Rikhoff, Jeffrey

From: Rogers, Evelyn [EVELYN.ROGERS@aecom.com]
Sent: Monday, August 16, 2010 1:29 PM
To: Hurley, Bobbie; Pham, Bo; Spangler, Nicole
Cc: Eccleston, Charles; Imboden, Andy; Rikhoff, Jeffrey
Subject: RE: Chapter 8 edits for Salem & HC
Attachments: Chapter 8 v.4.docx

Sure....here is the latest version of the document.

Is 2:30 OK for the call?
Call in # 866-203-6896
Conference Code (b)(6)

Evelyn Rogers, P.E.
D 864.234.2253
evelyn.rogers@aecom.com

-----Original Message-----
From: Hurley, Bobbie
Sent: Monday, August 16, 2010 1:06 PM
To: Pham, Bo; Rogers, Evelyn; Spangler, Nicole
Cc: Eccleston, Charles; Imboden, Andy; Rikhoff, Jeffrey
Subject: RE: Chapter 8 edits for Salem & HC

I have back to back conference calls most of the afternoon ... Evelyn, can you handle this????

Bobbie Hurley
Section/Office Manager
D 864.234.8913
C (b)(6)
bobbie.hurley@aecom.com

-----Original Message-----
From: Pham, Bo [mailto:Bo.Pham@nrc.gov]
Sent: Monday, August 16, 2010 1:00 PM
To: Rogers, Evelyn; Hurley, Bobbie; Spangler, Nicole
Cc: Eccleston, Charles; Imboden, Andy; Rikhoff, Jeffrey
Subject: RE: Chapter 8 edits for Salem & HC

Can we do a call this afternoon after 2pm? I thought I remembered "Land Use" to be a subsection of "Socioeconomics" for only the Coal-fired and Combined-cycle alternatives, and it was a separate section of its own only in the Combination alternative.

Can you also send out the latest version as a reference for the call this afternoon? Thanks.

Bo Pham
Chief, Projects Branch 1
Division of License Renewal
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission

301-415-8450

-----Original Message-----
From: Rogers, Evelyn [mailto:EVELYN.ROGERS@aecom.com]
Sent: Monday, August 16, 2010 8:48 AM
To: Pham, Bo; Hurley, Bobbie; Spangler, Nicole
Cc: Eccleston, Charles; Imboden, Andy; Rikhoff, Jeffrey
Subject: RE: Chapter 8 edits for Salem & HC

Bo-
I was planning to move Land Use out of the Socioeconomics section in all three alternatives (Land Use is currently a subsection of Socioeconomics in all 3 alternatives) and also add it as a separate criterion in all of the Section 8 tables. If we are to leave Land Use in socioeconomics, then I would like to revise Section 8.4 so that it does not discuss Land Use as if it was a separate criterion.
Please let me know which way to proceed.
Thanks!

Evelyn Rogers, P.E.
D 864.234.2253
evelyn.rogers@aecom.com

-----Original Message-----
From: Pham, Bo [mailto:Bo.Pham@nrc.gov]
Sent: Friday, August 13, 2010 6:47 PM
To: Hurley, Bobbie; Spangler, Nicole
Cc: Eccleston, Charles; Rogers, Evelyn; Imboden, Andy; Rikhoff, Jeffrey
Subject: Chapter 8 edits for Salem & HC

Hi Bobbie,

I spoke to Jeff & Andy today regarding the format/flow of Chapter 8, and we have all agreed that the section on the Combination Alternative should be revised to match the layout of the Coal-fired and Combined-cycle alternatives.

As I understand it per our phone conversation, this would mainly involve revising the table summarizing the impacts of the Combination Alternatives & putting it close to the top of the section and putting the "Land Use" discussion under the "Socioeconomic" subsection. Please go forth with making those changes and let me know if there were other major changes to consider from our discussion.

Thanks.

Bo Pham
Chief, Projects Branch 1
Division of License Renewal
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
301-415-8450

8.0 ENVIRONMENTAL IMPACTS OF ALTERNATIVES

The National Environmental Policy Act (NEPA) mandates that each environmental impact statement (EIS) consider alternatives to any proposed major Federal action significantly affecting the quality of the human environment. U.S. Nuclear Regulatory Commission (NRC) regulations implementing NEPA for license renewal require that a supplemental environmental impact statement (SEIS) consider and weigh " the environmental effects of the proposed action (license renewal); the environmental impacts of alternatives to the proposed action; and alternatives available for reducing or avoiding adverse environmental impacts," (Title 10 of the *Code of Federal Regulations* (CFR) 51.71d).

This SEIS considers the proposed Federal action of issuing a renewed license for the Salem Nuclear Generating Stations, Units 1 and 2 (Salem) and Hope Creek Generating Station (HCGS), which would allow the plants to operate for 20 years beyond the current license expiration dates. In this chapter, the NRC staff (Staff) examines the potential environmental impacts of alternatives to issuing a renewed operating license for Salem and HCGS, as well as alternatives that may reduce or avoid adverse environmental impacts from license renewal, when and where these alternatives are applicable.

While the *Generic Environmental Impact Statement (GEIS) for License Renewal of Nuclear Plants*, NUREG-1437 (NRC, 1996; NRC, 1999), reached generic conclusions regarding many environmental issues associated with license renewal, it did not determine which alternatives are reasonable or reach conclusions about site-specific environmental impact levels. As such, the Staff must evaluate environmental impacts of alternatives on a site-specific basis.

Alternatives to the proposed action of issuing renewed Salem and HCGS operating licenses must meet the purpose and need for issuing a renewed license; they must

> 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.

The Staff ultimately makes no decision as to which alternative (or the proposed action) to implement, since that decision falls to utility, State, or other Federal officials to decide. Comparing the environmental effects of these alternatives will assist the Staff in deciding whether the 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]). If the NRC acts to issue renewed licenses, all of the alternatives, including the proposed action, will be available to energy-planning decision-makers. If NRC decides not to renew the licenses (or takes no action at all), then energy-planning decision-makers may no longer elect to continue operating Salem and HCGS and will have to resort to another alternative—which may or may not be one of the alternatives considered in this section—to meet their energy needs.

In evaluating alternatives to license renewal, the Staff first selects energy technologies or options currently in commercial operation, as well as some technologies not currently in commercial operation but likely to be commercially available by the time the current Salem and

HCGS operating licenses expire. The current Salem operating licenses will expire on August 13, 2016 for Unit 1 and April 18, 2020 for Unit 2. The current HCGS operating license will expire on April 11, 2026. An alternative must be available (constructed, permitted, and connected to the grid) by the time the current Salem and HCGS licenses expire.

Second, the Staff screens the alternatives to remove those that cannot meet future system needs, and then screens the remaining options to remove those whose costs or benefits do not justify inclusion in the range of reasonable alternatives. Any alternatives remaining constitute alternatives to the proposed action that the Staff evaluates in detail throughout this section. In Section 8.2, the SEIS briefly addresses each alternative that the Staff removed during screening and explains why each alternative was removed.

The Staff initially considered 17 discrete potential alternatives to the proposed action, and then narrowed the list to two discrete alternatives and a combination of alternatives considered in Section 8.1.

Once the Staff identifies alternatives for in-depth review, the Staff refers to generic environmental impact evaluations in the GEIS. The GEIS provides overviews of some energy technologies available at the time of its publishing in 1996, though it does not reach any conclusions regarding which alternatives are most appropriate, nor does it precisely categorize impacts for each site. In addition, since 1996, many energy technologies have evolved significantly in capability and cost, while regulatory structures have changed to either promote or impede development of particular alternatives.

As a result, the Staff's analysis starts with the GEIS and then includes updated information from sources like the Energy Information Administration (EIA), other organizations within the Department of Energy (DOE), the Environmental Protection Agency (EPA), industry sources and publications, and information submitted in the PSEG Nuclear, LLC (PSEG, the applicant) environmental report (ER).

In-Depth Alternatives:

- **Supercritical coal-fired**
- **Natural gas-fired combined-cycle**
- **Combination**

Other Alternatives Considered:

- **Offsite Coal-Fired and Natural Gas-Fired**
- **New nuclear**
- **Conservation/ Efficiency**
- **Purchased power**
- **Solar power**
- **Wood-fired**
- **Wind (onshore/offshore)**
- **Hydroelectric power**
- **Wave and ocean energy**
- **Geothermal power**
- **Municipal solid waste**
- **Biofuels**
- **Oil-fired power**
- **Fuel cells**
- **Delayed retirement**

For each in-depth analysis, the Staff analyzes environmental impacts across seven impact categories: (1) air quality, (2) groundwater use and quality, (3) surface water use and quality, (4) aquatic and terrestrial ecology, (5) human health, (6) socioeconomics, and (7) waste management. As in earlier chapters of this draft SEIS, the Staff uses the NRC's three-level standard of significance—SMALL, MODERATE, or LARGE—to indicate the degree of the environmental effect on each of the seven aforementioned categories that have been evaluated.

The in-depth alternatives that the Staff considered include a supercritical coal-fired plant in Section 8.1.1, a natural gas-fired combined-cycle power plant in Section 8.1.2, and a combination of alternatives in Section 8.1.3 that includes natural gas-fired combined-cycle generation, energy conservation, and a wind power component. In Section 8.2, the Staff explains why it dismissed many other alternatives from in-depth consideration. In Section 8.3, the Staff considers the environmental effects that may occur if NRC takes no action and does not issue renewed licenses for Salem and HCGS. Finally, in Section 8.4, the impacts of all alternatives are summarized.

> **Energy Outlook:** Each year the Energy Information Administration (EIA), part of the U.S. Department of Energy (DOE), issues its updated *Annual Energy Outlook (AEO)*. *AEO 2009* indicates that natural gas, coal, and renewable are likely to fuel most new electrical capacity through 2030, with some growth in nuclear capacity (EIA, 2009a), though all projections are subject to future developments in fuel price or electricity demand:
>
> "Natural-gas-fired plants account for 53 percent of capacity additions in the reference case, as compared with 22 percent for renewable, 18 percent for coal-fired plants, and 5 percent for nuclear. Capacity expansion decisions consider capital, operating, and transmission costs. Typically, coal-fired, nuclear, and renewable plants are capital-intensive, whereas operating (fuel) expenditures account for most of the costs associated with natural-gas-fired capacity."

8.1 ALTERNATIVE ENERGY SOURCES

8.1.1 Supercritical Coal-Fired Generation

The GEIS indicates that a 3656 megawatt-electric (MWe) supercritical coal-fired power plant (a plant equivalent in capacity to each individual Salem Unit 1, Salem Unit 2, and HCGS plants) could require 6,233 acres (2,523 hectares) of available land area, and thus would not fit on the existing 1,480 (599 hectares) acres owned by PSEG at the Salem and HCGS sites; however, the Staff notes that many coal-fired power plants with larger capacities have been located on smaller sites. In the ERs, PSEG assumed that a coal-fired alternative would be developed on the existing Salem and HCGS sites. The Staff believes this to be reasonable and, as such, will consider a coal-fired alternative located on the current Salem and HCGS sites.

Coal-fired generation accounts for 48.2 percent of U.S. electrical power generation, a greater share than any other fuel (EIA, 2010a). Furthermore, the EIA projects that coal-fired power plants will account for the greatest share of added capacity through 2030—more than natural gas, nuclear or renewable generation options (EIA, 2009a). While coal-fired power plants are widely used and likely to remain widely used, the Staff notes that future coal capacity additions may be affected by perceived or actual efforts to limit greenhouse gas (GHG) emissions. For now, the Staff considers a coal-fired alternative to be a feasible, commercially available option that could provide electrical generating capacity after the Salem and HCGS current licenses expire.

Supercritical technologies are increasingly common in new coal-fired plants. Supercritical plants operate at higher temperatures and pressures than most existing coal-fired plants (beyond water's "critical point", where boiling no longer occurs and no clear phase change occurs between steam and liquid water). Operating at higher temperatures and pressures allows this coal-fired alternative to function at a higher thermal efficiency than many existing coal-fired power plants do. While supercritical facilities are more expensive to construct, they consume less fuel for a given output, reducing environmental impacts. Based on technology forecasts from EIA, the Staff expects that a new, supercritical coal-fired plant beginning operation in 2014 would operate at a heat rate of 9069 British thermal units/kilowatt hour (Btu/kWh), or approximately 38 percent thermal efficiency (EIA, 2009a).

In a supercritical coal-fired power plant, burning coal heats pressurized water. As the supercritical steam/water mixture moves through plant pipes to a turbine generator, the pressure drops and the mixture flashes to steam. The heated steam expands across the turbine stages, which then spin and turn the generator to produce electricity. After passing through the turbine, any remaining steam is condensed back to water in the plant's condenser.

In most modern U.S. facilities, condenser cooling water circulates through cooling towers or a cooling pond system (either of which are closed-cycle cooling systems). Older plants often withdraw cooling water directly from existing rivers or lakes and discharge heated water directly to the same body of water (called open-cycle cooling). Salem operates open-cycle cooling water using once-through cooling at both of their units, while HCGS operates a closed-cycle cooling system with a natural draft cooling tower. Although nuclear plants require more cooling capacity than an equivalently sized coal-fired plant, the existing cooling tower at HCGS, by itself, is not expected to be adequate to support a coal-fired alternative that would have the capacity to replace both Salem and HCGS. Therefore, implementation of a coal-fired alternative would require the construction of additional cooling towers to provide the necessary cooling capacity to support the replacement of both Salem and HCGS. Under the coal-fired alternative, the facility would withdraw makeup water from and discharge blowdown (water containing concentrated dissolved solids and biocides) from cooling towers back to the Delaware River, similar to the manner in which the current HCGS cooling tower operates. However, additional cooling towers would be required, so the volume of water managed in cooling towers would increase. At the same time, the once-through cooling system associated with the Salem Units 1 and 2 would cease operation.

In order to replace the 3656 net MWe that Salem and HCGS currently supply, the coal-fired alternative would need to produce roughly 3889 gross MWe, using about 6 percent of power output for onsite power usage (PSEG, 2009a; PSEG, 2009b). Onsite electricity demands include scrubbers, cooling towers, coal-handling equipment, lights, communication, and other onsite needs. A supercritical coal-fired plant equivalent in capacity to Salem and HCGS would require less cooling water than Salem and HCGS because the alternative operates at a higher thermal efficiency. The 3889 gross MWe would be achieved using standard-sized units, which are assumed to be approximately equivalent to six units of 630 MWe each.

The 3656 net MWe power plants would consume approximately 11.1 million metric tons (MT, 12.2 million tons) of coal annually (EPA, 2006). EIA reports that most coal consumed in New Jersey originates in West Virginia or Pennsylvania (EIA, 2010b). Given current coal mining operations in this area, the coal used in this alternative would likely be mined by a combination of strip (mountaintop-removal) mining and underground mining. The coal would be mechanically processed and washed, and transported by barge to the Salem and HCGS facility. Limestone for scrubbers would also likely be delivered by barge. This coal-fired alternative would produce roughly 684,440 MT (753,960 tons) of ash annually (EIA, 2010b), and roughly 222,700 MT (245,300 tons) of scrubber sludge annually (PSEG, 2009a; PSEG, 2009b). Much of the coal ash and scrubbed sludge could be reused depending on local recycling and reuse markets.

The coal-fired alternative would also include construction impacts such as clearing the plant site of vegetation, excavation, and preparing the site surface before other crews begin actual construction of the plant and any associated infrastructure. Because this alternative would be constructed at the Salem and HCGS site, it is unlikely that new transmission lines would be necessary. Because coal would be supplied by barge, no construction of a new rail line would be necessary.

Table 8-1. Summary of Environmental Impacts of the Supercritical Coal-Fired Alternative Compared to Continued Operation of Salem and HCGS

	Supercritical Coal-Fired Generation	Continued Salem and HCGS Operation
Air Quality	MODERATE	SMALL
Groundwater	SMALL	SMALL
Surface Water	SMALL	SMALL
Aquatic and Terrestrial Resources	SMALL to MODERATE	SMALL
Human Health	MODERATE	SMALL
Socioeconomics	SMALL to MODERATE	SMALL
Waste Management	MODERATE	Not Applicable

8.1.1.1 Air Quality

Air quality impacts from coal-fired generation can be substantially increased because these power plants emit significant quantities of sulfur oxides (SOx), nitrogen oxides (NOx), particulates, carbon monoxide (CO), and hazardous air pollutants such as mercury. However, many of these pollutants can be substantially reduced using various pollution control technologies.

Salem and HCGS are located in Salem County, New Jersey. Salem County is designated as an attainment/unclassified area with respect to the National Ambient Air Quality Standards (NAAQSs) for particulate matter 2.5 microns or less in diameter ($PM_{2.5}$), Sulfur dioxide (SO_2), NOx, CO, and lead. The county, along with all of southern New Jersey, is a nonattainment area with respect to the 1-hour primary ozone standard and the 8-hour ozone standard. For the 1-hour ozone standard, Salem County is located within the multi-state Philadelphia-Wilmington-Trenton non-attainment area, and for the 8-hour ozone standard, it is located in the Philadelphia-Wilmington-Atlantic City (PA-NJ-DE-MD) non attainment area.

A new coal-fired generating plant would qualify as a new major-emitting industrial facility and would be subject to Prevention of Significant Deterioration of Air Quality Review under requirements of Clean Air Act (CAA), adopted by the New Jersey Department of Environmental Protection (NJDEP) Bureau of Air Quality Permitting. A new coal-fired generating plant would need to comply with the new source performance standards for coal-fired plants set forth in 40 CFR 60 Subpart Da. The standards establish limits for particulate matter and opacity (40 CFR 60.42(a)), SO_2 (40 CFR 60.43(a)), and NOx (40 CFR 60.44(a)). Regulations issued by NJDEP adopt the EPA's CAA rules (with modifications) to limit power plant emissions of SOx, NOx, particulate matter, and hazardous air pollutants. The new coal-fired generating plant would qualify as a major facility as defined in Section 7:27-22.1 of the New Jersey Administrative Code, and would be required to obtain a major source permit from NJDEP.

Section 169A of the CAA (42 *United States Code* (U.S.C.) 7401) establishes a national goal of preventing future and remedying existing impairment of visibility in mandatory Class I Federal areas when impairment results from man-made air pollution. The EPA issued a new regional haze rule in 1999 (64 *Federal Register* (FR) 35714). The rule specifies that for each mandatory Class I Federal area located within a state, the State must establish goals that provide for reasonable progress towards achieving natural visibility conditions. The reasonable progress goals must provide an improvement in visibility for the most-impaired days over the period of implementation plan and ensure no degradation in visibility for the least-impaired days over the same period (40 CFR 51.308(d)(1)). Five regional planning organizations (RPO) collaborate on the visibility impairment issue, developing the technical basis for these plans. The State of New Jersey is among eleven member states (Maryland, Delaware, New Jersey, Pennsylvania, New York, Connecticut, Rhode Island, Massachusetts, Vermont, New Hampshire, and Maine) of the Mid-Atlantic/Northeast Visibility Union (MANE-VU), along with tribes, Federal agencies, and other interested parties that identifies regional haze and visibility issues and develops strategies to address them (NJDEP, 2009a). The visibility protection regulatory requirements, contained in 40 CFR Part 51, Subpart P, include the review of the new sources that would be constructed in the attainment or unclassified areas and may affect visibility in any Federal Class I area (40 CFR Part 51, Subpart P, §51.307). If a coal-fired plant were located close to a mandatory Class I area, additional air pollution control requirements would be imposed. There is one mandatory Class I Federal area in the State of New Jersey, which is the Brigantine National Wildlife Refuge (40 CFR 81.420), located approximately 58 miles (mi; 93 kilometer [km]) southeast of the Salem and HCGS facilities. There are no Class I Federal areas in Delaware, and no other areas located within 100 miles (161 km) of the facilities (40 CFR 81.400). New Jersey is also subject to the Clean Air Interstate Rule (CAIR), which has outlined emissions reduction goals for both SO_2 and NOx for the year 2015. CAIR will aid New Jersey sources in reducing SO_2 emissions by 23,000 MT (25,000 tons, or 49 percent), and NOx emissions by 10,000 MT (11,000 tons, or 48 percent) (EPA, 2010).

The Staff projects that the coal-fired alternative at the Salem and HCGS site would have the following emissions for criteria and other significant emissions based on published EIA data, EPA emission factors and on performance characteristics for this alternative and likely emission controls:

- Sulfur oxides (SOx) – 11,407 MT (12,566 tons) per year
- Nitrogen oxides (NOx) – 2769 MT (3050 tons) per year
- Particulate matter (PM) PM_{10} – 77.5 MT (85.4 tons) per year
- Particulate matter (PM) $PM_{2.5}$ – 20.5 MT (22.6 tons) per year
- Carbon monoxide (CO) – 2773 MT (3050 tons) per year

Sulfur Oxides

The coal-fired alternative at the Salem and HCGS site would likely use wet, limestone-based scrubbers to remove SOx. The EPA indicates that this technology can remove more than 95 percent of SOx from flue gases. The Staff projects total SOx emissions after scrubbing would be 11,407 MT (12,566 tons) per year. SOx emissions from a new coal-fired power plant would be subject to the requirements of Title IV of the CAA. Title IV was enacted to reduce emissions of SO_2 and NOx, the two principal precursors of acid rain, by restricting emissions of these pollutants from power plants. Title IV caps aggregate annual power plant SO_2 emissions and imposes controls on SO_2 emissions through a system of marketable allowances. The EPA issues one allowance for each ton of SO_2 that a unit is allowed to emit. New units do not receive allowances, but are required to have allowances to cover their SO_2 emissions. Owners of new units must therefore purchase allowances from owners of other power plants or reduce SO_2 emissions at other power plants they own. Allowances can be banked for use in future years. Thus, provided a new coal-fired power plant is able to purchase sufficient allowances to operate, it would not add to net regional SO_2 emissions, although it might do so locally.

Nitrogen Oxides

A coal-fired alternative at the Salem and HCGS site would most likely employ various available NOx-control technologies, which can be grouped into two main categories: combustion modifications and post-combustion processes. Combustion modifications include low-NOx burners, over fire air, and operational modifications. Post-combustion processes include selective catalytic reduction and selective non-catalytic reduction. An effective combination of the combustion modifications and post-combustion processes allow the reduction of NOx emissions by up to 95 percent (EPA, 1998). PSEG indicated in its ER that the technology would use low NOx burners, overfire air, and selective catalytic reduction to reduce NOx emissions by approximately 95 percent from uncontrolled emissions. As a result, the NOx emissions associated with a coal-fired alternative at the Salem and HCGS site would be approximately 2,769 MT (3,050 tons) per year.

Section 407 of the CAA establishes technology-based emission limitations for NOx emissions. A new coal-fired power plant would be subject to the new source performance standards for such plants as indicated in 40 CFR 60.44a(d)(1). This regulation, issued on September 16, 1998 (63 FR 49453), limits the discharge of any gases that contain nitrogen oxides (NO_2) to 200 nanograms (ng) of NOx per joule (J) of gross energy output (equivalent to 1.6 pounds per megawatt hour [lb/MWh]), based on a 30-day rolling average. Based on the projected emissions, the proposed alternative would easily meet this regulation.

Particulates

The new coal-fired power plant would use baghouse-based fabric filters to remove particulates from flue gases. PSEG indicated that this technology would remove 99.9 percent of particulate matter. The EPA notes that filters are capable of removing in excess of 99 percent of particulate matter, and that SO_2 scrubbers further reduce particulate matter emissions (EPA, 2008a). Based on EPA emission factors, the new supercritical coal-fired plant would emit 77.5 MT (85.4 tons) per year of particulate matter having an aerodynamic diameter less than or equal to 10 microns (PM_{10}) annually (EPA, 1998; EIA, 2010b). In addition, coal burning would also result in approximately 20.5 MT (22.6 tons) per year of $PM_{2.5}$. Coal-handling equipment would introduce fugitive dust emissions when fuel is being transferred to onsite storage and then reclaimed from storage for use in the plant. During the construction of a coal-fired plant, onsite activities would also generate fugitive dust. Vehicles and motorized equipment would create exhaust emissions during the construction process. These impacts would be intermittent and short-lived, however, and to minimize dust generation construction crews would use applicable dust-control measures.

Carbon Monoxide

Based on EPA emission factors and assumed plant characteristics, the Staff computed that the total CO emissions would be approximately 2,769 MT (3,050 tons) per year (EPA, 1998).

Hazardous Air Pollutants

Consistent with the D.C. Circuit Court's February 8, 2008 ruling that vacated its Clean Air Mercury Rule (CAMR), the EPA is in the process of developing mercury emissions standards for power plants under the CAA (Section 112) (EPA, 2009a). Before CAMR, the EPA determined that coal-and oil-fired electric utility steam-generating units are significant emitters of hazardous air pollutants (HAPs) (EPA, 2000a). The EPA determined that coal plants emit arsenic, beryllium, cadmium, chromium, dioxins, hydrogen chloride, hydrogen fluoride, lead, manganese, and mercury (EPA, 2000a). The EPA concluded that mercury is the HAP of greatest concern; it further concluded that:

(1) a link exists between coal combustion and mercury emissions

(2) electric utility steam-generating units are the largest domestic source of mercury emissions, and

(3) certain segments of the U.S. population (e.g., the developing fetus and subsistence fish-eating populations) are believed to be at potential risk of adverse health effects resulting from mercury exposures caused by the consumption of contaminated fish (EPA, 2000a).

On February 6, 2009, the Supreme Court dismissed the EPA's request to review the 2008 Circuit Court's decision, and also denied a similar request by the Utility Air Regulatory Group later that month (EPA, 2009a).

Carbon Dioxide

A coal-fired plant would also have unregulated carbon dioxide (CO_2) emissions during operations as well as during mining, processing, and transportation, which the GEIS indicates could contribute to global warming. The coal-fired plant would emit approximately 30,512,000 MT (33,611,000 tons) per year of CO_2.

Summary of Air Quality

While the GEIS analysis mentions global warming from unregulated CO_2 emissions and acid rain from SOx and NOx emissions as potential impacts, it does not quantify emissions from coal-fired power plants. However, the GEIS analysis does imply that air impacts would be substantial (NRC, 1996). The above analysis shows that emissions of air pollutants, including SOx, NOx, CO, and particulates, exceed those produced by the existing nuclear power plant, as well as those of the other alternatives considered in this section. Operational emissions of CO_2 are also much greater under the coal-fired alternative, as reviewed by the Staff in Section 6.2 and in the previous paragraph. Adverse human health effects such as cancer and emphysema have also been associated with air emissions from coal combustion, and are discussed further in Section 8.1.1.5.

The NRC analysis for a coal-fired alternative at the Salem and HCGS site indicates that impacts from the coal-fired alternative would have clearly noticeable effects, but given existing regulatory regimes, permit requirements, and emissions controls, the coal-fired alternative would not destabilize air quality. Therefore, the appropriate characterization of air impacts from coal-fired plant located at Salem and HCGS site would be MODERATE. Existing air quality would result in varying needs for pollution control equipment to meet applicable local requirements, or varying degrees of participation in emissions trading schemes.

8.1.1.2 Groundwater Use and Quality

If the onsite coal-fired alternative continued to use groundwater for drinking water and service water, the need for groundwater at the plant would be minor. Total usage would likely be less than Salem and HCGS because many fewer workers would be onsite, and because the coal-fired unit would have fewer auxiliary systems requiring service water. No effect on groundwater quality would be apparent.

Construction of a coal-fired plant could have a localized effect on groundwater due to temporary dewatering and run-off control measures. Because of the temporary nature of construction and the likelihood of reduced groundwater usage during operation, the impact of the coal-fired alternative would be SMALL.

8.1.1.3 Surface Water Use and Quality

The alternative would require a consumptive use of water from the Delaware River for cooling purposes. Because this consumptive loss would be from an estuary, the NRC concludes the impact of surface water use would be SMALL. A new coal-fired plant would be required to obtain a National Pollutant Discharge and Elimination System (NPDES) permit from the NJDEP for regulation of industrial wastewater, storm water, and other discharges. Assuming the plant operates within the limits of this permit, the impact from any cooling tower blowdown, site runoff, and other effluent discharges on surface water quality would be SMALL.

8.1.1.4 Aquatic and Terrestrial Ecology

Aquatic Ecology

Impacts to aquatic ecology resources from a coal-fired alternative at the Salem and HCGS site could result from effects on water bodies both adjacent to and distant from the site. Temporary effects on some aquatic organisms likely would result from construction that could occur in the water near the shoreline at the facility. Longer-term, more extensive effects on aquatic organisms likely would occur during the period of operation of the facility due to the intake of cooling water and discharge of effluents to the estuary. The numbers of fish and other aquatic organisms affected by impingement, entrainment, and thermal impacts would be substantially smaller than those associated with license renewal. Water consumption from and discharge of blowdown to the Delaware Estuary would be lower due to the higher thermal efficiency of the coal-fired facility and its use of only closed-cycle cooling. In addition, the intake and discharge would be monitored and regulated by the NJDEP under the facility's NPDES permit, including requirements under Clean Water Act (CWA) Section 316(a) and 316(b) for thermal discharges and cooling water intakes, respectively. Assuming the use of closed-cycle cooling and adherence to regulatory requirements, the impact on ecological resources of the Delaware Estuary from operation of the intake and discharge facilities would be minimal for this alternative.

Aquatic resources distant from the site also have the potential to be affected by a coal-fired alternative. Disposal of waste by landfilling offsite could affect the aquatic ecology of water bodies downgradient from the disposal site; however, regulatory requirements for such facilities are expected to minimize or prevent such effects. Aquatic ecology in offsite coal mining areas also could be affected, such as by acid mine drainage, although water bodies in the mining areas are likely to be disturbed already due to ongoing mining operations, and regulatory requirements are expected to limit these impacts. Acid rain resulting from NOx and SOx emissions, as well as the deposition of other pollutants, also could affect the aquatic ecology of water bodies downwind of the site. The emission controls discussed in Section 8.1.1.1 are expected to reduce but not eliminate such effects.

Thus, impacts to aquatic ecology as a result of the effects of facility operations may occur on the adjacent Delaware Estuary as well as more distant effects from waste disposal, coal mining, and air emissions. The coal-fired alternative potentially would have noticeable effects on aquatic resources in multiple areas. Given existing regulatory regimes, permit requirements, and emissions controls, these effects would be limited and unlikely to destabilize aquatic communities. Therefore, the impacts to aquatic resources from a coal-fired plant located at the Salem and HCGS site would be SMALL for the Delaware Estuary but could range from SMALL to MODERATE depending on the extent to which other aquatic resources may be affected.

Terrestrial Ecology

Constructing the coal-fired alternative onsite would require approximately 204 hectares [ha] (505 acres [ac]) of land for construction of the power block with an additional 78–156 ha (193–386 ac) for waste disposal, which PSEG indicated could be accommodated on the existing site (see Section 8.1.1.6) (PSEG, 2009a; PSEG, 2009b). Terrestrial ecology in offsite coal mining areas also could be affected, although some of the land is likely to already be disturbed as a result of ongoing mining operations. Thus, impacts to terrestrial ecology may occur as a result of construction and operational activities both onsite and offsite.

Onsite impacts to terrestrial ecology would be minor because the site is on an artificial island and most of the site has been previously disturbed. If additional roads would need to be constructed through less disturbed areas, impacts would be greater since these construction activities may fragment or destroy local ecological communities. Land disturbances could affect habitats of native wildlife; however, these impacts are not expected to be extensive. Cooling tower operation would produce drift that could result in some deposition of dissolved solids on surrounding vegetation and soils onsite and offsite. Overall, impacts to terrestrial resources at the site would be minimal and limited mostly to the period of construction.

Onsite or offsite waste disposal by landfilling also would affect terrestrial ecology at least until the time when the disposal area is reclaimed. Deposition of acid rain resulting from NOx and SOx emissions, as well as the deposition of other pollutants, also could affect terrestrial ecology. Air deposition impacts may be noticeable but, given the emission controls discussed in Section 8.1.1.1, are unlikely to be destabilizing. Thus, the impacts to terrestrial resources from a coal-fired plant located at the Salem and HCGS site would be SMALL for the area of the site but could range from SMALL to MODERATE depending on the extent to which terrestrial resources at other locations may be affected.

8.1.1.5 Human Health

Coal-fired power plants introduce worker risks from new plant construction, coal and limestone mining, from coal and limestone transportation, and from disposal of coal combustion and scrubber wastes. In addition, there are public risks from inhalation of stack emissions (as addressed in Section 8.1.1.1) and the secondary effects of eating foods grown in areas subject to deposition from plant stacks.

Human health risks of coal-fired power plants are described, in general, in Table 8-2 of the GEIS (NRC, 1996). Cancer and emphysema as a result of the inhalation of toxins and particulates are identified as potential health risks to occupational workers and members of the public (NRC, 1996). The human health risks of coal-fired power plants, both to occupational workers and to members of the public, are greater than those of the current Salem and HCGS facilities due to exposures to chemicals such as mercury; SOx; NOx; radioactive elements such as uranium and thorium contained in coal and coal ash; and polycyclic aromatic hydrocarbon (PAH) compounds, including benzo(a)pyrene.

During construction activities there would be also risk to workers from typical industrial incidents and accidents. Accidental injuries are not uncommon in the construction industry and accidents resulting in fatalities do occur. However, the occurrence of such events is mitigated by the use of proper industrial hygiene practices, worker safety requirements, and training. Occupational and public health impacts during construction are expected to be controlled by continued application of accepted industrial hygiene and occupational health and safety practices.

Regulations restricting emissions—enforced by EPA or State agencies—have acted to significantly reduce potential health effects but have not entirely eliminated them. These agencies also impose site-specific emission limits as needed to protect human health. Even if the coal-fired alternative were located in a nonattainment area, emission controls and trading or offset mechanisms could prevent further regional degradation; however, local effects could be visible. Many of the byproducts of coal combustion responsible for health effects are largely controlled, captured, or converted in modern power plants (as described in Section 8.1.1.1), although some level of health effects may remain.

Aside from emission impacts, the coal-fired alternative introduces the risk of coal pile fires and, for those plants that use coal combustion liquid and sludge waste impoundments, the release of the waste due to a failure of the impoundment. Although there have been several instances of this occurring in recent years, these types of events are still relatively rare.

Based on the cumulative potential impacts of construction activities, emissions, and materials management on human health, the NRC staff considers the overall impact of constructing and operating a new coal-fired facility to be MODERATE.

8.1.1.6 Socioeconomics

Land Use

The GEIS generically evaluates the impacts of nuclear power plant operations on land use both on and off each power plant site. The analysis of land use impacts focuses on the amount of land area that would be affected by the construction and operation of a new supercritical coal-fired power plant on the Salem and HCGS site.

The GEIS indicates that an estimated 700 ha, (1,700 ac) would be required for constructing a 1,000-MW(e) coal plant. Scaling from the GEIS estimate, approximately 2,523 ha (6,233 ac) would be required to replace the 3,660 MW(e) provided by Salem and HCGS. PSEG indicated that approximately 204 ha (505 ac) of land would be needed to support the power block for a coal-fired alternative capable of replacing the Salem and HCGS facilities (PSEG, 2009a; PSEG, 2009b). The Staff notes that many coal-fired power plants with larger capacities have been located on smaller sites, and believes that the PSEG estimate is reasonable. PSEG indicated that an additional 78 ha (193 ac) of land area may be needed for waste disposal over the 20-year license renewal term, or 156 ha (386 ac) over the 40-year operational life of a coal-fired alternative, which PSEG indicated could be accommodated onsite (PSEG, 2009a), (PSEG, 2009b).

Offsite land use impacts would occur from coal mining, in addition to land use impacts from the construction and operation of the new power plant. In the GEIS, the Staff estimated that supplying coal to a 1,000-MW(e) plant would disturb approximately 8,900 ha (22,000 ac) of land for mining the coal and disposing of the wastes during the 40-year operational life. Scaling from GEIS estimates, approximately 80,500 ac (32,580 ha) of land would be required for a coal-fired alternative to replace Salem and HCGS. However, most of the land in existing coal-mining areas has already experienced some level of disturbance. The elimination of the need for uranium mining to supply fuel for the Salem and HCGS facilities would partially offset this offsite land use impact. In the GEIS, the Staff estimated that approximately 1,480 ha (3,660 ac) of land would be affected by the mining and processing of uranium over the operating life of a plant with the capacity of Salem and HCGS.

Based on this information, land use impacts would be MODERATE.

Socioeconomics

Socioeconomic impacts are defined in terms of changes to the demographic and economic characteristics and social conditions of a region. For example, the number of jobs created by the construction and operation of a new coal-fired power plant could affect regional employment, income, and expenditures. Two types of job creation result from this alternative: (1) construction-related jobs, and (2) operation-related jobs in support of power plant operations, which have the greater potential for permanent, long-term socioeconomic impacts. The Staff estimated workforce requirements during power plant construction and operation for the coal-fired alternative in order to measure their possible effect on current socioeconomic conditions.

The GEIS projects a peak construction workforce of 1,200 to 2,500 for a 1,000 MW(e) plant (when extrapolated, a lower-end workforce of approximately 4,400 for a 3,660-MW(e) plant). PSEG projected a peak workforce of about 5,660 required to construct the coal-fired alternative at the Salem and HCGS site (PSEG 2009a; PSEG, 2009b). During the construction period, the communities surrounding the plant site would experience increased demand for rental housing and public services. The relative economic contributions of these relocated workers to local business and tax revenues would vary over time.

After construction, local communities could be temporarily affected by the loss of construction jobs and associated loss in demand for business services. In addition, the rental housing market could experience increased vacancies and decreased prices. As noted in the GEIS, the socioeconomic impacts at a rural construction site could be larger than at an urban site, because the workforce would need to relocate closer to the construction site. Although the ER indicates that Salem and HCGS is a rural site (PSEG, 2009a; PSEG, 2009b), it is located near the Philadelphia and Wilmington metropolitan areas. Therefore, these effects may be somewhat lessened because workers are likely to commute to the site from these areas instead of relocating closer to the construction site. Based on the site's proximity to these metropolitan areas, construction impacts would be SMALL.

PSEG estimated an operational workforce of approximately 500 workers for the 3,660 MWe alternative (PSEG, 2009a; PSEG 2009b). The area would experience a loss of approximately 1,100 permanent, relatively high-paying jobs (based on a current Salem and HCGS workforce of 1,614), with a corresponding reduction in purchasing activity and tax contributions to the regional economy. The impact of the job loss is, however, expected to be SMALL given the relatively large area from which Salem and HCGS personnel are currently drawn and the extensive timeframe over which construction of a new plant and decommissioning of the existing facility would occur. The coal-fired alternative would provide a new tax base in Lower Alloways Creek Township and Salem County to offset the loss of taxes that would occur assuming Salem and HCGS are decommissioned. While it is difficult to estimate the impact of this scenario on Lower Alloways Creek Township and Salem County resources, it would not be unreasonable to assume that, on balance, the township's and county's tax base would not be significantly altered and that resulting impacts could be best characterized as SMALL to MODERATE.

Transportation

During construction, up to 5,660 workers would be commuting to the site, as well as the current 1,614 workers already at Salem and HCGS. In addition to commuting workers, trucks would transport construction materials and equipment to the worksite, increasing the amount of traffic on local roads. The increase in vehicular traffic on roads would peak during shift changes, resulting in temporary level of service impacts and delays at intersections. Barges would likely be used to deliver large components to the Salem and HCGS site. Transportation impacts are likely to be MODERATE during construction.

Transportation impacts would be greatly reduced after construction, but would not disappear during plant operations. The maximum number of plant operating personnel commuting to the Salem and HCGS site would be approximately 500 workers. Deliveries of coal and limestone would be by barge. The coal-fired alternative would likely create SMALL transportation impacts during plant operations.

Aesthetics

The aesthetics impact analysis focuses on the degree of contrast between the coal-fired alternative and the surrounding landscape and the visibility of the coal plant.

The coal-fired alternative would have boiler houses up to 200 feet (61 meters [m]) tall with exhaust stacks up to 500 feet (152 m) and would be visible offsite in daylight hours. The coal-fired plant would be similar in height to the current Salem and HCGS reactor containment buildings (190 to 200 feet, or 58 to 61 m, tall) and the HCGS cooling tower, which stands at 514 feet (157 m). The coal-fired alternative would require the use of multiple cooling towers instead of the current one tower, thus increasing the size of the condensate plume. Lighting on plant structures would be visible offsite at night. Overall, aesthetic impacts associated with the coal-fired alternative would likely be SMALL to MODERATE.

Coal-fired generation would introduce mechanical sources of noise that would be audible offsite, although given the low population near the plant's periphery, nuisance impacts are not expected. Sources contributing to total noise produced by plant operation would be classified as continuous or intermittent. Continuous sources include the mechanical equipment associated with normal plant operations. Intermittent sources include the equipment related to coal handling, solid-waste disposal, use of outside loudspeakers, and the commuting of plant employees. The nuisance impacts of plant noise emissions are expected to be SMALL due to the large area encompassed by the Salem and HCGS site and the fact that sensitive land uses do not occur in the immediate plant vicinity.

Historic and Archaeological Resources

Before construction at the Salem and HCGS site studies would likely be needed to identify, evaluate, and address mitigation of potential impacts of new plant construction on cultural resources. Studies would be needed for all areas of potential disturbance at the proposed plant site and along associated corridors where construction would occur (e.g., roads, transmission corridors, rail lines, or other Right-of-Ways [ROWs]). Areas with the greatest sensitivity should be avoided.

As noted in Section 4.9.6, there is little potential for historic and archaeological resources to be present on most of the Salem and HCGS site; therefore, the impact for a coal-fired alternative at the Salem and HCGS site would likely be SMALL.

Environmental Justice

The environmental justice impact analysis evaluates the potential for disproportionately high and adverse human health and environmental effects on minority and low-income populations that could result from the construction and operation of a new coal-fired power plant. Adverse health effects are measured in terms of the risk and rate of fatal or nonfatal adverse impacts on human health. Disproportionately high and adverse human health effects occur when the risk or rate of exposure to an environmental hazard for a minority or low-income population is significant and exceeds the risk or exposure rate for the general population or for another appropriate comparison group. For socioeconomic data regarding the analysis of environmental justice issues, the reader is referred to Section 4.9.7, Environmental Justice.

No environmental or human health impacts were identified that would result in disproportionately high and adverse environmental impacts on minority and low-income populations if a replacement coal-fired plant were built at the Salem and HCGS site. Some impacts on rental and other temporary housing availability and lease prices during construction might occur, and this could disproportionately affect low-income populations. Although the site is located in a rural area, it is near the Philadelphia and Wilmington metropolitan areas. Therefore, the demand for rental housing would be mitigated because workers would be likely to commute to the site from these areas instead of relocating closer to the construction site. Thus, the impact on minority and low-income populations would be SMALL.

8.1.1.7 Waste Management

Coal combustion generates several waste streams including ash (a dry solid) and sludge (a semi-solid byproduct of emission control system operation). The Staff estimates that an approximately 3,656 MWe power plant comprised of six units of approximately 630 MWe each would generate annually a total of approximately 684,440 MT (753,960 tons) of ash (EIA, 2010b), and 222,700 MT (245,300 tons) of scrubber sludge (PSEG, 2009a; PSEG, 2009b) About 309,000MT (340,000 tons) or 45 percent of the ash waste and 176,000 MT(193,800 tons) or 79 percent of scrubber sludge would be recycled, based on industry-average recycling rates (ACAA, 2007). Therefore, approximately 375,000 MT (414,000 tons) of ash and 467,000 MT (51,500 tons) of scrubber sludge would remain annually for disposal. Disposal of the remaining waste could noticeably affect land use and groundwater quality, but would require proper citing in accordance with the describe local ordinance and the implementation of the required monitoring and management practices in order to minimize these impacts (state reference). After closure of the waste site and revegetation, the land could be available for other uses.

In May 2000, the EPA issued a "Notice of Regulatory Determination on Wastes from the Combustion of Fossil Fuels" (EPA, 2000b) stating that it would issue regulations for disposal of coal combustion waste under Subtitle D of the Resource Conservation and Recovery Act. The EPA has not yet issued these regulations.

The impacts from waste generated during operation of this coal-fired alternative would be clearly visible, but would not destabilize any important resource.

The amount of the construction waste would be small compared to the amount of waste generated during operational stage and much of it could be recycled. Overall, the impacts from waste generated during construction stage would be minor.

Therefore, the Staff concludes that the overall impacts from construction and operation of this alternative would be MODERATE.

8.1.2 Natural Gas-fired Combined-Cycle Generation

In this section, the Staff evaluates the environmental impacts of a natural gas-fired combined-cycle generation plant at the Salem and HCGS site.

Natural gas fueled 21.4 percent of electric generation in the US in 2008 (the most recent year for which data are available); this accounted for the second greatest share of electrical power after coal (EIA, 2010a). Like coal-fired power plants, natural gas-fired plants may be affected by perceived or actual actions to limit GHG emissions; they produce markedly lower GHG emissions per unit of electrical output than coal-fired plants. Natural gas-fired power plants are feasible and provide commercially available options for providing electrical generating capacity beyond Salem and HCGS's current license expiration dates.

Combined-cycle power plants differ significantly from coal-fired and existing nuclear power plants. They derive the majority of their electrical output from a gas-turbine cycle, and then generate additional power—without burning any additional fuel—through a second, steam-turbine cycle. The first, gas turbine stage (similar to a large jet engine) burns natural gas that turns a driveshaft that powers an electric generator. The exhaust gas from the gas turbine is still hot enough, however, to boil water into steam. Ducts carry the hot exhaust to a heat recovery steam generator, which produces steam to drive a steam turbine and produce additional electrical power. The combined-cycle approach is significantly more efficient than any one cycle on its own; thermal efficiency can exceed 60 percent. Since the natural gas-fired alternative derives much of its power from a gas turbine cycle, and because it wastes less heat than either the coal-fired alternative or the existing Salem and HCGS, it requires significantly less cooling.

In order to replace the 3,656 MWe that Salem and HCGS currently supply, the Staff selected a gas-fired alternative that uses nine GE STAG 107H combined-cycle generating units. While any number of commercially available combined-cycle units could be installed in a variety of combinations to replace the power currently produced by Salem and HCGS, the STAG 107H is a highly efficient model that would help minimize environmental impacts (GE, 2001). Other manufacturers, like Siemens, offer similarly high efficiency models. This gas-fired alternative produces a net 400 MWe per unit. Nine units would produce a total of 3600 MWe, or nearly the same output as the existing Salem and HCGS plants.

The combined-cycle alternative operates at a heat rate of 5,687 btu/kWh, or about 60 percent thermal efficiency (GE, 2001). Allowing for onsite power usage, including cooling towers and site lighting, the gross output of these units would be roughly 3,744 MWe. As noted above, this gas-fired alternative would require much less cooling water than Salem and HCGS because it operates at a higher thermal efficiency and because it requires much less water for steam cycle condenser cooling. This alternative would likely make use of the site's existing natural draft cooling tower, but may require the construction of an additional tower.

In addition to the already existing natural draft cooling tower, other visible structures onsite would include the turbine buildings, two exhaust stacks, an electrical switchyard, and, possibly, equipment associated with a natural gas pipeline, like a compressor station. The GEIS estimates indicate that this 3,600 MWe plant would require 166 ha (409 ac), which would be feasible on the 599 ha (1,480 ac) PSEG site.

This 3600 MWe power plant would consume 161.65 billion cubic feet (ft^3) (4,578 million cubic meters [m^3]) of natural gas annually assuming an average heat content of 1,029 btu/ft^3 (EIA, 2009b). Natural gas would be extracted from the ground through wells, then treated to remove impurities (like hydrogen sulfide), and blended to meet pipeline gas standards, before being piped through the interstate pipeline system to the power plant site. This gas-fired alternative would produce relatively little waste, primarily in the form of spent catalysts used for emissions controls.

Environmental impacts from the gas-fired alternative would be greatest during construction. The closest natural gas pipeline that could serve as a source of natural gas for the plant is located in Logan Township, approximately 25 miles (40 km) from the Salem and HCGS facilities (PSEG, 2010). Site crews would clear vegetation from the site, prepare the site surface, and begin excavation before other crews begin actual construction on the plant and any associated infrastructure, including the 25-mile (40 Km) pipeline spur to serve the plant and electricity transmission infrastructure connecting the plant to existing transmission lines. Constructing the gas-fired alternative on the Salem and HCGS site would allow the gas-fired alternative to make use of the existing electric transmission system.

Table 8-2. Summary of Environmental Impacts of the Natural Gas Combined-Cycle Generation Alternative Compared to Continued Operation of Salem and HCGS

	Natural Gas Combined-Cycle Generation	Continued Salem and HCGS Operation
Air Quality	SMALL to MODERATE	SMALL
Groundwater	SMALL	SMALL
Surface Water	SMALL	SMALL
Aquatic and Terrestrial Resources	SMALL	SMALL
Human Health	SMALL	SMALL
Socioeconomics	SMALL to MODERATE	SMALL
Waste Management	SMALL	Not Applicable

8.1.2.1 Air Quality

Salem and HCGS are located in Salem County, New Jersey. Salem County is designated as an attainment/unclassified with respect to the NAAQSs for $PM_{2.5}$, SO_2, NOx, CO, and lead. The county, along with all area southern New Jersey, is a nonattainment area with respect to the 1-hour primary ozone standard and the 8-hour ozone standard. For the 1-hour ozone standard, Salem County is located within the multi-state Philadelphia-Wilmington-Trenton non-attainment area, and for the 8-hour ozone standard, it is located in the Philadelphia-Wilmington-Atlantic City (PA-NJ-DE-MD) non attainment area.

A new gas-fired generating plant would qualify as a new major-emitting industrial facility and would be subject to Prevention of Significant Deterioration of Air Quality Review under requirements of CAA, adopted by the NJDEP Bureau of Air Quality Permitting. The natural gas-fired plant would need to comply with the standards of performance for stationary gas turbines set forth in 40 CFR Part 60 Subpart GG. Regulations issued by NJDEP adopt the EPA's CAA rules (with modifications) to limit power plant emissions of SOx, NOx, particulate matter, and hazardous air pollutants. The new gas-fired generating plant would qualify as a major facility as defined in Section 7:27-22.1 of the New Jersey Administrative Code, and would be required to obtain a major source permit from NJDEP.

Section 169A of the CAA (42 U.S.C. 7401) establishes a national goal of preventing future and remedying existing impairment of visibility in mandatory Class I Federal areas when impairment results from man-made air pollution. The EPA issued a new regional haze rule in 1999 (64 FR 35714). The rule specifies that for each mandatory Class I Federal area located within a state, the State must establish goals that provide for reasonable progress towards achieving natural visibility conditions. The reasonable progress goals must provide an improvement in visibility for the most-impaired days over the period of implementation plan and ensure no degradation in visibility for the least-impaired days over the same period (40 CFR 51.308(d)(1)). Five RPO collaborate on the visibility impairment issue, developing the technical basis for these plans. The State of New Jersey is among eleven member states (Maryland, Delaware, New Jersey, Pennsylvania, New York, Connecticut, Rhode Island, Massachusetts, Vermont, New Hampshire, and Maine) of the MANE-VU, along with tribes, Federal agencies, and other interested parties that identifies regional haze and visibility issues and develops strategies to address them (NJDEP, 2009a). The visibility protection regulatory requirements, contained in 40 CFR Part 51, Subpart P, include the review of the new sources that would be constructed in the attainment or unclassified areas and may affect visibility in any Federal Class I area (40 CFR Part 51, Subpart P, §51.307). If a gas-fired plant were located close to a mandatory Class I area, additional air pollution control requirements would be imposed. There is one mandatory Class I Federal areas in the State of New Jersey, which is the Brigantine National Wildlife Refuge (40 CFR 81.420), located approximately 58 mi (93 km) southeast of the Salem and HCGS facilities. There are no Class I Federal areas in Delaware, and no other area located within 100 mi (161 km) of the facilities (40 CFR 81.400). New Jersey is also subject to the CAIR, which has outlined emissions reduction goals for both SO_2 and NOx for the year 2015. CAIR will aid New Jersey sources in reducing SO_2 emissions by 23,000 MT (25,000 tons or 49 percent), and NOx emissions by 10,000 MT (11,000 tons or 48 percent) (EPA 2010).

The Staff projects the following emissions for a gas-fired alternative based on data published by the EIA, the EPA, and on performance characteristics for this alternative and its emissions controls:

- Sulfur oxides (SOx) – 48 MT (53 tons) per year
- Nitrogen oxides (NOx) – 846 MT (932 tons) per year
- Carbon monoxide (CO) – 175 MT (193 tons) per year
- Total suspended particles (TSP) – 147 MT (162 tons) per year
- Particulate matter (PM) PM_{10} – 147 MT (162 tons) per year
- Carbon dioxide (CO_2) – 8,500,000 MT (9,400,000 tons) per year

Sulfur and Nitrogen Oxides

As stated above, the new natural gas-fired alternative would produce 48 MT (53 tons) per year of SOx (assumed to be all SO_2) (EPA, 2000c; INGAA, 2000) and 846 MT (932 tons) per year of NOx based on the use of the dry low NOx combustion technology and use of the selective catalytic reduction (SCR) in order to significantly reduce NOx emissions (INGAA, 2000). The new plant would be subjected to the continuous monitoring requirements of SO_2, NO_x and CO_2 specified in 40 CFR Part 75. A new natural gas-fired plant would have to comply with Title IV of the CAA reduction requirements for SO_2 and NOx, which are the main precursors of acid rain and the major cause of reduced visibility. Title IV establishes maximum SO_2 and NOx emission rate from the existing plants and a system of the SO_2 emission allowances that can be used, sold or saved for future use by new plants.

Particulates

Based on EPA emission factors (EPA, 2000c), the new natural gas-fired alternative would produce 147 MT (162 tons) per year of TSP, all of which would be emitted as PM_{10}.

Carbon Monoxide

Based on EPA emission factors (EPA, 2000c), the Staff estimates that the total CO emissions would be approximately 175 MT (193 tons) per year.

Hazardous Air Pollutants

The EPA issued in December 2000 regulatory findings (EPA, 2000a) on emissions of hazardous air pollutants from electric utility steam-generating units, which identified that natural gas-fired plants emit hazardous air pollutants such as arsenic, formaldehyde and nickel and stated that

> . . . the impacts due to HAP emissions from natural gas-fired electric utility steam generating units were negligible based on the results of the study. The Administrator finds that regulation of HAP emissions from natural gas-fired electric utility steam generating units is not appropriate or necessary.

Carbon Dioxide

The new plant would be subjected to the continuous monitoring requirements of SO_2, NO_x and CO_2 specified in 40 CFR Part 75. The Staff computed that the natural gas-fired plant would emit approximately 8.5 million MT (9.4 million tons) per year of unregulated CO_2 emissions. In response to the Consolidated Appropriations Act of 2008, the EPA has proposed a rule that requires mandatory reporting of GHG emissions from large sources that would allow collection of accurate and comprehensive emissions data to inform future policy decisions (EPA, 2009b). The EPA proposes that suppliers of fossil fuels or industrial GHGs, manufacturers of vehicles and engines, and facilities that emit 25,000 MT or more per year of GHG emissions submit annual reports to the EPA. The gases covered by the proposed rule are CO_2, methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFC), perfluorocarbons (PFC), sulfur hexafluoride (SF_6), and other fluorinated gases including nitrogen trifluoride (NF_3) and hydrofluorinated ethers (HFE).

Construction Impacts

Activities associated with the construction of the new natural gas-fired plant at the Salem and HCGS site would cause some additional air effects as a result of equipment emissions and fugitive dust from operation of the earth-moving and material handling equipment. Workers' vehicles and motorized construction equipment would generate temporary exhaust emissions. The construction crews would employ dust-control practices in order to control and reduce fugitive dust, which would be temporary in nature. The Staff concludes that the impact of vehicle exhaust emissions and fugitive dust from operation of earth-moving and material handling equipment would be SMALL.

The overall air-quality impacts of a new natural gas-fired plant located at the Salem and HCGS site would be SMALL to MODERATE.

8.1.2.2 Groundwater Use and Quality

The use of groundwater for a natural gas-fired combined-cycle plant would likely be limited to supply wells for drinking water and possibly filtered service water for system cleaning purposes. Total usage would likely be much less than Salem and HCGS because many fewer workers would be onsite, and because the gas-fired alternative would have fewer auxiliary systems requiring service water.

No effects on groundwater quality would be apparent except during the construction phase due to temporary dewatering and run-off control measures. Because of the temporary nature of construction and the likelihood of reduced groundwater usage during operation, the impact of the natural gas-fired alternative would be SMALL.

8.1.2.3 Surface Water Use and Quality

The alternative would require a consumptive use of water from the Delaware River for cooling purposes. Because this consumptive loss would be from an estuary, the NRC concludes the impact of surface water use would be SMALL. A new natural gas-fired plant would be required to obtain an NPDES permit from the NJDEP for regulation of industrial wastewater, storm water, and other discharges. Assuming the plant operates within the limits of this permit, the impact from any cooling tower blowdown, site runoff, and other effluent discharges on surface water quality would be SMALL.

8.1.2.4 Aquatic and Terrestrial Ecology

Aquatic Ecology

Compared to the existing Salem and HCGS facilities, impacts on aquatic ecology from the onsite, gas-fired alternative would be substantially smaller because the combined-cycle plant would inject significantly less heat to the environment and require less water. The numbers of fish and other aquatic organisms affected by impingement, entrainment, and thermal impacts would be smaller than those associated with license renewal because water consumption and blowdown discharged to the Delaware Estuary would be substantially lower. Some temporary impacts on aquatic organisms may occur due to construction. Longer-term effects could result from effluents discharged to the river. However, NRC assumes that the appropriate agencies would monitor and regulate such activities. The number of organisms affected by impingement, entrainment, and thermal effects of this alternative would be substantially less than for license renewal, so NRC expects that the levels of impact for the natural gas alternative would be SMALL.

Terrestrial Ecology

Constructing the natural gas alternative would require approximately 52 ha (128 ac) of land according to PSEG estimates (PSEG, 2009a; PSEG, 2009b). Scaling from the GEIS estimate, approximately 161 ha (396 ac) would be required to replace the 3,600 MW(e) provided by Salem and HCGS. These land disturbances are the principal means by which this alternative would affect terrestrial ecology.

Onsite impacts to terrestrial ecology would be minor because the site is on an artificial island and most of the site has been previously disturbed. If additional roads would need to be constructed through less disturbed areas, impacts would be greater as these construction activities may fragment or destroy local ecological communities. Land disturbances could affect habitats of native wildlife; however, these impacts are not expected to be extensive. Gas extraction and collection would also affect terrestrial ecology in offsite gas fields, although much of this land is likely already disturbed by gas extraction, and the incremental effects of this alternative on gas field terrestrial ecology are difficult to gauge.

Construction of the nine natural-gas-fired units could entail some loss of native wildlife habitats; however, these impacts are not expected to be extensive. If new roads were required to be constructed through less disturbed areas, this activity could fragment or destroy local ecological communities, thereby increasing impacts. Operation of the cooling tower would cause some deposition of dissolved solids on surrounding vegetation (including wetlands) and soils from cooling tower drift. Overall, impacts to terrestrial resources at the site would be minimal and limited mostly to the construction period. Construction of the 25-mi (40 Km) gas pipeline (to the nearest assumed tie-in) could lead to further disturbance to undeveloped areas. However, PSEG indicated that the pipeline would be routed along existing, previously disturbed rights-of-way and would not be expected to impact terrestrial species. Because of the relatively small potential for undisturbed land to be affected, impacts from construction of the pipeline are expected to be minimal.

Based on this information, impacts to terrestrial resources from the onsite, gas-fired alternative would be SMALL.

8.1.2.5 Human Health

Like the coal-fired alternative discussed above, a gas-fired plant would emit criteria air pollutants, but in smaller quantities (except NOx, which requires additional controls to reduce emissions). Human health effects of gas-fired generation are generally low, although in Table 8-2 of the GEIS (NRC, 1996), the Staff identified cancer and emphysema as potential health risks from gas-fired plants. NOx emissions contribute to ozone formation, which in turn contributes to human health risks. Emission controls on this gas-fired alternative maintain NOx emissions well below air quality standards established for the purposes of protecting human health, and emissions trading or offset requirements mean that overall NOx in the region would not increase. Health risks to workers may also result from handling spent catalysts from NOx emission control equipment that may contain heavy metals.

During construction activities there would be a risk to workers from typical industrial incidents and accidents. Accidental injuries are not uncommon in the construction industry, and accidents resulting in fatalities do occur. However, the occurrence of such events is mitigated by the use of proper industrial hygiene practices, worker safety requirements, and training. Occupational and public health impacts during construction are expected to be controlled by continued application of accepted industrial hygiene and occupational health and safety practices. Fewer workers would be on site for a shorter period of time to construct a gas-fired plant that other new power generation alternatives, and so exposure to occupational risks tends to be lower than other alternatives.

Overall, human health risks to occupational workers and to members of the public from gas-fired power plant emissions sited at the Salem and HCGS site would be less than the risks described for coal-fired alternative and therefore, would likely be SMALL.

8.1.2.6 Socioeconomics

Land Use

As discussed in Section 8.1.1.6, the GEIS generically evaluates the impacts of nuclear power plant operations on land use both on and off each power plant site. The analysis of land use impacts focuses on the amount of land area that would be affected by the construction and operation of a nine-unit natural gas-fired combined-cycle power plant at the Salem and HCGS site.

Based on GEIS estimates, PSEG indicated that approximately 52 ha (128 ac) of land would be needed to support a natural gas-fired alternative to replace Salem and HCGS (PSEG 2009a; PSEG, 2009b). Scaling from the GEIS estimate, approximately 161 ha (396 ac) would be required to replace the 3,600 MW(e) provided by Salem and HCGS. This amount of onsite land use would include other plant structures and associated infrastructure. Onsite land use impacts from construction would be SMALL.

In addition to onsite land requirements, land would be required offsite for natural gas wells and collection stations. Scaling from GEIS estimates, approximately 5,200 ha (12,960 ac) would be required for wells, collection stations, and a 25-mi (40 Km) pipeline spur to bring the gas to the plant. Most of this land requirement would occur on land where gas extraction already occurs. In addition, some natural gas could come from outside of the United States and be delivered as liquefied gas.

The elimination of uranium fuel for the Salem and HCGS facilities could partially offset offsite land requirements. Scaling from GEIS estimates, the Staff estimated that approximately 1,480 ha (3,660 ac) would not be needed for mining and processing uranium during the 40-year operating life of the plant. Overall land use impacts from a gas-fired power plant would be SMALL to MODERATE.

Socioeconomics

Socioeconomic impacts are defined in terms of changes to the demographic and economic characteristics and social conditions of a region. For example, the number of jobs created by the construction and operation of a new natural gas-fired power plant could affect regional employment, income, and expenditures. Two types of job creation would result: (1) construction-related jobs, which are transient, short in duration, and less likely to have a long-term socioeconomic impact; and (2) operation-related jobs in support of power plant operations, which have the greater potential for permanent, long-term socioeconomic impacts. Staff evaluated workforce requirements for construction and operation of the natural gas-fired power plant alternative in order to measure their possible effect on current socioeconomic conditions.

While the GEIS estimates a peak construction workforce of 4,320, PSEG projected a maximum construction workforce of 2,920 (PSEG 2009a; PSEG, 2009b). During construction, the communities surrounding the power plant site would experience increased demand for rental housing and public services. The relative economic effect of construction workers on local economy and tax base would vary over time.

After construction, local communities could be temporarily affected by the loss of construction jobs and associated loss in demand for business services, and the rental housing market could experience increased vacancies and decreased prices. As noted in the GEIS, the socioeconomic impacts at a rural construction site could be larger than at an urban site, because the workforce would have to move to be closer to the construction site. Although the ER identifies the Salem and HCGS site as a primarily rural site (PSEG, 2009a; PSEG, 2009b), it is located near the Philadelphia and Wilmington metropolitan areas. Therefore, these effects would likely be lessened because workers are likely to commute to the site from these areas instead of relocating closer to the construction site. Because of the site's proximity to these highly populated areas, the impact of construction on socioeconomic conditions would be SMALL.

PSEG estimated a power plant operations workforce of approximately 132 (PSEG, 2009a), (PSEG, 2009b). Scaling from GEIS estimates of an operational workforce of 150 employees for a 1,000-MW(e) gas-fired plant, 540 workers would be required to replace the 3600 MW(e) provided by Salem and HCGS. The PSEG estimate appears reasonable and is consistent with trends toward lowering labor costs by reducing the size of power plant operations workforces. The area would experience a loss of approximately 1,074 to 1,482 permanent, relatively high-paying jobs (based on a current Salem and HCGS workforce of 1,614), with a corresponding reduction in purchasing activity and tax contributions to the regional economy. The impact of the job loss is, however, expected to be SMALL given the relatively large area from which Salem and HCGS personnel are currently drawn and the extensive timeframe over which construction of a new plant and decommissioning of the existing facility would occur. The gas-fired alternative would provide a new tax base in Lower Alloways Creek Township and Salem County to offset the loss of taxes that would occur assuming Salem and HCGS are decommissioned. While it is difficult to estimate the impact of this scenario on Lower Alloways Creek Township and Salem County resources, it would not be unreasonable to assume that, on balance, the township's and county's tax base would not be significantly altered and that resulting impacts could be best characterized as SMALL to MODERATE.

Transportation

Transportation impacts associated with construction and operation of a nine-unit gas-fired power plant would consist of commuting workers and truck deliveries of construction materials to the Salem and HCGS site. During construction, a peak workforce of between 2,920 and 4,320 workers would be commuting to the site, as well as the current 1,614 workers already at Salem and HCGS. In addition to commuting workers, trucks would transport construction materials and equipment to the worksite, increasing the amount of traffic on local roads. The increase in vehicular traffic would peak during shift changes, resulting in temporary level of service impacts and delays at intersections. Some large plant components would likely be delivered by barge. Pipeline construction and modification to existing natural gas pipeline systems could also have an impact on local traffic. Transportation impacts are likely to be MODERATE during construction.

During plant operations, transportation impacts would be greatly reduced. According to PSEG, approximately 132 workers would commute to the Salem and HCGS site to operate the gas-fired power plant. Fuel for the plant would be transported by pipeline. The transportation infrastructure would experience little to no increased use from plant operations. The gas-fired alternative would have a SMALL impact on transportation conditions in the region around the Salem and HCGS site during plant operations.

Aesthetics

The aesthetics impact analysis focuses on the degree of contrast between the natural gas-fired alternative and the surrounding landscape and the visibility of the gas-fired plant.

The nine gas-fired units would be approximately 100 feet (30 m) tall, with an exhaust stack up to 200 feet (61 m) and may be visible offsite in daylight hours. However, the gas-fired plant would be shorter than the existing HCGS cooling tower, which stands at 514 feet (157 m). This alternative would likely make use of the site's existing natural draft cooling tower. The mechanical draft tower would generate a condensate plume, which would be no more noticeable than the existing HCGS plume. Noise and light from plant operations, as well as lighting on plant structures, would be detectable offsite. Pipelines delivering natural gas fuel could be audible offsite near gas compressors.

In general, aesthetic impacts associated with the gas-fired alternative would likely be SMALL to MODERATE and noise impacts would likely be SMALL.

Historic and Archaeological Resources

Before construction at the Salem and HCGS site, studies would likely be needed to identify, evaluate, and address mitigation of potential impacts of new plant construction on cultural resources. Studies would be needed for all areas of potential disturbance at the proposed plant site and along associated corridors where construction would occur (e.g., roads, transmission corridors, rail lines, or other ROWs). Areas with the greatest sensitivity should be avoided.

As noted in Section 4.9.6, there is little potential for historic and archaeological resources to be present on most of the Salem and HCGS site; therefore, the impact for a natural gas-fired alternative at the Salem and HCGS site would likely be SMALL.

Environmental Justice

The environmental justice impact analysis evaluates the potential for disproportionately high and adverse human health and environmental effects on minority and low-income populations that could result from the construction and operation of a new natural gas-fired power plant. Adverse health effects are measured in terms of the risk and rate of fatal or nonfatal adverse impacts on human health. Disproportionately high and adverse human health effects occur when the risk or rate of exposure to an environmental hazard for a minority or low-income population is significant and exceeds the risk or exposure rate for the general population or for another appropriate comparison group. For socioeconomic data regarding the analysis of environmental justice issues, the reader is referred to Section 4.9.7, Environmental Justice.

No environmental or human health impacts were identified that would result in disproportionately high and adverse environmental impacts on minority and low-income populations if a replacement gas-fired plant were built at the Salem and HCGS site. Some impacts on rental and other temporary housing availability and lease prices during construction might occur, and this could disproportionately affect low-income populations. Although the site is located in a rural area, it is near the Philadelphia and Wilmington metropolitan areas. Therefore, the demand for rental housing would be mitigated because workers would be likely to commute to the site from these areas instead of relocating closer to the construction site. Thus, the impact on minority and low-income populations would be SMALL.

8.1.2.7 Waste Management

During the construction phase of this alternative, land clearing and other construction activities would generate waste that can be recycled, disposed onsite or shipped to an offsite waste disposal facility. Because the alternative would be constructed on the previously disturbed Salem and HCGS site, the amounts of wastes produced during land clearing would be reduced.

During the operational stage, spent SCR catalysts used to control NOx emissions from the natural gas-fired plants would make up the majority of the waste generated by this alternative. This waste would be disposed of according to applicable Federal and state regulations.

The Staff concluded in the GEIS (NRC, 1996), that a natural gas-fired plant would generate minimal waste and the waste impacts would be SMALL for a natural gas-fired alternative located at the Salem and HCGS site.

8.1.3 Combination Alternative

Even though individual alternatives to license renewal might not be sufficient on their own to replace the 3,656 MW(e) total capacity of Salem and HCGS because of the lack of resource availability, technical maturity, or regulatory barriers, it is conceivable that a combination of alternatives might be sufficient.

There are many possible combinations of alternatives that could be considered to replace the power generated by Salem and HCGS. In the GEIS, NRC staff indicated that consideration of alternatives would be limited to single, discrete generating options, given the virtually unlimited number of combinations available. In this section, the NRC staff examines a possible combination of alternatives. Under this alternative, both Salem and HCGS would be retired and a combination of other alternatives would be considered, as follows:

- Denying the re-license application for Salem and HCGS
- Constructing five 400 MW(e) natural gas-fired combined-cycle plants at Salem
- Obtaining 878 MW(e) from renewable energy sources (primarily offshore wind)
- Implementing 731 MW(e) of efficiency and conservation programs, from among the 3,300 MW of energy efficiency and conservation goals identified by the New Jersey Energy Master Plan (State of New Jersey, 2008) and the Northeast Energy Efficiency Partnerships (NEEP, 2009).

The potential contributions of efficiency and conservation programs and renewable energy are based on achievement of the goals of the New Jersey Energy Master Plan (State of New Jersey, 2008). Goal #1 of this Plan is to reduce energy consumption by 20 percent through efficiency and conservation programs. Based on the current generating capacity of 3656 MW(e) of Salem and HCGS, achievement of the 20 percent objective would contribute 731 MW(e) equivalent to this combination alternative. Goal #3 of the New Jersey Energy Master Plan is to increase the current Renewable Portfolio Standard (RPS) to 30 percent. Based on the original generating capacity of 3656 MW(e), with demand reduced by 20 percent to 2925 MW(e) through achievement of Goal #1, a 30 percent renewable energy contribution to this portfolio would comprise 878 MW(e). The remainder of the capacity, or approximately 2000 MW(e), would be generated by the implementation of natural gas generating units.

The following sections analyze the impacts of the alternative outlined above. In some cases, detailed impact analyses for similar actions are described in previous sections of this Chapter. When this occurs, the impacts of the combined alternatives are discussed in a general manner with reference to other sections of this draft SEIS.

8.1.3.1 Impacts of Combination Alternative

Each component of the combination alternative produces different environmental impacts, though several of the options would have impacts similar to—but smaller than—alternatives already addressed in this SEIS. Constructing a total of 2,000 MW(e) of gas-fired capacity on the Salem and HCGS sites would create roughly the same impacts as the on-site combined-cycle natural gas alternative described in Section 8.1.2. This alternative would make use of the existing transmission lines at the sites, but would require construction of a 25-mile (40 Km) long natural gas pipeline, the same as would be required under the combined-cycle natural gas alternative evaluated in Section 8.1.2. The amount of air emissions, land use, and water consumption would be reduced due to the smaller number of natural-gas fired units.

The Staff has not yet addressed the impacts of wind power or conservation in this SEIS. A wind installation capable of yielding 878 MW(e) of capacity would likely entail placing wind turbines off of the New Jersey coast. A wind installation capable of delivering 878 MW(e) on average would require approximately 245 turbines with a capacity of 3.6 MW each (Mineral Management Service [MMS] 2010). Because wind power installations do not provide full power all the time, the total installed capacity exceeds the capacity stated here.

Impacts from conservation measures are likely to be negligible, as the Staff indicated in the GEIS (NRC, 1996). The primary concerns the Staff identified in the GEIS related to indoor air quality and waste disposal. In the GEIS, NRC Staff indicated that air quality appeared to become an issue when weatherization initiatives exacerbated existing problems, and were expected not to present significant effects. The Staff also indicated that waste disposal concerns related to energy-saving measures like fluorescent lighting could be addressed by recycling programs. The Staff considers the overall impact from conservation to be SMALL in all resource areas, though measures that provide weatherization assistance to low-income populations may have positive effects on environmental justice.

8.1.3.1 Air Quality

The combination alternative will have some impact on air quality as a result of emissions from the onsite gas turbines. Because of the size of the units, an individual unit's impacts would be SMALL. Section 8.1.2.1 of this draft SEIS describes the impacts on air quality from the construction and operation of natural gas units as SMALL. The construction and operation of the wind farm would have only minor impacts on air quality.

Overall, the Staff considers that the air quality impacts from the combination alternative would be SMALL.

8.1.3.2 Groundwater Use and Quality

8.1.3.3 Surface Water Use and Quality Impact

The primary water use and quality issues from this alternative would be from the gas-fired units at Salem and HCGS. While construction of a wind farm, particularly if located offshore, would result in some impacts to surface water, these impacts are likely to be short lived. An offshore wind farm is unlikely to be located immediately adjacent to any water users. Construction activities may increase turbidity; however, construction of onshore wind farm could create additional erosion, as would construction of a gas-fired unit on the Salem and HCGS sites. In general, site management practices keep these effects to a small level.

During operations, only the gas-fired plants would require water for cooling. The natural gas would likely use closed-cycle cooling, which would limit the effects on water resources. As the Staff indicated for the coal-fired and gas-fired alternatives, the gas-fired portion of this alternative is likely to rely on surface water for cooling (or, as is the case in some locations, treated sewage effluent).

The Staff considers impacts on water use and quality to be SMALL for the combination alternative. The onsite impacts at the Salem and HCGS facility would be expected to be similar to the impacts described in Sections 8.1.2.2 and 8.1.2.3 of this draft SEIS.

8.1.3.4 Aquatic and Terrestrial Resources

Impacts on aquatic and terrestrial ecology from the gas-fired power plant component of the combination alternative, which includes seven gas-fired units, would be similar to those described for the gas-fired alternative in Section 8.1.2.4. Therefore, ecological impacts would similarly be SMALL.

Aquatic Ecology

The wind farm component of this alternative, if located offshore, could have temporary impacts on aquatic organisms due to construction activities, which would likely increase turbidity in the area of construction. The Staff assumes that the appropriate agencies would monitor and regulate such activities. Overall, the impacts to aquatic resources would be SMALL.

Based on data in the GEIS, an onshore wind farm component of the combination alternative producing 878 MWe of electricity would require approximately 53,400 ha (132,000 ac) spread over several offsite locations, with less than 10 percent of that land area in actual use for turbines and associated infrastructure. The remainder of the land, if located onshore, could remain in use for activities such as agriculture. Additional land would likely be needed for construction of support infrastructure to connect to existing transmission lines. During construction, there would be an increased potential for erosion and adverse effects on adjacent water bodies, though stormwater management practices are expected to minimize such impacts.

Terrestrial Ecology

Impacts to terrestrial ecology from construction of the wind farm portion of the combination alternative and any needed transmission lines could include loss of terrestrial habitat, an increase in habitat fragmentation and corresponding increase in edge habitat, and may impact threatened and endangered species. The GEIS notes that habitat fragmentation may lead to declines of migrant bird populations. Once operational, birds would be likely to collide with the turbines, and migration routes would need to be considered during site selection. Based on this information, impacts to terrestrial resources would be MODERATE.

8.1.3.5 Human Health

The primary health concerns under this option would be occupational health and safety risks during the construction of the new gas turbine and the wind farm. As described previously, if the risks are appropriately managed, the human health impacts from construction and operation of a gas-fired power plant are SMALL. Human health impacts from a wind farm would also be associated primarily with the construction of the facility and would also be minimal. Continued operation of HCGS with the existing closed-cycle cooling system would not change the human health impacts designation of SMALL as discussed in Chapter 4.

Therefore, the Staff concludes that the overall human health impact from the combination alternative would be SMALL.

8.1.3.6 Socioeconomics

Land Use

Impacts from this alternative would include the types of impacts discussed for land use in Section 8.1.2.6 of this draft SEIS. Section 8.1.2.6 states that the land use impacts from the construction of nine gas-fired units at the Salem site would be SMALL to MODERATE. The combined alternative includes five gas-fired units, which would fit on the existing site without purchasing offsite land. In addition to onsite land requirements, land would be required offsite for natural gas wells and collection stations. The elimination of uranium fuel for the Salem and HCGS facilities could partially offset offsite land requirements. The land use impacts of the gas-fired component of the combination alternative would be expected to be similar to the impacts described in Sections 8.1.2.6; that is, SMALL to MODERATE.

Impacts from the wind power component of this alternative would depend largely on whether the wind facility is located onshore or offshore. Onshore wind facilities would incur greater land use impacts than offshore facilities, simply because all towers and supporting infrastructure would be located on land. NRC observations provided in the GEIS indicate that onshore installations could require approximately 53,400 ha (132,000 ac), though turbines and infrastructure would actually occupy only a small percentage (less than 10 percent) of that land area. Land around wind installations could remain in use for activities like agriculture (a practice consistent with wind farm siting throughout the U.S.).

Although the offsite wind component of this alternative would require a large amount of land, only a small component of that land would be in actual use. Overall, the Staff considers that the land use impacts from the combination alternative would be SMALL to MODERATE.

Socioeconomics

Impacts from this alternative would include the types of impacts discussed for socioeconomics in Section 8.1.2.6 of this draft SEIS. Section 8.1.2.6 states that the socioeconomics impacts from the construction and operation of nine gas-fired units at the Salem site would be SMALL to MODERATE. The combined alternative includes five gas-fired units. The associated construction workforce and number of operational workers, and the property taxes paid to the local jurisdiction, would be similar to the gas-fired alternative. Accordingly, the socioeconomic impacts from the gas-fired component of the combination alternative would be SMALL to MODERATE.

Socioeconomic impacts from the wind component of this alternative were evaluated based on construction and operations workforce requirements. Additional estimated construction workforce requirements for this combination alternative would include 600 workers for the wind farm. The number of additional workers would cause a short-term increase in demand for public services and rental housing in the region around the construction site(s). Following construction, some local communities may be temporarily affected by the loss of the construction jobs and associated loss in demand for business services. The rental housing market could also experience increased vacancies and decreased prices. Considering the relatively low levels of employment associated with construction of this component of the combination alternative, the impact on socioeconomic conditions would be SMALL. Also, employment effects would likely be spread over a larger area, as the wind farms may be constructed in more than one location.

Additional estimated operations workforce requirements for the wind farm component of the combination alternative would include 100 workers. Given the small number of operations workers, socioeconomic impacts associated with operation of the wind farm would be SMALL.

Transportation

Construction and operation of a natural gas-fired power plant and a wind farm would increase the number of vehicles on roads in the vicinity of these facilities. During construction, cars and trucks would deliver workers, materials, and equipment to the work sites. The increase in vehicular traffic would peak during shift changes resulting in temporary level of service impacts and delays at intersections. Transporting components of wind turbines could have a noticeable impact, but is likely to be spread over a large area. Pipeline construction and modification to existing natural gas pipeline systems could also have an impact on land traffic. Transportation impacts would be SMALL to MODERATE.

During plant operations, transportation impacts would lessen. Given the small numbers of operations workers at these facilities, overall operational impacts on levels of service on local roads from operation of the gas-fired power plant at the Salem and HCGS site as well as the wind farm would be SMALL. Transportation impacts at the wind farm site or sites would also depend on current road capacities and average daily traffic volumes, but are likely to be SMALL given the low number of workers employed by that component of the alternative.

Aesthetics

Aesthetic impacts from the gas-fired power plant component of the combination alternative would be essentially the same as those described for the gas-fired alternative in Section 8.1.2.6. Aesthetic impacts associated with visibility of the gas-fired units and exhaust stacks and the existing HCGS cooling tower would be SMALL to MODERATE. The impact associated with noise from plant operations, which may be detectable offsite, would be SMALL.

The wind farm component would have the greatest aesthetic effect of this combination alternative. Several hundred wind turbines at over 91 m (300 feet) in height and spread over 53,400 ha (132,000 ac) may dominate the view and, in the absence of larger topographic features, would be the major focus of viewer attention. The overall impact would depend on the sensitivity of the site. Therefore, overall aesthetic impacts from the construction and operation of a wind farm would be MODERATE, or LARGE if the wind farm is built at a site where aesthetics is an important element of the natural environment.

Historic and Archeological Resources

Onsite impacts to historical and cultural resources from the construction of a gas-fired power plant are expected to be SMALL. The offsite impacts from the construction of a wind farm are also expected to be small given the opportunity to evaluate and select the sites in accordance with applicable regulations and the ability to minimize impacts before construction. Therefore, the Staff concludes that the overall impacts on historic and archeological resources from the combination alternative would be SMALL.

Environmental Justice

The environmental justice impact analysis evaluates the potential for disproportionately high and adverse human health and environmental effects on minority and low-income populations that could result from the construction and operation of a new natural gas-fired power plant and a new wind farm, and from energy efficiency and conservation programs. No environmental or human health impacts were identified that would result in disproportionately high and adverse environmental impacts on minority and low-income populations if a replacement gas-fired plant were built at the Salem and HCGS site and a wind farm was built in the area. Some impacts on rental and other temporary housing availability and lease prices during construction may occur, and this could disproportionately affect low-income populations. The demand for rental housing would be mitigated because workers would be likely to commute to the construction sites from metropolitan areas in the region instead of relocating closer to the construction sites. Thus, the impact of the gas-fired and wind farm components of the combination alternative on minority and low-income populations would be SMALL.

Weatherization programs associated with the conservation component of this alternative could target low-income residents as a cost-effective energy efficiency option since low-income populations tend to spend a larger proportion of their incomes paying utility bills. According to the Office of Management and Budget, low income populations experience energy burdens more than four times as large as those (OMB, 2007) of average households. Impacts to minority and low-income populations from the energy efficiency and conservation programs component of this alternative, although dependent on program design and enrollment, would be SMALL.

8.1.3.7 Waste Management

The primary source of waste would be associated with the construction of the new gas turbine facility and the wind farm. Waste impacts could be substantial but likely not noticeably alter or destabilize the resource during construction of the alternatives, depending on how the various sites handle wastes.

The waste contribution from the remaining HCGS unit would be roughly one-third of the waste generated by the current facility (Salem and HCGS) described in Sections 2.1.2 and 2.1.3. If the remaining HCGS unit were to continue operation with the existing closed-cycle cooling system, waste impacts would be minor.

Therefore, the Staff concludes that the overall impact from waste from the combination alternative would be SMALL.

1 **Table 8-3 Summary of Environmental Impacts of Combination Alternative**

Impact Category	Combination Alternative	
	Impact	Comments
Air Quality	SMALL	Air emissions of the gas-fired unit would be minor considering their size. A wind farm would have only minor impact on air quality.
Ground water		
Surface water	SMALL	Minor impacts would result from construction of wind farm and gas-fired plant. Gas-fired plant would likely use surface water for cooling water.
Aquatic Terrestrial Resources	SMALL to MODERATE	Impacts would be greatest to terrestrial resources from a wind farm.
Human Health	SMALL	Occupational health and safety risks would be managed in accordance with applicable regulations.
Land Use	SMALL to MODERATE	Although the offsite wind farm component requires a large amount of land, only a small portion would be in actual use.
Socioeconomics		
Socioeconomics	SMALL to MODERATE	Most of the socioeconomic impacts would be associated with the gas-fired plant.
Transportation	SMALL to MODERATE	Traffic impacts would be greater during construction, with minor impacts during operations.
Aesthetics	SMALL to LARGE	The greatest aesthetic effects would be associated with the wind farm component.
Historic and Archeological Resources	SMALL	Minor impacts would occur to the combination alternative.

Impact Category	Combination Alternative	
	Impact	Comments
Environmental Justice	SMALL	Impacts would be similar to those experienced by the general population in the region.
Waste Management	SMALL	Waste volumes could be substantial during construction. Operational waste volumes would be SMALL

8.2 ALTERNATIVES CONSIDERED BUT DISMISSED

In this section, the Staff presents the alternatives it initially considered for analysis as alternatives to license renewal of Salem and HCGS, but later dismissed due to technical, resource availability, or commercial limitations that currently exist and that the Staff believes are likely to continue to exist when the existing Salem and HCGS licenses expire. Under each of the following technology headings, the Staff indicates why it dismissed each alternative from further consideration.

8.2.1 Offsite Coal- and Natural Gas-Fired

While it is possible that coal- and natural gas-fired alternatives like those considered in 8.1.1 and 8.1.2, respectively, could be constructed at sites other than Salem and HCGS, the Staff determined that they would likely result in greater impacts than alternatives constructed at the Salem and HCGS site. Greater impacts would occur from construction of support infrastructure, like transmission lines, and roads that are already present on the Salem and HCGS site. Further, the community around Salem and HCGS is already familiar with the appearance of a power facility and it is an established part of the region's aesthetic character. Workers skilled in power plant operations would also be available in this area. The availability of these factors are only likely to be available on other recently-industrial sites. In cases where recently-industrial sites exist, other remediation may also be necessary in order to ready the site for redevelopment. In short, an existing power plant site would present the best location for a new power facility.

8.2.2 New Nuclear

In its ER, PSEG indicated that it is unlikely that a nuclear alternative could be sited, constructed and operational by the time the HCGS operating license expires in 2026 (PSEG, 2009b), nor this could this be accomplished in a timeframe necessary to replace the generating output of Salem Unit 1, which has a license expiration date of 2016 (PSEG, 2009a). Given the relatively short time remaining on the current Salem and HCGS licenses, the Staff has not evaluated new nuclear generation as an alternative to license renewal.

8.2.3 Energy Conservation/Energy Efficiency

Though often used interchangeably, energy conservation and energy efficiency are different concepts. Energy efficiency typically means deriving a similar level of services by using less energy, while energy conservation simply indicates a reduction in energy consumption. Both fall into a larger category known as demand-side management (DSM). DSM measures—unlike the energy supply alternatives discussed in previous sections—address energy end uses. DSM can include measures that shift energy consumption to different times of the day to reduce peak loads, measures that can interrupt certain large customers during periods of high demand, measures that interrupt certain appliances during high demand periods, and measures like replacing older, less efficient appliances, lighting, or control systems. DSM also includes measures that utilities use to boost sales, such as encouraging customers to switch from gas to electricity for water heating.

Unlike other alternatives to license renewal, the GEIS notes that conservation is not a discrete power generating source; it represents an option that states and utilities may use to reduce their need for power generation capability (NRC, 1996).

In October 2008, the State of New Jersey published their Energy Master Plan (New jersey, 2008), which established goals and evaluated potential options for meeting the protected increase in electricity demand in the state through 2020. As part of this Master Plan, actions were identified to maximize energy conservation and energy efficiency, including: transitioning the state's current energy efficiency programs to be implemented by the electric and gas utilities, modifying the statewide building code for new buildings to make new buildings as least 30 percent more energy efficient, increasing energy efficiency standards for new appliances and other equipment, and developing education and outreach programs for the public. An additional goal is to reduce peak electricity demand, primarily by expanding incentives developing technologies to increase participation in regional demand response programs. A separate goal established in the report (not related to energy conservation) included successful accomplishment of the state's Renewable Energy Portfolio Standard by 2020.

The report concluded that the combination of all of these efforts (energy conservation, efficiency, and renewable energy sources) would still not result in meeting the increased demand for electricity in the state, and that additional development of traditional electricity sources would still be required. Therefore, these measures would not be able to replace the output of the Salem and HCGS facilities. Because of this, the Staff has not evaluated energy conservation/efficiency as a discrete alternative to license renewal. It has, however, been considered as a component of the combination alternative.

8.2.4 Purchased Power

In the Salem and HCGS ERs, PSEG indicated that purchased electrical power is a potentially viable option for replacing the generating capacity of the Salem and HCGS facilities. PSEG anticipated that this power could be purchased from other generation sources within the PJM region, but that the source would likely be from new capacity generated using technologies that are evaluated in the GEIS. The technologies that would most likely be used to generate the purchased power would be coal and natural gas, and therefore the impacts associated with the power purchase would be similar to those evaluated in Sections 8.1.1 and 8.1.2. In addition, purchased power would likely require the addition of transmission capacity, which would result in additional land use impacts. Because purchased electrical power would likely be provided by new generation sources evaluated elsewhere in this section, and would also require new transmission capacity, the Staff has not evaluated purchased power as a separate alternative to license renewal.

8.2.5 Solar Power

Solar technologies use the sun's energy to produce electricity. Currently, the Salem and HCGS area receives approximately 4.5 to 5.5 kWh per square meter per day, for solar collectors oriented at an angle equal to the installation's latitude (National Renewable Energy Laboratory [NREL], 2010). Since flat-plate photovoltaics tend to be roughly 25 percent efficient, a solar-powered alternative would require more than 56,000 ha (140,000 ac) of collectors to provide an amount of electricity equivalent to that generated by Salem and HCGS. Space between parcels and associated infrastructure increase this land requirement. This amount of land, while large, is consistent with the land required for coal and natural gas fuel cycles. In the GEIS, the Staff noted that, by its nature, solar power is intermittent (i.e., it does not work at night and cannot serve baseload when the sun is not shining), and the efficiency of collectors varies greatly with weather conditions. A solar-powered alternative would require energy storage or backup power supply to provide electric power at night. Given the challenges in meeting baseload requirements, the Staff did not evaluate solar power as an alternative to license renewal of Salem and HCGS.

8.2.6 Wood-Fired

The National Renewable Energy Laboratory estimates the amount of biomass fuel resources, including forest, mill, agricultural, and urban residues, available within New Jersey, Delaware, and Pennsylvania to be approximately 5.6 million dry tons per year (NREL, 2005). Based on an estimate of 9.961 million Btu per dry ton and a thermal conversion efficiency of 25%, conversion of this entire resource would generate the equivalent of less than 500 MWe. Of the available biomass in the three states, the vast majority (80 percent) is in Pennsylvania, and assumed to be located primarily in the western portion of the state. Therefore, the volume that would be available for fueling a plant in the local area would be much less, and is not likely to be sufficient to substitute for the capacity provided by Salem and HCGS. As a result, the Staff has not considered a wood-fired alternative to Salem and HCGS license renewal.

8.2.7 Wind (Onshore/Offshore)

The American Wind Energy Association indicates that New Jersey currently ranks 33rd among the states in installed wind power capacity (7.5 MW), and 29th among the state in potential capacity. No projects are currently under construction (American Wind Energy Association [AWEA], 2010). No wind capacity is installed in Delaware. Although Pennsylvania ranks 15th among the states in installed capacity, with a total of 748 MW, most of this installed capacity is located in the western portion of the state (AWEA, 2010). The Report of the New Jersey Governor's Blue Ribbon Panel on Development of Wind Turbine Facilities in Coastal Waters (State of New Jersey, 2006) concluded that onshore wind speeds in New Jersey are not viable for commercial wind power development, and that the vast majority of the state's wind generation capacity was offshore. The report also concluded that development of the offshore resources is not commercially viable without significant state and/or federal subsidies. Also, preliminary information evaluated in the report indicated that the timing of peak offshore wind speeds did not coincide with the times of peak energy demand, and that offshore wind alone could not significantly reduce reliance on fossil fuel and domestic nuclear capacity (State of New Jersey, 2006). Finally, the results of a study of potential impacts of large-scale wind turbine siting by NJDEP identified large areas along the New Jersey Coast that would likely be considered to be off limits to large scale wind development due to documented bird concentrations, nesting for resident threatened and endangered bird species, and stopover locations for migratory birds (NJDEP, 2009b).

Given wind power's intermittency, the lack of easily implementable onshore resources in New Jersey, and restrictions on placement of turbines in areas that would otherwise have high resource potential, the Staff will not consider wind power as a stand-alone alternative to license renewal. However, given the potential for development of offshore resources, the Staff will consider wind power as a portion of a combination alternative.

8.2.8 Hydroelectric Power

According to researchers at Idaho National Energy and Environmental Laboratory [NEEL], New Jersey has an estimated 11 MW of technically available, undeveloped hydroelectric resources at 12 sites throughout the State (INEEL, 1996). Given that the available hydroelectric potential in the State of New Jersey constitutes only a small fraction of generating capacity of Salem and HCGS, the Staff did not evaluate hydropower as an alternative to license renewal.

8.2.9 Wave and Ocean Energy

Wave and ocean energy has generated considerable interest in recent years. Ocean waves, currents, and tides are often predictable and reliable. Ocean currents flow consistently, while tides can be predicted months and years in advance with well-known behavior in most coastal areas. Most of these technologies are in relatively early stages of development, and while some results have been promising, they are not likely to be able to replace the capacity of Salem and HCGS by the time their licenses expire. Therefore, the NRC did not consider wave and ocean energy as an alternative to Salem and HCGS license renewal.

8.2.10 Geothermal Power

Geothermal energy has an average capacity factor of 90 percent and can be used for baseload power where available. However, geothermal electric generation is limited by the geographical availability of geothermal resources (NRC, 1996). Although New Jersey has some geothermal potential in a heating capacity, it does not have geothermal electricity potential for electricity generation (Geo-Heat Center [GHC], 2008). The Staff concluded that geothermal energy is not a reasonable alternative to license renewal at Salem and HCGS.

8.2.11 Municipal Solid Waste

Municipal solid waste combustors use three types of technologies—mass burn, modular, and refuse-derived fuel. Mass burning is currently the method used most frequently in the United States and involves no (or little) sorting, shredding, or separation. Consequently, toxic or hazardous components present in the waste stream are combusted, and toxic constituents are exhausted to the air or become part of the resulting solid wastes. Currently, approximately 87 waste-to-energy plants operate in the United States. These plants generate approximately 2,531 MWe, or an average of 29 MWe per plant (Energy Recovery Council, 2010). This includes five plants in New Jersey generating a total of 173 MWe. More than 124 average-sized plants would be necessary to provide the same level of output as the other alternatives to Salem and HCGS license renewal.

Estimates in the GEIS suggest that the overall level of construction impact from a waste-fired plant would be approximately the same as that for a coal-fired power plant. Additionally, waste-fired plants have the same or greater operational impacts than coal-fired technologies (including impacts on the aquatic environment, air, and waste disposal). The initial capital costs for municipal solid-waste plants are greater than for comparable steam-turbine technology at coal-fired facilities or at wood-waste facilities because of the need for specialized waste separation and handling equipment (NRC, 1996).

The decision to burn municipal waste to generate energy is usually driven by the need for an alternative to landfills rather than energy considerations. The use of landfills as a waste disposal option is likely to increase in the near term as energy prices increase; however, it is possible that municipal waste combustion facilities may become attractive again.

Given the small average installed size of municipal solid waste plants and the unfavorable regulatory environment, the Staff does not consider municipal solid waste combustion to be a feasible alternative to Salem and HCGS license renewal.

8.2.12 Biofuels

In addition to wood and municipal solid waste fuels, there are other concepts for biomass-fired electric generators, including direct burning of energy crops, conversion to liquid biofuels, and biomass gasification. In the GEIS, the Staff indicated that none of these technologies had progressed to the point of being competitive on a large scale or of being reliable enough to replace a baseload plant such as Salem and HCGS. After reevaluating current technologies, the Staff finds other biomass-fired alternatives are still unable to reliably replace the Salem and HCGS capacity. For this reason, the Staff does not consider other biomass-derived fuels to be feasible alternatives to Salem and HCGS license renewal.

8.2.13 Oil-Fired Power

EIA projects that oil-fired plants would account for very little of the new generation capacity constructed in the United States during the 2008 to 2030 time period. Further, EIA does not project that oil-fired power would account for any significant additions to capacity (EIA, 2009a).

The variable costs of oil-fired generation tend to be greater than those of the nuclear or coal-fired operations, and oil-fired generation tends to have greater environmental impacts than natural gas-fired generation. In addition, future increases in oil prices are expected to make oil-fired generation increasingly more expensive (EIA, 2009a). The high cost of oil has prompted a steady decline in its use for electricity generation. Thus, the Staff did not consider oil-fired generation as an alternative to Salem and HCGS license renewal.

8.2.14 Fuel Cells

Fuel cells oxidize fuels without combustion and its environmental side effects. Power is produced electrochemically by passing a hydrogen-rich fuel over an anode and air (or oxygen) over a cathode and separating the two by an electrolyte. The only byproducts (depending on fuel characteristics) are heat, water, and CO_2. Hydrogen fuel can come from a variety of hydrocarbon resources by subjecting them to steam under pressure. Natural gas is typically used as the source of hydrogen.

At the present time, fuel cells are not economically or technologically competitive with other alternatives for electricity generation. In addition, fuel cell units are likely to be small in size. While it may be possible to use a distributed array of fuel cells to provide an alternative to Salem and HCGS, it would be extremely costly to do so and would require many units. Accordingly, the Staff does not consider fuel cells to be an alternative to Salem and HCGS license renewal.

8.2.15 Delayed Retirement

The power generating merchants within the PJM region have retired a large number of generation sources since 2003, totaling 5,945 MW retired and 2,629 MW pending retirement. Most of these retirements involve older fossil fuel-powered plants which are retired due to challenges in meeting increasingly stringent air quality standards (PJM, 2009). Although these retirements have caused reliability criteria violations, PJM does not have any authority to compel owners to delay retirement (PJM, 2009), and therefore retirements are likely to continue. Therefore, delayed retirement of non-nuclear plants is not considered as a feasible alternative to Salem and HCGS license renewal.

8.3 NO-ACTION ALTERNATIVE

This section examines environmental effects that would occur if NRC takes no action. No Action in this case means that NRC does not issue a renewed operating license for Salem and HCGS and the licenses expire at the end of their current license terms. If NRC takes no action, the plants would shutdown at or before the end of the current license. After shutdown, plant operators would initiate decommissioning according to 10 CFR 50.82. Table 8-4 provides a summary of environmental impacts of No Action compared to continued operation of the Salem and HCGS.

The Staff notes that the option of No Action is the only alternative considered in-depth that does not satisfy the purpose and need for this SEIS, as it does not provide power generation capacity nor would it meet the needs currently met by Salem and HCGS or that the alternatives evaluated in Section 8.1 would satisfy. Assuming that a need currently exists for the power generated by Salem and HCGS, the no-action alternative would require that the appropriate energy planning decision-makers rely on an alternative to replace the capacity of Salem and HCGS or reduce the need for power.

This section addresses only those impacts that arise directly as a result of plant shutdown. The environmental impacts from decommissioning and related activities have already been addressed in several other documents, including the *Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities*, NUREG-0586, Supplement 1 (NRC, 2002); the license renewal GEIS (chapter 7; NRC, 1996); and Chapter 7 of this SEIS. These analyses either directly address or bound the environmental impacts of decommissioning whenever PSEG ceases operating Salem and HCGS.

The Staff notes that, even with renewed operating licenses, Salem and HCGS would eventually shut down, and the environmental effects addressed in this section would occur at that time. Since these effects have not otherwise been addressed in this SEIS, the impacts will be addressed in this section. As with decommissioning effects, shutdown effects are expected to be similar whether they occur at the end of the current license or at the end of a renewed license.

Table 8-4. Summary of Environmental Impacts of No Action Compared to Continued Operation of Salem and HCGS

	No Action	Continued Salem and HCGS Operation
Air Quality	SMALL	SMALL
Groundwater	SMALL	SMALL
Surface Water	SMALL	SMALL
Aquatic and Terrestrial Resources	SMALL	SMALL
Human Health	SMALL	SMALL
Socioeconomics	SMALL to LARGE	SMALL
Waste Management	SMALL	Not Applicable

8.3.1 Air Quality

When the plant stops operating, there would be a reduction in emissions from activities related to plant operation such as use of diesel generators and employees vehicles. In Chapter 4, the Staff determined that these emissions would have a SMALL impact on air quality during the renewal term. Therefore, if the emissions decrease, the impact to air quality would also decrease and would be SMALL.

8.3.2 Groundwater Use and Quality

The use of groundwater would diminish as plant personnel are removed from the site and operations cease. Some consumption of groundwater may continue as a small staff remains onsite to maintain facilities prior to decommissioning. Overall impacts would be smaller than during operations, but would remain SMALL.

8.3.3 Surface Water Use and Quality

The rate of consumptive use of surface water would decrease as the plant is shut down and the reactor cooling system continues to remove the heat of decay. Wastewater discharges would also be reduced considerably. Shutdown would reduce the already SMALL impact on surface water resources and quality.

8.3.4 Aquatic and Terrestrial Resources

Aquatic Ecology

If the plant were to cease operating, impacts to aquatic ecology would decrease, as the plant would withdraw and discharge less water than it does during operations. Shutdown would reduce the already SMALL impacts to aquatic ecology.

Terrestrial Ecology

Shutdown would result in no additional land disturbances onsite or offsite, and terrestrial ecology impacts would be SMALL.

8.3.5 Human Health

Human health risks would be smaller following plant shutdown. The plant, which is currently operating within regulatory limits, would emit less gaseous and liquid radioactive material to the environment. In addition, following shutdown, the variety of potential accidents at the plant (radiological or industrial) would be reduced to a limited set associated with shutdown events and fuel handling and storage. In Chapter 4 of this draft SEIS, the Staff concluded that the impacts of continued plant operation on human health would be SMALL. In Chapter 5, the Staff concluded that the impacts of accidents during operation were SMALL. Therefore, as radioactive emissions to the environment decrease, and as the likelihood and variety of accidents decrease following shutdown, the Staff concludes that the risks to human health following plant shutdown would be SMALL.

8.3.6 Socioeconomics

Land Use

Plant shutdown would not affect onsite land use. Plant structures and other facilities would likely remain in place until decommissioning. Most transmission lines connected to Salem and HCGS would remain in service after the facilities stop operating. Maintenance of most existing transmission lines would continue as before. The transmission lines could be used to deliver the output of any new capacity additions made on the Salem and HCGS site. Impacts on land use from plant shutdown would be SMALL.

Socioeconomics

Plant shutdown would have an impact on socioeconomic conditions in the region around Salem and HCGS. Plant shutdown would eliminate approximately 1,614 jobs and would reduce tax revenue in the region. The loss of these contributions, which may not entirely cease until after decommissioning, could have a MODERATE impact within Salem County and a LARGE impact within Lower Alloways Creek Township, which receives approximately 57 percent of its total property tax revenue from Salem and HCGS. See Appendix J to NUREG-0586, Supplement 1 (NRC, 2002), for additional discussion of the potential socioeconomic impacts of plant decommissioning.

Transportation

Traffic volumes on the roads in the vicinity of Salem and HCGS would be reduced after plant shutdown. Most of the reduction in traffic volume would be associated with the loss of jobs at the facilities. Deliveries of materials and equipment to the plant would be reduced until decommissioning. Transportation impacts would be SMALL as a result of plant shutdown.

Aesthetics

Plant structures and other facilities would likely remain in place until decommissioning. The plume from the cooling tower would cease or greatly decrease after shutdown. Noise caused by plant operation would cease. Aesthetic impacts of plant closure would be SMALL.

Historic and Archaeological Resources

Impacts from the no-action alternative would be SMALL, since Salem and HCGS would be decommissioned. A separate environmental review would be conducted for decommissioning. That assessment would address the protection of historic and archaeological resources.

Environmental Justice

Impacts to minority and low-income populations when Salem and HCGS cease operation would depend on the number of jobs and the amount of tax revenues lost by the communities surrounding the facilities. Closure of Salem and HCGS would reduce the overall number of jobs (there are currently 1,614 permanent positions at the facilities) and the tax revenue attributed to plant operations (approximately 57 percent of Lower Alloways Creek Township's tax revenues and 2.9 percent of Salem County's tax revenues are from Salem and HCGS). Since the Salem and HCGS tax payments represent such a significant percentage of Lower Alloways Creek Township's total annual property tax revenue, it is likely that economic impacts within the townsip would range from MODERATE to LARGE should Salem and HCGS be shut down and closed. Minority and low-income populations in the township could experience a disproportionately high and adverse socioeconomic impact from plant shutdown.

8.3.7 Waste Management

If the no-action alternative were implemented the generation of high-level waste would stop and generation of low-level and mixed waste would decrease. Impacts from implementation of no-action alternative are expected to be SMALL.

Wastes associated with plant decommissioning are unavoidable and will be significant whether the plant is decommissioned at the end of the initial license period or at the end of the relicensing period. Therefore, the selection of the no-action alternative has no impact on issues relating to decommissioning waste.

8.4 ALTERNATIVES SUMMARY

In this chapter, the Staff considered the following alternatives to Salem and HCGS license renewal: supercritical coal-fired generation; natural gas combined-cycle generation; and a combination of alternatives. No Action by the NRC and the effects it would have were also considered. The impacts for all alternatives are summarized in Table 8-5.

The environmental impacts of the proposed action (issuing renewed Salem and HCGS operating licenses) would be SMALL for all impact categories except for the Category 1 issue of collective offsite radiological impacts from the fuel cycle, high level waste (HLW), and spent fuel disposal.

In the Staff's professional opinion, the coal-fired alternative would have the greatest overall adverse environmental impact. This alternative would result in MODERATE waste management, landuse, and air quality impacts. Its impacts upon socioeconomic and biological resources could range from SMALL to MODERATE. This alternative is not an environmentally preferable alternative due to air quality impacts from NO_x, SO_x, PM, PAHs, CO, CO_2, and mercury (and the corresponding human health impacts), as well as construction impacts to aquatic, terrestrial, and potential historic and archaeological resources.

With the exception of landuse, socioeconomic, and air quality impacts, the gas-fired alternative would result in SMALL impacts. Socioeconomic, landuse, and air quality impacts could range from SMALL to MODERATE. This alternative would result in substantially lower air emissions and waste management than the coal-fired alternative.

The combination alternative would have lower air emissions and waste management impacts than both the gas-fired and coal-fired alternatives; however, it would have relatively higher construction impacts in terms of land use, aquatic and terrestrial resources, and potential disruption to historic and archaeological resources, mainly as a result of the wind turbine component.

Under the No Action alternative, plant shutdown would eliminate approximately 1,614 jobs and would reduce tax revenue in the region. The loss of these contributions, which may not entirely cease until after decommissioning, would have a MODERATE to LARGE impact. However, the No Action alternative does not meet the purpose and need stated in this draft SEIS.

Therefore, in the Staff's best professional opinion, the environmentally preferred alternative in this case is the license renewal of Salem and HCGS. All other alternatives capable of meeting the needs currently served by Salem and HCGS entail potentially greater impacts than the proposed action of license renewal of Salem and HCGS.

Table 8-5. Summary of Environmental Impacts of Proposed Action and Alternatives

Alternative	Impact Area						
	Air Quality	Groundwater	Surface Water	Aquatic and Terrestrial Resources	Human Health	Socio-economics	Waste Management
License Renewal	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL(a)
Supercritical Coal-fired Alternative	MODERATE	SMALL	SMALL	SMALL to MODERATE	MODERATE	SMALL to MODERATE	MODERATE
Gas-fired Alternative	SMALL to MODERATE	SMALL	SMALL	SMALL	SMALL	SMALL to MODERATE	SMALL
Combination Alternative	SMALL	SMALL	SMALL	SMALL to MODERATE	SMALL	SMALL to LARGE	SMALL
No Action Alternative	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL to LARGE	SMALL

[a] For the Salem and HCGS license renewal alternative, waste management was evaluated in Chapter 6. Consistent with the findings in the GEIS, these impacts were determined to be SMALL with the exception of collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal.

8.5 REFERENCES

10 CFR Part 50. *Code of Federal Regulations*, Title 10, *Energy*, Part 50, "Domestic Licensing of Production and Utilization Facilities."

10 CFR Part 51. Code of Federal Regulations, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

40 CFR Part 60. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 60, "Standards of Performance for New Stationary Sources."

40 CFR Part 51. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 51, "Requirements for Preparation, Adoption, and Submittal of Implementation Plans."

40 CFR Part 75.

40 CFR Part 81. Code of Federal Regulations, Title 40, *Protection of the Environment*, Part 81, "Designation of Areas for Air Quality Planning Purposes."

63 FR 49453, Revision of Standards of Performance for Nitrogen Oxide Emissions From New Fossil-Fuel Fired Steam Generating Units. September 16, 1998.

64 FR 35714, Regional Haze Regulations. July 1, 1999.

American Wind Energy Association (AWEA). 2010. U.S. Wind Energy Projects, New Jersey, Delaware, and Pennsylvania. Available URL: http://www.awea.org/projects/Projects.aspx?s=New+Jersey (Accessed April 16, 2010).

Energy Information Administration (EIA). 2009a. *Annual Energy Outlook 2009 With Projections to 2030.* DOE/EIA 0383(2009). Washington, D.C. Available URL: http://www.eia.doe.gov/oiaf/aeo/pdf/0383(2009).pdf (accessed April 15, 2010).

EIA. 2009b. Table A4. Approximate Heat Content of Natural Gas, 1949–2008 (Btu per Cubic Foot). Available URL: http://www.eia.doe.gov/emeu/aer/txt/ptb1304.html (accessed April 15, 2010).

EIA. 2010a. *Electric Power Annual with data for 2008.* Available URL: http://www.eia.doe.gov/cneaf/electricity/epa/epates.html (accessed April 12, 2010).

EIA. 2010b. *Cost and Quality of Fuels for Electric Plants 2007 and 2008.* DOE/EIA-0191(2008). Available URL: http://www.eia.doe.gov/cneaf/electricity/cq/cqa2008.pdf (Accessed April 12, 2010).

Energy Recovery Council. 2010. The 2007 IWSA Directory of Waste-to-Energy Plants. Available URL: http://www.energyrecoverycouncil.org/userfiles/file/IWSA_2007_Directory.pdf (Accessed April 15, 2010).

Environmental Protection Agency (EPA). 1998. *Compilation of Air Pollutant Emission Factors*, Volume 1: *Stationary Point and Area Sources*: AP 42, Fifth Edition. "Section 1.1: Bituminous and Subbituminous Coal Combustion: Final Section Supplement E." Washington, D.C.

EPA. 1998a. "Regulatory Finding on the Emissions of Hazardous Air Pollutants from Electric Utility Steam Generating Units." *Federal Register*, Vol. 65, No. 245, pp. 79825–79831. Washington, D.C. December 20, 2000.

EPA. 2000b. "Notice of Regulatory Determination on Wastes from the Combustion of Fossil Fuels." *Federal Register*, Vol. 65, pp.32214–32237. Washington, D.C.

EPA. 2000c. Emissions Factors & AP 42. Available URL: http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s01.pdf. (Accessed April 15, 2010).

EPA. 2006. *Final report: Environmental Footprints and Costs of Coal-Based Integrated Gasification Combined Cycle and Pulverized Coal Technologies.* EPA-430/R-06/006. July, 2006. Available URL: http://www.epa.gov/air/caaac/coaltech/2007_01_epaigcc.pdf (Accessed April 15, 2010).

EPA. 2009a. Clean Air Mercury Rule. Available URL: http://www.epa.gov/mercuryrule/ (Accessed April 17, 2010).

EPA. 2009b. Proposed Mandatory Greenhouse Gas Reporting Rule. Available URL: http://www.epa.gov/climatechange/emissions/ghgrulemaking.html (Accessed April 15, 2010).

EPA. 2010. Clean Air Interstate Rule: New Jersey. Available URL: http://www.epa.gov/CAIR/nj.html (accessed April 5, 2010).

GE Power Systems (GE). 2001. "Advanced Technology Combined Cycles." May 2001.

Geo-Heat Center (GHC). 2008. U.S. Geothermal Projects and Resource Areas. Available URL: http://geoheat.oit.edu/dusys.htm (Accessed April 16, 2010.

Idaho National Engineering and Environmental Laboratory (INEEL). 1996. "U.S. Hydropower Resource Assessment for New Jersey." DOE/ID-10430(NJ). Available URL: http://hydro2.inel.gov/resourceassessment/pdfs/states/nj.pdf (Accessed April 15, 2010).

INGAA Foundation. 2008. *Implications of Reduced Gas Use on Emissions from Power Generation.* Available URL: http://www.ingaa.org/File.aspx?id=282 (Accessed April 15, 2010).

Minerals Management Service (MMS). 2010. *Renewable Energy Program, Cape Wind project, Project Overview.* Available URL: http://www.mms.gov/offshore/RenewableEnergy/CapeWind.htm (Accessed April 16, 2010).

National Energy Efficiency Partnerships (NEEP). 2009. *An Energy Efficiency Strategy for New Jersey: Achieving the 2020 Master Plan Goals.* Available URL: http://neep.org/uploads/About%20NEEP/News%20Media/an-energy-efficieny-plan-for-nj.pdf (Accessed April 16, 2010).

National Renewable Energy Laboratory (NREL). 2005. *A Geographic Perspective on the Current Biomass Resources Availability in the United States.* Technical Report NREL/TP-560-39181. December 2005. Available URL: http://www.nrel.gov/docs/fy06osti/39181.pdf (Accessed April 16, 2010).

NREL. 2010. "United States Atlas of Renewable Resources." Interactive Map. Available URL: http://mapserve2.nrel.gov/website/Resource_Atlas/viewer.htm (accessed April 15, 2010).

New Jersey Department of Environmental Protection (NJDEP). 2009a. *State Implementation Plan for Regional Haze.* Available URL: http://www.state.nj.us/dep/baqp/2008%20Regional%20Haze/Complete%20Regional%20Haze%20SIP.pdf (Accessed April 15, 2010).

NJDEP. 2009b. *Large Scale Wind Turbine Siting Map Report.* Available URL: http://www.state.nj.us/dep/landuse/forms/wind_report090908f.pdf (Accessed April 16, 2010).

PSEG Nuclear, LLC (PSEG). 2009a. Salem Nuclear Generating Station, License Renewal Application, Appendix E – Applicant's Environmental Report – Operating License Renewal Stage, Salem Nuclear Generating Station. July 2009. ADAMS Accession No. ML092400532.

PSEG 2009b. Hope Creek Generating Station, License Renewal Application, Appendix E – Applicant's Environmental Report – Operating License Renewal Stage, Hope Creek Generating Station. July 2009. ADAMS Accession No. ML092430389.

PSEG 2010. PSEG Response to NRC Audit Question #ENV-106.

PJM Interconnection Association (PJM). 2009. *Regional Transmission Expansion Plan.* Available at: http://www.pjm.com/documents/reports/rtep-report.aspx on April 16, 2010.

State of New Jersey. 2006. *Blue Ribbon Panel on Development of Wind Turbine Facilities in Coastal Waters, Final Report.* April 2006. Available at: http://www.state.nj.us/njwindpanel/docs/finalwindpanelreport.pdf on April 16, 2010.

State of New Jersey. 2008. *New Jersey Energy Master Plan.* Available at: http://www.nj.gov/emp/docs/pdf/081022_emp.pdf on April 16, 2010.

U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement. for License Renewal of Nuclear Plants.* NUREG-1437, Vols. 1 and 2. Washington, D.C.

NRC. 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Main Report,* "Section 6.3 – Transportation, Table 9.1, Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants, Final Report." NUREG-1437, Vol. 1, Add. 1. Washington, D.C.

NRC. 2002. *Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors.* NUREG-0586, Supplement 1, Vols. 1 and 2. Washington, D.C.

U.S. Office of Management and Budget (OMB). 2007. "Detailed Information on the Low Income Home Energy Assistance Program Assessment." Accessed at: http://www.whitehouse.gov/omb/expectmore/detail/10001059.2003.html on July 10, 2007. ADAMS No. ML082880730.