups within 50 Miles								Low-Income Block Groups Within 50 Miles	2000 Population Adjusted for Area Within 50 Miles
				American Indian or Alaskan Native	Asian	Native Hawaiian or Other Pacific Islander	Black Races	All Other Single Minorities	Multi-Racial Minorities	Aggregate of Minority Races	Hispanic Ethnicity		
Bucks	Pennsylvania	42017	232	0	0	0	3	0	0	10	1	0	325180.1
Montgomery	Pennsylvania	42091	12	0	0	0	0	0	0	0	0	0	7099.7
Philadelphia	Pennsylvania	42101	458	0	0	0	13	0	0	57	3	7	449486.2
Richmond	New York	36085	33	0	1	0	0	0	0	1	0	0	44115.3
Somerset	New Jersey	34035	25	0	0	0	5	0	0	11	0	0	48221.1
Middlesex	New Jersey	34023	382	0	4	0	3	0	0	87	40	3	475385
Mercer	New Jersey	34021	237	0	0	0	49	0	0	77	3	1	347717.9
Monmouth	New Jersey	34025	529	0	0	0	33	0	0	60	2	2	615301
Burlington	New Jersey	34005	295	0	0	0	26	0	0	40	0	0	423394

Table 2-3. Minority and Low-Income Population Census Blocks within 50-Mile Radius of OCGS (Continued).

Block groups where minorities exceed 50 percent (continued)

County	State	FIPS No.	Total Block Groups Within 50 Miles	Minority Population Block Groups within 50 Miles								Low-Income Block Groups Within 50 Miles	2000 Population Adjusted for Area Within 50 Miles
				American Indian or Alaskan Native	Asian	Native Hawaiian or Other Pacific Islander	Black Races	All Other Single Minorities	Multi-Racial Minorities	Aggregate of Minority Races	Hispanic Ethnicity		
Camden	New Jersey	34007	407	0	0	0	49	0	0	106	23	9	508110.7
Gloucester	New Jersey	34015	136	0	0	0	3	0	0	7	0	1	159862
Salem	New Jersey	34033	3	0	0	0	0	0	0	0	0	0	399.5
Ocean	New Jersey	34029	342	0	0	0	0	0	0	6	2	2	510916
Cumberland	New Jersey	34011	38	0	0	0	0	0	0	14	9	0	46918.3
Atlantic	New Jersey	34001	177	0	0	0	22	0	0	51	4	2	252552
Cape May	New Jersey	34009	20	0	0	0	0	0	0	0	0	0	28803.8
Totals			3326	0	5	0	206	0	0	527	87	27	4,243,462.6
Counties completely within 50-mile radius													

State Percentages

State	State Fips.	American Indian or Alaskan Native	Asian	Native Hawaiian or Other Pacific Islander	Black Races	All Other Single Minorities	Multi-Racial Minorities	Aggregate of Minority Races	Hispanic Ethnicity	Low-Income
New Jersey	34	0.1	5.7	0	13	0.2	1.6	34	13.3	8.5
New Jersey	36	0.3	5.5	0	14.8	0.4	1.9	38	15.1	14.6
Pennsylvania	42	0.1	1.7	0	9.8	0.1	0.9	15.9	3.2	11

FIPS = Federal Information Processing Standards

Table 2-4. Oyster Creek Generating Station Property Tax Information 2001-2003.

Year	Lacey Township Property Tax Revenues	Property Tax Paid by OCGS	Percent of Lacey Township Revenues
2001	$36,485,905	$1,770,053	4.9
2002	$40,573,260	$1,677,843	4.1
2003	$44,967,097	$1,838,252	4.1

Table 2-5. Major Ocean County Public Water Suppliers[a].

Water Supplier[b]	Water Source[b]	Average Daily Use (2003) (MGD)[c]	Maximum Daily Capacity (MGD)[c]
Barnegat Township Water and Sewer	GW	0.34	1.26
Beachwood Water Department	GW	0.69	2.09
Berkeley Township MUA	GW	0.52	1.01
Berkeley Water Company	GW	0.80	2.63
Brick Township MUA	SW	9.15	47.31
Crestwood Village Water Company	GW	1.38	6.05
Jackson Township MUA	GW	2.51	11.04
Lacey Township MUA	GW	1.88	7.2
Lakewood Township MUA	GW	2.02	2.22
Little Egg Harbor Township MUA	GW	1.29	5.95
Long Beach Township – Brant Beach	GW	1.00	7.52
Manchester Township Water Utility	GW	1.90	7.63
NJ American Water Company -Lakewood	SW	3.04	7.92
NJ American Water Company – Ocean City	GW	2.76	12.24
Ocean Township MUA - Pebble Beach	GW	0.77	3.82
Point Pleasant Beach Water Department	Purchased GW	N/A	N/A
Point Pleasant Water Department	GW	1.03	4.68
Stafford Township MUA	GW	1.41	0.94
Tuckerton Water and Sewer Department	GW	0.34	0.72
United Water – Toms River	GW	12.31	30.24

GW = Groundwater
SW = Surface water
MUA = Municipal Utilities Authority
MGD = Million Gallons Daily
N/A – Not Applicable
a. Municipal water suppliers serving populations greater than 4,500. These suppliers serve approximately 90 percent of the Ocean County population.
b. USEPA 2004a
c. NJDEP 2004c
Shaded row indicates that demand exceeds supply.

Table 2-6. Traffic Counts for Roads in the Vicinity of OCGS.

Roadway and Location	Annual Average Daily Traffic (AADT)	Year (Most Current)
County Route 532 between the Garden State Parkway and US 9 – Station 6D5C912.	3,003	1999
US 9 between County Route 532 and County Route 614 – Station 6-1-013.	19,930	2002
County Route 614 between US 9 and the Garden State Parkway.	None Available	NA
County Route 614 west of the Garden State Parkway -- Station 6-4-503.	5,575	2003
Garden State Parkway between Interchange 69 at County Route 532 and Interchange 67	69,880	2003
Garden State Parkway between Interchange 67 and Interchange 63 at NJ 72	52,750	2003
US 9 between County Route 532 and NJ 72 – Station 6-0-106.	16,245	2002
US 9 between County Route 614 and the Garden State Parkway – south of Laurel Blvd.	17,480	1991
US 9 between County Route 614 and the Garden State Parkway – north of Laurel Blvd.	14,660	1991
US 9 between County Route 614 and NJ 37 – Station 6-6-006.	20,926	2002
Garden State Parkway between Interchange 74 at County Route 614 and Interchange 77	81,170	2003
Garden State Parkway between Interchange 77 and Interchange 80.	85,770	2003
Garden State Parkway between Interchange 80 and Interchange 81.	116,100	2003
Garden State Parkway between Interchange 81 and Interchange 82.	107,410	2003
On NJ 166, the parallel road to the coincident section of US 9 and the Garden State Parkway: between US 9 and NJ 37.	27,154	2001
NJ 72 -- 1.75 miles east of US 9.	23,980	2003
NJ 37 -- at milepost 12.5 -- just east of the bridge over Barnegat Bay.	38,013	2003

Note: All AADTs represent traffic during the average 24-hour day during the year indicated.

Table 2-7. Sites Listed in the National Register of Historic Places that fall within a 6-mile Radius of OCGS.

Site Name	Location
Barnegat Light Public School	501 Central Ave., Barnegat Light
Barnegat Lighthouse	North end of Long Beach Island, off Broadway Ave., Barnegat Light
Double Trouble Historic District	South of Beachwood off of Garden State Parkway, Beachwood
Falkinburg Farmstead	28 Westcott Avenue, Ocean Township, Wareton
Manahawkin Baptist Church	North Main Street (US 9) and Lehigh Avenue, Manahawkin

Source: U.S. Department of the Interior 2004.

LEGEND

- ★ Oyster Creek
- 50 Mile Radius
- Transmission Line
- County
- National or State Forest
- National Wildlife Refuge
- Urban Areas

0 10 20 Miles

FIGURE 2-1
50-Mile Vicinity Map

LEGEND

- ★ Oyster Creek
- 6 Mile Radius
- Transmission Line
- Proposed Transmission Line Route (Northern Phase)

0 1 2 3 4 5 6 Miles

Scale is approximate.

FIGURE 2-2
6-Mile Vicinity Map

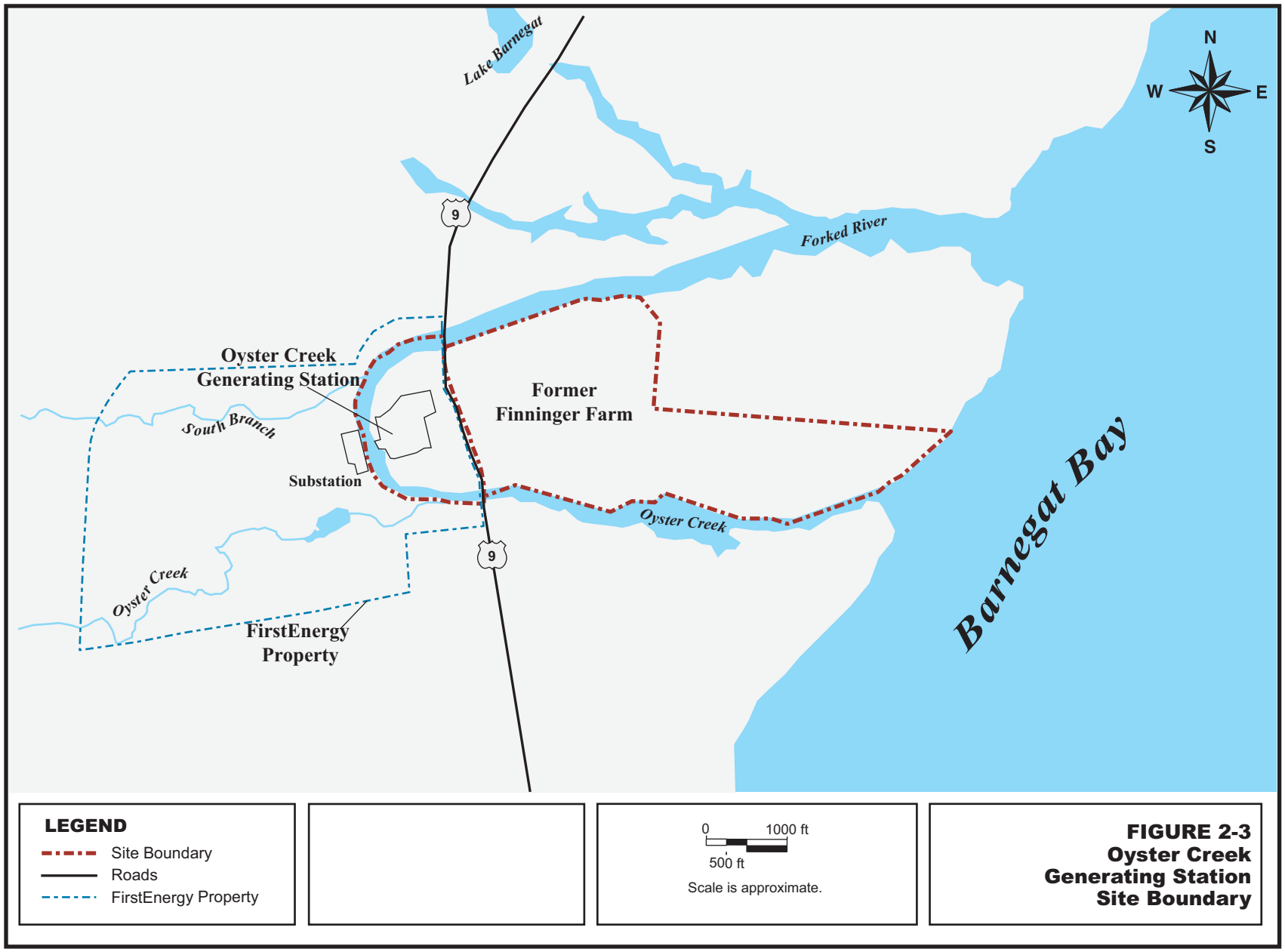


FIGURE 2-3
Oyster Creek Generating Station Site Boundary

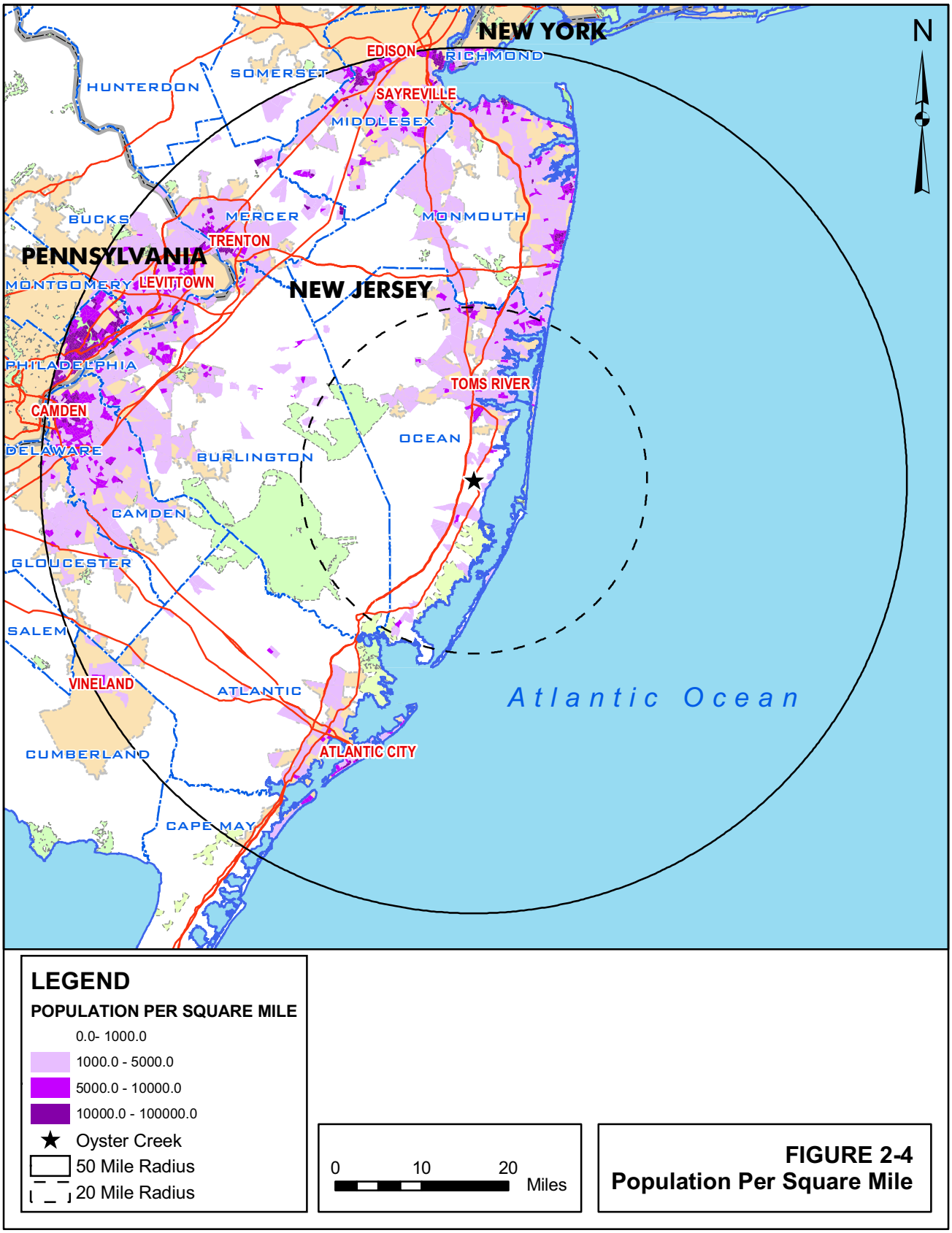
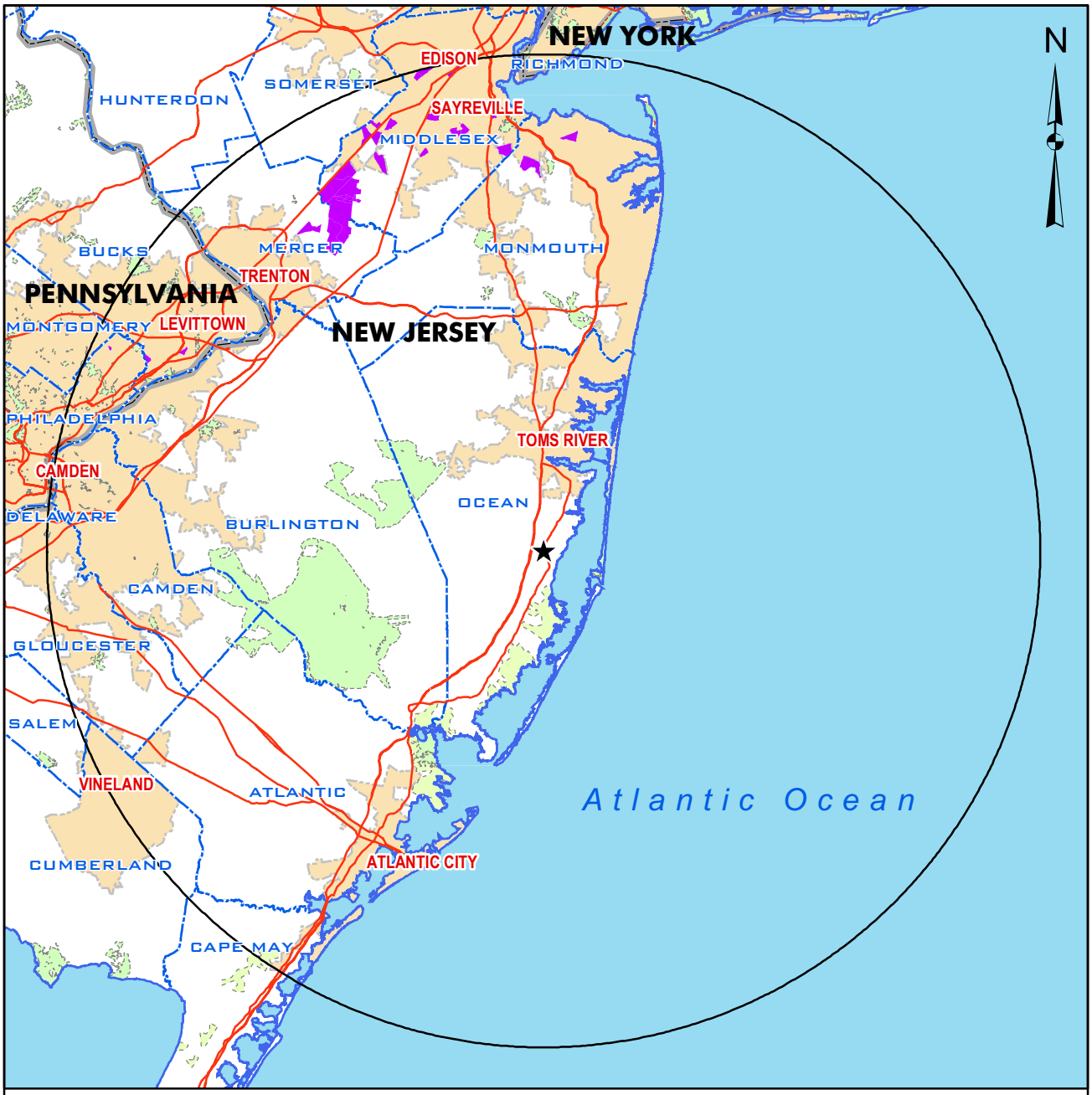


FIGURE 2-4
Population Per Square Mile

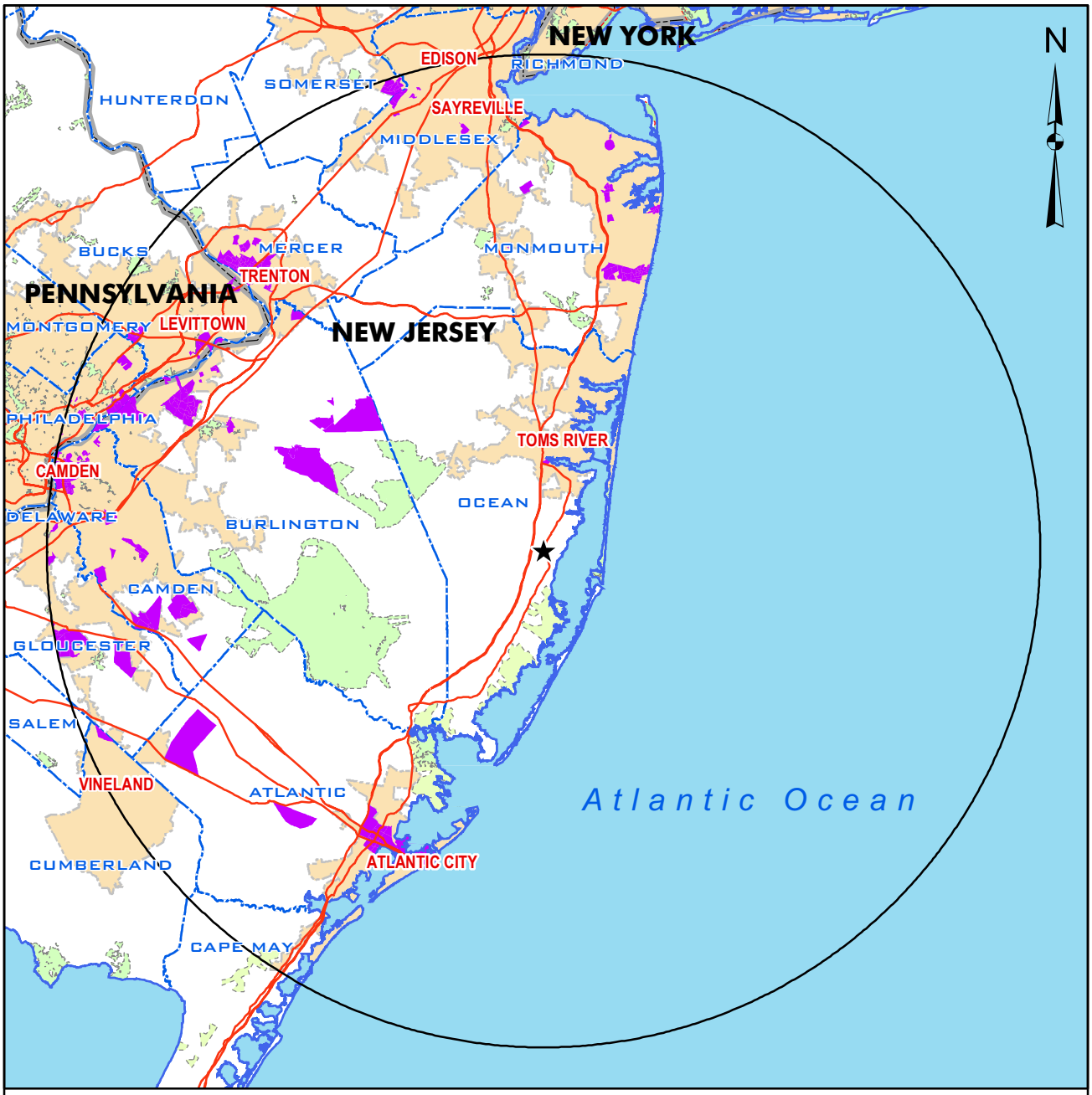


LEGEND

- Asian Population
- ★ Oyster Creek
- 50 Mile Radius

0 10 20 30 Miles

FIGURE 2-5
Asian Population

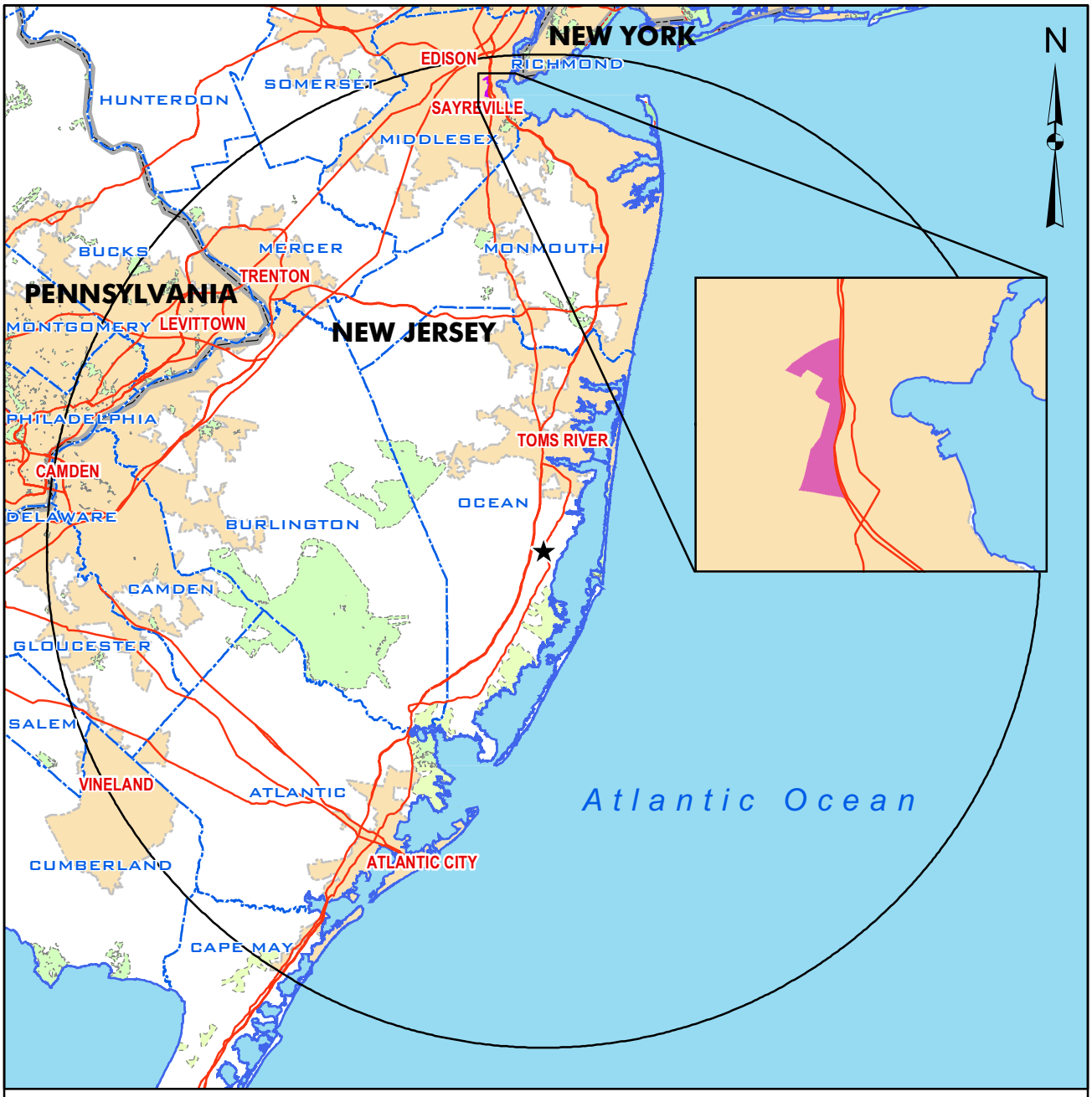


LEGEND

- Black Races Population
- ★ Oyster Creek
- 50 Mile Radius

0 10 20 Miles

FIGURE 2-6
Black Races Population



LEGEND

- Multi-Racial Minority Population
- ★ Oyster Creek
- 50 Mile Radius

0 5 10 Miles

FIGURE 2-7
Multi-Racial Minority Population

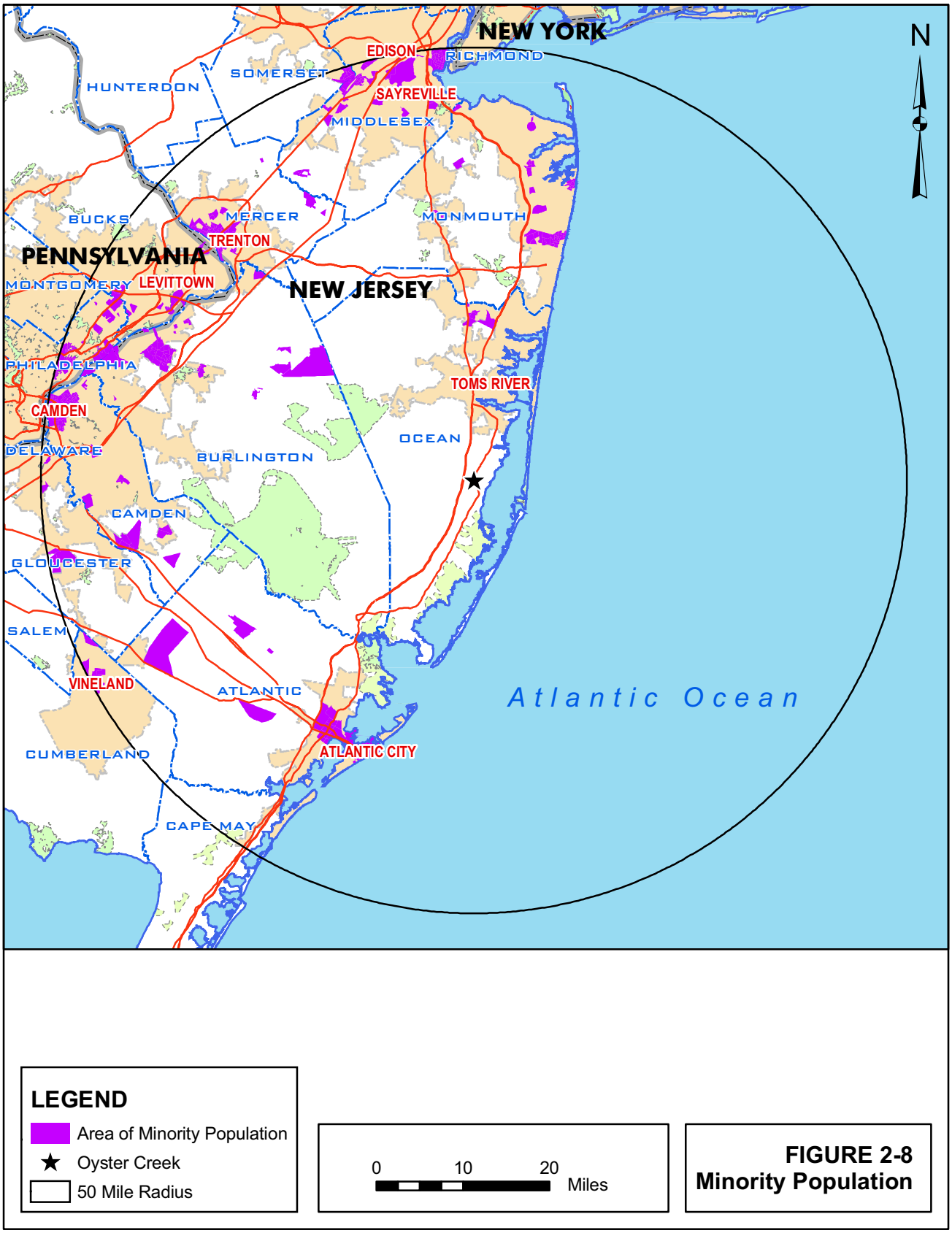


FIGURE 2-8
Minority Population

LEGEND

- Hispanic Ethnicity Population
- ★ Oyster Creek
- 50 Mile Radius

0 5 10 15 Miles

FIGURE 2-9
Hispanic Ethnicity Population

LEGEND

- Area of Low-Income Population
- ★ Oyster Creek
- 50 Mile Radius

0 10 20 Miles

FIGURE 2-10
Low-Income Population

2.13 References

Note to reader: Hard copies of cited web pages are available in AmerGen files. Some sites, for example the census data, cannot be accessed through their given URLs. The only way to access these pages is to follow queries on previous web pages. The complete URLs used by AmerGen have been given for these pages, even though they may not be directly accessible.

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Chapter 3

The Proposed Action

NRC

"…The report must contain a description of the proposed action, including the applicant's plans to modify the facility or its administrative control procedures…. This report must describe in detail the modifications directly affecting the environment or affecting plant effluents that affect the environment…." 10 CFR 51.53(c)(2)

AmerGen proposes that the U.S. Nuclear Regulatory Commission (NRC) renew the operating licenses for Oyster Creek Generating Station (OCGS) for an additional 20 years. Renewal would give AmerGen and the state of New Jersey the option of relying on OCGS to meet future electricity needs. Section 3.1 discusses the plant in general. Sections 3.2 through 3.4 address potential changes that could occur as a result of license renewal.

3.1 General Plant Information

General information about OCGS is available in several documents. In 1974, the U.S. Atomic Energy Commission, the predecessor agency of NRC, prepared the Final Environmental Statement (FES) related to the operation of Oyster Creek Nuclear Generating Station (USAEC 1974). The NRC Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) (USNRC 1996) describes OCGS features and, in accordance with NRC requirements, AmerGen maintains the Updated Final Safety Analysis Report (FSAR) for OCGS (AmerGen 2003). AmerGen has referred to each of these documents while preparing this environmental report for license renewal.

3.1.1 REACTOR AND CONTAINMENT SYSTEMS

OCGS is a single-unit plant with a boiling water reactor and steam turbine supplied by General Electric (GE). Initial criticality was achieved on May 3, 1969 and OCGS began commercial operation on December 23, 1969 under a Provisional Operating License. On July 2, 1991, the NRC issued a Full Term Operating License (Facility Operating License No. DPR-16) which superceded the Provisional Operating License in its entirety. The license expires at midnight, April 9, 2009. This license permits steady-state reactor core power to 1,930 megawatts-thermal (MWt) with an output to the grid of 640 MWe.

The prime contractor for the plant was General Electric (GE) which utilized the services of Burns and Roe, Inc. for engineering support and construction management. The unit's Mark I Containment was designed by the Chicago Bridge and Iron Company under contract to Burns and Roe, Inc.

The primary containment consists of the drywell, ventpipes, and a pool of water in the absorption chamber. The reactor building encloses the primary containment, thereby providing secondary containment. The reactor building is constructed entirely of reinforced concrete to the refueling floor. Above the refueling floor, the structure is steel framework with insulated, corrosion resistant metal siding. The foundation mat is 146 feet by 146 feet and about 10 feet thick.

The reactor fuel is uranium dioxide pellets sealed in Zircalloy-2 tubes. Fuel is enriched to no more than 5 percent, with a burnup rate of approximately 62,000 megawatt days per metric ton uranium.

The containment systems and their engineered safeguards are designed to ensure that offsite doses resulting from postulated accidents are well below the guidelines in 10 CFR 100.

3.1.2 COOLING AND AUXILIARY WATER SYSTEMS

Surface Water

OCGS employs a once-through heat dissipation system designed to remove waste heat from the condensers (Figure 3-1). The circulating water system includes the intake canal, an intake structure divided into two bays, circulating water pumps, condensers, dilution pumps, discharge pipes and discharge canal. The purpose of the dilution pumps is to decrease the attractiveness of the heated discharge to migratory fish species during the spring and fall, and to reduce thermal stress on organisms in the discharge canal during the summer. An angled boom in the intake canal immediately in front of the intake prevents large mats of eelgrass and algae from clogging the intake system.

Barnegat Bay is the plant's cooling water source and heat sink. Cooling water is drawn from Barnegat Bay through the South

Branch of Forked River and into a 150-foot wide intake canal dredged to a depth of 10 feet. The circulating water is returned to the 150-foot wide discharge canal and from there flows to Oyster Creek and back to Barnegat Bay (Figure 3-1). The intake and discharge canals are separated by a berm. A recirculation tunnel transfers water from the discharge to the intake as needed in winter to prevent icing. Three dilution pumps are available to pump water from the intake canal to the discharge canal to reduce the water temperature in the discharge canal. Requirements for dilution pump operations are included in the New Jersey Pollutant Discharge Elimination System (NJPDES) permit. The NJPDES permit allows only two of the three pumps to operate at the same time during normal operations. During shutdown, dilution pumps will be operated to minimize adverse impacts of the shutdown upon marine and estuarine life in Oyster Creek and Barnegat Bay. Depth in the South Branch of the Forked River, canals, and lower reaches of Oyster Creek is maintained by periodic dredging.

Circulating Water System Description

Unless otherwise noted, the discussion of the circulating water system was taken from the FSAR (AmerGen 2003) or the FES (USAEC 1974). The intake structure has two bays. Each bay is equipped with a trash rack and 3/8-inch mesh traveling screen. The circulating water system includes, for each bay, a screen wash system, two service water pumps, two emergency service water pumps, and two circulating water pumps.

Each of the four circulating water pumps can provide up to 115,000 gallons per minute (gpm) of condenser cooling water, or 460,000 gpm when all pumps are operating. The circulating water system cools the Station's main condensers.

Each section of the intake structure has a service water pump with a pump capacity of 6,000 gpm, a service water pump with a pump capacity of 2,000 gpm, two emergency service water pumps with a pump capacity of 4,150 gpm each and a screen wash pump with a pump capacity of 900 gpm. The pumps are located immediately downstream of the traveling screens. Service water provides cooling water to the reactor building and turbine building heat exchangers. The service water empties into the discharge canal and mixes with the circulating water (NJDEP 2004a) prior to discharge to the discharge canal.

Three low-speed, axial flow dilution pumps with 7-foot impellers are located on the opposite side of the intake canal from the intake structure. Each pump is rated at 260,000 gpm. They are protected only by trash racks which permit the passage of fish into and through the pumps.

Maximum flow with all circulating and dilution pumps working is 1.25 million gpm. At this flow rate, velocity in the intake and discharge canals is typically less than 2.0 feet per second (fps).

Water enters the intake through trashracks of almost vertical steel bars on 3-inch centers. The openings in the trash rack are 2.5 inches. Water then passes through 3/8-inch mesh traveling screens with Ristroph buckets. The screen wash system includes a low-pressure wash to gently remove aquatic organisms and debris impinged on the traveling screens. The Ristroph buckets empty into a fish flume that moves the fish and shellfish to the head of the discharge canal in the area of the dilution pump discharge (NJDEP 2004a).

Sodium hypochlorite is injected into the circulating water and plant service water systems and chlorine gas is injected into the Augmented Offgas/New Radwaste service water system to minimize fouling in the pipes and condensers. The concentration of chlorine-produced oxidants is maintained at less than 0.2 milligrams per liter and not

discharged from the main condenser for a period longer than 2 hours per day, by NPDES permit requirements. In actuality, the concentrations of chlorine-produced oxidants is typically less than 0.1 milligrams per liter.

Ground Water

The site uses bottled water for drinking. OCGS has two active, permitted wells, the South Well and the North Well, both constructed in the Kirkwood-Cohansey aquifer. The South Well is used for makeup and potable domestic water. The North Well is used for potable domestic water and may be used for makeup water if needed. These wells are permitted through the New Jersey Water Supply Administration (NJDEP 2001). The South Well is approximately 350 feet deep and has a pumping capacity of 200 gpm. The North Well has a pumping capacity of 225 gpm. The total pumping capacity for these wells is 425 gpm. The actual total production of these wells during 2001 was 7,379,654 gallons or 14 gpm. In 2001 the South Well produced 5,205,454 gallons (9.9 gallons per minute) and the North Well produced 2,174,200 gallons (4.1 gallons per minute) (AmerGen 2001).

3.1.3 TRANSMISSION FACILITIES

The FES (USAEC 1974) identifies one 230-kilovolt transmission line that was built to connect OCGS to the electric grid (Figure 2-2). It is a double circuit line hung on a single set of towers that runs 11.1 miles from the OCGS 230 Kilovolt Substation to the Manitou Substation near Toms River. Beyond the OCGS substation transformer-side disconnects, the line is owned and operated, and corridor easements held, by FirstEnergy, an Ohio utility.

The transmission line corridor is 240 feet wide and approximately parallels the New Jersey State Parkway, occupying approximately 320 acres (Figure 2-2). The corridor passes through land that is primarily pine forest and swamp forest. The areas are mostly remote, with low population densities, but there are some residential subdivisions under the line. Approximately 1 mile of the line passes through Double Trouble State Park. The line crosses numerous county roads and the New Jersey State Parkway. FirstEnergy plans to maintain this transmission line, which is integral to the larger transmission system, indefinitely. The transmission line will remain a permanent part of the transmission system after OCGS is decommissioned.

Jersey Central Power and Light Company, now a subsidiary of FirstEnergy, designed and constructed the OCGS transmission line in accordance with industry guidance that was current when the line was built. Ongoing surveillance and maintenance of the transmission facilities ensure continued conformance to design standards. These maintenance practices are described in Section 4.13. Section 4.13 examines the conformance of the line with the NESC requirements on line clearance to limit shock from induced currents (IEEE 1997).

The northern phase of a second 230 kV transmission line will run from OCGS substation to the Cedar substation in Ocean County (Figure 2-2). The line would be owned by Conectiv, a mid-Atlantic distribution company. Conectiv will comply with the National Electrical Safety Code (NESC) regarding line clearances. Conectiv's maintains its rights-of-way using an Integrated Vegetation Management program recognized by the US EPA as complying with the goals of the Pesticide Environmental Stewardship Program (Conectiv 2004). This line is not evaluated in this environmental report because it has not been constructed, however, NJDEP has reviewed and approved the route (NJDEP 2004b).

3.2 Refurbishment Activities

NRC

"… The report must contain a description of … the applicant's plans to modify the facility or its administrative control procedures…. This report must describe in detail the modifications directly affecting the environment or affecting plant effluents that affect the environment…." 10 CFR 51.53(c)(2)

"… The incremental aging management activities carried out to allow operation of a nuclear power plant beyond the original 40 year license term will be from one of two broad categories: ... and (2) major refurbishment or replacement actions, which usually occur fairly infrequently and possibly only once in the life of the plant for any given item…." USNRC 1996

AmerGen has addressed refurbishment activities in this environmental report in accordance with NRC regulations and complementary information in the NRC GEIS for license renewal (USNRC 1996). NRC requirements for the renewal of operating licenses for nuclear power plants include the preparation of an Integrated Plant Assessment (IPA) (10 CFR 54.21). The IPA must identify and list systems, structures, and components subject to an aging management review. Items that are subject to aging and might require refurbishment include, for example, piping, supports, and pump casings (see 10 CFR 54.21 for details), as well as items that are not subject to periodic replacement.

In turn, NRC regulations for implementing the National Environmental Policy Act require environmental reports to describe in detail and assess the environmental impacts of refurbishment activities such as planned modifications to systems, structures, and components or plant effluents [10 CFR 51.53(c)(2)]. Resource categories to be evaluated for impacts of refurbishment include terrestrial resources, threatened and endangered species, air quality, housing, public utilities and water supply, education, land use, transportation, and historic and archaeological resources.

The GEIS (USNRC 1996) provides helpful information on the scope and preparation of refurbishment activities to be evaluated in this environmental report. It describes major refurbishment activities that utilities might perform for license renewal that would necessitate changing administrative control procedures and modifying the facility. The GEIS analysis assumes that an applicant would begin any major refurbishment work shortly after NRC grants a renewed license and would complete the activities during five outages, including one major outage at the end of the 40th year of operation. The GEIS refers to this as the refurbishment period.

GEIS Table B.2 lists license renewal refurbishment activities that NRC anticipated utilities might undertake. In identifying these activities, the GEIS intended to encompass actions that typically take place only once, if at all, in the life of a nuclear plant. The GEIS analysis assumed that a utility would undertake these activities solely for the purpose of extending plant operations beyond 40 years, and would undertake them during the refurbishment period. The GEIS indicates that many plants will have undertaken various refurbishment activities to support the current license period, but that some plants

might undertake such tasks only to support extended plant operations.

The OCGS IPA that AmerGen conducted under 10 CFR 54 has not identified the need to undertake any major refurbishment or replacement actions to maintain the functionality of important systems, structures, and components during the OCGS license renewal period. AmerGen has included the IPA as part of this application (see Sections 2, 3, and 4).

3.3 Programs and Activities for Managing the Effects of Aging

NRC

"…The report must contain a description of … the applicant's plans to modify the facility or its administrative control procedures…. This report must describe in detail the modifications directly affecting the environment or affecting plant effluents that affect the environment…." 10 CFR 51.53(c)(2)

"…The incremental aging management activities carried out to allow operation of a nuclear power plant beyond the original 40 year license term will be from one of two broad categories: (1) SMITTR actions, most of which are repeated at regular intervals …." USNRC 1996 (SMITTR is defined in USNRC 1996 as surveillance, monitoring, inspections, testing, trending, and recordkeeping.)

The IPA required by 10 CFR 54.21 identifies the programs and inspections for managing aging effects at OCGS. These programs are described in the Oyster Creek Generating Station License Renewal Application, Appendix B, Aging Management Programs.

3.4 Employment

Current Workforce

OCGS employs a nuclear-related permanent workforce of approximately 470 employees and up to an additional 150 contract and matrixed employees; this is within the range of 600 to 800 personnel per reactor unit estimated in the GEIS (USNRC 1996, Section 2.3.8.1). Approximately 80 percent of OCGS's permanent employees live in Ocean County, New Jersey. The remaining 20 percent are distributed across 20 counties in New Jersey and Pennsylvania with numbers ranging from 1 to 28 employees per county. A very small percentage (less than one percent) of the workforce lives outside of New Jersey or Pennsylvania.

The OCGS reactor is on a 24-month refueling cycle. During refueling outages, site employment increases above the permanent workforce by as many as 1,300 workers for temporary (20 days) duty. This number is outside the GEIS range of 200 to 900 additional workers per reactor outage. However, AmerGen has chosen to increase the number of outage workers in order to reduce the duration of OCGS outages. Outage durations are significantly shorter than those depicted in the analyses performed by the NRC for the GEIS.

License Renewal Increment

Performing license renewal activities may necessitate increasing OCGS staff workload by some increment. The size of this increment would be a function of the schedule within which AmerGen must accomplish the work and the amount of work involved. Having determined that it would not undertake refurbishment (Section 3.2), AmerGen focused its analysis of license renewal employment increment on programs and activities for managing the effects of aging (Section 3.3).

The GEIS (USNRC 1996, Section 2.6.2.7) assumes that NRC would renew a nuclear power plant license for a 20-year period. The GEIS further assumes that the utility would initiate surveillance, monitoring, inspections, testing, trending and recordkeeping (SMITTR) activities at the time of issuance of the renewed license and would conduct license renewal SMITTR activities throughout the remaining life of the plant, sometimes during full-power operation (USNRC 1996, Section B.3.1.3), but mostly during normal refueling and the 5- and 10-year in-service refueling outages (USNRC 1996, Table B.4).

AmerGen has determined that the GEIS scheduling assumptions are reasonably representative of OCGS incremental license renewal workload scheduling. Many OCGS license renewal SMITTR activities would have to be performed during outages. Although some OCGS license renewal SMITTR activities would be one-time efforts, others would be recurring periodic activities that would continue for the life of the station.

The GEIS estimates that the most additional personnel needed to perform license renewal SMITTR activities would typically be 60 persons during the 3-month duration of a 10-year in-service refueling. Having established this upper value for what would be a single event in 20 years, the GEIS uses this number as the expected number of additional permanent workers needed per unit attributable to license renewal. GEIS Section 4.7 uses this approach in order to "...provide a realistic upper bound to potential population-driven impacts…."

AmerGen expects that existing "surge" capabilities for routine activities, such as outages, will enable AmerGen to perform the increased SMITTR workload without adding workers to the OCGS staff. Therefore, AmerGen for purposes of analysis in this environmental report is assuming that OCGS would require 60 additional permanent workers to perform all license renewal SMITTR activities.

Adding full-time employees to the plant workforce for the period of extended operation would have the indirect effect of creating additional jobs and related population growth in the community. AmerGen has used an employment multiplier appropriate to Ocean County, New Jersey (2.7084), to calculate the total direct and indirect jobs in service industries that would be supported by the spending of the OCGS workforce. The addition of 60 license renewal employees would generate approximately 103 indirect jobs in Ocean County. This number was calculated as follows: 60 (additional employees) × 2.7084 (regional multiplier) = 163 (total employees). Of these, 60 would be direct employees and 103 would be indirect.

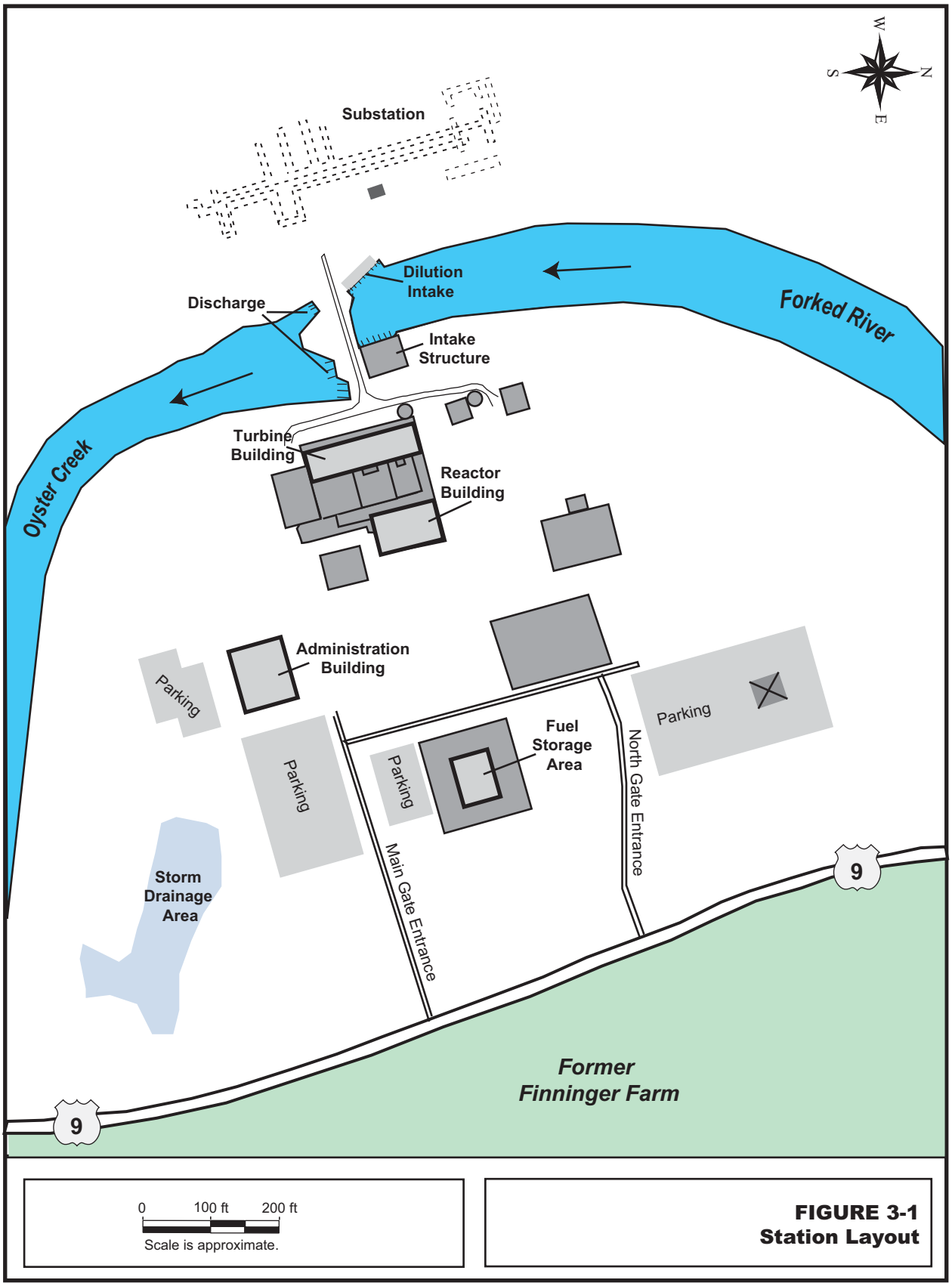

FIGURE 3-1
Station Layout

3.5 References

Note to reader: Hard copies of cited web pages are available in AmerGen files. Some sites, for example the census data, cannot be accessed through their given URLs. The only way to access these pages is to follow queries on previous web pages. The complete URLs used by AmerGen have been given for these pages, even though they may not be directly accessible.

AmerGen. 2001. OCGS Water Use Registration Annual Report.

AmerGen. 2003. Oyster Creek Nuclear Generating Station Final Safety Analysis Report. Revision 13, April.

Conectiv. 2004. Oyster Creek to Cordiff 230kV Electric Transmission Line. Northern Phase-Planned Router Oyster Creek Power Plant to Cedar Substation. Application for Individual Freshwater Wetlands Permit and Special Activity Transition Area Waiver for Linear Development. February.

IEEE (Institute of Electrical and Electronics Engineers). 1997. *National Electrical Safety Code, 1997 Edition, New York, New York*.

NJDEP (New Jersey Department of Environmental Protection). 2001. Water Use Registration No. 11108W. July 25.

NJDEP (New Jersey Department of Environmental Protection). 2004a. New Jersey Pollutant Discharge Elimination System Surface Water Renewal Permit.

NJDEP (New Jersey Department of Environmental Protection). 2004b. Land Use Regulation Program Approval Form – Oyster Creek to Cedar 230kV – Northern Phase. February 13.

USAEC (U.S. Atomic Energy Commission) 1974. Final Environmental Statement related to the operation of Oyster Creek Nuclear Generating Station, Jersey Central Power and Light, Docket 50-219, U.S. Nuclear Regulatory Commission, Washington, DC, August.

USNRC (U.S. Nuclear Regulatory Commission). 1996. Generic Environmental Impact Statement for License Renewal of Nuclear Plants. NUREG-1437, Office of Nuclear Regulatory Research. Washington DC. May.

Chapter 4

Environmental Consequences of the Proposed Action and Mitigating Actions

NRC

"The information submitted…should not be confined to information supporting the proposed action but should also include adverse information." 10 CFR 51.45(e) as adopted by 10 CFR 51.53(c)(2)

"The report must contain a consideration of alternatives for reducing impacts…for all Category 2 license renewal issues…." 10 CFR 51.53(c)(3)(iii)

"The environmental report shall include an analysis that considers…the environmental effects of the proposed action…and alternatives available for reducing or avoiding adverse environmental effects." 10 CFR 51.45(c) as adopted by 10 CFR 51.53(c)(2)

The environmental report shall discuss the "…impact of the proposed action on the environment. Impacts shall be discussed in proportion to their significance…." 10 CFR 51.45(b)(1) as adopted by 10 CFR 51.53(c)(2)

Chapter 4 presents an assessment of the environmental consequences associated with the renewal of the Oyster Creek Generating Station (OCGS) operating license. The U.S. Nuclear Regulatory Commission (NRC) has identified and analyzed 92 environmental issues that it considers to be associated with nuclear power plant license renewal and has designated the issues as Category 1, Category 2, or NA (not applicable). NRC designated an issue as Category 1 if, based on the result of its analysis, the following criteria were met:

- the environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristic;
- a single significance level (i.e., small, moderate, or large) has been assigned to the impacts that would occur at any plant, regardless of which plant is being evaluated (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent-fuel disposal); and
- mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely to be not sufficiently beneficial to warrant implementation.

If the NRC analysis concluded that one or more of the Category 1 criteria could not be met, NRC designated the issue as Category 2. NRC requires plant-specific analyses for Category 2 issues.

Finally, NRC designated two issues as NA, signifying that the categorization and impact definitions do not apply to these issues.

NRC rules do not require analyses of Category 1 issues that NRC resolved using generic findings (10 CFR 51) as described in the Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) (USNRC 1996a). Absent new and significant information, an applicant may reference the generic findings

or GEIS analyses for Category 1 issues. Appendix A of this report lists the 92 issues and identifies the environmental report section that addresses each issue.

Category 1 and NA License Renewal Issues

NRC

"The environmental report for the operating license renewal stage is not required to contain analyses of the environmental impacts of the license renewal issues identified as Category 1 issues in Appendix B to subpart A of this part." 10 CFR 51.53(c)(3)(i)

"…[A]bsent new and significant information, the analyses for certain impacts codified by this rulemaking need only be incorporated by reference in an applicant's environmental report for license renewal…." (USNRC 1996b, pg. 28483)

AmerGen has determined that 11 of the 69 Category 1 issues do not apply to OCGS because they are specific to design or operational features that are not found at the facility. Because AmerGen is not planning any refurbishment activities, seven additional Category 1 issues related to refurbishment do not apply. Appendix Table A-1 lists the 69 Category 1 issues, indicates whether or not each issue is applicable to OCGS, and if inapplicable provides the AmerGen basis for this determination. Appendix Table A-1 also includes references to supporting analyses in the GEIS where appropriate.

AmerGen has reviewed the NRC findings at 10 CFR 51 (Table B-1) and has not identified any new and significant information that would make the NRC findings, with respect to Category 1 issues, inapplicable to OCGS (see Chapter 5). Therefore, AmerGen adopts by reference the NRC findings for these Category 1 issues.

"NA" License Renewal Issues

NRC determined that its categorization and impact-finding definitions did not apply to Issues 60 and 92; however, AmerGen included these issues in Table A-1. NRC noted that applicants currently do not need to submit information on Issue 60, chronic effects from electromagnetic fields (10 CFR 51). For Issue 92, environmental justice, NRC does not require information from applicants, but noted that it will be addressed in individual license renewal reviews (10 CFR 51). AmerGen has included environmental justice demographic information in Section 2.6.2.

Category 2 License Renewal Issues

NRC

"The environmental report must contain analyses of the environmental impacts of the proposed action, including the impacts of refurbishment activities, if any, associated with license renewal and the impacts of operation during the renewal term, for those issues identified as Category 2 issues in Appendix B to subpart A of this part." 10 CFR 51.53(c)(3)(ii)

"The report must contain a consideration of alternatives for reducing adverse impacts, as required by § 51.45(c), for all Category 2 license renewal issues…." 10 CFR 51.53(c)(3)(iii)

NRC designated 21 issues as Category 2. Sections 4.1 through 4.20 (Section 4.17 addresses 2 issues) address the Category 2 issues, beginning with a statement of the issue. Six Category 2 issues apply to operational features that OCGS does not have. In addition, four Category 2 issues apply only to refurbishment activities. If the issue does not apply to OCGS, the section explains the basis for inapplicability.

For the 11 Category 2 issues that AmerGen has determined to be applicable to OCGS, the appropriate sections contain the required analyses. These analyses include conclusions regarding the significance of the impacts relative to the renewal of the operating license for OCGS and, if applicable, discuss potential mitigative alternatives to the extent required. AmerGen has identified the significance of the impacts associated with each issue as either small, moderate, or large, consistent with the criteria that NRC established in 10 CFR 51, Appendix B, Table B-1, Footnote 3 as follows:

SMALL - Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the Commission has concluded that those impacts that do not exceed permissible levels in the Commission's regulations are considered small.

MODERATE - Environmental effects are sufficient to alter noticeably, but not to destabilize, any important attribute of the resource.

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

In accordance with National Environmental Policy Act (NEPA) practice, AmerGen considered ongoing and potential additional mitigation in proportion to the significance of the impact to be addressed (i.e., impacts that are small receive less mitigative consideration than impacts that are large).

4.1 Water Use Conflicts (Plants with Cooling Ponds or Cooling Towers Using Makeup Water from a Small River with Low Flow)

NRC

"If the applicant's plant utilizes cooling towers or cooling ponds and withdraws make-up water from a river whose annual flow rate is less than 3.15×10^{12} ft^3/year (9×10^{10} m^3/year), an assessment of the impact of the proposed action on the flow of the river and related impacts on instream and riparian ecological communities must be provided. The applicant shall also provide an assessment of the impacts of the withdrawal of water from the river on alluvial aquifers during low flow." 10 CFR 51.53(c)(3)(ii)(A)

"…The issue has been a concern at nuclear power plants with cooling ponds and at plants with cooling towers. Impacts on instream and riparian communities near these plants could be of moderate significance in some situations…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 13

The NRC made surface water use conflicts a Category 2 issue because consultations with regulatory agencies indicate that water use conflicts are a concern at two closed-cycle plants (Limerick and Palo Verde) and may be a problem in the future at other plants. In the GEIS, NRC notes two factors that may cause water use and availability issues to become important for some nuclear power plants that use cooling towers. First, some plants equipped with cooling towers are located on small rivers that are susceptible to droughts or competing water uses. Second, consumptive water loss associated with closed-cycle cooling systems may represent a substantial proportion of the flows in small rivers (USNRC 1996a, Section 4.3.2.1).

The issue of surface water use conflicts does not apply to OCGS because the plant does not use cooling towers or cooling ponds. As Section 3.1.2 describes, OCGS uses a once-through cooling system that withdraws water from and discharges water to Barnegat Bay.

4.2 Entrainment of Fish and Shellfish in Early Life Stages

NRC

"If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of current Clean Water Act 316(b) determinations…or equivalent State permits and supporting documentation. If the applicant can not provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from…entrainment." 10 CFR 51.53(c)(3)(ii)(B)

"The impacts of entrainment are small at many plants but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems. Further, ongoing efforts in the vicinity of these plants to restore fish populations may increase the numbers of fish susceptible to intake effects during the license renewal period, such that entrainment studies conducted in support of the original license may no longer be valid." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 25

NRC made impacts of entrainment on fish and shellfish resources a Category 2 issue, because it could not assign a single significance level to the issue. The impacts of entrainment are small at many plants, but they may be moderate or large at others. Also, ongoing restoration efforts may increase the number of fish susceptible to intake effects during the license renewal period (USNRC 1996a, Section 4.2.2.1.2). Information needing to be ascertained includes: (1) type of cooling system (whether once-through or cooling pond), and (2) status of Clean Water Act (CWA) Section 316(b) determination or equivalent state documentation.

As Section 3.1.2 describes, OCGS has a once-through heat dissipation system that withdraws condenser cooling water from Barnegat Bay via the South Branch of the Forked River and an intake canal. Heated effluent is returned to the Bay via a discharge canal and Oyster Creek.

CWA Section 316(b) requires that any standard established pursuant to Sections 301 or 306 of the CWA shall require that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impacts (33 USC 1326). Entrainment through the condenser cooling system of fish and shellfish in early life stages is a potential adverse environmental impact that can be minimized by the best available technology.

Jersey Central Power & Light Company submitted a combined CWA Section 316(a) and 316(b) demonstration to the New Jersey Department of Environmental Protection (NJDEP) and the U.S. Environmental Protection Agency, Region II, in 1978 (Jersey Central Power and Light Company 1978). This demonstration was intended to satisfy CWA Section 316(b) and the requirements of the plant's NJPDES permit, which was issued with the stipulation that a study of the environmental impacts of the plant's cooling water intake structure be conducted.

GPU Nuclear submitted supplemental information on impingement and entrainment at OCGS to NJDEP in 1986 (EA 1986). The 1986 report, which contained information on impingement and entrainment studies conducted from November 1984 through December 1985, is considered by NJDEP to be part of the Oyster Creek 316(b) demonstration (NJDEP 1994, page 61 of 84).

In 1994, after reviewing the OCGS CWA 316(b) submittals and performing its own evaluation of the data, NJDEP issued NJDPDES permit number NJ0005550 to GPU Nuclear for the Oyster Creek Generating Station. OCGS submitted its application for NJDPDES permit renewal on May 28, 1999, six months prior to the November 30, 1999 permit expiration date. In accordance with the NJDEP (N.J.A.C. 7:14-6.1) and U. S. Environmental Protection Agency (40 CFR 122.6) regulations, the OCGS 1994 permit remains in effect pending NJDEP final action on the renewal applicaition. Thus, the NJPDES permit (NJ0005550) under which OCGS is currently operating, issued October 21, 1994 (effective December 1, 1994), constitutes the current CWA Section 316(b) determination for OCGS. Appendix B contains relevant portions of the 1994 NJPDES permit, which was the basis for the discussion in Sections 4.2 and 4.3.

Because OCGS has an approved CWA 316(b) determination, AmerGen concludes that impacts of entrainment of fish and shellfish at OCGS are SMALL and warrant no additional mitigation.

4.3 Impingement of Fish and Shellfish

NRC

"If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of current Clean Water Act 316(b) determinations…or equivalent State permits and supporting documentation. If the applicant can not provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from…impingement…." 10 CFR 51.53(c)(3)(ii)(B)

"The impacts of impingement are small at many plants but may be moderate or even large at a few plants with once-through and cooling-pond cooling systems." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 26

NRC made impacts of impingement on fish and shellfish resources a Category 2 issue because it could not assign a single significance level to the issue. The impacts of impingement are small at many plants, but they may be moderate or large at others (USNRC 1996a, Section 4.2.2.1.3). Information needing to be ascertained includes: (1) type of cooling system (whether once-through or cooling pond), and (2) status of CWA Section 316(b) determination or equivalent state documentation.

As Section 3.1.2 describes, OCGS has a once-through heat dissipation system that withdraws condenser cooling water from Barnegat Bay via the South Branch of the Forked River and an intake canal. Heated effluent is returned to the Bay via a discharge canal and Oyster Creek. Section 4.2 discusses the OCGS CWA 316(b) demonstration (some of which was prepared by Jersey Central Power and Light Company and some of which was prepared by GPU Nuclear).

The NJPDES permit under which OCGS currently operates was issued in October 1994, as discussed in Section 4.2. Appendix B contains relevant portions of this NJPDES permit. Because OCGS has a valid NJPDES permit (NJ0005550) that includes a CWA Section 316(b) determination, AmerGen concludes that impacts due to the impingement of fish and shellfish are SMALL and do not require mitigation measures beyond those already in place.

4.4 Heat Shock

NRC

"If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of current Clean Water Act… 316(a) variance in accordance with 40 CFR 125, or equivalent State permits and supporting documentation. If the applicant cannot provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from heat shock …." 10 CFR 51.53(c)(3)(ii)(B)

"…Because of continuing concerns about heat shock and the possible need to modify thermal discharges in response to changing environmental conditions, the impacts may be of moderate or large significance at some plants…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 27

NRC made impacts on fish and shellfish resources resulting from heat shock a Category 2 issue, because of continuing concerns about thermal discharge effects and the possible need to modify thermal discharges in the future in response to changing environmental conditions (USNRC 1996a). Information to be ascertained includes: (1) type of cooling system (whether once-through or cooling pond), and (2) evidence of a CWA Section 316(a) variance or equivalent state documentation.

As Section 3.1.2 describes, OCGS has a once-through heat dissipation system that withdraws condenser cooling water from Barnegat Bay via the South Branch of the Forked River and an intake canal. Heated effluent is returned to the Bay via a discharge canal and Oyster Creek.

Jersey Central Power & Light Company submitted a combined CWA Section 316(a) and 316(b) demonstration to the New Jersey Department of Environmental Protection and the U.S. Environmental Protection Agency, Region II, in 1978 (Jersey Central Power and Light 1978).

Based on the CWA 316(a) demonstration and its own evaluation, NJDEP determined that thermal discharges from OCGS did not jeopardize aquatic populations and that applicable thermal water quality-based effluent limitations would be more stringent than necessary to assure the protection and propagation of the balanced indigenous populations.

As discussed in Section 4.2, NJDEP issued an NJPDES permit to OCGS in October 1994. Because OCGS currently operates under an NJPDES permit with a CWA 316(a) thermal variance, AmerGen concludes that heat shock impacts are SMALL and no further mitigation is necessary.

4.5 Groundwater Use Conflicts (Plants Using > 100 GPM of Groundwater)

NRC

"If the applicant's plant…pumps more than 100 gallons (total onsite) of ground water per minute, an assessment of the impact of the proposed action on groundwater use must be provided." 10 CFR 51.53(c)(3)(ii)(C)

"…Plants that use more than 100 gpm may cause ground-water use conflicts with nearby ground-water users…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 33

NRC made this groundwater use conflict a Category 2 issue because overuse of an aquifer could exceed the natural recharge. A withdrawal rate of more than 100 gallons per minute (gpm) could create a cone of depression that could extend offsite. This could inhibit the withdrawal capacity of nearby offsite users.

As described in Section 3.1.2 (Cooling and Auxiliary Water Systems), the total capacity of the two active water supply wells at OCGS is 425 gpm. However, actual total usage is much lower and averages 20,218 gallons per day, or 14 gpm. The withdrawal is permitted by the State of New Jersey's Water Use Registration No. 11108W. The registration limits water withdrawal from all sources to 100,000 gallons per day or 70 gpm. Therefore, the issue of groundwater use conflicts (plants using more than 100 gpm groundwater) does not apply.

4.6 Groundwater Use Conflicts (Plants Using Cooling Towers or Cooling Ponds and Withdrawing Makeup Water from a Small River)

NRC

"If the applicant's plant utilizes cooling towers or cooling ponds and withdraws make-up water from a river whose annual flow rate is less than 3.15×10^{12} ft^3/year...[t]he applicant shall also provide an assessment of the impacts of the withdrawal of water from the river on alluvial aquifers during low flow." 10 CFR 51.53(3)(ii)(A)

"…Water use conflicts may result from surface water withdrawals from small water bodies during low flow conditions which may affect aquifer recharge, especially if other groundwater or upstream surface water users come on line before the time of license renewal…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 34

NRC made this groundwater use conflict a Category 2 issue because consumptive use of withdrawals from small rivers could adversely impact aquatic life, downstream users, and groundwater-aquifer recharge. This is a particular concern during low-flow conditions and could create a cumulative impact due to upstream consumptive use. Cooling tower and cooling ponds lose water due to evaporation, which is necessary to cool the heated water before it is discharged to the environment.

The issue of groundwater use conflicts does not apply to OCGS because the plant does not use cooling towers or cooling ponds and does not withdraw water from a small river. As Section 3.1.2 describes, OCGS uses a once-through cooling system that withdraws water from and discharges water to Barnegat Bay.

4.7 Groundwater Use Conflicts (Plants Using Ranney Wells)

NRC

"If the applicant's plant uses Ranney wells…an assessment of the impact of the proposed action on groundwater use must be provided." 10 CFR 51.53(c)(3)(ii)(C)

"…Ranney wells can result in potential ground-water depression beyond the site boundary. Impacts of large ground-water withdrawal for cooling tower makeup at nuclear power plants using Ranney wells must be evaluated at the time of application for license renewal…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 35

NRC made this groundwater use conflict a Category 2 issue because large quantities of groundwater withdrawn from Ranney wells could degrade groundwater quality at river sites by induced infiltration of poor-quality river water into an aquifer.

The issue of groundwater use conflicts does not apply to OCGS because the plant does not use Ranney wells. As Section 3.1.2 describes, OCGS uses a once-through cooling system that withdraws from and discharges to Barnegat Bay.

4.8 Degradation of Groundwater Quality

NRC

"If the applicant's plant is located at an inland site and utilizes cooling ponds, an assessment of the impact of the proposed action on groundwater quality must be provided." 10 CFR 51.53(c)(3)(ii)(D)

"…Sites with closed-cycle cooling ponds may degrade ground-water quality. For plants located inland, the quality of the ground water in the vicinity of the ponds must be shown to be adequate to allow continuation of current uses…." 10 CFR 51, Subpart A, Appendix B, Table B 1, Issue 39

NRC made degradation of groundwater quality a Category 2 issue because evaporation from closed-cycle cooling ponds concentrates dissolved solids in the water and settles suspended solids. In turn, seepage into the water table aquifer could degrade groundwater quality.

The issue of groundwater degradation does not apply to OCGS because the plant is not located at an inland site and does not use cooling ponds. As Section 3.1.2 describes, OCGS uses a once-through cooling system that withdraws from and discharges to Barnegat Bay.

4.9 Impacts of Refurbishment on Terrestrial Resources

NRC

The environmental report must contain an assessment of "…the impacts of refurbishment and other license renewal-related construction activities on important plant and animal habitats…." 10 CFR 51.53(c)(3)(ii)(E)

"…Refurbishment impacts are insignificant if no loss of important plant and animal habitat occurs. However, it cannot be known whether important plant and animal communities may be affected until the specific proposal is presented with the license renewal application…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 40

"…If no important resources would be affected, the impacts would be considered minor and of small significance. If important resources could be affected by refurbishment activities, the impacts would be potentially significant…." (USNRC 1996a)

NRC made impacts to terrestrial resources from refurbishment a Category 2 issue, because the significance of ecological impacts cannot be determined without considering site- and project-specific details (USNRC 1996a). Aspects of the site and project to be ascertained are: (1) the identification of important ecological resources, (2) the nature of refurbishment activities, and (3) the extent of impacts to plant and animal habitats.

The issue of impacts of refurbishment on terrestrial resources is not applicable to OCGS because, as discussed in Section 3.2, AmerGen has no plans for refurbishment or other license-renewal-related construction activities at OCGS.

4.10 Threatened and Endangered Species

NRC

"Additionally, the applicant shall assess the impact of the proposed action on threatened or endangered species in accordance with the Endangered Species Act." 10 CFR 51.53(c)(3)(ii)(E)

"Generally, plant refurbishment and continued operation are not expected to adversely affect threatened or endangered species. However, consultation with appropriate agencies would be needed at the time of license renewal to determine whether threatened or endangered species are present and whether they would be adversely affected." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 49

NRC made impacts to threatened and endangered species a Category 2 issue because the status of many species is being reviewed continuously, and site-specific assessment is required to determine whether any identified species could be affected by refurbishment activities or continued plant operations through the renewal period. In addition, compliance with the Endangered Species Act requires consultation with the appropriate federal agency (USNRC 1996a, Sections 3.9 and 4.1).

Section 2.2 of this Environmental Report describes the aquatic communities of Barnegat Bay and discusses population trends in recreationally and commercially important populations. Section 2.4 describes important terrestrial habitats at OCGS and along the associated OCGS-to-Manitou transmission corridor. Section 2.5 discusses threatened or endangered species that occur or may occur at OCGS and along the associated transmission corridor, or in Barnegat Bay in the vicinity of the plant's cooling canals.

With the exception of the species identified in Section 2.5, AmerGen is not aware of any threatened or endangered terrestrial species that could occur at OCGS or along the associated transmission corridors. Current AmerGen operation of OCGS and FirstEnergy vegetation management practices along the transmission line right-of-way do not adversely affect any listed terrestrial species or its habitat (see Section 2.5). Furthermore, plant operations and transmission line maintenance practices are not expected to change significantly during the license renewal term. Therefore, no adverse impacts to threatened or endangered terrestrial species from current or future operations are anticipated.

As noted in Section 2.5, two federally-endangered (Kemp's ridley sea turtle and green sea turtle) and one federally-threatened (loggerhead sea turtle) species of sea turtles have occasionally been impinged on the trash racks at the OCGS circulating water and dilution pump intakes. The NRC consulted with National Marine Fisheries Service under Section 7 of the Endangered Species Act in 1983 and 2000 regarding the effect of OCGS operations on sea turtle populations. NMFS concluded that incidental takes at OCGS are not likely to jeopardize the continued existence of these turtle species (NMFS 2001). A third consultation is ongoing.

AmerGen corresponded with the New Jersey Department of Environmental Protection, the U.S. Fish and Wildlife Service requesting information on any listed

species or critical habitats that might occur on the OCGS site or along the associated transmission corridor, with particular emphasis on species that might be adversely affected by continued operation over the license renewal period. NRC is corresponding with NMFS regarding protected turtle species. Agency responses are provided in Appendix C.

As discussed in Section 3.1.3, Conectiv has proposed the construction of a 230kV transmission line from OCGS to Atlantic County. Conectiv has consulted with the U.S. Fish and Wildlife Service regarding threatened or endangered species along the proposed route (Frederick 2002, Day 2002).

As discussed in Section 3.2, AmerGen has no plans to conduct refurbishment or construction activities at OCGS during the license renewal term. Therefore, there would be no refurbishment-related impacts to special-status species and no further analysis of refurbishment-related impacts is applicable. Furthermore, because AmerGen has no plans to alter current operations and resource agencies contacted by AmerGen evidenced no concerns about license renewal impacts, AmerGen concludes that impacts to threatened or endangered species (with the exception of Kemp's ridley which is being reviewed by NMFS for impacts) from license renewal would be SMALL and do not warrant mitigation.

NMFS expects to issue its Biological Opinion by September 10, 2005. For the interim NMFS has recommended that NRC continue to implement the requirements imposed on OCGS in the July 21, 2001 Opinion and the August 29, 2001 Incidental Take Statement (NMFS 2005).

4.11 Air Quality During Refurbishment (Non-Attainment Areas)

NRC

"…If the applicant's plant is located in or near a nonattainment or maintenance area, an assessment of vehicle exhaust emissions anticipated at the time of peak refurbishment workforce must be provided in accordance with the Clean Air Act as amended…." 10 CFR 51.53(c)(3)(ii)(F)

"…Air quality impacts from plant refurbishment associated with license renewal are expected to be small. However, vehicle exhaust emissions could be cause for concern at locations in or near nonattainment or maintenance areas. The significance of the potential impact cannot be determined without considering the compliance status of each site and the numbers of workers expected to be employed during the outage…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 50

NRC made impacts to air quality during refurbishment a Category 2 issue because vehicle exhaust emissions could be cause for some concern, and a general conclusion about the significance of the potential impact could not be drawn without considering the compliance status at each site and the number of workers expected to be employed during an outage (USNRC 1996a). Information needed would include: (1) the attainment status of the plant-site area, and (2) the number of additional vehicles as a result of refurbishment activities.

Air quality during refurbishment is not applicable to OCGS because, as discussed in Section 3.2, AmerGen has no plans for refurbishment at OCGS.

4.12 Microbiological Organisms

NRC

"If the applicant's plant uses a cooling pond, lake, or canal or discharges into a river having an annual average flow rate of less than 3.15×10^{12} ft^3/year (9×10^{10} m^3/year), an assessment of the impact of the proposed action on public health from thermophilic organisms in the affected water must be provided." 10 CFR 51.53(c)(3)(ii)(G)

"…These organisms are not expected to be a problem at most operating plants except possibly at plants using cooling ponds, lakes, or canals that discharge to small rivers. Without site-specific data, it is not possible to predict the effects generically…." 10 CFR 51, Subpart A, Table B-1, Issue 57

Due to the lack of sufficient data for facilities using cooling ponds, lakes, or canals that discharge to small rivers, NRC designated impacts on public health from thermophilic organisms a Category 2 issue. Information to be ascertained is: (1) whether the plant discharges to a small river, and (2) whether discharge characteristics (particularly temperature) are favorable to the survival of thermophilic organisms. This issue does not apply to OCGS because, as indicated in Section 3.1.2, OCGS does not use cooling ponds, lakes, or canals (as defined in the GEIS and used in the regulation) and does not discharge to a small river, (USNRC 1996a; Table 5-13).

4.13 Electric Shock from Transmission-Line-Induced Currents

NRC

The environmental report must contain an assessment of the impact of the proposed action on the potential shock hazard from transmission lines "...[i]f the applicant's transmission lines that were constructed for the specific purpose of connecting the plant to the transmission system do not meet the recommendations of the National Electric Safety Code for preventing electric shock from induced currents…" 10 CFR 51.53(c)(3)(ii)(H)

"…Electrical shock resulting from direct access to energized conductors or from induced charges in metallic structures have not been found to be a problem at most operating plants and generally are not expected to be a problem during the license renewal term. However, site-specific review is required to determine the significance of the electric shock potential at the site…." 10 CFR 51, Subpart A, Table B 1, Issue 59

NRC made impacts of electric shock from transmission lines a Category 2 issue because, without a review of each plant's transmission line conformance with the National Electrical Safety Code (NESC) criteria (IEEE 1997), NRC could not determine the significance of the electrical shock potential.

In the case of OCGS, there have been no previous NRC or National Environmental Policy Act analyses of transmission-line-induced-current hazard. Therefore, this section provides an analysis of the OCGS's transmission line's conformance with the NESC standard. The analysis is based on computer modeling of induced current under the line.

Objects located near transmission lines can become electrically charged due to their immersion in the lines' electric field. This charge results in a current that flows through the object to the ground. The current is called "induced" because there is no direct connection between the line and the object. The induced current can also flow to the ground through the body of a person who touches the object. An object that is insulated from the ground can actually store an electrical charge, becoming what is called "capacitively charged." A person standing on the ground and touching a vehicle or a fence receives an electrical shock due to the sudden discharge of the capacitive charge through the person's body to the ground. After the initial discharge, a steady-state current can develop, the magnitude of which depends on several factors, including the following:

- the strength of the electric field which, in turn, depends on the voltage of the transmission line as well as its height and geometry
- the size of the object on the ground
- the extent to which the object is grounded.

In 1977, the NESC adopted a provision that describes how to establish minimum vertical clearances to the ground for electric lines having voltages exceeding 98-kilovolt alternating current to ground.[1] The clearance must limit the induced current[2] due to electrostatic effects to 5 milliamperes if the largest anticipated truck, vehicle, or equipment were short-circuited to ground. By way of comparison, the setting of ground fault circuit interrupters used in residential wiring (special breakers for outside circuits or those with outlets around water pipes) is 4 to 6 milliamperes.

As described in Section 3.1.3, there is one 230-kilovolt line of two circuits that was specifically constructed to distribute power from OCGS to the electric grid. AmerGen's analysis of this transmission line began by identifying all road crossing and selecting the two lowest clearances for analysis. In addition, AmerGen selected the lowest clearance location along the line regardless of the presence of a road. These limiting cases represent locations along the line where the potential for current-induced shock would be greatest. Once the limiting cases were identified, AmerGen calculated the electric field strength for the transmission line at that location, then calculated the induced current. If the limiting cases' induced current exceeded the NESC limit, additional analyses would be performed to identify all locations with potential to exceed the limit.

AmerGen calculated electric field strength and induced current using a computer code called ACDCLINE, produced by the Electric Power Research Institute. The results of this computer program have been field-verified through actual electric field measurements by several utilities. The input parameters included design features of the limiting-case scenario and the NESC requirement that line sag be determined at 120 degrees Fahrenheit conductor temperature. For analysis purposes, the maximum vehicle size under the lines is considered to be a tractor-trailer for road crossings and a farm combine for nonroad crossings.

The analysis determined that there are no locations under the transmission line that have the capacity to induce more than 5 milliamperes in a vehicle parked beneath the line. The analytical results are as follows:

- Intersection of Hill Street and proposed 5th Avenue
  2.8 milliamperes

- Proposed Grove Street
  2.8 milliamperes

- Medium woods (no road)
  2.1 milliamperes

FirstEnergy, the owner and operator of the transmission line, conducts surveillance and maintenance to ensure that design ground clearances will not endanger continued operation of the line. These procedures include routine inspection by aircraft on approximately 5 year rotations. The aerial patrols include checks for encroachments, broken conductors, broken or leaning structures, and signs of burnt trees, any of which would be evidence of clearance problems. Ground inspections include examination for clearance at questionable locations, integrity of structures, and surveillance for dead or diseased trees that might fall on the transmission line. Problems noted during any inspection are brought to the attention of the appropriate organizations for corrective action. Vegetation maintenance practices include the use of power saws, EPA-approved herbicides, mechanical equipment or a combination (FirstEnergy Undated).

[1] Part 2, Rules 232C1c and 232D3c.
[2] The NESC and the GEIS use the phrase "steady-state current," whereas 10 CFR 51.53(c)(3)(ii)(H) uses the phrase "induced current." The phrases mean the same here.

AmerGen's assessment under 10 CFR 51 concludes that electric shock is of SMALL significance for the OCGS transmission line because the magnitude of the induced currents do not exceed the NESC standard. Mitigation measures are not warranted.

4.14 Housing Impacts

NRC

The environmental report must contain "...[a]n assessment of the impact of the proposed action on housing availability…" 10 CFR 51.53(c)(3)(ii)(I)

"…Housing impacts are expected to be of small significance at plants located in a medium or high population area and not in an area where growth control measures that limit housing development are in effect. Moderate or large housing impacts of the workforce associated with refurbishment may be associated with plants located in sparsely populated areas or areas with growth control measures that limit housing development…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 63

"...[S]mall impacts result when no discernible change in housing availability occurs, changes in rental rates and housing values are similar to those occurring statewide, and no housing construction or conversion occurs…." (USNRC 1996, Section 4.7.1.1, pp. 4-101 to 4-102)

NRC made housing impacts a Category 2 issue, because impact magnitude depends on local conditions which the NRC could not predict for all plants at the time of GEIS publication (USNRC 1996a, Section 3.7.2). Local conditions that need to be ascertained are: (1) population categorization as small, medium, or high, and (2) applicability of growth control measures.

Refurbishment activities and continued operations could result in housing impacts as a result of increased staffing. As described in Section 3.2, AmerGen has no plans to increase staff because no refurbishment-related activities required for extended operations have been identified. AmerGen concludes that there would be no refurbishment-related impacts to area housing and no analysis is therefore required. The following discussion focuses on impacts of continued operations on local housing availability, and the assumption that OCGS would add up to 60 additional license-term employees.

As described in Section 2.6, OCGS is located in a high population area. As noted in Section 2.8, the area of interest is not subject to growth control measures that limit housing development. In 10 CFR 51, Subpart A, Appendix B, Table B-1, NRC concluded that impacts to housing are expected to be of small significance at plants located in high population areas where growth control measures are not in effect. Therefore, AmerGen expects housing impacts to be small.

The maximum impact to area housing was calculated using the following assumptions: (1) all direct and indirect jobs would be filled by in-migrating residents; (2) the residential distribution of new residents would be similar to current worker distribution; and (3) each new job created (direct and indirect) would represent one housing unit. As described in Section 3.4, OCGS's estimate of 60 license renewal employees could generate the demand for 163 housing units (60 direct and 103 indirect jobs). In an area

which has a population within a 50-mile radius of approximately 4,243,000 and an average of 2.51 persons per household (USCB 2000), suggesting the existence of approximately 1.7 million housing units, it is reasonable to conclude that this demand would not create a discernible change in housing availability, rental rates or housing values, or spur housing construction or conversion. OCGS concludes that impacts to housing availability resulting from station-related population growth would be SMALL and would not warrant mitigation.

4.15 Public Utilities: Public Water Supply Availability

NRC

The environmental report must contain "…an assessment of the impact of population increases attributable to the proposed project on the public water supply." 10 CFR 51.53(c)(3)(ii)(l)

"…An increased problem with water shortages at some sites may lead to impacts of moderate significance on public water supply availability…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 65

"Impacts on public utility services are considered small if little or no change occurs in the ability to respond to the level of demand and thus there is no need to add capital facilities. Impacts are considered moderate if overtaxing of facilities during peak demand periods occurs. Impacts are considered large if existing service levels (such as quality of water and sewage treatment) are substantially degraded and additional capacity is needed to meet ongoing demands for services." (USNRC 1996, Section 3.7.4.5, pg. 3-19)

NRC made public utility impacts a Category 2 issue because an increased problem with water availability, resulting from pre-existing water shortages, could occur in conjunction with plant demand and plant-related population growth (USNRC 1996a, Section 4.7.3.5). Local information needed would include: (1) a description of water shortages experienced in the area, and (2) an assessment of the public water supply system's available capacity.

NRC's analysis of impacts to the public water supply system considered both plant demand and plant-related population growth demands on local water resources. As Section 3.4 indicates, AmerGen analyzed a hypothetical 60-person increase in OCGS employment attributable to license renewal. Section 2.6 describes the OCGS regional demography. Section 2.9.1 describes the public water supply systems in the area, their permitted capacities, and current demands. As discussed in Section 3.2, no refurbishment is planned for OCGS and no refurbishment impacts are therefore expected. Accordingly, the following discussion focuses on impacts of continued operations on local public utilities, and the assumption that OCGS would add up to 60 additional employees during the period of extended operation for license renewal activities.

OCGS does not use water from a municipal system and plant groundwater usage during the renewed license period of operations would be considered small (Section 4.5); therefore, AmerGen does not expect OCGS operations to have an effect on local water supplies.

The impact to the local water supply systems from plant-related population growth can be determined by calculating the amount of water that would be required by these individuals. The average American uses about 90 gallons per day for personal use (USEPA 2003). As described in Section 3.4, OCGS's estimate of 60 additional employees could generate a total of 163 new jobs, which could result in a population increase of 409 in the area (163 jobs multiplied by 2.51, which is the average number of persons per household in the area [USCB 2000]). Using this consumption

rate, the plant-related population increase could require an approximate additional 36,810 gallons per day (409 people multiplied by 90 gallons per day) in an area where the excess public water supply capacity is approximately 12 million gallons per day from the United Water – Toms River supplier alone. Of the 20 major water suppliers in Ocean County, there is only one for which demand exceeds supply. If it is assumed that this increase in population would be consistent with current employee trends (i.e., 80 percent would settle in Ocean County), the increase in water demand would not create shortages in capacity of the water supply systems in these communities. AmerGen concludes that impacts resulting from plant-related population growth to public water supplies would be SMALL, requiring no additional capacity and not warranting mitigation.

4.16 Education Impacts from Refurbishment

NRC

The environmental report must contain "…[a]n assessment of the impact of the proposed action on…public schools (impacts from refurbishment activities only) within the vicinity of the plant…." 10 CFR 51.53(c)(3)(ii)(l)

"…Most sites would experience impacts of small significance but larger impacts are possible depending on site- and project-specific factors…." 10 CFR 51, Subpart A, Table B-1, Issue 66

"…[S]mall impacts are associated with project-related enrollment increases of 3 percent or less. Impacts are considered small if there is no change in the school systems' abilities to provide educational services and if no additional teaching staff or classroom space is needed. Moderate impacts are generally associated with 4 to 8 percent increases in enrollment. Impacts are considered moderate if a school system must increase its teaching staff or classroom space even slightly to preserve its pre-project level of service….Large impacts are associated with project-related enrollment increases above 8 percent…." (USNRC 1996a)

NRC made refurbishment-related impacts to education a Category 2 issue because site- and project-specific factors determine the significance of impacts (USNRC 1996a). Local factors to be ascertained include: (1) project-related enrollment increases and (2) status of the student/teacher ratio.

The issue of education impacts from refurbishment is not applicable to OCGS because, as discussed in Section 3.2, AmerGen has no plans for refurbishment or other license-renewal-related construction activities at OCGS.

4.17 Offsite Land Use

4.17.1 OFFSITE LAND USE – REFURBISHMENT

NRC

The environmental report must contain "…an assessment of the impact of the proposed action on... land-use... (impacts from refurbishment activities only) within the vicinity of the plant…" 10 CFR 51.53(c)(3)(ii)(I)

"…Impacts may be of moderate significance at plants in low population areas…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 68

"…[I]f plant-related population growth is less than 5 percent of the study area's total population, off-site land-use changes would be small, especially if the study area has established patterns of residential and commercial development, a population density of at least 60 persons per square mile, and at least one urban area with a population of 100,000 or more within 50 miles…." (USNRC 1996, Section 3.7.5)

NRC made impacts to offsite land use as a result of refurbishment activities a Category 2 issue because land-use changes could be considered beneficial by some community members and adverse by others. Local conditions to be ascertained include: (1) plant-related population growth, (2) patterns of residential and commercial development, and (3) proximity to an urban area with a population of at least 100,000.

This issue is not applicable to OCGS because, as Section 3.2 discusses, AmerGen has no plans for refurbishment as a result of license renewal at OCGS.

4.17.2 OFFSITE LAND USE – LICENSE RENEWAL TERM

NRC

The environmental report must contain "…an assessment of the impact of the proposed action on …land-use…within the vicinity of the plant…" 10 CFR 51.53(c)(3)(ii)(I)

"Significant changes in land use may be associated with population and tax revenue changes resulting from license renewal." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 69

"…[I]f plant-related population growth is less than five percent of the study area's total population, off-site land-use changes would be small…" (USNRC 1996a, Section 3.7.5)

"If the plant's tax payments are projected to be small, relative to the community's total revenue, new tax-driven land-use changes during the plant's license renewal term would be small, especially where the community has pre-established patterns of development and has provided adequate public services to support and guide development." (USNRC 1996a, Section 4.7.4.1)

NRC made impacts to offsite land use during the license renewal term a Category 2 issue because land-use changes may be perceived as beneficial by some community members and adverse by others. Therefore, NRC could not assess the potential significance of site-specific offsite land-use impacts (USNRC 1996a, Section 4.7.4.1). Site-specific factors to be considered in an assessment of new tax-driven land-use impacts include: (1) the size of plant-related population growth compared to the area's total population, (2) the size of the plant's tax payments relative to the community's total revenue, (3) the nature of the community's existing land-use pattern, and (4) the extent to which the community already has public services in place to support and guide development.

The GEIS presents an analysis of offsite land use for the renewal term that is characterized by two components: population-driven and tax-driven impacts (USNRC 1996a, Section 4.7.4.1).

Population-Driven Impacts

Based on the GEIS case-study analysis, NRC concluded that all new population-driven land-use changes during the license renewal term at all nuclear plants would be small. Population growth caused by license renewal would represent a much smaller percentage of the local area's total population than the percentage presented by operations-related growth (USNRC 1996a, Section 4.7.4.2).

Tax-Revenue-Driven Impacts

NRC has determined that the significance of tax payments as a source of local government revenue would be large if the payments are greater than 20 percent of revenue, moderate if the payments are between 10 and 20 percent of revenue, and small if the payments are less than 10 percent of revenue (USNRC 1996a, Section 3.7.3).

NRC defined the magnitude of land-use changes as follows (USNRC 1996a, Section 4.7.4):

Small - very little new development and minimal changes to an area's land-use pattern.

Moderate - considerable new development and some changes to land-use pattern.

Large - large-scale new development and major changes in land-use pattern.

NRC further determined that, if a plant's tax payments are projected to be small relative to the community's total revenue, new tax-driven land-use changes would be small, especially where the community has preestablished patterns of development and has provided adequate public services to support and guide development.

Table 2-4 provides a comparison of total tax payments made by OCGS to Lacey Township and Lacey Township's annual property tax revenues. For the three-year period from 2001 through 2003, OCGS's tax payments to Lacey Township represented 4 to 5 percent of the Township's total annual property tax revenues. Using NRC's criteria, OCGS's tax payments are of small significance to Lacey Township.

Ocean County is the fastest growing county in New Jersey. Ocean County has a growing year-round population and its economic base is increasingly diverse, with a variety of industries now supplementing traditional tourist-related businesses.

The surrounding population and the level of commercial and industrial activity in this region supports the conclusion that OCGS has a small impact on the local economy and tax base. Any increase in license renewal-related population (assuming 100 percent in-migration) would be far less than one percent of the surrounding population. The local tax base is very large and tax payments made by OCGS are comparatively small. Any changes to the infrastructures of Lacey Township and Ocean County would be attributable to the large population immigration already experienced by the County, and a large pool of residential, industrial, and commercial tax payers.

AmerGen does not anticipate refurbishment or license renewal-related construction during the license renewal period. Therefore, AmerGen does not anticipate any increase in the assessed value of OCGS due to refurbishment-related improvements, nor any related tax-increase-driven changes to offsite land-use and development patterns.

Conclusion

AmerGen concludes that the land-use impact would be SMALL. Mitigation for land-use impacts during the license renewal term would not be warranted.

4.18 Transportation

NRC

The environmental report must "...assess the impact of highway traffic generated by the proposed project on the level of service of local highways during periods of license renewal refurbishment activities and during the term of the renewed license." 10 CFR 51.53(c)(3)(ii)(J)

"…Transportation impacts…are generally expected to be of small significance. However, the increase in traffic associated with additional workers and the local road and traffic control conditions may lead to impacts of moderate or large significance at some sites…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 70

Small impacts would be associated with U.S. Transportation Research Board Level of Service A, having the following condition: "…Free flow of the traffic stream; users are unaffected by the presence of others." and Level of Service B, having the following condition: "…Stable flow in which the freedom to select speed is unaffected but the freedom to maneuver is slightly diminished…." (USNRC 1996a, Section 3.7.4.2, pp. 3 18 and 3-19)

NRC made impacts to transportation a Category 2 issue, because impact significance is determined primarily by road conditions existing at the time of license renewal, which NRC could not forecast for all facilities (USNRC 1996a, Section 3.7.4.2). Local road conditions to be ascertained are: (1) level of service conditions, and (2) incremental increases in traffic associated with refurbishment activities and license renewal staff.

As described in Section 3.2, no major refurbishment is planned and no refurbishment impacts to local transportation are therefore anticipated. Accordingly, the following discussion focuses on impacts of continued operations on transportation, and the assumption that OCGS would add up to 60 additional employees during the period of extended operations. Level of service information is not available for the roads used by OCGS employees traveling to work.

AmerGen's OCGS workforce includes approximately 470 permanent and 150 contract employees. On a 24-month cycle, as many as 1,300 additional workers join the permanent workforce during a refueling outage, which typically lasts approximately 20 days. AmerGen's projection of 60 additional employees associated with license renewal for OCGS represents a 9.7 percent increase in the current number of permanent and contract employees and an even smaller percentage of employees present onsite during the biennial refueling outage. Given these employment projections and the average number of vehicles per day currently using the surrounding roads to OCGS (Table 2-6), AmerGen concludes that impacts to transportation would be SMALL and mitigative measures would be unwarranted.

4.19 Historic and Archaeological Resources

NRC

The environmental report must contain an assessment of "…whether any historic or archaeological properties will be affected by the proposed project." 10 CFR 51.53(c)(3)(ii)(K)

"Generally, plant refurbishment and continued operation are expected to have no more than small adverse impacts on historic and archaeological resources. However, the National Historic Preservation Act requires the Federal agency to consult with the State Historic Preservation Officer to determine whether there are properties present that require protection." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 71

"Sites are considered to have small impacts to historic and archaeological resources if (1) the State Historic Preservation Officer (SHPO) identifies no significant resources on or near the site; or (2) the SHPO identifies (or has previously identified) significant historic resources but determines they would not be affected by plant refurbishment, transmission lines, and license-renewal term operations and there are no complaints from the affected public about altered historic character; and (3) if the conditions associated with moderate impacts do not occur." (USNRC 1996a, Section 3.7.7)

NRC made impacts to historic and archaeological resources a Category 2 issue, because determinations of impacts to historic and archaeological resources are site-specific in nature and the National Historic Preservation Act mandates that impacts must be determined through consultation with the State Historic Preservation Officer (USNRC 1996a, Section 4.7.7.3). In the context of the National Historic Preservation Act, the NRC has determined that the Area of Potential Effect for a license renewal action is the area at the power plant site and its immediate environs which may be impacted by post-license renewal land disturbing activities specifically related to license renewal, regardless of ownership or control of the land of interest.

In the Final Environmental Statement, the AEC reported that "[t]he site includes no historic places. The station and transmission lines do not intrude upon or otherwise affect the setting and significance of any historic place. In addition, the Curator of Cultural History of the New Jersey State Museum found no evidence of archaeological sites within the station property bounded by the South Branch Forked River, the Parkway, and the bay. The Historic Sites Office of the New Jersey Department of Environmental Protection confirmed that there are no National Register or State Register sites in the area and that no historical or architectural structures are impaired…"(USAEC 1974).

As discussed in Section 3.2, AmerGen has no refurbishment plans and no refurbishment-related impacts are anticipated. AmerGen is not aware of any historic or archaeological resources that have been affected by OCGS operations, including operation and maintenance of transmission lines. Because AmerGen has

no plans to construct additional facilities at OCGS related to license renewal and because any land-disturbing activities that were required would be done under the auspices of Exelon's corporate procedures that insure the protection of cultural resources, AmerGen concludes that operation of OCGS over the license renewal term would not impact cultural resources; hence, no mitigation would be warranted.

By letter dated 10/15/04, the state SHPO concurs with Amergen's conclusion (Appendix D).

4.20 Severe Accident Mitigation Alternatives (SAMA)

NRC

The environmental report must contain a consideration of alternatives to mitigate severe accidents "…if the staff has not previously considered severe accident mitigation alternatives for the applicant's plant in an environmental impact statement or related supplement or in an environment assessment..." 10 CFR 51.53(c)(3)(ii)(L)

"…The probability weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to ground water, and societal and economic impacts from severe accidents are small for all plants. However, alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives…." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 76

Section 4.20 summarizes Exelon's analysis of alternative ways to mitigate the impacts of severe accidents. Appendix F provides a detailed description of the severe accident mitigation alternatives (SAMA) analysis.

The term "accident" refers to any unintentional event (i.e., outside the normal or expected plant operation envelope) that results in the release or a potential for release of radioactive material to the environment. NRC categorizes accidents as "design basis" or "severe." Design basis accidents are those for which the risk is great enough that NRC requires plant design and construction to prevent unacceptable accident consequences. Severe accidents are those that NRC considers too unlikely to warrant design controls.

NRC concluded in its license renewal rulemaking that the unmitigated environmental impacts from severe accidents met its Category 1 criteria. However, NRC made consideration of mitigation alternatives a Category 2 issue because not all plants had completed ongoing regulatory programs related to mitigation (e.g., individual plant examinations and accident management). Site-specific information to be presented in the license renewal environmental report includes: (1) potential SAMAs; (2) benefits, costs, and net value of implementing potential SAMAs; and (3) sensitivity of analysis to changes in key underlying assumptions.

Exelon maintains a probabilistic safety assessment (PSA) model to use in evaluating the most significant internal events related risks of radiological release from Oyster Creek fuel into the reactor, from the reactor into the containment structure, and from the containment to the environment.

External event related risks are accounted for in the quantitative methodology in an approximate manner. The recognition that external events are not explicitly modeled in the current PSA model led to the following treatment of external events:

(1) The insights from the Oyster Creek Individual Plant External Event Examination (IPEEE) and subsequent NRC reviews are used to support the SAMA identification.

(2) Cost benefit evaluations are evaluated by doubling the averted cost-risk associated with the internal events

results to approximate the benefit associated with a SAMA's impact on external events.

For the SAMA analysis, Exelon used the PSA model output as input to an NRC-approved consequence assessment code (MACCS2) that calculates economic costs and dose to the public from hypothesized releases from the containment structure into the environment. Then, using NRC regulatory analysis techniques, Exelon calculated the monetary value of the Oyster Creek severe accident risk. The result represents the monetary value of the base risk of dose to the public and workers, offsite and onsite economic costs, and replacement power. This value was doubled to account for external events and became a cost/benefit-screening tool for potential SAMAs; a SAMA whose cost of implementation exceeded the base cost-risk value could be rejected as being not cost-beneficial.

Exelon used industry, NRC, and Oyster Creek-specific information to create a list of approximately 138 SAMAs for consideration. Exelon analyzed this list and screened out SAMAs that: (1) would not apply to the Oyster Creek design; (2) had already been implemented at Oyster Creek; and/or (3) would achieve results that Exelon had already achieved at Oyster Creek by other means. Exelon prepared preliminary cost estimates for the remaining SAMAs and used the base risk value to screen out SAMAs that would not be cost-beneficial. Thirty-seven candidate SAMAs remained for further consideration.

Exelon calculated the cost-risk reduction that would be attributable to each candidate SAMA (assuming SAMA implementation) and re-quantified the cost-risk value. The difference between the base cost-risk value and the SAMA-reduced cost-risk value became the averted cost-risk, or the value of implementing the SAMA. Exelon confirmed the cost estimates for implementing each of these SAMA items and implemented the cost/benefit comparison. Seven SAMAs were found to be cost beneficial based on the best estimate analysis. However, three of the SAMAs are found to be not cost-beneficial when implemented in tandem with other more cost-beneficial SAMAs.

Exelon performed two additional sensitivity analyses to evaluate how the SAMA analysis would change if the discount rate in the present value calculation is changed or the risk is characterized by the 95% upper bound estimate. The results of these sensitivity analyses identified seven additional SAMA candidates that could be further examined as part of the decision making process.

In summary, based on the results of the Oyster Creek SAMA analysis, Exelon concludes that several cost-beneficial options exist to reduce plant risk, but that none are related to plant aging.

4.21 References

Note to reader: Hard copies of cited web pages are available in AmerGen files. Some sites, for example the census data, cannot be accessed through their given URLs. The only way to access these pages is to follow queries on previous web pages. The complete URLs used by AmerGen have been given for these pages, even though they may not be directly accessible.

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Chapter 5

Assessment of New and Significant Information

NRC

"…The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware." 10 CFR 51.53(c)(3)(iv)

The U.S. Nuclear Regulatory Commission (NRC) licenses the operation of domestic nuclear power plants and provides for license renewal, requiring a license renewal application that includes an environmental report (10 CFR 54.23). NRC regulations, 10 CFR 51, prescribe the environmental report content and identify the specific analyses the applicant must perform. In an effort to streamline the environmental review, NRC has resolved most of the environmental issues generically and only requires an applicant's analysis of the remaining issues.

While NRC regulations do not require an applicant's environmental report to contain analyses of the impacts of those Category 1 environmental issues that have been generically resolved [10 CFR 51.53(c)(3)(i)], the regulations do require that an applicant identify any new and significant information of which the applicant is aware [10 CFR 51.53(c)(3)(iv)]. The purpose of this requirement is to alert NRC staff to such information, so the staff can determine whether to seek the Commission's approval to waive or suspend application of the rule with respect to the affected generic analysis. NRC has explicitly indicated, however, that an applicant is not required to perform a site-specific validation of Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS) conclusions (USNRC 1996).

AmerGen expects that new and significant information would include:

- Information that identifies a significant environmental issue not covered in the GEIS and codified in the regulation, or
- Information that was not covered in the GEIS analyses and that leads to an impact finding different from that codified in the regulation.

NRC does not specifically define the term "significant." For the purpose of its review, AmerGen used guidance available in Council on Environmental Quality (CEQ) regulations. The National Environmental Policy Act authorizes CEQ to establish implementing regulations for federal agency use. NRC requires license renewal applicants to provide NRC with input, in the form of an environmental report, that NRC will use to meet National Environmental Policy Act requirements as they apply to license renewal (10 CFR 51.10). CEQ guidance provides that federal agencies should prepare environmental impact statements for actions that would significantly affect the environment (40 CFR 1502.3), focus on significant environmental issues (40 CFR 1502.1), and eliminate from detailed study issues that are not significant [40 CFR 1501.7(a)(3)]. The CEQ guidance includes a lengthy definition of "significantly" that requires consideration of the context of the action and the intensity or severity of the impact(s) (40 CFR 1508.27). AmerGen expects that moderate or large impacts, as defined by NRC, would be significant. Chapter 4 presents the NRC definitions of "moderate" and "large" impacts.

The new and significant assessment process AmerGen used during preparation of this license renewal application included: (1) interviews with AmerGen and Exelon subject experts on the validity of the conclusions in the GEIS as they relate to Oyster Creek Generating Station (OCGS),

(2) an extensive review of documents related to environmental issues at OCGS, (3) correspondence with state and federal agencies, in part to determine if the agencies had concerns relevant to their resource areas that had not been addressed in the GEIS, (4) credit for OCGS environmental monitoring and reporting required by regulations and oversight of plant facilities and operations by state and federal regulatory agencies, and (5) review of previous license renewal applications for issues relevant to the OCGS application.

As a result of this review, AmerGen is not aware of any new and significant information regarding the plant's environment or operations that would make any generic conclusion codified by the NRC for Category 1 issues not applicable to OCGS, that would alter regulatory or GEIS statements regarding Category 2 issues or that would suggest any other measure of license renewal environmental impact.

5.1 References

USNRC (U.S. Nuclear Regulatory Commission). 1996. Public Comments on the Proposed 10 CFR 51 Rule for Renewal of Nuclear Power Plant Operating Licenses and Supporting Documents: Review of Concerns and NRC Staff Response. Volumes 1 and 2. NUREG-1529. Washington, DC. May.

Chapter 6

Summary of License Renewal Impacts and Mitigating Actions

6.1 License Renewal Impacts

AmerGen has reviewed the environmental impacts of renewing the Oyster Creek Generating Station (OCGS) operating license and has concluded that impacts would be small and would not require mitigation. This environmental report documents the basis for AmerGen's conclusion. Chapter 4 incorporates by reference U.S. Nuclear Regulatory Commission (NRC) findings for the 52 Category 1 issues that apply to OCGS, all of which have impacts that are small (Table A-1). The rest of Chapter 4 analyzes Category 2 issues, all of which are either not applicable or have impacts that are small. Table 6-1 identifies the impacts that OCGS license renewal would have on resources associated with Category 2 issues.

6.2 Mitigation

NRC

"The report must contain a consideration of alternatives for reducing adverse impacts…for all Category 2 license renewal issues…" 10 CFR 51.53(c)(3)(iii)

"The environmental report shall include an analysis that considers and balances…alternatives available for reducing or avoiding adverse environmental effects…" 10 CFR 51.45(c) as incorporated by 10 CFR 51.53(c)(2) and 10 CFR 51.45(c)

Impacts of license renewal are small and would not require mitigation. Current operations include monitoring activities that would continue during the license renewal term. AmerGen performs routine monitoring to ensure the safety of workers, the public, and the environment. These activities include the biological monitoring program, radiological environmental monitoring program, continuous emissions monitoring, effluent chemistry monitoring, and effluent toxicity testing. These monitoring programs ensure that the plant's permitted emissions and discharges are within regulatory limits and any unusual or off-normal emissions/discharges would be quickly detected, mitigating potential impacts.

6.3 Unavoidable Adverse Impacts

NRC

The environmental report shall discuss any "...adverse environmental effects which cannot be avoided should the proposal be implemented..." 10 CFR 51.45(b)(2) as adopted by 10 CFR 51.53(c)(2)

This environmental report adopts by reference NRC findings for applicable Category 1 issues, including discussions of any unavoidable adverse impacts (Table A-1). AmerGen examined 21 Category 2 issues and identified the following unavoidable adverse impacts of license renewal.

- Waste heat from plant operations is discharged to Barnegat Bay.
- Construction of the plant caused the tidal flow, salinity, nutrient flux, and suspended solids in Oyster Creek and Forked River to change from historic values. The flow in the Forked River was reversed (USAEC 1974). This would remain unchanged throughout the license renewal term.
- Because the land surrounding the plant is flat, some structures are visible from offsite. This visual impact will continue during the license renewal term.
- Procedures for the disposal of sanitary, chemical, and radioactive wastes are intended to reduce adverse impacts from these sources to acceptably low levels. A small impact will be present as long as the plant is in operation. Solid radioactive wastes are a product of plant operations and long-term disposal of these materials must be considered.
- Operation of OCGS results in a very small increase in radioactivity in the air and water. However, fluctuations in natural background radiation are expected to exceed the small increase in dose to the local population. Operation of OCGS also creates a very low probability of accidental radiation exposure to inhabitants of the area.
- Sea turtles are occasionally impinged at the circulating water or dilution pump intake structures. OCGS has mitigation measures in place to minimize adverse impacts.
- Some adult and juvenile fish and shellfish are impinged on the traveling screens at the circulating water intake structure.
- Some fish and shellfish are entrained at the circulating water and dilution pump intake structures.

6.4 Irreversible and Irretrievable Resource Commitments

NRC

The environmental report shall discuss any "...irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented…" 10 CFR 51.45(b)(5) as adopted by 10 CFR 51.53(c)(2)

Continued operation of OCGS for the license renewal term will result in irreversible and irretrievable resource commitments, including the following:

- nuclear fuel, which is used in the reactor and is converted to radioactive waste;
- land required to dispose of spent nuclear fuel, low-level radioactive wastes generated as a result of plant operations; and sanitary wastes generated from normal industrial operations;
- elemental materials that will become radioactive; and
- materials used for the normal industrial operations of the plant that cannot be recovered or recycled or that are consumed or reduced to unrecoverable forms.

6.5 Short-Term Use Versus Long-Term Productivity of the Environment

NRC

The environmental report shall discuss the "...relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity..." 10 CFR 51.45(b)(4) as adopted by 10 CFR 51.53(c)(2)

The current balance between short-term use and long-term productivity at the OCGS site was established when the plant began operating in 1969. The Final Environmental Statement (USAEC 1974) evaluated the impacts of constructing and operating OCGS. Natural resources that would experience short-term use include land and water. The area immediately surrounding the plant site is largely undeveloped and is protected by the Pinelands Protection Act. Approximately 150 acres of the 800-acre site are devoted to the production of electrical energy. This includes the area occupied by OCGS facilities (buildings, Independent Spent Fuel Storage Installation, parking lots, roadways) and landscaped areas around the facilities. Two tidal rivers, the Forked River and Oyster Creek were modified by dredging to create intake and discharge canals. The dredging, and reversal of flow in Forked River produced local changes in salinity, tidal patterns, sedimentation, and nutrient flux patterns. Most of the upland areas of the OCGS site not required for plant operations are early succession coastal forests. Transmission line construction required about 320 acres of new land that resulted in the alteration of natural wildlife habitats.

After decommissioning, most environmental disturbances would cease and restoration of the natural habitat would occur. Thus, the "trade-off" between the production of electricity and changes in the local environment is reversible to some extent.

Experience with other experimental, developmental, and commercial nuclear plants has demonstrated the feasibility of decommissioning and dismantling such plants sufficiently to restore a site to its former use. The degree of dismantlement will take into account the intended new use of the site and a balance among health and safety considerations, salvage values, and environmental impacts. However, decisions on the ultimate disposition of these lands have not yet been made.

Table 6-1. Environmental Impacts Related to License Renewal at OCGS.

No.	Issue	Environmental Impact
	Surface Water Quality, Hydrology, and Use (for all plants)	
13	Water use conflicts (plants with cooling ponds or cooling towers using makeup water from a small river with low flow)	**None.** This issue does not apply because OCGS does not use cooling ponds or cooling towers that withdraw makeup water from a small river with no flow.
	Aquatic Ecology (for plants with once-through and cooling pond heat dissipation systems)	
25	Entrainment of fish and shellfish in early life stages	**Small.** AmerGen has a current NJPDES permit which constitutes compliance with CWA Section 316(b) requirements to provide best technology available to minimize entrainment.
26	Impingement of fish and shellfish	**Small.** AmerGen has a current NJPDES permit which constitutes compliance with CWA Section 316(b) requirements to provide best technology available to minimize impingement.
27	Heat shock	**Small.** AmerGen has a current NJPDES permit with a thermal variance which constitutes compliance with CWA Section 316(a).The OCGS discharge meets state water quality standards.
	Groundwater Use and Quality	
33	Groundwater use conflicts (potable and service water, and dewatering; plants that use > 100 gpm)	**None.** This issue does not apply because OCGS uses less than 100 gallons of groundwater per minute.
34	Groundwater use conflicts (plants using cooling towers or cooling ponds withdrawing makeup water from a small river)	**None.** This issue does not apply because OCGS does not use cooling ponds or cooling towers that withdraw makeup water from a small river.
35	Groundwater use conflicts (Ranney wells)	**None.** This issue does not apply because OCGS does not use Ranney wells.
39	Groundwater quality degradation (cooling ponds at inland sites)	**None.** This issue does not apply because OCGS is not located at an inland site and does not use cooling ponds.
	Terrestrial Resources	
40	Refurbishment impacts	**None.** No impacts are expected because OCGS has no plans to undertake refurbishment.
	Threatened or Endangered Species	
49	Threatened or endangered species	**Small.** NMFS has concluded that incidental takes of loggerheads and green sea turtles at the OCGS intake have not jeopardized the continued existence of those species. NRC and NMFS are in consultation regarding impacts to Kemp's ridley sea turtle.
	Air Quality	
50	Air quality during refurbishment (non-attainment and maintenance areas)	**None.** No impacts are expected because OCGS has no plans to undertake refurbishment.

Table 6-1. Environmental Impacts Related to License Renewal at OCGS (Continued).

No.	Issue	Environmental Impact
		Human Health
57	Microbiological organisms (public health) (plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river)	**None.** This issue does not apply because OCGS does not have cooling canals (as defined by the regulation), cooling towers, or cooling ponds that discharge to a small river.
59	Electromagnetic fields, acute effects (electric shock)	**Small.** The largest modeled induced current under the OCGS lines is substantially less than the 5-milliampere limit. Therefore, the OCGS transmission lines conform to the National Electrical Safety Code provisions for preventing electric shock from induced current.
		Socioeconomics
63	Housing impacts	**Small.** The conceptual addition of 163 direct/indirect jobs would not noticeably affect a housing market of more than 1 million housing units.
65	Public services: public utilities	**Small.** Most water suppliers in Ocean County have excess capacity. The conceptual addition of 163 direct/indirect jobs would not adversely affect the available water.
66	Public services: education (refurbishment)	**None.** No impacts are expected because OCGS has no plans to undertake refurbishment.
68	Offsite land use (refurbishment)	**None.** No impacts are expected because OCGS has no plans to undertake refurbishment.
69	Offsite land use (license renewal term)	**Small.** No plant-induced changes to offsite land use are expected from license renewal.
70	Public services: transportation	**Small.** The addition of 60 employees would not noticeably increase traffic or adversely affect level of service in the vicinity of OCGS.
71	Historic and archaeological resources	**Small.** Continued operation of OCGS would not require construction at the site. Therefore, license renewal would have little or no effect on historic or archeological resources.
		Postulated Accidents
76	Severe accidents	**Small.** AmerGen did not identify any cost-effective SAMAs related to aging management.

6.6 References

USAEC (U. S. Atomic Energy Commission). 1974. Final Environmental Report Related to the Operation of Oyster Creek Nuclear Generating Station, Jersey Central Power & Light, Docket No. 50-219. Washington D.C., December.

Chapter 7

Alternatives to the Proposed Action

NRC

The environmental report shall discuss "Alternatives to the proposed action.…" 10 CFR 51.45(b)(3), as adopted by reference at 10 CFR 51.53(c)(2).

"...The report is not required to include discussion of need for power or economic costs and benefits of ... alternatives to the proposed action except insofar as such costs and benefits are either essential for a determination regarding the inclusion of an alternative in the range of alternatives considered or relevant to mitigation...." 10 CFR 51.53(c)(2).

"While many methods are available for generating electricity, and a huge number of combinations or mixes can be assimilated to meet a defined generating requirement, such expansive consideration would be too unwieldy to perform given the purposes of this analysis. Therefore, NRC has determined that a reasonable set of alternatives should be limited to analysis of single, discrete electric generation sources and only electric generation sources that are technically feasible and commercially viable…" (USNRC 1996a).

"…The consideration of alternative energy sources in individual license renewal reviews will consider those alternatives that are reasonable for the region, including power purchases from outside the applicant's service area...." (USNRC 1996b).

Chapter 7 evaluates alternatives to Oyster Creek Generating Station (OCGS) license renewal. The chapter identifies actions that AmerGen might take, and associated environmental impacts, if the U.S. Nuclear Regulatory Commission (NRC) chooses not to renew the plant's operating license. The chapter also addresses actions that AmerGen has considered, but would not take, and identifies AmerGen bases for determining that such actions would be unreasonable.

AmerGen divided the possible alternatives discussion into two categories, "no-action" and "alternatives that meet system generating needs." In considering the level of detail and analysis that it should provide for each category, AmerGen relied on the NRC decision-making standard for license renewal:

"…the NRC staff, adjudicatory officers, and Commission shall determine whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy planning decision makers would be unreasonable." [10 CFR 51.95(c)(4)].

AmerGen has determined that the environmental report would support NRC decision making as long as the document provides sufficient information to clearly indicate whether an alternative would have a smaller, comparable, or greater environmental impact than the proposed action. Providing additional detail or analysis serves no function if it only brings to light additional adverse impacts of alternatives to license renewal. This approach is consistent with regulations of the Council on Environmental Quality, which provide that the consideration of alternatives (including the proposed action) should

enable reviewers to evaluate their comparative merits (40 CFR 1500-1508). AmerGen believes that Chapter 7 provides sufficient detail about alternatives to establish the basis for necessary comparisons to the Chapter 4 discussion of impacts from the proposed action.

In characterizing environmental impacts from alternatives, AmerGen has used the same definitions of “small,” “moderate,” and “large” that are presented in the introduction to Chapter 4.

7.1 No-Action Alternative

AmerGen uses "no-action alternative" to refer to a scenario in which NRC does not renew the OCGS operating license. Components of this alternative include replacing the generating capacity of OCGS and decommissioning the facility, as described below.

OCGS provides approximately 5.3 terawatt[1] hours annually of electricity to AmerGen's customers in the mid-Atlantic region (AmerGen 2004). AmerGen believes that any alternative would be unreasonable that did not include replacing this capacity. Replacement could be accomplished by (1) building new generating capacity, or (2) purchasing power from the wholesale market. Section 7.2.1 describes each of these possibilities in detail, and Section 7.2.2 describes environmental impacts from feasible alternatives.

The *Generic Environmental Impact Statement* (GEIS) (USNRC 1996a, pg. 7-1) defines decommissioning as the safe removal of a nuclear facility from service and the reduction of residual radioactivity to a level that permits release of the property for unrestricted use and termination of the license. NRC-evaluated decommissioning options include immediate decontamination and dismantlement (DECON), and safe storage of the stabilized and defueled facility (SAFSTOR) for a period of time, followed by decontamination and dismantlement. Regardless of the option chosen, decommissioning must be completed within a 60-year period. Under the no-action alternative, AmerGen would continue operating OCGS until the current license expires, then initiate decommissioning activities in accordance with NRC requirements. The GEIS describes decommissioning activities based on an evaluation of a larger reactor (the "reference" boiling-water reactor is the 1,155-megawatt electric [MWe] Energy Northwest's Columbia Plant). This description is comparable to decommissioning activities that AmerGen would conduct at OCGS.

As the GEIS notes, NRC has evaluated environmental impacts from decommissioning. NRC-evaluated impacts include: occupational and public radiation dose; impacts of waste management; impacts to air and water quality; and ecological, economic, and socioeconomic impacts. NRC indicated in the *Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities; Supplement 1* (USNRC 2002, Section 4.3.8) that the environmental effects of greatest concern (i.e., radiation dose and releases to the environment) are substantially less than the same effects resulting from reactor operations. AmerGen adopts by reference the NRC conclusions regarding environmental impacts of decommissioning.

AmerGen notes that decommissioning activities and their impacts are not discriminators between the proposed action and the no-action alternative. AmerGen will have to decommission OCGS regardless of the NRC decision on license renewal; license renewal would only postpone decommissioning for another 20 years. NRC has established in the GEIS that the timing of decommissioning operations does not substantially influence the environmental impacts of decommissioning. AmerGen adopts by reference the NRC findings (10 CFR 51, Appendix B, Table B-1, Decommissioning) to the effect that delaying decommissioning until after the renewal term would have small environmental impacts. The discriminators between the proposed action and the no-action alternative lie within the choice of generation replacement options to be part of the no-action alternative. Section 7.2.2 analyzes the impacts from these options.

[1] A terawatt-hour is one billion kilowatt-hours.

AmerGen concludes that the decommissioning impacts under the no-action alternative would not be substantially different from those occurring following license renewal, as identified in the GEIS (USNRC 1996a) and in the decommissioning generic environmental impact statement (USNRC 2002). These impacts would be temporary and would occur at the same time as the impacts from meeting system generating needs.

7.2 Alternatives that Meet System Generating Needs

OCGS has a net capacity of approximately 640 MWe and, in the year 2003, generated approximately 5.3 terawatt-hours of electricity (AmerGen 2004). This power, equivalent to the energy used by approximately 600,000 residential customers, would be unavailable to AmerGen's customers in the event the OCGS operating license is not renewed. In the event the OCGS operating license is not renewed, the electric power requirements of AmerGen's customers could be met by building new generating capacity, or purchasing power from the open market.

New Jersey is a net importer of electric power, using more electricity than is generated within the state. In 2001, 59 terawatt-hours of electricity, approximately 79 percent of the power consumed in New Jersey were supplied by generators located outside the state (USDOE-EIA 2004a). New Jersey relies on electricity drawn from the PJM Interconnection to provide this imported power. The PJM Interconnection is a regional network that pools power generated in Pennsylvania, New Jersey, Maryland, and all or parts of Delaware, Ohio, Virginia, West Virginia and the District of Columbia.

The current mix of power generation options within the PJM region is one indicator of what AmerGen believes to be feasible alternatives. In 2003, electric generators connected to the PJM network had a total generating capacity of 76,664 MWe (PJM 2004a). This capacity includes units fueled by coal (36.2 percent), dual-fired (i.e., gas and oil; 18.9 percent); nuclear (17.1 percent), oil (14.3 percent), gas (6.8 percent), hydroelectric (5.4 percent), and renewable (1.3 percent). New Jersey has a similar mix with dual-fired and nuclear units representing 33.7 percent and 21.1 percent respectively, of the generating capacity in the state (USDOE-EIA 2004b). In 2003, the electric industry in the PJM region provided 348.7 terawatt hours of electricity (PJM 2004b). Utilization of generating capacity in the PJM region was dominated by coal (53.5 percent), followed by nuclear (32.9 percent), gas (8.4 percent), hydroelectric (2.1 percent), oil (2.0 percent) and renewable (1.1 percent) (PJM 2004c). Utilization of generating capacity in New Jersey is dominated by nuclear (50.1 percent) followed by natural gas (31.0 percent). Figures 7-1 and 7-2 illustrate the electric industry generating capacity and utilization, respectively, for the PJM region. Comparison of generating capacity with actual utilization of this capacity within the PJM region indicates that coal and nuclear are used to a substantially greater degree relative to available capacity than either oil-fired or gas-fired generation. This condition reflects the relatively low fuel cost and baseload suitability for nuclear power and coal-fired plants, and relatively higher use of gas- and oil-fired units to meet peak loads. Comparison of capability and utilization for petroleum and gas-fired facilities indicates a strong preference of gas firing over oil firing, indicative of higher cost and air emissions associated with oil firing. Energy production from hydroelectric sources is similarly preferred from a cost standpoint, but capacity is limited and utilization can vary substantially depending on water availability.

7.2.1 ALTERNATIVES CONSIDERED

Technology Choices

For the purposes of this environmental report, AmerGen conducted evaluations of alternative generating technologies to identify candidate technologies that would be capable of replacing the net base-load capacity (approximately 640 MWe) of the nuclear unit at OCGS.

Based on these evaluations, it was determined that feasible new plant systems to replace the capacity of the OCGS nuclear unit are limited to pulverized-coal and gas-fired combined-cycle units for base-load operation. This conclusion is borne out by the generation utilization information presented above that identifies coal as the most heavily utilized non-nuclear generating technology in the PJM region. AmerGen would use gas as the primary fuel in its combined-cycle turbines because of the economic and environmental advantages of gas over oil. Manufacturers now have large standard sizes of combined-cycle gas turbines that are economically attractive and suitable for high-capacity base-load operation. For the purposes of the OCGS license renewal environmental report, AmerGen has limited its analysis of new generating capacity alternatives to the technologies it considers feasible: pulverized coal- and gas-fired units. AmerGen chose to evaluate combined-cycle turbines in lieu of simple-cycle turbines because the combined-cycle option is more economical. The benefits of lower operating costs for the combined-cycle option outweigh its higher capital costs.

Effects of Restructuring

Nationally, the electric power industry has been undergoing a transition from a regulated monopoly to a competitive market environment. Efforts to deregulate the electric utility industry began with passage of the National Energy Policy Act of 1992. Provisions of this act required electric utilities to allow open access to their transmission lines and encouraged development of a competitive wholesale market for electricity. The Act did not mandate competition in the retail market, leaving that decision to the states (NEI 2000). Over the past few years, all the states within the PJM region have transitioned to competitive wholesale and retail markets.

In 1999, New Jersey enacted the "Electric Discount and Energy Competition Act" (Act). Provisions of the Act opened New Jersey's retail electric power market to competition and provided retail customers with a 10 percent rate reduction phased in over 4 years. The New Jersey Board of Public Utilities (NJBPU) provides strategic direction and policy guidance for energy production and use in the State, including the restructuring initiative.

Competitive suppliers are required to meet renewable requirements for electricity sold in New Jersey. The Act divides renewables into two classes: Class I consists of energy produced from solar technologies, photovoltaic technologies, wind energy, fuel cells, geothermal technologies, wave or tidal action, and methane gas from landfills or a sustainable biomass facility. Class II consists of solid waste incinerators and hydropower facilities located in a retail competition area which meet certain environmental criteria. In 2002, 2.2 percent of the power sold in New Jersey was produced by Class I energy sources (USDOE-EIA 2004b). By 2008, four percent of the power sold in New Jersey must include Class I energy, and the percentage increases by half a percentage each year until the Class I energy requirement reaches twenty percent. Suppliers have the option of satisfying this requirement either by participating in a trading program or by auctioning their production in the wholesale market to other suppliers (NJBPU 2003). The Act also requires suppliers to provide customers with emissions data and the fuel mix used by the provider. The NJBPU is permitted to adopt emissions portfolio standards if needed to comply with federal clean air standards, and must adopt emissions standards if two states in the PJM power pool making up forty percent of PJM consumption adopt such standards. Suppliers are also required to offer net

metering[2] for wind or solar photovoltaic systems of residential and small commercial customers at non-discriminatory rates.

Alternatives

The following sections present fossil-fuel-fired generation (Section 7.2.1.1) and purchased power (Section 7.2.1.2) as reasonable alternatives to license renewal. Section 7.2.1.3 discusses reduced demand and presents the basis for concluding that it is not a reasonable alternative to license renewal. Section 7.2.1.4 discusses other alternatives that AmerGen has determined are not reasonable and AmerGen bases for these determinations.

7.2.1.1 Construct and Operate Fossil-Fuel-Fired Generation

AmerGen analyzed locating hypothetical new coal- and gas-fired units at the existing OCGS site and at an undetermined green field site. AmerGen concluded that OCGS is the preferred site for new construction because this approach would minimize environmental impacts by building on previously disturbed land and by making the most use possible of existing facilities, such as transmission lines, roads and parking areas, office buildings, and components of the cooling system. Locating hypothetical units at the existing site has, therefore, been applied to the coal- and gas-fired units.

For comparability, AmerGen selected gas- and coal-fired units of equal electric power capacity. One unit with a net capacity of approximately 640 MWe could be assumed to replace the 640-MWe OCGS net capacity. However, AmerGen's experience indicates that, although custom size units can be built, using standardized sizes is more economical. For example, standard-sized units include a gas-fired combined-cycle plant of 600-MWe net capacity (Sempra 2004). For comparability, AmerGen set the net power of the coal-fired unit equal to the gas-fired plants (600 MWe). Although this provides less capacity than the existing unit, it ensures against overestimating environmental impacts from the alternatives. The shortfall in capacity could be replaced by other methods.

It must be emphasized, however, that these are hypothetical scenarios. AmerGen does not have plans for such construction at OCGS.

Gas-Fired Generation

For purposes of this analysis, AmerGen assumed development of a modern natural gas-fired combined-cycle plant with design characteristics similar to those being developed elsewhere in the PJM region, and with a generating capacity similar to OCGS. The Catoctin Power Project, a planned 600 MWe plant in Frederick County, Maryland, meets these general criteria. Therefore, AmerGen used characteristics of this plant as described in its application to the Maryland Public Service Commission (Sempra 2004) and other relevant resources in defining the OCGS gas-fired alternative. AmerGen assumes that the representative plant would be located at the OCGS site, which offers potential advantages of existing infrastructure (e.g., cooling water system, transmission lines, roads, and technical and administrative support facilities). Table 7-1 presents the basic gas-fired alternative characteristics.

Coal-Fired Generation

NRC evaluated coal-fired generation alternatives for the Calvert Cliffs Nuclear Power Plant (USNRC 1999a) and for the Oconee Nuclear Station (USNRC 1999b). For Oconee, NRC analyzed 2,500 MWe of

[2] Net metering requires electric utilities to permit customers to reduce their electric bills by generating their own power using small-scale renewable energy systems. The excess power they generate can be fed back to their utilities, actually running their electric meters backwards.

coal-fired generation capacity. AmerGen has reviewed the NRC analysis, believes it to be sound, and notes that it analyzed more generating capacity than the 600 MWe discussed in this analysis. In defining the OCGS coal-fired alternative, AmerGen has used site- and New Jersey-specific input and has scaled from the NRC analysis, where appropriate.

Table 7-2 presents the basic coal-fired alternative emission control characteristics. AmerGen based its emission control technology and percent control assumptions on alternatives that the U.S. Environmental Protection Agency (USEPA) has identified as being available for minimizing emissions (USEPA 1998a). For the purposes of analysis, AmerGen has assumed that coal and lime (calcium oxide) would be delivered via a new rail spur from Toms River, New Jersey to OCGS. The impacts of the construction of this rail spur are not analyzed here.

7.2.1.2 Purchase Power

In a traditional alternatives analysis for examining the energy alternative to utility generation capacity, the purchased power alternative meant that the utility would meet a portion of its service territory demand by providing power purchased from another utility. Deregulation, however, has changed this traditional analysis. First, the end-user can purchase electricity from another entity (in this case from a company other than AmerGen). Second AmerGen expects retail competition to decrease generators' incentives to provide wholesale power to competing companies for resale, thus reducing the availability of power for AmerGen to purchase and resell competitively.

AmerGen has evaluated conventional and prospective power supply options that could be reasonably implemented before the current OCGS license expires in 2009. As noted in Section 7.2.1, electric industry restructuring initiatives in the State of New Jersey and other jurisdictions in the PJM region are designed to promote competition in energy supply markets by facilitating participation by non-utility suppliers. PJM has implemented market rules to appropriately anticipate and meet electricity demands in the resulting wholesale electricity market. As an additional facet of this restructuring effort, retail customers in the PJM region now may choose among a number of sources to supply their power, resulting in uncertainty with regard to future AmerGen load obligations. In view of these conditions, AmerGen assumes for purposes of this analysis that adequate supplies of electricity would be available, and that purchased power would be a reasonable alternative to meet the load requirements of AmerGen customers in the event the operating license for OCGS is not renewed.

The source of this purchased power is speculative, but may reasonably include new generating facilities developed within the State, or neighboring jurisdictions in the PJM region. The technologies that would be used to generate this purchased power are similarly speculative. AmerGen assumes that the generating technology used to produce purchased power would be one of those that NRC analyzed in the GEIS. For this reason, AmerGen is adopting by reference the GEIS description of the alternative generating technologies as representative of the purchase power alternative. Of these technologies, facilities fueled by coal and combined-cycle facilities fueled by natural gas are the most cost effective for providing base-load capacity.

AmerGen anticipates that additional transmission infrastructure would be needed to implement the purchased power alternative. A PJM assessment of the impact of potential OCGS retirement on transmission requirements concluded that loss of the OCGS would overload existing transmission lines in proximity to Warren, Morris, Sussex, and Somerset Counties. System upgrades and the construction of

new transmission lines could be required to ensure system stability (PJM 2004d).

7.2.1.3 Demand Side Management

Historically, state regulatory bodies have required regulated utilities to institute programs designed to reduce demand for electricity. Demand side management (DSM) programs included energy conservation and load management measures. In a deregulated market, electric power generators would not be able to offer competitively priced power if they had to retain an extensive conservation and load-modification-incentive program.

In New Jersey, the NJBPU promotes and advances DSM in the retail electric market. The NJBPU works in partnership with other state agencies, electric utilities, business organizations and environmental organizations to develop and implement "tools" to save energy. New Jersey's DSM program offerings are diverse, ranging from load curtailment incentives during periods of peak demand to rebates and financial incentives for commercial, industrial, and residential customers for installation of energy-efficient appliances and equipment to the adoption by the New Jersey Department of Consumer Affairs of updated energy codes for new building construction.

Over the years, the New Jersey Clean Energy Programs – from the energy conservation programs in the mid- '80s to the DSM programs offered today – have saved New Jersey residents and businesses over 30 terawatt hours in avoided electricity use. Overall, the New Jersey Clean Energy Program has reduced peak electric demand by a total of 242 MWe in 2002, and additional peak demand reductions are projected to result from these efforts (NJBPU 2003). However, it is expected that projected energy efficiencies would be anticipated by the market. As a practical matter, it would be impossible to increase those energy savings by an additional 640 MWe to replace OCGS generating capability, particularly in or near AmerGen's service area, which represents a relatively small fraction of electrical load in the State. For these reasons, AmerGen does not consider DSM to represent a reasonable alternative to renewal of the OCGS operating license.

7.2.1.4 Other Alternatives

This section identifies alternatives that AmerGen has determined are not reasonable and the AmerGen bases for these determinations. AmerGen accounted for the fact that OCGS is a base-load generator and that any feasible alternative to OCGS would also need to be able to generate base-load power. For the purposes of analysis AmerGen assumed that the states of Pennsylvania, New Jersey and Maryland comprise PJM region. In performing this evaluation, AmerGen relied heavily upon NRC's GEIS (USNRC 1996a).

Wind

Wind power, by itself, is not suitable for large base-load generation. As discussed in Section 8.3.1 of the GEIS, wind has a high degree of intermittence, and average annual capacity factors for wind plants are relatively low (less than 30 percent). Wind power, in conjunction with energy storage mechanisms, might serve as a means of providing base-load power. However, current energy storage technologies are too expensive for wind power to serve as a large base-load generator.

Based on U.S. Department of Energy estimates (USDOE 2004a), the PJM region has the technical potential (the upper limit of renewable electricity production and capacity that could be brought online, without regard to cost, market acceptability, or market constraints) for roughly 12,796 MWe of installed wind power capacity. The full exploitation of wind energy is constrained by a variety of factors including land availability and land-use patterns, surface topography, offshore conditions,

infrastructure constraints, environmental constraints, wind turbine capacity factor, wind turbine availability, and grid availability. When these constraints on wind energy development are considered the achievable wind energy potential is expected to fall in the range of 10-30 percent of technical potential estimates or 1,280-3,840 MWe. By the end of 2004 a total of 129 MWe of wind energy had been developed in PJM region. Projected new capacity in various stages of review within the PJM region includes an additional 226 MWe of wind energy (USDOE 2004b).

Wind farms generally consist of 10-50 turbines in the 1-3 MWe range. Estimates based on existing installations indicate that a utility-scale wind farm would occupy about 50 acres per MWe of installed capacity (McGowan & Connors 2000). Therefore, replacement of OCGS generating capacity (640 MWe net) with wind power, even assuming ideal wind conditions, would require an area of about 50 square miles.[3] Based on the amount of land needed to replace OCGS, the wind alternative would require a large green field site, which would result in a large environmental impact. Additionally, wind plants have aesthetic impacts, generate noise, and harm birds.

The scale of this technology is too small to directly replace a power plant of the size of OCGS, capacity factors are low (30 to 40 percent), and the land requirement (50 square miles) is large. Therefore, AmerGen has concluded that wind power is not a reasonable alternative to OCGS license renewal.

Solar

By its nature, solar power is intermittent. In conjunction with energy storage mechanisms, solar power might serve as a means of providing base-load power. However, current energy storage technologies are too expensive to permit solar power to serve as a large base-load generator. Even without storage capacity, solar power technologies (photovoltaic and thermal) cannot currently compete with conventional fossil-fueled technologies in grid-connected applications, due to high costs per kilowatt of capacity (USNRC 1996a).

Solar power is not a technically feasible alternative for baseload capacity in the PJM region. The PJM region receives 2.8 to 3.9 kilowatt hours of solar radiation per square meter per day, compared with 5 to 7.2 kilowatt hours per square meter per day in areas of the West, such as California, which are most promising for solar technologies (NREL 1994).

Finally, land requirements for solar plants are high. Estimates based on existing installations indicate that utility-scale plants would occupy about 7.4 acres per MWe for photovoltaic and 4.9 acres per MWe for solar thermal systems (USDOE 2004c). Utility-scale solar plants have only been used in regions, such as the western U.S., that receive high concentrations (5 to 7.2 kilowatt hours per square meter per day) of solar radiation. Amergen believes that a utility-scale solar plant located in the PJM region, which receives 2.8 to 3.9 kilowatt hours of solar radiation per square meter per day, would occupy about 16.4 acres per MWe for photovoltaic and 10.9 acres per MWe for solar thermal systems. Therefore, AmerGen believes that replacement of OCGS generating capacity with solar power would require dedication of about 16.4 square miles for photovoltaic and 10.9 square miles for solar thermal systems.[4] Neither type of solar electric system would fit at the OCGS site, and both would have large environmental impacts at a green field site.

[3] 50 acres per MWe × 640 MWe × square mile per 640 acres = 50 square miles.

[4] 16.4 acres per MWe × 640 MWe × square mile per 640 acres = 16.4 square miles.

AmerGen has concluded that, due to the high cost, limited availability of sufficient incident solar radiation, and amount of land needed (approximately 10.9 to 16.4 square miles), solar power is not a reasonable alternative to OCGS license renewal.

Hydropower

A portion (about 4,150 MWe) of utility generating capacity in the PJM region is hydroelectric (PJM 2004a). As the GEIS points out in Section 8.3.4, hydropower's percentage of United States generating capacity is expected to decline because hydroelectric facilities have become difficult to site as a result of public concern over flooding, destruction of natural habitat, and alteration of natural river courses. According to the U.S. Hydropower Resource Assessment (INEEL 1998), there are no remaining sites in the PJM region that would be environmentally suitable for a large hydroelectric facility.

The GEIS estimates land use of 1,600 square miles per 1,000 MWe for hydroelectric power. Based on this estimate, replacement of OCGS generating capacity would require flooding approximately 1,020 square miles, resulting in a large impact on land use. Further, operation of a hydroelectric facility would alter aquatic habitats above and below the dam, which would impact existing aquatic communities.

AmerGen has concluded that, due to the lack of suitable sites in the PJM region and the amount of land needed (approximately 1,020 square miles), hydropower is not a reasonable alternative to OCGS license renewal.

Geothermal

As illustrated by Figure 8.4 in the GEIS, geothermal plants might be located in the western continental United States, Alaska, and Hawaii, where hydrothermal reservoirs are prevalent. However, because there are no high-temperature geothermal sites in PJM region, AmerGen concludes that geothermal is not a reasonable alternative to OCGS license renewal.

Wood Energy

As discussed in the GEIS (USNRC 1996a), the use of wood waste to generate electricity is largely limited to those states with significant wood resources. The pulp, paper, and paperboard industries in states with adequate wood resources generate electric power by consuming wood and wood waste for energy, benefiting from the use of waste materials that could otherwise represent a disposal problem. According to the U.S. Department of Energy, Pennsylvania is the only state in the PJM region that is considered to have adequate wood resource potential (Walsh et al. 2000). However, the largest wood waste power plants are 40 to 50 MWe in size.

Further, as discussed in Section 8.3.6 of the GEIS, construction of a wood-fired plant would have an environmental impact that would be similar to that for a coal-fired plant, although facilities using wood waste for fuel would be built on smaller scales. Like coal-fired plants, wood-waste plants require large areas for fuel storage, processing, and waste (i.e., ash) disposal. Additionally, operation of wood-fired plants has environmental impacts, including impacts on the aquatic environment and air. Wood has a low heat content that makes it unattractive for base-load applications. It is also difficult to handle and has high transportation costs.

While some wood resources are available in the PJM region, AmerGen has concluded that, due to the lack of an environmental advantage, low heat content, handling difficulties, and high transportation costs, wood energy is not a reasonable alternative to OCGS license renewal.

Municipal Solid Waste

As discussed in Section 8.3.7 of the GEIS, the initial capital costs for municipal solid waste plants are greater than for comparable steam turbine technology at wood-waste facilities. This is due to the need for specialized waste separation and handling equipment.

The decision to burn municipal solid waste to generate energy is usually driven by the need for an alternative to landfills, rather than by energy considerations. The use of landfills as a waste disposal option is likely to increase in the near term; however, it is unlikely that many landfills will begin converting waste to energy because of unfavorable economics.

Estimates in the GEIS suggest that the overall level of construction impacts from a waste-fired plant should be approximately the same as that for a coal-fired plant. Additionally, waste-fired plants have the same or greater operational impacts (including impacts on the aquatic environment, air, and waste disposal). Some of these impacts would be moderate, but still larger than the environmental effects of OCGS license renewal.

AmerGen has concluded that, due to the high costs and lack of environmental advantages, burning municipal solid waste to generate electricity is not a reasonable alternative to OCGS license renewal.

Other Biomass Derived Fuels

In addition to wood and municipal solid waste fuels, there are several other concepts for fueling electric generators, including burning energy crops, converting crops to a liquid fuel such as ethanol (ethanol is primarily used as a gasoline additive), and gasifying energy crops (including wood waste). As discussed in the GEIS, none of these technologies has progressed to the point of being competitive on a large scale or of being reliable enough to replace a base-load plant such as OCGS.

Further, estimates in the GEIS suggest that the overall level of construction impacts from a crop-fired plant should be approximately the same as that for a wood-fired plant. Additionally, crop-fired plants would have similar operational impacts (including impacts on the aquatic environment and air). These systems also have large impacts on land use, due to the acreage needed to grow the energy crops.

AmerGen has concluded that, due to the high costs and lack of environmental advantage, burning other biomass-derived fuels is not a reasonable alternative to OCGS license renewal.

Petroleum

The PJM region has several petroleum (oil)-fired power plants; however, they produce less than 2 percent of the total power generated in the region (PJM 2004c). From 1993 to 2002, power producers in the PJM region reduced the amount of power produced by oil-fired generating plants by about 46 percent (USDOE-EIA 2004b). Oil-fired operation is more expensive than nuclear or coal-fired operation, and future increases in petroleum prices are expected to make oil-fired generation increasingly more expensive than coal-fired generation.

Also, construction and operation of an oil-fired plant would have environmental impacts. For example, Section 8.3.11 of the GEIS estimates that construction of a 1,000-MWe oil-fired plant would require about 120 acres. Additionally, operation of oil-fired plants would have environmental impacts (including impacts on the aquatic environment and air) that would be similar to those from a coal-fired plant.

AmerGen has concluded that, due to the high costs and lack of obvious environmental advantage, oil-fired

generation is not a reasonable alternative to OCGS license renewal.

Fuel Cells

Fuel cell power plants are in the initial stages of commercialization. While more than two hundred turnkey plants have been installed, the global stationary fuel cell electricity generating capacity was just 75 MWe in 2001 (Hemberger 2001). Recent estimates suggest that a company would have to produce about 100 MWe of fuel cell stacks annually to achieve a price of $1,000 to $1,500 per kilowatt (Kenergy 2000). However, the production capability of the largest stationery fuel cell manufacturer is 50 MWe per year (CSFCC 2002). AmerGen believes that this technology has not matured sufficiently to support production for a facility the size of OCGS. AmerGen has concluded that, due to cost and production limitations, fuel cell technology is not a reasonable alternative to OCGS license renewal.

Advanced Nuclear Reactor

Increased interest in the development of advanced nuclear power plants has been expressed recently by members of both industry and government. However, it is extremely unlikely that a replacement for the OCGS could be planned, licensed, constructed, and on line by the time the operating license expires in 2009.

Delayed Retirement

As the NRC noted in the GEIS (USNRC 1996a, Section 8.3.13), extending the lives of existing non-nuclear generating plants beyond the time they were originally scheduled to be retired represents another potential alternative to license renewal. Non-nuclear generating plants slated for retirement tend to be ones that are old enough to have difficulty in economically meeting today's restrictions on air contaminant emissions. In the face of increasingly stringent environmental restrictions, delaying retirement in order to compensate for the closure of a large base-load plant, such as OCGS, would require major construction to upgrade or replace plant components. AmerGen concludes that the environmental impacts of such a scenario are bounded by its coal- and gas-fired alternatives discussed in Section 7.2.2.

Combination of Alternatives

A large number of potential combinations of alternatives may exist for replacing OCGS's 640 MWe of generation. These combinations would comprise alternatives previously discussed. The same factors that eliminated these alternatives as stand-alone sources of power would make them impractical or unlikely in a combined scenario. Low capacity factors, even in a combined scenario, would still eliminate many alternatives such as wind, solar, and hydroelectric. Many others would remain impractical for the mid-Atlantic region or are simply not cost competitive when compared with other alternatives.

A combination of purchase power agreements along with construction of new generation is a potential alternative for replacing 640 MWe. Construction of a new standard-sized 300 MWe combined-cycle plant would leave 340 MWe to be purchased in the open market. Construction of 300 MWe at OCGS or a green field site would have similar environmental impacts in the 600 MWe scenario, but to a lesser degree. Air emissions impacts would be less for the lower generation level but would still require offsets from other generating sources and would create much greater impact on air quality than license renewal. Power purchased on the open market would likely be generated using fossil-fuel-fired technologies and the environmental impacts under the combination of alternatives scenario would be similar to those described in Section 7.2.2. For these reasons the combination of alternatives is

not considered as a reasonable alternative to the license renewal at OCGS.

7.2.2 ENVIRONMENTAL IMPACTS OF ALTERNATIVES

This section evaluates the environmental impacts of alternatives that AmerGen has determined to be reasonable alternatives to OCGS license renewal: coal-fired generation, gas-fired generation, and purchased power.

7.2.2.1 Gas-Fired Generation

NRC evaluated environmental impacts from gas-fired generation alternatives in the GEIS, focusing on combined-cycle plants. Section 7.2.1.1 presents AmerGen's reasons for defining the gas-fired generation alternative as a combined-cycle plant on the OCGS site. Land-use impacts from gas-fired units on OCGS would be less than those from the existing plant. Reduced land requirements, due to a smaller facility footprint, would reduce impacts to ecological, aesthetic, and cultural resources. A smaller workforce could have adverse socioeconomic impacts. Human health effects associated with air emissions would be of concern. Aquatic biota losses due to cooling water withdrawals would be offset by the concurrent shutdown of the nuclear generator.

NRC has evaluated the environmental impacts of constructing and operating four 440 MWe combined-cycle gas-fired units as an alternative to a nuclear power plant license renewal (USNRC 1999a). That analysis was for a generating capacity somewhat greater than and bounds the OCGS gas-fired alternatives analysis, because AmerGen would install 600 MWe of net power. AmerGen has adopted the rest of the NRC analysis with necessary New Jersey- and AmerGen-specific modifications noted.

Air Quality

Natural gas is a relatively clean-burning fossil fuel that primarily emits nitrogen oxides (NO_x), a regulated pollutant, during combustion. A natural gas-fired plant would also emit small quantities of sulfur oxides (SO_x), particulate matter, and carbon monoxide, all of which are regulated pollutants. Control technology for gas-fired turbines focuses on NO_x emissions. AmerGen estimates the gas-fired alternative emissions to be as follows:

SO_x = 42 tons per year

NO_x = 135 tons per year

Carbon monoxide = 28 tons per year

Filterable Particulates = 24 tons per year (all particulates are PM_{10})

Table 7-3 shows how AmerGen calculated these emissions.

In 2002, New Jersey was ranked 36th nationally in emissions of sulfur dioxide (SO_2) and 11th nationally in emissions of NO_x from electric power plants (USDOE-EIA 2004b). Ranking is based on quantity emitted. For example, the electric power plants in only 10 states emitted more NOx than those located in New Jersey. The acid rain requirements of the Clean Air Act Amendments capped the nation's SO_2 emissions from power plants. Each company with fossil-fuel-fired units was allocated SO_2 allowances. To be in compliance with the Act, the companies must hold enough allowances to cover their annual SO_2 emissions. AmerGen would need to obtain SO_2 credits to operate a fossil-fuel-burning plant at the OCGS site. In 1998, the USEPA promulgated the NO_x SIP (State Implementation Plan) Call regulation that required 22 states, including New Jersey, to reduce their NO_x emissions by over 30 percent to address regional transport of ground-level ozone across state lines (USEPA 1998b). To operate a fossil-

fuel-fired plant at the OCGS site, AmerGen would need to obtain enough NO_x credits to cover annual emissions either from the set-aside pool or by buying NO_x credits from other sources.

NO_x effects on ozone levels, SO_2 allowances, and NO_x emission offsets could all be issues of concern for gas-fired combustion. While gas-fired turbine emissions are less than coal-fired boiler emissions, and regulatory requirements are less stringent, the emissions are still substantial. AmerGen concludes that emissions from the gas-fired alternative at OCGS would noticeably alter local air quality, but would not destabilize regional resources (i.e., air quality). Air quality impacts would therefore be moderate, but substantially smaller than those of coal-fired generation.

Waste Management

Gas-fired generation would result in almost no waste generation, producing minor (if any) impacts. AmerGen concludes that gas-fired generation waste management impacts would be small.

Other Impacts

The ability to construct the gas-fired alternative on the existing OCGS site would reduce construction-related impacts. A new gas pipeline would be required for the two 170-MWe gas turbine generators in this alternative. To the extent practicable, AmerGen would route the pipeline along existing, previously disturbed, right-of-way to minimize impacts. Approximately 2 miles of new pipeline construction would be required to connect OCGS to the existing pipeline at the Forked River plant. A 16-inch diameter pipeline would necessitate a 50-foot-wide corridor, resulting in the disturbance of as much as 12 acres. This new construction may also necessitate an upgrade of the State-wide pipeline network. AmerGen estimates that 40 acres would be needed for a plant site; this much previously disturbed acreage is available at OCGS, reducing loss of terrestrial habitat. As with any large construction project, some erosion and sedimentation and fugitive dust emissions could be anticipated, but would be minimized by using best management practices. Debris from clearing and grubbing could be disposed of onsite. AmerGen estimates a peak construction workforce of 360 so socioeconomic impacts of construction would be minimal. However, AmerGen estimates a workforce of approximately 24 for gas operations. The reduction in work force would result in adverse socioeconomic impacts. AmerGen believes these impacts would be small and would be mitigated by the site's proximity to Atlantic City (38 miles) and Nework (60 miles), New Jersey and Philadelphia, PA (60 miles).

Impacts to aquatic resources and water quality would be similar to, but smaller than the impacts of OCGS, due to the plant's use of the existing cooling water system that withdraws from and discharges to Barnegat Bay, and would be offset by the concurrent shutdown of OCGS. The additional stacks and boilers would increase the visual impact of the existing site. Impacts to cultural resources would be unlikely, due to the previously disturbed nature of the site.

AmerGen notes the EPA has revised requirements (USEPA 2003) that could affect the design of cooling water intake structures for new facilities. This could require constructing a natural draft cooling tower or mechanical cooling towers. Recirculation would reduce cooling water intake volume by approximately 90 percent. Should cooling towers be required, the tower would be designed to ensure that the quantity of sea salt entrained in the water vapor from the tower does not exceed the NJDEP limits on particulate emissions defined in N.J.A.C. 7:27-6 Control and Prohibition of Particles from Manufacturing Processes.

AmerGen believes that other construction and operation impacts would be small. In most cases, the impacts would be detectable, but they would not destabilize any important attribute of the resource involved. Due to the minor nature of these other impacts, mitigation would not be warranted beyond that previously mentioned.

7.2.2.2 Coal-Fired Generation

NRC evaluated environmental impacts from coal-fired generation alternatives in the GEIS (USNRC 1996a). NRC concluded that construction impacts could be substantial, due in part to the large land area required (which can result in natural habitat loss) and the large workforce needed. NRC pointed out that siting a new coal-fired plant where an existing nuclear plant is located would reduce many construction impacts. NRC identified major adverse impacts from operations as human health concerns associated with air emissions, waste generation, and losses of aquatic biota due to cooling water withdrawals and discharges.

The coal-fired alternative that AmerGen has defined in Section 7.2.1.1 would be located at OCGS.

Air Quality

A coal-fired plant would emit oxides of sulfur (SO_x) and nitrogen (NO_x), particulate matter, and carbon monoxide, all of which are regulated pollutants. As Section 7.2.1.1 indicates, AmerGen has assumed a plant design that would minimize air emissions through a combination of boiler technology and post-combustion pollutant removal. AmerGen estimates the coal-fired alternative emissions to be as follows:

SO_x = 2,796 tons per year

NO_x = 469 tons per year

Carbon monoxide = 469 tons per year

Particulates:

Total suspended particulates = 89 tons per year

PM_{10} (particulates having a diameter of less than 10 microns) = 20 tons per year

Table 7-4 shows how AmerGen calculated these emissions.

The Section 7.2.2.1 discussion of regional air quality is applicable to the coal-fired generation alternative. In addition, NRC noted in the GEIS that adverse human health effects from coal combustion have led to important federal legislation in recent years and that public health risks, such as cancer and emphysema, have been associated with coal combustion. NRC also mentioned global warming and acid rain as potential impacts. AmerGen concludes that federal legislation and large-scale concerns, such as global warming and acid rain, are indications of concerns about destabilizing important attributes of air resources. However, SO_x emission allowances, NO_x emission offsets, low NO_x burners, overfire air, fabric filters or electrostatic precipitators, and scrubbers are regulatorily-imposed mitigation measures. As such, AmerGen concludes that the coal-fired alternative would have moderate impacts on air quality; the impacts would be noticeable, but would not destabilize air quality in the area.

Waste Management

AmerGen concurs with the GEIS assessment that the coal-fired alternative would generate substantial solid waste. The coal-fired plant would annually consume approximately 1,875,000 tons of coal having an ash content of 9.48 percent (Tables 7-2 and 7-5, respectively). After combustion, most (99.9 percent) of this ash, approximately 178,000 tons per year, would be collected and disposed of onsite. In addition, approximately 153,000 tons of scrubber sludge would be disposed of onsite each year (based on annual lime

usage of nearly 52,000 tons). AmerGen estimates that ash and scrubber waste disposal over a 40-year plant life would require approximately 173 acres (a square area with sides of approximately 2,750 feet). Table 7-5 shows how AmerGen calculated ash and scrubber waste volumes. The OCGS site is approximately 860 acres. While only half this waste volume and acreage would be attributable to the 20-year license renewal period alternative, the total numbers are pertinent as a cumulative impact.

AmerGen believes that, with proper siting coupled with current waste management and monitoring practices, waste disposal would not destabilize any resources. There would be space within the OCGS property for this disposal. After closure of the waste site and revegetation, the land would be available for other uses. For these reasons, AmerGen believes that waste disposal for the coal-fired alternative would have moderate impacts; the impacts of increased waste disposal would be noticeable, but would not destabilize any important resource, and further mitigation would be unwarranted.

Other Impacts

AmerGen estimates that construction of the powerblock and coal storage area would affect 171 acres of land and associated terrestrial habitat. Because most of this construction would be on previously cleared land, impacts at the OCGS site would be small to moderate but would be somewhat less than the impacts of using a green field site. A new rail spur, approximately 15 miles in length, would be required for coal and lime deliveries under this alternative. To the extent practicable, AmerGen would route the rail spur along existing, previously disturbed, right-of-way to minimize impacts. Assuming the rail spur would require a 100-foot-wide corridor, the resulting land disturbance would be approximately 180 acres. Visual impacts would be consistent with the industrial nature of the site. Aesthetic impacts, erosion and sedimentation, fugitive dust, and construction debris impacts would be similar to the gas-fired alternative, but greater because of the larger site size. AmerGen estimates a peak construction work force of 400. Socioeconomic impacts from the construction workforce would be minimal, because worker relocation would not be expected, due to the site's proximity to Atlantic City and Newark, New Jersey and Philadelphia, Pennsylvania, which are 35, 60, and 60 miles from the site, respectively. AmerGen estimates an operational workforce of only 170 for the coal-fired alternative. The reduction in workforce would result in adverse socioeconomic impacts. AmerGen believes these impacts would be small, due to OCGS's proximity to large metropolitan areas.

Impacts to aquatic resources and water quality would be similar to impacts of OCGS, due to the plant's use of the existing cooling water system that withdraws from and discharges to Barnegat Bay, and would be offset by the concurrent shutdown of OCGS. The additional stacks, boilers, and rail deliveries would increase the visual impact of the existing site. Impacts to cultural resources would be unlikely, due to the previously disturbed nature of the site.

AmerGen notes the EPA has revised requirements (USEPA 2003) that could affect the design of cooling water intake structures for new facilities. This could require constructing a natural draft cooling tower or mechanical cooling towers. Recirculation would reduce cooling water intake volume by approximately 90 percent. Should cooling towers be required, the tower would be designed to ensure that the quantity of sea salt entrained in the water vapor from the tower does not exceed the NJDEP limits on particulate emissions defined in N.J.A.C. 7:27-6 Control and Prohibition of Particles from Manufacturing Processes.

AmerGen believes that other construction and operation impacts would be small. In most cases, the impacts would be detectable, but they would not destabilize any important attribute of the resource involved. Due to the minor nature of these other impacts, mitigation would not be warranted beyond that previously mentioned.

7.2.2.3 Purchased Power

As discussed in Section 7.2.1.2, in a deregulated retail market the end-user can purchase electricity from another entity (in this case from a company other than AmerGen) and retail competition decreases generators' incentives to provide wholesale power to competing companies for resale, thus reducing the availability of power for AmerGen to purchase and resell competitively.

AmerGen assumes that the generating technology used under the purchased power alternative would be one of those that NRC analyzed in the GEIS. AmerGen is also adopting by reference the NRC analysis of the environmental impacts from those technologies. Under the purchased power alternative, therefore, environmental impacts would still occur, but they would likely originate from a power plant located elsewhere in the State or other jurisdictions in the PJM region. AmerGen believes that imports from outside the PJM region would not be required.

The purchased power alternative could include constructing up to 100 miles of high-voltage (i.e., 345- or 500-kilovolt) transmission lines to get power from the remote locations in the PJM region to the south-central New Jersey. AmerGen believes most of the transmission lines could be routed along existing rights-of-way, so the environmental impacts of transmission line construction would be small to moderate. As indicated in the introduction to Section 7.2.1.1, the environmental impacts of construction and operation of new coal- or gas-fired generating capacity for purchased power at a previously undisturbed green field site would exceed those of a coal- or gas-fired alternative located on the OCGS site.

Table 7-1. Gas-Fired Alternative.

Characteristic	Basis
Unit size = 300 MWe ISO rating net:[a] Combined cycle consisting of a 170 MW net combustion turbine and a 130 MWe net heat recovery steam generator (HRSG)[b]	Manufacturer's standard size gas-fired combined-cycle plant that is < OCGS net capacity - 640 MWe
Unit size = 312 MWe ISO rating gross:[a]	Calculated based on 4 percent onsite power
Number of units = 2	
Fuel type = natural gas	Assumed
Fuel heating value = 1,032 Btu/ft^3	2002 value for gas used in New Jersey (USDOE-EIA 2004b)
Fuel sulfur content = 0.0034 lb/MMBtu	Used when sulfur content is not available (USEPA 2000)
NO_x control = selective catalytic reduction (SCR) with steam/water injection	Best available for minimizing NO_x emissions (USEPA 2000)
Fuel NO_x content = 0.0109 lb/MMBtu	Typical for large SCR-controlled gas fired units with water injection (USEPA 2000)
Fuel CO content = 0.00226 lb/MMBtu	Typical for large SCR-controlled gas fired units (USEPA 2000)
Heat rate = 9,427 Btu/KWh	(Sempra 2004)
Capacity factor = 0.85	Assumed based on performance of modern plants

a. The difference between "net" and "gross" is electricity consumed onsite.
b. The HRSG does not contribute to air emissions.
Btu = British thermal unit
ft^3 = cubic foot
ISO rating = International Standards Organization rating at standard atmospheric conditions of 59°F, 60 percent relative humidity, and 14.696 pounds of atmospheric pressure per square inch
KWh = kilowatt hour
MM = million
MWe = megawatt electric
NO_x = nitrogen oxides
≤ = less than or equal to

Table 7-2. Coal-Fired Alternative.

Characteristic	Basis
Unit size = 600 MWe ISO rating net[a]	Calculated to be < OCGS net capacity – 640 MWe
Unit size = 637 MWe ISO rating gross[a]	Calculated based on 6 percent onsite power
Number of units = 1	
Boiler type = tangentially fired, dry-bottom	Minimizes nitrogen oxides emissions (USEPA 1998a)
Fuel type = bituminous, pulverized coal	Typical for coal used in New Jersey
Fuel heating value = 12,883 Btu/lb	2001 value for coal used in New Jersey (USDOE-EIA 2004c)
Fuel ash content by weight = 9.48 percent	2001 value for coal used in New Jersey (USDOE-EIA 2004c)
Fuel sulfur content by weight = 1.57 percent	2001 value for coal used in New Jersey (USDOE-EIA 2004c)
Uncontrolled NO_x emission = 10 lb/ton Uncontrolled CO emission = 0.5 lb/ton	Typical for pulverized coal, tangentially fired, dry-bottom, NSPS (USEPA 1998a)
Heat rate = 10,200 Btu/KWh	Typical for coal-fired, single-cycle steam turbines (USDOE-EIA 2002)
Capacity factor = 0.85	Typical for large coal-fired units
NO_x control = low NO_x burners, overfire air and selective catalytic reduction (95 percent reduction)	Best available and widely demonstrated for minimizing NO_x emissions (USEPA 1998a)
Particulate control = fabric filters (baghouse-99.9 percent removal efficiency)	Best available for minimizing particulate emissions (USEPA 1998a)
SO_x control = Wet scrubber – lime (95 percent removal efficiency)	Best available for minimizing SO_x emissions (USEPA 1998a)

a. The difference between "net" and "gross" is electricity consumed onsite.

Btu	=	British thermal unit
ISO rating	=	International Standards Organization rating at standard atmospheric conditions of 59°F, 60 percent relative humidity, and 14.696 pounds of atmospheric pressure per square inch
KWh	=	kilowatt hour
NSPS	=	New Source Performance Standard
Lb	=	pound
MWe	=	megawatt electric
NO_x	=	nitrogen oxides
SO_x	=	oxides of sulfur
≤	=	less than or equal to

Table 7-3. Air Emissions from Gas-Fired Alternative.

Parameter	Calculation	Result
Annual gas consumption	$2\text{ units} \times \frac{177\text{ MW}}{\text{unit}} \times \frac{9{,}427\text{ Btu}}{\text{kW} \times \text{hr}} \times \frac{1{,}000\text{ kW}}{\text{MW}} \times 0.85 \times \frac{\text{ft}^3}{1{,}032\text{ Btu}} \times \frac{24\text{ hr}}{\text{day}} \times \frac{365\text{ day}}{\text{yr}}$	24,077,983,012 ft^3 per year
Annual Btu input	$\frac{24{,}077{,}983{,}012\text{ ft}^3}{\text{yr}} \times \frac{1{,}032\text{ Btu}}{\text{ft}^3} \times \frac{\text{MM Btu}}{10^6\text{ Btu}}$	24,848,478 MMBtu per year
SO_x[a]	$\frac{0.0034\text{ lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\text{ lb}} \times \frac{24{,}848{,}478\text{ MMBtu}}{\text{yr}}$	42 tons SO_x per year
NO_x[b]	$\frac{0.0109\text{ lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\text{ lb}} \times \frac{24{,}848{,}478\text{ MMBtu}}{\text{yr}}$	135 tons NO_x per year
CO[b]	$\frac{0.00226\text{ lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\text{ lb}} \times \frac{24{,}848{,}478\text{ MMBtu}}{\text{yr}}$	28 tons CO per year
TSP[a]	$\frac{0.0019\text{ lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\text{ lb}} \times \frac{24{,}848{,}478\text{ MMBtu}}{\text{yr}}$	24 tons filterable TSP per year
PM_{10}[a]	$\frac{24\text{ tons TSP}}{\text{yr}}$	24 tons filterable PM_{10} per year

a. USEPA 2000, Table 3.1-1.
b. USEPA 2000, Table 3.1-2.
CO = carbon monoxide
NO_x = oxides of nitrogen
PM_{10} = particulates having diameter less than 10 microns
SO_x = oxides of sulfur
TSP = total suspended particulates

Table 7-4 Air Emissions from Coal-Fired Alternative.

Parameter	Calculation	Result
Annual coal consumption	$1\,\text{unit} \times \frac{636\,\text{MW}}{\text{unit}} \times \frac{10{,}200\,\text{Btu}}{\text{kW} \times \text{hr}} \times \frac{1{,}000\,\text{kW}}{\text{MW}} \times \frac{\text{lb}}{12{,}883\,\text{Btu}} \times \frac{\text{ton}}{2{,}000\,\text{lb}} \times 0.85 \times \frac{24\,\text{hr}}{\text{day}} \times \frac{365\,\text{day}}{\text{yr}}$	1,874,707 tons of coal per year
SO_x[a,c]	$\frac{38 \times 1.57\,\text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\,\text{lb}} \times (100 - 95/100) \times \frac{1{,}874{,}707\,\text{tons}}{\text{yr}}$	2,796 tons SO_x per year
NO_x[b, c]	$\frac{10\,\text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\,\text{lb}} \times (100 - 95/100) \times \frac{1{,}874{,}707\,\text{tons}}{\text{yr}}$	469 tons NO_x per year
CO[c]	$\frac{0.5\,\text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\,\text{lb}} \times \frac{1{,}874{,}707\,\text{tons}}{\text{yr}}$	469 tons CO per year
TSP[d]	$\frac{10 \times 9.48\,\text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\,\text{lb}} \times (100 - 99.9/100) \times \frac{1{,}874{,}707\,\text{tons}}{\text{yr}}$	89 tons TSP per year
PM_{10}[d]	$\frac{2.3 \times 9.48\,\text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\,\text{lb}} \times (100 - 99.9/100) \times \frac{1{,}874{,}707\,\text{tons}}{\text{yr}}$	20 tons PM_{10} per year

a. USEPA 1998a, Table 1.1-1.
b. USEPA 1998a, Table 1.1-2.
c. USEPA 1998a, Table 1.1-3.
d. USEPA 1998a, Table 1.1-4.
CO = carbon monoxide
NO_x = oxides of nitrogen
PM_{10} = particulates having diameter less than 10 microns
SO_x = oxides of sulfur
TSP = total suspended particulates

Table 7-5. Solid Waste from Coal-Fired Alternative.

Parameter	Calculation	Result
Annual SO_x generated[a]	$\frac{1{,}874{,}707\ \text{ton coal}}{\text{yr}} \times \frac{1.57\ \text{ton S}}{100\ \text{ton coal}} \times \frac{64.1\ \text{ton } SO_2}{32.1\ \text{ton S}}$	58,836 tons of SO_x per year
Annual SO_x removed	$\frac{58{,}836\ \text{ton SO}}{\text{yr}} \times (95/100)$	55,895 tons of SO_x per year
Annual ash generated	$\frac{1{,}874{,}707\ \text{ton coal}}{\text{yr}} \times \frac{9.48\ \text{ton ash}}{100\ \text{ton coal}} \times (99.9/100)$	177,544 tons of ash per year
Annual lime consumption[b]	$\frac{58{,}836\ \text{ton } SO_2}{\text{yr}} \times \frac{56.1\ \text{ton CaO}}{64.1\ \text{ton } SO_2}$	51,493 tons of CaO per year
Calcium sulfate[c]	$\frac{55{,}895\ \text{ton } SO_2}{\text{yr}} \times \frac{172\ \text{ton } CaSO_4 \bullet 2H_2O}{64.1\ \text{ton } SO_2}$	149,982 tons of $CaSO_4 \cdot 2H_2O$ per year
Annual scrubber waste[d]	$\frac{51{,}493\ \text{ton CaO}}{\text{yr}} \times \frac{(100-95)}{100} + 149{,}982\ \text{ton } CaSO_4 \bullet 2H_2O$	152,557 tons of scrubber waste per year
Total volume of scrubber waste[e]	$\frac{152{,}557\ \text{ton}}{\text{yr}} \times 40\ \text{yr} \times \frac{2{,}000\ \text{lb}}{\text{ton}} \times \frac{\text{ft}^3}{144.8\ \text{lb}}$	84,304,291 ft^3 of scrubber waste
Total volume of ash[f]	$\frac{177{,}544\ \text{ton}}{\text{yr}} \times 40\ \text{yr} \times \frac{2{,}000\ \text{lb}}{\text{ton}} \times \frac{\text{ft}^3}{100\ \text{lb}}$	142,035,574 ft^3 of ash
Total volume of solid waste	84,304,291 ft^3 + 142,035,574 ft^3	7,544,662 ft^3 of solid waste
Waste pile area (acres)	$\frac{7{,}544{,}662\ \text{ft}^3}{30\ \text{ft}} \times \frac{\text{acre}}{43{,}560\ \text{ft}^2}$	173 acres of solid waste
Waste pile area (ft x ft square)	$\sqrt{7{,}544{,}662\ \text{ft}^3/30\ \text{ft}}$	2,747 feet by feet square of solid waste

Based on annual coal consumption of 1,874,707 tons per year (Table 7-4).

a. Calculations assume 100 percent combustion of coal.
b. Lime consumption is based on total SO_2 generated.
c. Calcium sulfate generation is based on total SO_2 removed.
d. Total scrubber waste includes scrubbing media carryover.
e. Density of $CaSO_4 \cdot 2H_2O$ is 144.8 lb/ft^3.
f. Density of coal bottom ash is 100 lb/ft^3 (FHA 2000).

S = sulfur
SO_x = oxides of sulfur
CaO = calcium oxide (lime)
$CaSO_4 \cdot 2H_2O$ = calcium sulfate dehydrate

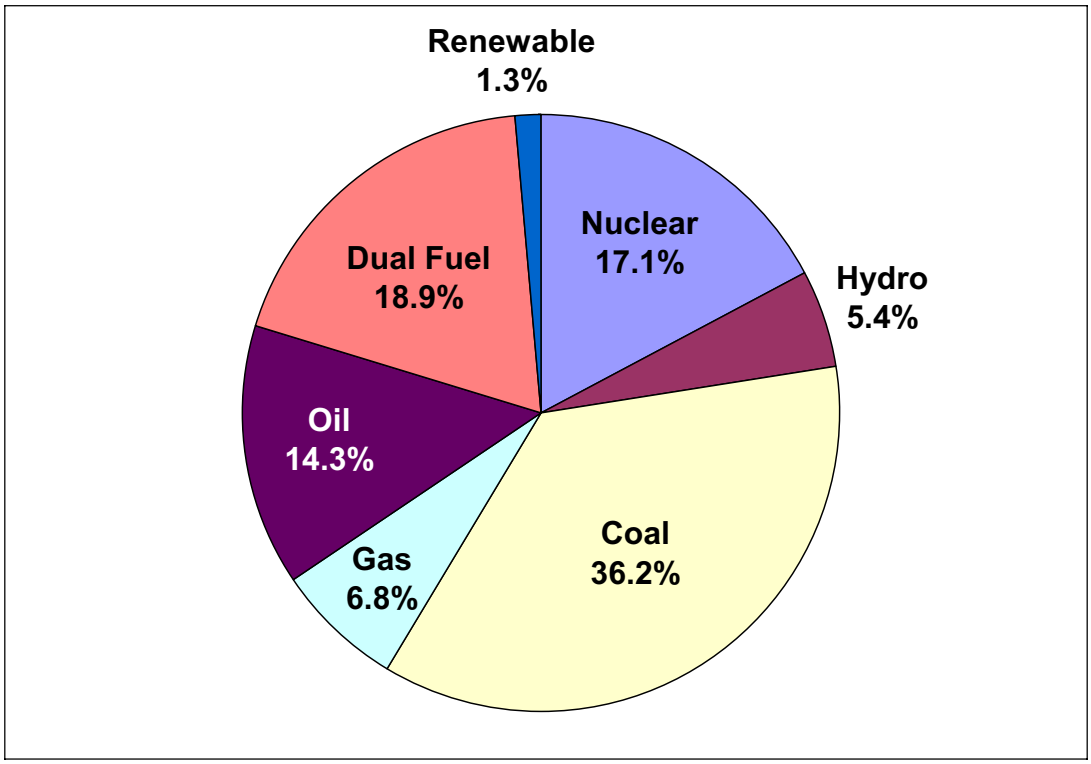

Figure 7-1. PJM Regional Generating Capacity by Fuel Type, 2003

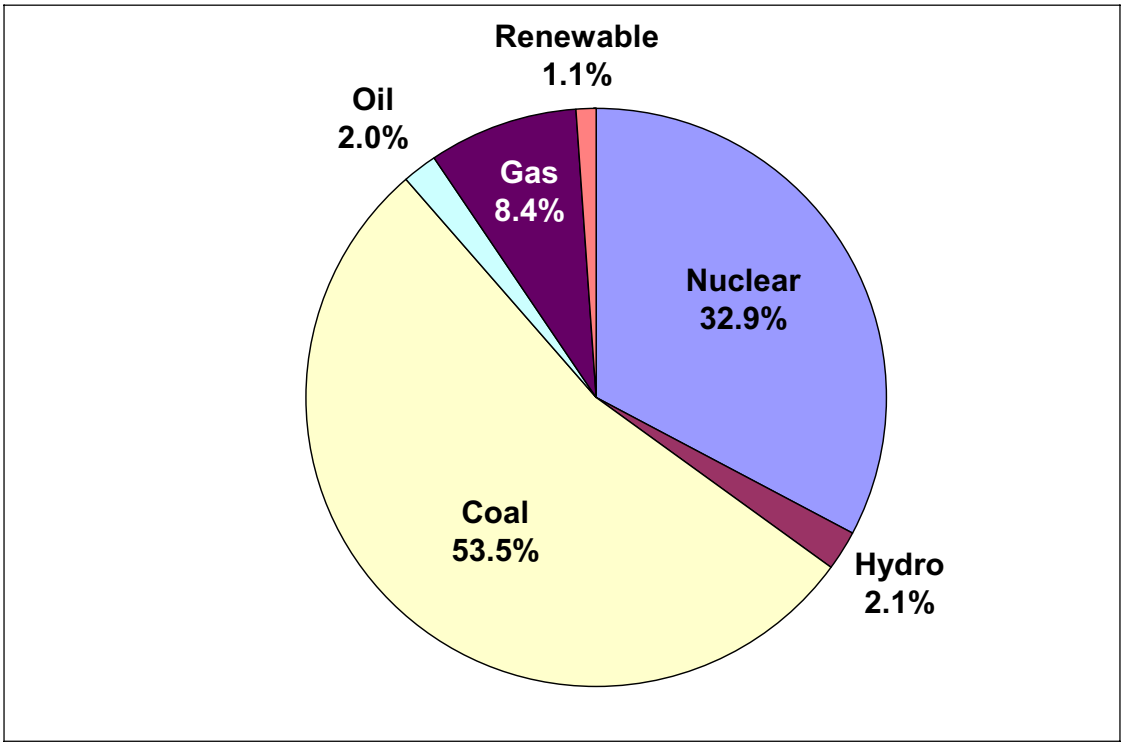

Figure 7-2. PJM Regional Generation by Fuel Type, 2003

7.3 References

Note to reader: Some web pages cited in this document are no longer available, or are no longer available through the original URL addresses. Hard copies of cited web pages are available in AmerGen files. Some sites, for example the census data, cannot be accessed through their given URLs. The only way to access these pages is to follow queries on previous web pages. The complete URLs used by AmerGen have been given for these pages, even though they may not be directly accessible.

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Chapter 8

Comparison of Environmental Impact of License Renewal with the Alternatives

NRC

"To the extent practicable, the environmental impacts of the proposal and the alternatives should be presented in comparative form..." 10 CFR 51.45(b)(3) as adopted by 51.53(c)(2)

Chapter 4 analyzes environmental impacts of Oyster Creek Generating Station (OCGS) license renewal and Chapter 7 analyzes impacts from renewal alternatives. Table 8-1 summarizes environmental impacts of the proposed action (license renewal) and the alternatives, for comparison purposes. The environmental impacts compared in Table 8-1 are those that are either Category 2 issues for the proposed action, license renewal, or are issues that the Generic Environmental Impact Statement (GEIS) (USNRC 1996) identified as major considerations in an alternatives analysis. For example, although the U. S. Nuclear Regulatory Commission (NRC) concluded that air quality impacts from the proposed action would be small (Category 1), the GEIS identified major human health concerns associated with air emissions from alternatives (Section 7.2.2). Therefore, Table 8-1 compares air impacts among the proposed action and the alternatives. Table 8-2 is a more detailed comparison of the alternatives.

Table 8-1. Impacts Comparison Summary.

Impact	Proposed Action (License Renewal)	No-Action Alternative			
		Base (Decommissioning)	With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Land Use	SMALL	SMALL	MODERATE	SMALL	MODERATE
Water Quality	SMALL	SMALL	SMALL	SMALL	SMALL to MODERATE
Air Quality	SMALL	SMALL	MODERATE	MODERATE	SMALL to MODERATE
Ecological Resources	SMALL	SMALL	MODERATE	SMALL to MODERATE	SMALL to MODERATE
Threatened or Endangered Species	SMALL	SMALL	SMALL	SMALL	SMALL
Human Health	SMALL	SMALL	MODERATE	SMALL	SMALL to MODERATE
Socioeconomics	SMALL	SMALL	SMALL	SMALL to MODERATE	SMALL to MODERATE
Waste Management	SMALL	SMALL	MODERATE	SMALL	SMALL to MODERATE
Aesthetics	SMALL	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE
Cultural Resources	SMALL	SMALL	SMALL	SMALL	SMALL

SMALL - Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
MODERATE - Environmental effects are sufficient to alter noticeably, but not to destabilize, any important attribute of the resource. Both definitions from 10 CFR 51, Subpart A, Appendix B, Table B-1, Footnote 3.

Table 8-2. Impacts Comparison Detail.

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternative: With Coal-Fired Generation	No-Action Alternative: With Gas-Fired Generation	No-Action Alternative: With Purchased Power
Alternative Descriptions				
OCGS license renewal for 20 years, followed by decommissioning	Decommissioning following expiration of current OCGS license. Adopting by reference, as bounding OCGS decommissioning, GEIS description (USNRC 1996, Section 7.1)	New construction at the OCGS site.	New construction at the OCGS site.	Would involve construction of new generation capacity in the PJM region. Adopting by reference GEIS description of alternate technologies (Section 7.2.1.2)
		Construct 15 miles of railroad in a 100-foot-wide corridor.	Construct 2 miles of gas pipeline in a 50-foot-wide corridor. May require upgrades to existing pipelines.	
		Use existing switchyard and transmission lines	Use existing switchyard and transmission lines	Construct up to 50 miles of transmission lines
		600-MW (net) tangentially-fired, dry bottom unit; capacity factor 0.85	Two 300-MW (net) Combined-cycle (170-MW combustion turbine, 130-MW heat recovery steam generator); capacity factor 0.85	
		Existing OCGS intake/ discharge canal system	Existing OCGS intake/ discharge canal system	
		Pulverized bituminous coal, 12,883 Btu/lb; 10,200 Btu/kWh; 9.48% ash; 1.57% sulfur; 10 lb/ton nitrogen oxides; 1,874,707 tons coal/yr	Natural gas, 1,032 Btu/ft^3; 9,427 Btu/kWh; 0.0034 lb sulfur/MMBtu; 0.0109 lb NO_x/MMBtu; 24,077,983,012 ft^3 gas/yr	

Table 8-2. Impacts Comparison Detail (Continued).

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternative		
		With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
		Low NO_x burners, overfire air and selective catalytic reduction (95% NO_x reduction efficiency). Wet scrubber – lime/limestone desulfurization system (95% SO_x removal efficiency); 51,493 tons lime/yr Fabric filters or electrostatic precipitators (99.9% particulate removal efficiency)	Selective catalytic reduction with steam/water injection	
470 permanent and 150 long term contract workers		170 workers (Section 7.2.2.2)	24 workers (Section 7.2.2.1)	
		Land Use Impacts		
SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issues 52, 53)	SMALL – Not an impact evaluated by GEIS (USNRC 1996)	MODERATE – 171 acres required for the powerblock and associated facilities; 180 acres for rail spur (Section 7.2.2.2). New rail spur would be built for delivering coal and lime to the plant. Existing right-of-ways would be utilized to the extent possible.	SMALL – 40 acres for facility at OCGS location; 12 acres for pipeline (Section 7.2.2.1). New gas pipeline would be built to connect with existing gas pipeline corridor.	MODERATE – most transmission facilities could be constructed along existing transmission corridors (Section 7.2.2.3). Adopting by reference GEIS description of land use impacts from alternate technologies (USNRC 1996)

Table 8-2. Impacts Comparison Detail (Continued).

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternative: With Coal-Fired Generation	No-Action Alternative: With Gas-Fired Generation	No-Action Alternative: With Purchased Power
Water Quality Impacts				
SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issues 3, 4, 6, 7-12, 32, and 37). Five Category 2 groundwater issues not applicable (Section 4.1, Issue 13; Section 4.5, Issue 33; Section 4.6, Issue 34; Section 4.7, Issue 35; and Section 4.8, Issue 39).	SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 89).	SMALL – Construction impacts minimized by use of best management practices. Operational impacts minimized by use of the existing cooling water system that withdraws from and discharges to Barnegat Bay. (Section 7.2.2.2)	SMALL – Reduced cooling water demands, inherent in combined-cycle design (Section 7.2.2.1)	SMALL to MODERATE – Adopting by reference GEIS description of water quality impacts from alternate technologies (USNRC 1996)
Air Quality Impacts				
SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 51). Category 2 issue not applicable (Section 4.11, Issue 50).	SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issue 88)	MODERATE – 2,796 tons SO_x/yr 469 tons NO_x/yr 469 tons CO/yr 89 tons TSP/yr 20 tons PM_{10}/yr (Section 7.2.2.2)	MODERATE – 42 tons SO_x/yr 135 tons NO_x/yr 28 tons CO/yr 24 tons PM_{10}/yr[a] (Section 7.2.2.1)	SMALL to MODERATE – Adopting by reference GEIS description of air quality impacts from alternate technologies (USNRC 1996)
Ecological Resource Impacts				
SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issues 15-24, 45-48). One Category 2 issue not applicable (Section 4.9, Issue 40). OCGS holds a current NPDES permit, which constitutes compliance with Clean Water Act Section 316(b) (Section 4.2, Issue 25; Section 4.3, Issue 26; Section 4.4, Issue 27).	SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 90)	MODERATE – 87 acres of former farm land could be required for ash/sludge disposal over 20-year license renewal term. (Section 7.2.2.2)	SMALL to MODERATE – Construction of the pipeline could alter habitat. (Section 7.2.2.1)	SMALL to MODERATE – Adopting by reference GEIS description of ecological resource impacts from alternate technologies (USNRC 1996)

Table 8-2. Impacts Comparison Detail (Continued).

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternative		
		With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Threatened or Endangered Species Impacts				
SMALL – With the exception of occasional sea turtles, no threatened or endangered species are known at the site or along the transmission corridors. (Section 4.10, Issue 49)	SMALL – Not an impact evaluated by GEIS (USNRC 1996)	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats	SMALL – Federal and state laws prohibit destroying or adversely affecting protected species and their habitats
Human Health Impacts				
SMALL – Adopting by reference Category 1 issues (Table A-1, Issues 56, 58, 61, 62). The issue of microbiological organisms (Section 4.12, Issue 57) does not apply. Risk due to transmission-line induced currents minimal due to conformance with consensus code (Section 4.13, Issue 59)	SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 86)	MODERATE – Adopting by reference GEIS conclusion that risks such as cancer and emphysema from emissions are likely (USNRC 1996)	SMALL – Adopting by reference GEIS conclusion that some risk of cancer and emphysema exists from emissions (USNRC 1996)	SMALL to MODERATE – Adopting by reference GEIS description of human health impacts from alternate technologies (USNRC 1996)
Socioeconomic Impacts				
SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issues 64, 67). Two Category 2 issues are not applicable (Section 4.16, Issue 66 and Section 4.17.1, Issue 68). Location in high population area with no growth controls minimizes potential for housing impacts. Section 4.14, Issue 63). Plant property tax payment represents 4 percent of county's total tax revenues (Section 4.17.2, Issue 69).	SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 91)	SMALL – Reduction in permanent work force at OCGS could adversely affect surrounding counties, but would be mitigated by OCGS's proximity to Atlantic City, Newark and Philadelphia (Section 7.2.2.2).	SMALL to MODERATE – Reduction in permanent work force at OCGS could adversely affect surrounding counties, but would be mitigated by OCGS's proximity to Atlantic City, Newark and Philadelphia (Section 7.2.2.1)	SMALL to MODERATE – Adopting by reference GEIS description of socioeconomic impacts from alternate technologies (USNRC 1996)

Table 8-2. Impacts Comparison Detail (Continued).

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternative		
		With Coal-Fired Generation	With Gas-Fired Generation	With Purchased Power
Capacity of public water supply and transportation infrastructure minimizes potential for related impacts (Section 4.15, Issue 65 and Section 4.18, Issue 70)				
Waste Management Impacts				
SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issues 77-85)	SMALL – Adopting by reference Category 1 issue finding (Table A-1, Issue 87)	MODERATE – 177,544 tons of coal ash and 152,577 tons of scrubber sludge annually would require 87 acres over 20-year license renewal term. Industrial waste generated annually (Section 7.2.2.2)	SMALL – Almost no waste generation (Section 7.2.2.1)	SMALL to MODERATE – Adopting by reference GEIS description of waste management impacts from alternate technologies (USNRC 1996)
Aesthetic Impacts				
SMALL – Adopting by reference Category 1 issue findings (Table A-1, Issues 73, 74)	SMALL – Not an impact evaluated by GEIS (USNRC 1996)	SMALL to MODERATE – The coal-fired power blocks and the exhaust stacks would be visible from a moderate offsite distance (Section 7.2.2.2)	SMALL– Steam turbines and stacks would create visual impacts comparable to those from existing OCGS facilities (Section 7.2.2.1)	SMALL to MODERATE – Adopting by reference GEIS description of aesthetic impacts from alternate technologies (USNRC 1996)

Table 8-2. Impacts Comparison Detail (Continued).

Proposed Action (License Renewal)	Base (Decommissioning)	No-Action Alternative: With Coal-Fired Generation	No-Action Alternative: With Gas-Fired Generation	No-Action Alternative: With Purchased Power
Cultural Resource Impacts				
SMALL – SHPO consultation minimizes potential for impact (Section 4.19, Issue 71)	SMALL – Not an impact evaluated by GEIS (USNRC 1996)	SMALL – Impacts to cultural resources would be unlikely due to developed nature of the site (Section 7.2.2.2)	SMALL – 2 miles of pipeline construction in previously disturbed soil would be unlikely to affect cultural resources (Section 7.2.2.1)	SMALL – Adopting by reference GEIS description of cultural resource impacts from alternate technologies (USNRC 1996)

SMALL - Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
MODERATE - Environmental effects are sufficient to alter noticeably, but not to destabilize, any important attribute of the resource. Both definitions from (10 CFR 51, Subpart A, Appendix B, Table B-1, Footnote 3).

Btu = British thermal unit
ft^3 = cubic foot
gal = gallon
GEIS = Generic Environmental Impact Statement (USNRC 1996)
kWh = kilowatt hour
lb = pound
MM = million
MW = megawatt
NO_x = nitrogen oxide
PM_{10} = particulates having diameter less than 10 microns
SHPO = State Historic Preservation Officer
SO_x = sulfur dioxide
TSP = total suspended particulates
yr = year

a. All TSP for gas-fired alternative is PM_{10}.

8.1 References

USNRC (U.S. Nuclear Regulatory Commission). 1996. Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS). Volumes 1 and 2. NUREG-1437. Washington, DC. May.

Chapter 9

Status of Compliance

9.1 Proposed Action

NRC

"The environmental report shall list all federal permits, licenses, approvals and other entitlements which must be obtained in connection with the proposed action and shall describe the status of compliance with these requirements. The environmental report shall also include a discussion of the status of compliance with applicable environmental quality standards and requirements including, but not limited to, applicable zoning and land-use regulations, and thermal and other water pollution limitations or requirements which have been imposed by Federal, State, regional, and local agencies having responsibility for environmental protection." 10 CFR 51.45(d), as adopted by 10 CFR 51.53(c)(2)

9.1.1 GENERAL

Table 9-1 lists authorizations that AmerGen has obtained for current Oyster Creek Generating Station (OCGS) operations. In this context, AmerGen uses "authorizations" to include any permits, licenses, approvals, or other entitlements. AmerGen expects to continue renewing these authorizations during the current license period and through the U.S. Nuclear Regulatory Commission (NRC) license renewal period. Because the NRC regulatory focus is prospective Table 9-1 does not include authorizations that AmerGen obtained for past activities but that did not include continuing obligations. For this reason, for example, Table 9-1 does not include the permits that AmerGen obtained to construct a well, but does include the permit that AmerGen obtained to use the well.

Preparatory to applying for renewal of the OCGS operating license, AmerGen conducted an assessment to identify any new and significant environmental information (Chapter 5). The assessment included interviews with AmerGen subject experts, review of OCGS environmental documentation, and communication with state and federal environmental protection agencies. Based on this assessment, AmerGen concludes that OCGS is in compliance with applicable environmental standards and requirements. The previous owner of the plant (now JCP&L/FirstEnergy) is responsible for treating contaminated groundwater at the site and holds a permit to operate a groundwater treatment and remediation system.

Table 9-2 lists additional authorizations and consultations related to NRC renewal of the OCGS license to operate. As indicated, AmerGen anticipates needing relatively few such authorizations and consultations. Sections 9.1.2 through 9.1.5 discuss some of these items in more detail.

9.1.2 THREATENED OR ENDANGERED SPECIES

Section 7 of the Endangered Species Act (16 USC 1531 et seq.) requires federal agencies to ensure that agency action is not likely to jeopardize any species that is listed, proposed for listing as endangered, or threatened. Depending on the action involved, the Act requires consultation with the U.S. Fish and Wildlife Service (FWS) regarding effects on non-marine species, the National Marine Fisheries Service (NMFS) for marine species, or both. FWS and NMFS have issued joint procedural regulations at 50 CFR 402, Subpart B, that address consultation, and FWS maintains

the joint list of threatened and endangered species at 50 CFR 17.

The NMFS issued Biological Opinions on the effects of OCGS on loggerhead, green, and Kemp's ridley sea turtles in September 1995 and July 2001. Both Opinions concluded that the operation of OCGS might adversely affect the endangered Kemp's ridley and green sea turtles and the threatened loggerhead sea turtle, but was not likely to jeopardize their existence (see more complete discussion in Section 2.5).

An Incidental Take Statement accompanying the July 2001 Biological Opinion authorized the annual take of 5 loggerhead (no more than 2 lethal), 4 Kemp's ridley (no more than 3 lethal), and 2 green (no more than one lethal) sea turtles by OCGS. AmerGen must provide NMFS with information regarding any impinged turtles. In 2004, OCGS exceeded the Incidental Take allowance for Kemp's ridley sea turtles. Consequently, NRC has reinitiated a formal Endangered Species Act Section 7 consultation with NMFS.

AmerGen has no plans to alter current operations and resource agencies contacted by AmerGen evidenced no concerns about license renewal impacts, therefore, AmerGen concludes that plant operations do not negatively impact threatened or endangered species (with the possible exception of Kemp's ridley which is being reviewed by NMFS for impacts).

NMFS expects to issue its Biological Opinion by September 10, 2005. For the interim NMFS has recommended that NRC continue to implement the requirements imposed on OCGS in the July 21, 2001 Opinion and the August 29, 2001 Incidental Take Statement (NMFS 2005).

Although not required of an applicant by federal law or NRC regulation, AmerGen has chosen to invite comment from federal and state agencies regarding potential effects that OCGS license renewal might have. Appendix C includes copies of AmerGen correspondence with FWS, and the New Jersey Division of Fish and Wildlife. The FWS concurs that operation of OCGS and the associated transmission line would not adversely affect any federally listed species. The New Jersey Division of Fish and Wildlife did not provide additional information beyond that requested by AmerGen from and provided to AmerGen by the state's Natural Heritage Program which maintains a database of known occurrences of protected species.

9.1.3 HISTORIC PRESERVATION

Section 106 of the National Historic Preservation Act (16 USC 470 et seq.) requires federal agencies having the authority to license any undertaking to take into account, prior to issuing the license, the effect of the undertaking on historic properties and to afford the Advisory Council on Historic Preservation an opportunity to comment on the undertaking. Council regulations provide for the State Historic Preservation Officer (SHPO) to have a consulting role (35 CFR 800.2). Although not required of an applicant by federal law or NRC regulation, AmerGen has chosen to invite comment by the New Jersey SHPO. Appendix D contains a copy of AmerGen's letter to the New Jersey State Historic Preservation Office and the New Jersey State Historic Preservation Office response. The SHPO concurred that the proposed project would not adversely affect cultural resources.

9.1.4 COASTAL ZONE MANAGEMENT PROGRAM COMPLIANCE

The federal Coastal Zone Management Act (16 USC 1451 et seq.) imposes requirements on applicants for a federal license to conduct an activity that could affect a state's coastal zone (USNRC 2001). OCGS, located in Ocean County, is within the New Jersey Coastal Management Area

(NJDEP 2004). Therefore, certification from the New Jersey Department of Environmental Protection Land Use Regulation Program is necessary. The certification prepared by AmerGen is in Appendix E. Copies of ongoing correspondence between NJDEP and AmerGen are also included in Appendix E. AmerGen is awaiting concurrence of the certification by the NJDEP.

9.1.5 WATER QUALITY (401) CERTIFICATION

Federal Clean Water Act Section 401 requires an applicant for a federal license to conduct an activity that might result in a discharge into navigable waters to provide the licensing agency a certification from the state that the discharge will comply with applicable Clean Water Act requirements (33 USC 1341). NRC has indicated in its *Generic Environmental Impact Statement for License Renewal* (USNRC 1996) that issuance of a National Pollutant Discharge Elimination System (NPDES) permit implies certification by the state. Appendix B contains excerpts from the OCGS NPDES permit. Consistent with the GEIS, AmerGen is providing OCGS's NPDES permit as evidence of state water quality (401) certification.

9.2 Alternatives

NRC

"The discussion of alternatives in the report shall include a discussion of whether the alternatives will comply with such applicable environmental quality standards and requirements." 10 CFR 51.45(d), as required by 10 CFR 51.53(c)(2)

The coal, gas, and purchased power alternatives discussed in Section 7.2.1 could be constructed and operated to comply with applicable environmental quality standards and requirements. AmerGen notes that increasingly stringent air quality protection requirements could make the construction of a large fossil-fueled power plant not feasible in many locations. AmerGen also notes that the U.S. Environmental Protection Agency has revised requirements for design and operation of cooling water intake structures at new and existing facilities (40 CFR 125 Subparts I and J). These requirements could necessitate construction of cooling towers for the coal- and gas-fired alternatives if surface water were used for cooling.

Table 9-1. Authorizations for Current OCGS Operations.

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
Federal Requirements to License Renewal					
U. S. Nuclear Regulatory Commission	Atomic Energy Act (42 USC 2011, et seq.), 10 CFR 50.10	License to operate	DPR-16	Issued: 4/9/1969 Expires: 4/9/2009	Operation of OCGS
U.S. Department of Transportation	49 USC 5108	Registration	052804 700 004MO	Issued: 5/28/04 Expires: 06/30/07	Hazardous materials shipments
National Marine Fisheries Service	Endangered Species Act of 1973 (16 USC 1531-1544)	Incidental Take Permit - Sea Turtles	ongoing	ongoing	Possession and disposition of impinged or stranded sea turtles
New Jersey Department of Environment Protection	Clean Water Act (33 USC 1251 et seq.), NJ Statutes Annotated (N.J.S.A.) Water Pollution Control Act 58:10A et seq. and N. J. Administrative Code (N.J.A.C.)7:14A et seq.	New Jersey Pollutant Discharge Elimination System Permit – surface water	NJ0005550	Issued: 10/21/94 Expires: remains in effect pending state action on current application	Wastewater (industrial surface water, thermal surface water and stormwater runoff) discharges to Oyster Creek, Forked River, and South Branch of Forked River
New Jersey Department of Environment Protection	Clean Water Act (33 USC 1251 et seq.), N.J.S.A. 58:10A et seq. and N.J.A.C. 7:14A et seq.	New Jersey Pollutant Discharge Elimination System Permit – ground water	NJ0101966	Issued: 2/20/04 Expires: 2/20/09	Wastewater (percolation lagoon, underground injection, dredge spoils) to groundwater

Table 9-1. Authorizations for Current OCGS Operations (Continued).

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
New Jersey Department of Environment Protection	Coastal Area Facility Review Act (N.J.S. A. 13:19-1 et seq.), Waterfront Development Act (N.J.S.A. 12:5-3), and Wetlands Act of 1970 (N.J.S.A. 13:9A-1 et seq.)	Certification			Compliance with Coastal Zone management rules, Freshwater Wetlands protection rules, and Coastal Permit Program rules
New Jersey Department of Environment Protection	Water Supply Management Act, N.J.S.A. 58: 1A et seq.	Water Use Registration	11108W	Issued: 7/25/01 Expires: not applicable	Registers two wells with collective diversions of less than 100,000 gallons per day
New Jersey Department of Environmental Protection	N.J.A.C. 7:7A	Freshwater Wetlands Statewide General Permit	1500-02-0004.1	Issued: 6/4/02 Expires: 6/4/07	Remove vegetation from fire pond
New Jersey Department of Environmental Protection	Chapter 251, Soil Erosion and Sediment Control Act, P.L. 195	Certificate	SCD 1302	Issued: 10/31/01 Expires: 4/3/05	Soil Erosion Control and Sediment Control plan for upland dredge disposal site
New Jersey Department of Environmental Protection	Clean Air Act (42 USC 7401 et seq); Air Pollution Control Act (1954), N.J.S.A. 26:2C-9.2	Certificate to operate	PCP970001	Issued: 9/8/97 Expires: 9/8/07	Air emission for DL-42 boiler and DL-68 boiler
New Jersey Department of Environmental Protection	Clean Air Act (42 USC 7401 et seq); Air Pollution Control Act (1954), N.J.S.A. 26:2C-9.2	Certificate to operate	PCP970002	Issued: 10/9/02 Expires: 10/9/07	Emergency Fire Diesel 1-2

Table 9-1. Authorizations for Current OCGS Operations (Continued).

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
New Jersey Department of Environmental Protection	Clean Air Act (42 USC 7401 et seq); Air Pollution Control Act (1954), N.J.S.A. 26:2C-9.2	Certificate to operate	PCP970003	Issued: 11/14/97 Expires: 11/14/07	#1 boiler
New Jersey Department of Environmental Protection	Clean Air Act (42 USC 7401 et seq); Air Pollution Control Act (1954), N.J.S.A. 26:2C-9.2	Certificate to operate	PCP970005	Issued: 1/8/03 Expires: 1/8/08	Forked River Emergency Fire Diesel
New Jersey Department of Environmental Protection	Clean Air Act (42 USC 7401 et seq); Air Pollution Control Act (1954), N.J.S.A. 26:2C-9.2	Certificate to operate	PCP970006	Issued: 10/31/02 Expires: 10/29/07	Dirty Oil Lube Tank
New Jersey Department of Environmental Protection	Clean Air Act (42 USC 7401 et seq); Air Pollution Control Act (1954), N.J.S.A. 26:2C-9.2	Certificate to operate	PCP960005	Issued: 3/23/04 Expires: 3/23/09	Main Fuel Tank
New Jersey Department of Environmental Protection	Clean Air Act (42 USC 7401 et seq); Air Pollution Control Act (1954), N.J.S.A. 26:2C-9.2	Certificate to operate	PCP960006	Issued: 7/101/04 Expires: 7/10/09	Emergency Generator 1
New Jersey Department of Environmental Protection	Clean Air Act (42 USC 7401 et seq); Air Pollution Control Act (1954), N.J.S.A. 26:2C-9.2	Certificate to operate	PCP960007	Issued: 7/101/04 Expires: 7/10/09	Emergency Diesel Generator 2

Table 9-1. Authorizations for Current OCGS Operations (Continued).

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
New Jersey Department of Environmental Protection	Clean Air Act (42 USC 7401 et seq); Air Pollution Control Act (1954), N.J.S.A. 26:2C-9.2	Certificate to operate	PCP960008	Issued: 6/26/96 Expires: 6/26/06	Grit Blaster
New Jersey Department of Environmental Protection	Clean Air Act (42 USC 7401 et seq); Air Pollution Control Act (1954), N.J.S.A. 26:2C-9.2	Certificate to operate	PCP020001	Issued: 7/29/02 Expires: 7/28/07	Emergency Fire Diesel 1-1
New Jersey Department of Environmental Protection	N.J.A.C. 7:14B	Certificate to operate	GEN000001	Issued: 7/19/00 Expires: 7/18/05	Emergency Generator C2
New Jersey Department of Environmental Protection	Clean Water Act (33 USC 1251 et seq.); Clean Air Act (42 USC 7401 et seq.); Resource Conservation and Recovery Act (42 USC 6901 et seq.); Water Pollution Control Act, N.J.S.A. 48:10A et seq.; Industrial Site Recovery Act, N.J.S.A. 26:2C-1 et seq. and N.J.A.C. 7:14B	Registration	UST 000002	Issued: 8/24/04 Expires: 8/24/09	Underground storage tank – emergency spill tank
New Jersey Department of Environmental Protection	Industrial Site Recovery Act, N.J.S.A. 26:2C-1 et.seq. and N.J.A.C. 7:27-8	Operating Certificate	CN 099746	Issued: 10/16/00 Expires: 10/16/05	Above-ground Gasoline Storage Tank
New Jersey Department of Environmental Protection	N.J.A.C. 7:18 et seq.	Laboratory Certification	15304	Issued: 6/30/04 Expires: 6/30/05	State certified laboratory to perform listed analyses

Table 9-1. Authorizations for Current OCGS Operations (Continued).

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
New Jersey Department of Transportation	Fish and Game, Wild Birds and Animals	License	H-205	Issued: 1/2005 Expires: 1/2006	Oyster Creek Helistop
New Jersey Department of Environmental Protection	Clean Air Act (42 USC 7401 et seq); Air Pollution Control Act (1954), N.J.S.A. 26:2C-9.2	Certificate to Operate	PCP960004	Issued: 2/13/01 Expires 2/13/06	EDG Fuel Oil Storage Tank
South Carolina Department of Health and Environmental Control – Division of Waste Management	South Carolina Radioactive Waste Transportation and Disposal Act (Act No. 429)	South Carolina Radioactive Waste Transport Permit	0043-29-04	12/31/2005	Transportation of radioactive waste into the State of South Carolina
Commonwealth of Virginia Department of Environmental Protection	Virginia Department of Emergency Management Title 44, Code of Virginia, Chapter 3.3, Section 44-146.3	Virginia Registration to Transport Hazardous Radioactive Materials	AO-S-063006	Issued: 5/27/2004 Expires: 6/30/2006	Transport of hazardous radioactive materials
State of Tennessee Department of Environment and Conservation Division of Radiological Health	Tennessee Department of Environment and Conservation Rule 1200-2-10.32	Tennessee Radioactive Waste License-for-Delivery	T-NJ001-L04	12/31/2005	Transportation of radioactive waste into the State of Tennessee
New Jersey Department of Environmental Protection	40 CFR 266 Subpart N N.J.A.C. 7:26G	Conditional Exemption			Storage and treatment of low-level mixed waste

Table 9-1. Authorizations for Current OCGS Operations (Continued).

Agency	Authority	Requirement	Number	Issue or Expiration Date	Activity Covered
Ocean County Utilities Authority		Agreement	Not applicable	Not applicable	OCGS provides continuous radiation monitoring of discharges of OCGS wastewater to publicly-owned treatment facility

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Table 9-2. Authorizations for OCGS License Renewal[a]

Agency	Authority	Requirement	Remarks
U.S. Nuclear Regulatory Commission	Atomic Energy Act (42 USC 2011 et seq.)	License renewal	Environmental Report submitted in support of license renewal application
U.S. Fish and Wildlife Service	Endangered Species Act Section 7 (16 USC 1536)	Consultation	Requires federal agency issuing a license to consult with the U.S. Fish and Wildlife Service (Appendix C)
New Jersey Department of Environmental Protection	Clean Water Act Section 401 (33 USC 1341)	Certification	State issuance of NPDES permit (Section 9.1.5) constitutes 401 certification (Appendix B)
New Jersey Department of Environmental Protection, Land Use Regulations	Federal Coastal Zone Management Act (16 USC 1452 et seq.)	Certification	Requires applicant to prove certification to Federal agency issuing the license that license renewal would be consistent with the Federally approved State Coastal Zone Management program. Based on its review of the proposed activity, the State must concur with or object to the applicant's certification (Appendix E).
New Jersey Department of Environmental Protection, Division of Parks and Forestry	National Historic Preservation Act Section 106 (16 USC 470f)	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with State Historic Preservation Officer (SHPO). SHPO must concur that license renewal will not affect any sites listed or eligible for listing (Appendix D)

a. No renewal-related requirements identified for local or other agencies.

9.3 References

Note to reader: Hard copies of cited web pages are available in AmerGen files. Some sites, for example the census data, cannot be accessed through their given URLs. The only way to access these pages is to follow queries on previous web pages. The complete URLs used by AmerGen have been given for these pages, even though they may not be directly accessible.

NJDEP (New Jersey Department of Environmental Protection). 2004. New Jersey Coastal Zone map. Available at http://www.nj.gov/dep/cmp/czm_map.html. Accessed July 9, 2004.

NMFS (National Marine Fisheries Service). 2005. "Oyster Creek Nuclear Generating Station, Formal Section 7 Consultation Initiation." Letter, M. Colligan to P.T. Kuo, NRC. June 3.

USNRC (U.S. Nuclear Regulatory Commission). 1996. Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS). Volume 1, Section 4.2.1.1, page 4-4. NUREG-1437. Washington, DC. May.