Chapter 10 Environmental Consequences of the Proposed Action

This chapter presents the potential environmental consequences of constructing and operating the two new AP1000 units at the Vogtle Electric Generating Plant (VEGP) site. The environmental consequences are evaluated in the following five sections:

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

10.1 Unavoidable Adverse Environmental Impacts

Unavoidable adverse impacts are predicted adverse environmental impacts that cannot be avoided and for which there are no practical means of mitigation. This section considers unavoidable adverse impacts from construction and operation of two AP1000 reactors at the VEGP site and of one transmission line to an existing substation.

10.1.1 Unavoidable Adverse Environmental Impacts of Construction

Construction impacts are described in detail in Chapter 4. Table 4.6-1 briefly describes those impacts and identifies the measures and controls that will be implemented to reduce or eliminate impacts. The expected impacts and the mitigation measures that are available to reduce these impacts are summarized in Table 10.1-1. For many of the impacts related to construction activities, mitigation measures that will be applied are referred to as “best management practices.” Typically, these mitigation measures are based on the types of activities that are to be performed. The mitigation measures are frequently implemented through permitting requirements, and plans and procedures developed for the construction.

Unavoidable adverse impacts from construction of two new units at the VEGP site would all occur in Burke County and would include the loss of some second-growth forest resources, including some bottomland hardwoods forest, to land clearing; additional traffic on local roads; potential housing shortages and school crowding; a decrease in the ability of the fire protection infrastructure to meet the needs of the increased population; and incidental external dose to construction workers working nearby the existing units. Nearly all of the impacts, other than socioeconomic, from the construction of new units and associated transmission line are small and many can be mitigated. The moderate or large socioeconomic impacts can be reduced through mitigation. The influx of construction workers has the potential to lead to a short-term housing shortage and short-term capacity concerns in local schools in Burke County. Also, increased construction traffic will have the potential to impact existing traffic patterns and levels

of service in the vicinity of VEGP. The fire protection infrastructure in Burke County is considered underfunded and understaffed. Increased property tax revenues during new unit construction could fund additional fire protection infrastructure, teachers, and school resources. SNC can put traffic mitigation programs such as carpooling, or staggered shifts, signage and turn lanes in place to alleviate traffic concerns. The short-term housing impact will generate new home starts which will eliminate that short-term impact.

10.1.2 Unavoidable Adverse Environmental Impacts of Operations

Operational impacts of new units at the VEGP site are discussed in detail in Chapter 5. Table 5.10-1 briefly describes those impacts and identifies measures and controls that will be implemented to reduce or eliminate adverse impacts. The expected impacts and the mitigation measures that are available to reduce these impacts are summarized in Table 10.1-2. Unavoidable adverse impacts from operations of two new units at the VEGP site include evaporative water loss from the Savannah River, additional groundwater withdrawal, air emissions, radioactive and non-radioactive waste to be treated and disposed of, radioactive emissions into the Savannah River and the air, increases in local traffic, and the addition of two natural draft cooling towers to the landscape.

The level of unavoidable adverse impacts from operation of the new units will be small when applicable mitigation measures are considered.

10.1.3 Summary of Adverse Environmental Impacts from Construction and Operations

As can be seen from Table 10.1-1 and Table 10.1-2, most of the adverse environmental impacts associated with the construction and operation of new units at the VEGP site will be reduced to SMALL through the application of mitigation measures. The unavoidable impacts are summarized by category below beginning with socioeconomics which is the only category that will have other than small impacts.

During construction, moderate to large socioeconomic impacts may result from the influx of 4,400 construction workers. Early in the construction phase in Burke County there is the potential for a shortage of suitable long-term housing or rental units. In addition, there is the possibility that the area schools' may not be able to accommodate the children of the construction workers. Fire protection infrastructure, already inadequate could not be able to meet the needs of the county. Roads in the vicinity of the VEGP site will experience increased traffic. Mitigation measures that could be implemented by SNC to minimize traffic impacts include staggering shifts, encouraging car pooling, erecting signs alerting drivers of increased construction traffic, and adding turn lanes at VEGP. Increases in tax revenue that will result from the construction of the new units could be used for school funding, road improvements, and upgrades to the fire protection infrastructure. If housing is not available, local market forces will likely stimulate new home construction. All other socioeconomic impacts from construction activities will be small and temporary.

Socioeconomic impacts during operations will be small. The estimated maximum increase in total population in the region due to the operations workforce is 2,600 people, a small fraction of the total projected population of the region. Most impacts that are functions of population increase (i.e., traffic, impacts to housing and school, tax revenue impacts) will be small. The impacts of increased tax revenues will be large, but most people would consider those impacts beneficial.

Two additional natural draft cooling towers will be visible from River Road, the Savannah River, and from a few locations in the surrounding Georgia and South Carolina counties. The incremental increase in visible impacts from two to four towers will not have any short- or long-term impacts to local residents or visitors, and will therefore be small.

Unavoidable, but small, adverse environmental impacts will be related to land use. Approximately 500 acres on the site will be affected; most of the land that will be cleared at VEGP has been disturbed within the last 30 years, although some is mature second growth pine or mixed hardwood forest. The proposed project is in keeping with the current use of the property, which is generation of power. It is estimated that approximately 2.0 square miles will be required for a new transmission corridor.

Clearing activities and construction of the new units will likely cause wildlife to leave or avoid the construction sites and relocate to other nearby areas. Although any changes to the wildlife population density in the site area or along the transmission line would be difficult to measure.

In addition, clearing of the 2 sq mi transmission corridor could affect some natural habitats. The land use maps of the areas where the corridor will be located, indicated that much of the land is rural forested or agricultural. The conversion of 2 sq mi of rural forested or agricultural land in west central Georgia will not adversely affect land use in the region. GPC will work with the Georgia Department of Natural Resources to ensure that this transmission corridor will be useful for productive wildlife habitat. After construction of the transmission corridors is completed, wildlife is expected to return. Operations of two new units at VEGP will not adversely affect land use at the VEGP site or in the corridor.

Construction activities along the river shoreline will adversely affect some shoreline habitat. In addition, they have potential to temporarily increase the sediment load in that section of the river, although, it is unlikely the increase would be measurable. Consumptive water loss from the Savannah River will be less than 2 percent of the 7Q10 low flow conditions, an amount that would drop the level of the river at VEGP less than 1 inch. Impacts to aquatic biota from water withdrawal will be small. Operation of the additional cooling towers will result in small amounts of salt deposition, but the deposits will be less than one half of the level considered a threshold for leaf damage and maximum deposition will occur on VEGP property. Very small, controlled and permitted concentrations of chemicals will be released to the river; however, these releases will have no measurable effect on water quality, the aquatic biota, or on downstream water users. The thermal plume from the new units will be small, less than 800 cubic feet under worst case

conditions, and will not affect the water quality or the biota of the river. Less than 20 percent of the width of the river will be affected by the discharge structure and mixing zone.

Both construction and operation of the new units will increase the amount of groundwater used at VEGP. However, in both cases, the currently permitted withdrawal limit will not be exceeded.

The new units will discharge small amounts of radioactive liquids and gases within permit and regulatory limits. Potential doses to workers and the public were calculated and determined to be well within regulatory limits.

No major releases of pollutants to the atmosphere will result from operation of the new units; however, testing of standby generators and occasional use of the auxiliary boiler will emit some air pollutants. The emissions from the cooling towers have the potential for making micro-level changes to the meteorology, but only in the immediate vicinity of the towers.

The AP1000 will generate radioactive waste that will need to be disposed. The 660-person workforce and the new units themselves will generate additional non-radioactive wastes. Existing permitted radioactive and sanitary landfills have the capacity to accept these additional wastes.

It is reasonable to expect that populations closest to the VEGP site would be most affected by activities at VEGP. VEGP is adjacent to several Black Races census block groups. The only adverse impact categorized as greater than small is the volume of traffic on River Road. However, SNC has identified mitigation measures to alleviate congestion. Other impacts would be small or beneficial. No impacts that would be disproportionately high and adverse on minority or low-income populations were identified.

Table 10.1-1 Construction-Related Unavoidable Adverse Environmental Impacts

Category	Adverse Impact	Mitigation Measure	Unavoidable Adverse Environmental Impacts
Land Use	Approximately 500 acres of land will be cleared during construction, with the potential for erosion. Land will not be available for other uses.	Comply with requirements of applicable federal, state and local construction permits/approvals and local ordinances. Clear only areas necessary for installation of the power plant/infrastructure. Restrict construction activities to the construction footprint. Use adequate erosion controls and stabilization measures, such as those provided in the Georgia Stormwater Manual. Restrict activities to actual construction site and access ways. Locate soil stockpiles near the construction site. Revegetate all affected temporary-use areas after completion of construction.	310 acres of land occupied on a long-term basis by nuclear plant and associated infrastructure.
	Construction of transmission corridor across approximately 60 linear miles of eastern Georgia.	Minimize potential impacts through compliance with permitting requirements and best management practices, including sediment basins. Restrict sites of access to corridor for construction equipment. Limit maintenance access roads. Revegetate, with attention to wildlife structure or food plots.	Land use on some land will change from woodland or agriculture to open scrub or grassland.

Table 10.1-1 (cont.) Construction-Related Unavoidable Adverse Environmental Impacts

Category	Adverse Impact	Mitigation Measure	Unavoidable Adverse Environmental Impacts
	Potential to disturb buried historic, archaeological, or paleontological resources.	Conduct sub-surface testing prior to start of any onsite work to identify buried historic, cultural, or paeleontological resources. Follow established VEGP procedures to stop work and contact appropriate regulatory agencies if potential unanticipated historic, cultural, or paleontological resources are discovered.	Potential for destruction of unanticipated historic, cultural, or paleontological resources.
	Construction debris will be disposed in on-site of off-site landfills.	Use waste minimization to reduce volume of debris.	Some land will be dedicated to disposal of construction debris and not available for other uses.
Hydrologic and Water Use /	Construction has potential to erode sediments into water resources and will dewater the shallow aquifer.	Adhere to applicable regulations, permits, and plans. Use best Management practices as found in the Georgia Stormwater Manual. Install drainage controls to direct dewatering runoff.	Dewatering of shallow aquifer to surface water.
	Construction will require approximately 460 gpm of groundwater.	Practice water conservation as practical. No other measures or controls will be necessary because withdrawals will be less than allowed by current permits.	Use of groundwater as source for all water used for construction.
	Construction along river banks or stream banks (in the case of the transmission line) could introduce sediments into the river or stream.	Adhere to best management practices. Install drainage controls. Revegetate as soon as possible after clearing.	No unavoidable adverse impacts.

Table 10.1-1 (cont.) Construction-Related Unavoidable Adverse Environmental Impacts

Category	Adverse Impact	Mitigation Measure	Unavoidable Adverse Environmental Impacts
	Use of heavy equipment introduces the possibility of petroleum spills that could enter surface water.	Use good maintenance practices to maintain equipment, and prevent spills and leaks. Invoke VEGP's existing SPCC plan for construction activities.	No unavoidable adverse impacts.
Aquatic Ecology	Construction at river's edge will cause the loss of some organisms, and temporary degradation of habitat. Transmission line construction across streams will cause the loss of some organisms and temporary degradation of habitat.	Install coffer dams or similar engineering protective measures around the construction site. Use best management practices to minimize erosion and sedimentation. Install storm water drainage system at large construction sites and stabilize disturbed soils.	No unavoidable adverse impacts.
Terrestrial Ecology	Habitat loss will kill or displace animals. Clearing and grading will kill or displace animals. Construction noises could startle or scare animals.	Plant footprint is sited on previously disturbed area that is poor natural habitat. Site new corridor to avoid critical or sensitive habitats/species as much as possible per Georgia regulations and GPC practices. Limit vegetation removal and construction activities to construction site or corridor and access roads.	No unavoidable impacts.
	Birds may collide with tall construction equipment.	No measures or controls will be necessary because impacts will be small.	No unavoidable impacts.

Table 10.1-1 (cont.) Construction-Related Unavoidable Adverse Environmental Impacts

Category	Adverse Impact	Mitigation Measure	Unavoidable Adverse Environmental Impacts
Socio-economics	Construction workers, employees at the existing units, and local residents will be exposed to elevated levels of dust, noise and exhaust emissions from vehicles.	Train and appropriately protect VEGP employees and construction workers to reduce the risk of potential exposure to noise, dust and exhaust emissions. Make public announcements or prior notification of atypically loud construction activities. Use dust control measures (such as watering, stabilizing disturbed areas, covering trucks). Ensure construction equipment is maintained. Manage concerns from adjacent residents or visitors on a case-by-case basis.	No unavoidable impacts.
	Construction workers, employees at the existing units, outage employees, and local residents will be exposed to elevated levels of traffic.	Post signs near construction entrances and exits to make the public aware of potentially high construction traffic areas. Add turn lanes at construction entrance. Consider buses, vans, carpools, or staggered shifts.	Level of service on River Road will be reduced during shift change.
	Construction workers could be injured.	Provide on-site services for emergency first aid, and arrange with local hospital emergency room to accept trauma victims, and conduct regular health and safety monitoring. Provide appropriate job-training to construction workers.	No unavoidable impacts.

Table 10.1-1 (cont.) Construction-Related Unavoidable Adverse Environmental Impacts

Category	Adverse Impact	Mitigation Measure	Unavoidable Adverse Environmental Impacts
	Initially sufficient housing to support the influx of construction workforce may be unavailable in Burke County.	Builders and developers will meet the demand for additional housing, and because the project has a long lead time, and the construction workforce will build gradually, it is likely that adequate housing will always be available.	Potential short-term housing shortage in Burke County.
	Initially there may be insufficient classroom space for the influx of construction workers families.	Increased tax revenues as a result of the large construction project will fund additional school resources.	In the short-term there could be school crowding and inadequate fire protection in Burke County.
	Inadequate fire protection infrastructure in Burke County will be further reduced.	Increased tax revenues will be used to purchase additional equipment and hire/ train staff. SNC has a history of keeping local officials apprised of activities at VEGP, and would continue to do so, thus county officials will be aware of any planned influx of construction workers, and would develop mitigation strategies before their arrival.	
Radiological	Construction workers will be exposed to small doses of radiation from the existing units.	None required. All doses will be well within regulatory limits.	Small radiation exposure to construction workers.
Atmospheric and Meteorological	Construction will cause increased air emissions from traffic and construction equipment, and fugitive dust.	Use dust control measures (such as watering, stabilizing disturbed areas, covering trucks). Ensure that construction equipment is well maintained.	No unavoidable adverse impacts.
Environmental Justice	Except for increased traffic on River Road, no disproportionately high or adverse impacts to minority or low-income populations were identified.	Consider buses, vans, carpools, or staggered shifts.	No unavoidable adverse impacts.

Table 10.1-2 Operations-Related Unavoidable Adverse Environmental Impacts

Category/ Vogtle ESP ER Section	Adverse Impact	Mitigation Measure	Unavoidable Adverse Environmental Impacts
Land Use	Operating the new units will increase radioactive and non-radioactive wastes that are required to be disposed in permitted disposal facilities or permitted landfills.	Practice waste minimization to minimize the volume of wastes.	Some land will be dedicated to permitted landfills or licensed disposal facilities and will not be available for other uses.
Hydrological and Water Use	Operations will result in discharge of small amounts of chemicals to the Savannah River.	All discharges will comply with Georgia NPDES permit and applicable water quality standards. Revise the existing VEGP Storm Water Pollution Prevention Plan or prepare and implement a new one to avoid/minimize releases of contaminated storm water. Revise the existing VEGP Spill Prevention Countermeasures and Control Plan or prepare and implement a new one to avoid/minimize contamination from spills.	No unavoidable adverse impacts.
	Water for some systems will be provided by groundwater.	Maximum normal groundwater use will be within existing permit limits.	Water withdrawn from groundwater will not be available for other uses. In the unlikely event of off-normal pumping by more than one unit, the groundwater withdrawal limits could be exceeded and the aquifer drawdown could be accelerated.
	Maintenance activities at the site and along the transmission line could result in small petroleum spills.	Revise the existing VEGP Spill Prevention Countermeasures and Control Plan or prepare and implement a new one to avoid/minimize contamination from spills. Adhere to the GPC SPCC plan when working on transmission lines.	No unavoidable adverse impacts.
	Maximum surface water consumptive use will be less than 2 percent of 7Q10.	No mitigation required.	Water lost through evaporation will not be available for other uses.

Table 10.1-2 (cont.) Operations-Related Unavoidable Adverse Environmental Impacts

Category/ Vogtle ESP ER Section	Adverse Impact	Mitigation Measure	Unavoidable Adverse Environmental Impacts
	Operations will result in a small thermal plume discharged to the Savannah River.	The differences between plume temperature and ambient water temperature will be maintained within limits set in the NPDES permit.	No unavoidable adverse impacts.
Aquatic Ecology	Operations will result in discharge of small amounts of chemicals to the Savannah River.	The NPDES permit limits are set to ensure that discharges do not affect aquatic populations or water quality.	No unavoidable adverse impacts.
	Routine maintenance activities could result in petroleum spills near water.	Revise the existing VEGP Spill Prevention Control and Countermeasures Plan or prepare and implement a new one to avoid/minimize contamination from spills.	No unavoidable adverse impacts.
Terrestrial Ecology	Some birds will collide with the cooling towers or the transmission line.	This is not a problem with the existing cooling towers and is not expected to be a problem with the new towers. Bird collisions with transmission lines are so rare that none have been reported to GPC. No mitigation is necessary.	No unavoidable adverse impacts.
	Salt drift will be distributed in a 3,300 foot radius around each tower.	The rate of deposition will be less than that expected to cause leaf damage. No mitigation is necessary.	No unavoidable adverse impacts.
	Episodic loud noises at the site or along transmission line could frighten animals.	None necessary.	No unavoidable adverse impacts.
Socioeconomic	The plants emit low noise.	Noise levels would normally not be above background at the site boundary. No mitigation is necessary.	No unavoidable adverse impacts.
	Episodic loud noises could annoy nearby residents	Handle incidents on a case-by-case basis.	
	New transmission line has potential to produce electric shock in people standing near the line.	Build transmission line to NESC code to minimize noise and electric shock.	No unavoidable adverse impacts.
	Additional cooling towers and plumes would impact existing viewscape.	Consider landscaping to hide towers from boaters on the river.	No unavoidable adverse impacts.

Table 10.1-2 (cont.) Operations-Related Unavoidable Adverse Environmental Impacts

Category/ Vogtle ESP ER Section	Adverse Impact	Mitigation Measure	Unavoidable Adverse Environmental Impacts
	Two additional units will double the traffic on local roads during shift change. More frequent outages at VEGP will increase traffic even further.	Consider staggering outage shifts to reduce plant-associated traffic on local roads during shift changes.	No unavoidable adverse impacts.
	Emissions from diesel generators and the auxiliary boilers.	No mitigation needed. Emission would be within limits established in certificates of operation.	No unavoidable adverse impacts.
	Population in the region may increase by 2,600 people.	No mitigation required. The increased tax revenues from construction will support upgrades to additional infrastructure. Housing availability is adequate in the region.	No unavoidable adverse impacts.
Radiological	Potential doses to members of the public from releases to air and surface water.	All releases will be well below regulatory limits. No mitigation required.	No unavoidable adverse impacts.
Atmospheric and Meteorological	Median plume from cooling towers will be about 0.5 miles long with a maximum plume length of 6.2 miles expected 3.5 percent of the time.	No mitigation required.	No unavoidable adverse impacts.
	Diesels and the auxiliary boiler would contribute to air emissions.	Comply with permit limits and regulations for installing and operating air emission sources.	No unavoidable adverse impacts.
Environmental Justice	No disproportionately high or adverse impacts on minority or low-income populations resulting from operation of the proposed new units have been identified.	None required.	No unavoidable adverse impacts.

10.2 Irreversible and Irretrievable Commitments of Resources

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

10.2.1 Irreversible Environmental Commitments

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

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

10.2.1.1 Groundwater and Surface Water

Permitted groundwater capacity will be sufficient for the water demands during construction and operation of the new units. Once groundwater is removed from the aquifer it will be consumed or managed as surface water run-off. Some of the cooling water taken from the Savannah River will be lost through evaporation. In both cases, the impact to the resource will be small. Because the resource use is consumptive, it will not be available for other uses, now or in the future.

10.2.1.2 Land Use

Land committed to the disposal of radioactive and non-radioactive wastes is committed to that use, and cannot be used for other purposes.

Once the units cease operations and the plant is decommissioned in accordance with NRC requirements, the land that supports the facilities could be returned to other industrial or non-industrial uses.

10.2.1.3 Aquatic and Terrestrial Biota

Construction will temporarily adversely affect the abundance and distribution of local flora and fauna on the VEGP site. However, no significant effect on habitat or individual species is expected to occur. Similar impacts should occur on the new transmission corridor. Once construction is complete flora and fauna will recover in areas that are not affected by operations.

10.2.1.4 Releases to air and surface water

Radioactivity, air pollutants, and chemicals will be released from the facility during normal operations. Releases can alter air and water quality. All the releases from the new units will be made in accordance with duly-issued-permits, and will not measurably adversely affect the resource.

10.2.2 Irretrievable Commitments of Resources

Irretrievable commitments of resources during construction of the new units generally will be similar to that of any major, multi-year, construction project. Unlike the earlier generation of nuclear plants, asbestos and other materials considered hazardous will not be used, or will be used sparingly and in accordance with safety regulations and practices. DOE's report **(DOE 2004)** on new reactor construction estimates 12,239 yds of concrete, and 3,107 tons of rebar for a reactor building; 2,500,000 linear feet of cable for a reactor building and 6,500,000 linear feet of cable for a single unit; and up to 275,000 feet of piping greater than 2.5 inches for a single 1300 Mwe reactor. While the amounts of these materials required will be large, the amounts will not be atypical of other types of power plants such as hydroelectric and coal-fired plants, nor of many large industrial facilities (e.g., refineries and manufacturing plants) that are constructed throughout the United States. Use of construction materials in the quantities associated with those expected for a nuclear power plant, while irretrievable unless they are recycled at decommissioning, will have a small impact, with respect to the availability of such resources.

During operations, the main resources that are irreversibly and irretrievably committed are the uranium that is used in fuel and the energy required to create the fuel. The World Nuclear Association studies supply and demand of uranium and states that a 50-year supply of lower-cost uranium is available and that supply could be expected to increase as market prices rise. A doubling in market price from 2003 could be expected to increase measured resources tenfold, over time **(World Nuclear Association 2005)**. Therefore, the uranium that will be used to generate power by the new units, while irretrievable, will have a small impact with respect to the long-term availability of uranium worldwide.

Other irretrievable commitments of resources include those materials used for the normal industrial operations of the plant that can not be recovered or recycled or that are consumed or reduced to unrecoverable forms, including elemental materials that will become radioactive.

Section 10.2 References

(Defense National Stockpile Center 2006) Defense Logistics Agency, "Inside DNSC," available online at https://dnsca.dla.mil/DNSC/contentview.asp?contentpage=inside& folder=dnsc, accessed 4/26/06.

(DOE 2004) U.S. Department of Energy, Study of Construction Technologies and Schedules, O&M Staffing and Cost, Decommissioning Costs and Funding Requirements for Advanced Reactor Designs, Vol. 2 – MPR-2610, prepared by Dominion Energy Inc., Bechtel Power Corporation, TLG, Inc., and MPR Associates under Contract DE-AT01-020NE23476, May 27.

(World Nuclear Association 2005) Supply of Uranium, available online at www.world-nuclear.org/info/printable_information_papers/inf75print.htm, accessed on 4/26/06.

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10.3 Relationship Between Short-Term Uses and Long-Term Productivity of the Human Environment

This environmental report has focused on the analyses and resulting conclusions associated with the environmental and socioeconomic impacts arising from activities during the construction and operation of new units at the VEGP site. These activities are considered to be short-term uses for purposes of this section. In this section, the long-term is considered to start with the conclusion of decommissioning of the new units at the VEGP site. This section includes an evaluation of the extent to which the short-term uses preclude any options for future use of the VEGP site.

10.3.1 Construction of New Units at VEGP and Long-Term Productivity

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

The new units will be constructed at the VEGP site, property selected and acquired for power generation. The acreage disturbed during construction of the new units will be larger than that required for the actual structures and other ancillary facilities because of the need for construction laydown and support areas and a parking area for the construction workforce. The clearance of this acreage, plus the noise of the construction, will displace some wildlife and destroy vegetation. Once the new units are completed, the disturbed areas will be restored. Wildlife will be expected to return to the restored area.

Noise emitted during some construction activities will increase the ambient noise levels in the vicinity of the site. However, upon completion of these activities, the ambient levels will return to the levels associated with the operation of the existing units. The workforce will be protected by adherence to the OSHA requirements for noise levels. There will be no effects on the long-term productivity of the VEGP site as a result of these impacts.

Construction traffic has the potential to impact traffic in the vicinity of the VEGP site, but the impact will cease once construction is completed.

The construction of the new units will be beneficial to the local area through the generation of new construction-related jobs, local spending by the construction workforce, and payment of taxes to the area. Some socioeconomic impacts that occur as a result of increased population and due to construction will cease once construction is complete and the workforce leaves the area, but changes incurred because of increased tax revenues will persist into the foreseeable future. In those cases, construction will have some impact on the long-term economic productivity of the area, particularly Burke County.

Construction will not affect long-term productivity of the environment.

10.3.2 Operation of the New Units and Long-Term Productivity

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

The VEGP site has been developed as a location for major energy generation facilities. Therefore, the operation of the new units represents a continuation of the current and planned use of the land. However, once the reactors cease to operate and the plant is decommissioned to NRC standards, the land will be available for other industrial or non-industrial uses.

The new units will require cooling water withdrawn from the Savannah River. Some of the water will be lost to evaporation, but the impacts to the river will not be noticeable. After the reactors cease to operate and the units are decommissioned, water withdrawal from the river will cease. Groundwater will be used for some plant systems. After the plant ceases to operate and is decommissioned, groundwater withdrawals will cease.

The operation of the new units will slightly increase air emissions because of diesel generators and the auxiliary boiler that will be operated intermittently. The Technical Support Center will have a small backup generator. This equipment will be operated in accordance with applicable federal, state, and local regulations and they will not create any measurable impacts on regional air quality. Additionally, no long-term impacts will result from salt deposition arising from salt drift from the cooling towers as the analysis has determined the amount deposited will be less than levels at which ecological impacts might occur. Normal maintenance activities and precipitation will prevent the buildup of salt in the soil at the cooling towers. No future issues for the long-term uses of the site will result from the impacts of increased air emissions or salt deposition. Once the plant ceases to operate and is decommissioned, impacts to air will cease.

Chemicals and thermal pollution will be released to the Savannah River, in compliance with state and federal regulations. The releases will not adversely affect the Savannah River water quality during the operation of the plant. After decommissioning, releases to surface waters will cease.

Impacts due to radiological emissions will be small, because the operation of the new units will be in accordance with state and federal regulations. Radiological emissions will not contaminate VEGP property or the surrounding land. Once the plants cease to operate and are decommissioned, radiological releases will cease. No future issues associated with the radiological emissions from operation of the new units will affect the long-term uses of the VEGP site.

Socioeconomic changes brought about by the operation of the plant will likely continue after the plant is decommissioned. Property taxes paid by GPC to Burke County will provide significant revenues to the county for the foreseeable future, and will support greater county infrastructure and social services improvements than taxes on other land uses would. The Burke County population increases during the life of the plant, will use the services provided as a result of VEGP-related tax revenues. Most of Burke County is forested or agricultural, and provides little tax revenue to support county infrastructure and services. Therefore, taxes paid to Burke County will have a long-term effect on the productivity of the county. The economic benefits to Burke County from VEGP would be considered by most people to be a benefit.

10.3.3 Summary of Relationship Between Short-Term Uses and Long-Term Productivity

The impacts resulting from the construction and operation of the new units at the VEGP site will result in some adverse short-term impacts. The principal short-term benefit is the production of electrical energy. In addition, the economic benefit of the VEGP site and the associated workforce is large compared with the economic benefit from agriculture or other likely uses for the site. Because the site will eventually be restored by decommissioning, there will be no impacts to long-term productivity.

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10.4 Benefit-Cost Balance

NRC Regulation 10 CFR 52.17(a)(2) indicates that an early site permit (ESP) application need not include an assessment of benefits, allowing applicants to defer the analysis until submittal of a combined license (COL). Southern Nuclear Company (SNC) intends to apply for a COL for the Vogtle Electric Generating Plant (VEGP) in 2008 but has as a goal minimization of the amount of additional environmental information needed for a COL application. For this reason, SNC has included the benefit-cost balance in its ESP application.

10.4.1 Benefits

10.4.1.1 Need for Power

VEGP Units 3 and 4 will each generate approximately 1,117 megawatts electric (MWe) net, for a total of 2,234 megawatts. Assuming a reasonably low capacity factor of 85 percent, the 2-unit plant average annual electrical-energy generation will be more than 16,000,000 megawatt-hours. A reasonably high capacity factor of 93 percent would result in slightly more than 18,000,000 megawatt-hours of electricity. As discussed in Chapter 8, the Georgia Power Company (GPC) need for this benefit (i.e., need for power) is subject to a Georgia Public Service Commission (GPSC) approval process. GPC and the GPSC will not formally review the case for including new nuclear capacity in the GPC generation mix until GPC submits its 2007 Integrated Resource Plan (IRP). However, the GPSC has approved the current GPC load forecast that shows a need for generating capacity that VEGP Units 3 and 4 could provide.

10.4.1.2 Fuel Diversity and Natural Gas Alternative

Fuel diversity is key to affordable and reliable electricity. A diverse fuel mix protects electric companies and consumers from contingencies such as fuel unavailability, price fluctuations, and changes in regulatory practices **(EEI 2006**). History has taught us that it is risky to develop an over-reliance on any one energy source. In fact, a balanced energy portfolio has been the key to providing America with a growing supply of affordable electricity for the past 30 years **(CEED 2006)**.

The GPC fuel mix is made up of approximately 72 percent coal, 19 percent nuclear, 3 percent hydroelectric, and less than 6 percent natural gas and oil **(GPC 2004)**. As observed in the press and academia, because fuel diversity has been excellent, Georgia's electrical utility industry was not overly dependent on natural gas for power generation **(ABC 2002)**. However, the GPC IRP for 2004 shows a trend of increasing dependence on gas, and a corresponding decreasing dependence on nuclear, coal, and hydro energy, with gas projected to account for **[confidential commercial information]** percent of GPC capacity by 2023. With no other fuel in the mix, gas would in that time frame fuel approximately **[confidential commercial information]** megawatts of base and intermediate load generation **(GPC 2004)**.

The projected GPC future reliance on gas is considerably higher than U. S. Energy Information Administration projection of natural gas providing 24 percent of the nation's electricity by 2025 **(NRRI 2005)**. The Georgia legislature has pointed out that virtually all new power plants built in Georgia in the last 15 years are fueled by natural gas, exposing electricity consumers to punishing price volatility, and went on to urge Georgia utilities to study the feasibility of building new nuclear power plants (Senate Resolution 865). Testimony during the 2004 IRP approval process expressed concern about GPC planning to rely exclusively on natural gas for future resource additions, a concern that the GPSC echoed in approving the plan **(GPSC 2004**. See Appendix C).

Closely intertwined with the issue of fuel diversity is the issue of using natural gas to generate electricity. Maintaining fuel diversity is a matter of maintaining a balance of fuel mixes. Relying heavily on gas is a matter of choosing a limited resource over more abundant fuels.

High prices for natural gas and the intense, recurring periods of price volatility experienced over the last 4 years are influenced partly by demand for natural gas in the electric generation sector. Electric sector demand for natural gas is being driven by the large amounts of new gas-fired electric generating capacity built in the United States during the last decade. More than 90 percent of all new electric generating capacity added over the past 5 years is fueled with natural gas. Natural gas has many desirable characteristics and should be part of the fuel mix, but "over-reliance on any one fuel source leaves consumers vulnerable to price spikes and supply disruptions." New nuclear plants provide forward price stability that is not available from generating plants fueled with natural gas. The intense volatility in natural gas prices experienced over the last several years is likely to continue, and leaves the U.S. economy vulnerable. Although nuclear plants are capital-intensive to build, the operating costs are stable and dampen the volatility elsewhere in the electricity market. **(NEI 2005)**

Natural gas has uses that are not readily served by other fuel choices, such as many manufacturing processes. This led the U. S. House to prepare a majority staff report that included the following findings **(USHR 2006)**:

- To enhance competitiveness and protect American jobs, natural gas must not be used for baseload electricity generation or for new generating capacity. Natural gas should be reserved for industries that use it as a feedstock or for primary energy – and cannot substitute for it by fuel-switching.
- Nuclear energy must become the primary generator of baseload electricity, thereby relieving the pressure on natural gas prices and dramatically improving atmospheric emissions.

GPC has committed to addressing the nuclear option in its next IRP update in 2007. For Georgia, VEGP Units 3 and 4 represent a step towards maintaining what has been a successful mix of fuel types for generating electricity. The new units will help maintain the state's fuel diversity while meeting state and national goals of creating new baseload generation that would not use natural gas as a fuel.

10.4.1.3 Emissions Reduction

As alluded to by the majority staff report, nuclear generation contributes considerable air quality benefits to the nation. Unlike electricity generated from coal and natural gas, nuclear energy does not result in any emissions of air pollutants associated with global warming and climate change (e.g., nitrogen oxides, sulfur dioxide, carbon dioxide) or methyl mercury. Power plants are responsible for 36 percent of carbon dioxide, 64 percent of sulfur dioxide, 26 percent of nitrogen oxides, and 13 percent of mercury emissions from industrial sources in this country. The majority of industry's emissions are from coal-fired plants. **(USHR 2006)**

Sections 9.2.3.1 and 9.2.3.2 analyze coal- and gas-fired alternatives to VEGP Units 3 and 4, respectively. Air emissions from these alternatives and nuclear power are summarized below:

Regardless of which reasonable alternative one compares to nuclear power, VEGP 3 and 4 would represent a substantial benefit in emission reduction, or emission avoidance, assuming that an alternative power source would be constructed if VEGP 3 and 4 were not. Given the concern within Georgia over projections of future use of gas for generating electricity, the coal-fired alternative would appear to be the most likely chosen in lieu of nuclear power.

10.4.1.4 Licensing Certainty

The regulatory scheme used for the existing domestic fleet of nuclear plants, under 10 CFR 50, was a two-step process that resulted in much uncertainty about cost projections and, in retrospect, final costs. This was due, in part, to the fact that the industry had to make large capital investments prior to resolving licensing issues. In large, capital-intensive construction projects, interest costs are a significant portion of the project cost. Interest charges on overnight capital costs account for a quarter of the levelized cost of electricity from nuclear power plants **(UC 2004)**. Under 10 CFR 50, licensing delays quickly and substantially increased project cost. Design changes, whether driven by licensing concerns, backfit requirements, or other factors, had similar effects.

SNC is looking to NRC's new 10 CFR 52 process to provide early resolution of siting issues prior to large investments of financial capital and human resources in new plant design and construction, early resolution of issues on the environmental impacts of construction and operation of proposed reactors, the ability to bank sites on which nuclear plants may be located, and the facilitation of future decisions on whether to build new nuclear plants. SNC believes that the resultant increase in licensing certainty will reduce project costs by decreasing premiums associated with uncertainty and making licensing and construction scheduling more controllable and reliable. SNC also believes that this increased certainty would become a factor that the Georgia Public Service Commission would consider in evaluating whether to authorize GPC to proceed with the project.

10.4.1.5 Advantages of Nuclear Power

Concerns about global warming and climatic change make it reasonable to expect that, eventually, the United States may have to strictly curb emissions from fossil-fuel electric generation plants, conceivably to the point of displacing coal- and gas-fired electricity generation. If environmental policies greatly restrict carbon emissions in the future, the cost of building and operating fossil-fired plants could increase by 50 to 100 percent. Nuclear power is the only technology currently available that is a viable alternative to fossil-fired plants for baseload generation. In view of the time that it takes to gear up the nuclear industry, the prospect of needing nuclear power to displace fossil-fuel power is one of the reasons for national concern with maintaining a nuclear energy capability. **(UC 2004)**

10.4.1.6 Tax Payments

The VEGP owners will pay property taxes on the new units for the duration of the 40-year operating licenses. Burke County received the taxes paid on VEGP property. As described in Section 5.8.2.2.1, over the life of the plant, annual tax payments could range from approximately $29,000,000 during initial operations to approximately $3,500,000 in the last years of the 40 year operational life. Most people consider large tax payments a benefit to the taxing entity because they support the development of infrastructure which supports further economic development.

10.4.1.7 Local Economy

The new units would require a workforce of about 660 people. The multiplier effect would create additional indirect jobs. In total, 1,600 new jobs within about a 50-mile radius of the plant (Section 5.8.2.2.1) would be created by the start-up of the new units and would be maintained throughout the life of the plant. Many of these jobs would be in the service sector and could be filled by unemployed local residents, lessening demands on social service agencies in addition to strengthening the economy. The economic multiplier effect of the increased spending by the direct and indirect labor force created as a result of two new units would increase the economic activity in the region, most noticeably in rural Burke County.

Nuclear plants such as VEGP generate approximately $350 million in total output for the local community and roughly $60 million in total labor income. These figures include direct effects, which reflect expenditures for goods, services, and labor, and secondary effects, which include subsequent spending in the community. The economic multiplier effect is one way of measuring secondary effects and means that every dollar spent by nuclear plants result in the creation of an additional $1.13 in the community. **(SSEB 2006)**

10.4.2 Costs

10.4.2.1 Monetary – Construction

In evaluating the VEGP Units 3 and 4 monetary costs, SNC reviewed published literature, vendor information, internally-generated general information, and internally-generated site-specific information. There are many cost studies available in the literature with a wide range of cost estimates. SNC found four studies to be most authoritative due to the breadth and depth of their analyses and the fact that other studies tend to be based on them. These are the following:

- MIT Study **(MIT 2003)**
- UC Study **(UC 2004)**
- EIA Study **(EIA 2004)**
- OECD Study **(OECD 2005)**

The phrase commonly used to describe the monetary cost of constructing a nuclear plant is "overnight capital cost." The capital costs are those incurred during construction, when the actual outlays for equipment and construction and engineering are expended. Overnight costs are exclusive of interest and include engineering, procurement, and construction costs, owner's costs, and contingencies.

Estimates of overnight capital costs for construction range from $1,100 per kilowatt to $2,300 per kilowatt, with $1,500 to $2,000 per kilowatt being the most representative range. Many factors account for the range; the specific technology and assumptions about the number of like-units built, allocation of first-of-a-kind costs, site location and parity adjustments to allow comparison between countries, and allowances for contingencies are some examples. The estimates are not based on nuclear plant construction experience in this country, which is more than 20 years old. Actual construction costs overseas have been less than most recent domestic construction, suggesting that the industry has learned from the domestic experience. There is an assumption that that the overseas' experience can be applied domestically and the studies have found the overseas experience to be most applicable to estimating the cost of new domestic nuclear plant construction.

The four studies tend to support $2,000 per kilowatt as a reasonable high-end overnight capital cost estimate. The $2,300 value is based on construction in Japan. While no explanation is offered as to why this is so high, it is reasonable to suggest that contributing factors are the high cost of living in Japan (labor accounts for more than 20 percent of costs) and difficulties associated with construction on an island. For the purposes of analysis in this environmental report, to avoid understating the cost, SNC has chosen to use the $2,000 per kilowatt value. Together with an installed capacity of 2,234 MWe, $2,000 per kilowatt results in a VEGP Units 3 and 4 construction cost of approximately $4.5 billion.

10.4.2.2 Monetary – Operation

As for construction costs, the four studies show a wide range of operation cost estimates Operation costs are frequently expressed as levelized cost of electricity, which is the price at the busbar needed to cover operating costs and annualized capital costs. Overnight capital costs account for a third of the levelized cost, and interest costs on the overnight costs account for another 25 percent **(UC 2004)**. Levelized cost estimates range from $36 to $83 per megawatt hour (3.6 to 8.3 cents per kilowatt hour). Factors affecting the range include choices for discount rate, construction duration, plant lifespan, capacity factor, cost of debt and equity and split between debt and equity financing, depreciation time, tax rates, and premium for uncertainty. Estimates include decommissioning but, due to the effect of discounting a cost that would occur as much as 40 years in the future, decommissioning costs have relatively little affect on the levelized cost. Using the same criteria as for construction costs, SNC has concluded that $65 per megawatt hour (6.5 cents per kilowatt hour) is a reasonably high-end levelized cost of electricity for nuclear generation. This compares well with preliminary cost information that GPC has filed with the GPSC **(GPC 2004)**.

In addition to nuclear plant costs, the four studies provide coal- and gas-fired generation costs for comparison to nuclear generation costs. One study **(OECD 2005)** showed nuclear costs competitive with coal and gas. The other studies showed nuclear costs that exceed those of coal and gas. One study **(MIT 2003)** indicated that new nuclear power is not economically competitive but went on to suggest steps that the government could take to improve nuclear economic viability. Since the study, the government has undertaken those steps as follows:

- U. S. Department of Energy has provided financial support for plants testing the U. S. Nuclear Regulatory Commission licensing processes for early site permits and combined operating licenses.
- The U. S. government has endorsed nuclear energy as a viable carbon-free generation option.
- The Energy Policy Act of 2005 instituted a production tax credit for the first advanced reactors brought on line in the U. S.

SNC has concluded that the government steps have negated the MIT study's conclusion that new nuclear power is not economically competitive.

10.4.2.3 Environmental and Material

Section 10.1 identifies unavoidable adverse impacts of the proposed action (i.e., impacts after consideration of proposed mitigation actions), and Section 10.2 identifies irretrievable commitments of resources. Table 10.4-2 includes these costs.

10.4.3 Summary

Table 10.4-2 summarizes benefits and costs of the proposed action. Costs that are environmental impacts are those anticipated after implementation of proposed mitigation measures.

Table 10.4-1 Avoided air pollutant emissions

Pollutant	Coal Emissions (tons per year/ 2,120 MW)[a]	Gas Emissions (tons per year/ 2,120 MW)[a]	Nuclear Emissions (tons per year)[b]
Sulfur dioxide	5,587	169	0
Nitrogen oxides	1,815	540	0
Carbon monoxide	1,815	112	0
Particulates having a diameter of less than 10 microns	91	94	0
Particulates having a diameter of less than 2.5 microns	0.39	94	0

a. Based on constructing two units to replace the power produced by Units 3 and 4 (see Section 9.2).
b. Nuclear power plants have emergency and auxiliary equipment that is fossil-fuel-fired and emits pollutants. The equipment is generally operated only for testing purposes for less than 250 hours per year. As such, the emissions are considered de minimus and are excluded here.

Table 10.4-2 Benefit-Cost Summary

Benefit-Cost Category	Description
	BENEFITS
Electricity generated	16,000,000 to 18,000,000 megawatt-hours per year
Generating capacity	2,234 megawatts
Fuel diversity and natural gas alternative	Nuclear option to coal- and gas-fired baseload generation
Emissions reduction	Avoidance of 169 to 5587 tons per year sulfur dioxide
	Avoidance of 540 to 1,815 tons per year nitrogen oxides
	Avoidance of 112 to 1,815 tons per year carbon monoxide
	Avoidance of 94 to 91 tons per year particulates
Licensing certainty	Early resolution of environmental issues, reliance on nuclear as generation option
Advanced Light Water Reactor development	Maintaining domestic nuclear technology capability as hedge against possible need to control global warming
Tax payments	Payments could range from approximately $29,000,000 to $3,500,000 annually over the life of the units
Local economy	Add 1600 jobs to the local economy
Cultural resources	Mitigative work adding to local historic and pre-historic knowledge base
	COSTS
Construction cost	$4.5 billion (overnight capital cost)
Operating cost	6.5 cents per kilowatt-hour (levelized cost of electricity)
Land use	310 acres occupied on long-term basis by nuclear plant and associated infrastructure. On-site landfill may restrict future uses of that land.
	Portion of new transmission line corridor that is wooded would be converted to open scrub or grassland
Housing	Potential short-term housing shortage in Burke County during the beginning of the 7.5-year construction period
Local Infrastructure	Potential short-term inadequate fire protection in Burke County during the beginning of the 7.5-year construction period
Cultural resources	Potential for destruction of historical, cultural, or paleontological resources

Table 10.4-2 (cont.) Benefit-Cost Summary

Benefit-Cost Category	Description
Groundwater use	During 7.5-year construction period, use of Cretaceous and Tertiary aquifers will increase potentiometric surface drawdown at site boundary by a maximum of approximately 2.3 feet. Dewatering of shallow, water-table aquifer would have only small, local affect. During 40-year operation period, an average 752 gpm will be withdrawn from the Cretaceous and Tertiary aquifers. This consumptive use will increase potentiometric surface drawdown at site boundary by a maximum of approximately 12.6 feet (based on four operating units). The drawdown effect is expected to disappear after operations cease.
Surface water use	During the 40-year operation period, approximately 37,000 gpm will be withdrawn from, and 9,000 gpm discharged to, the Savannah River. The balance, approximately 26,000 gpm, will be lost through evaporation.
Material	25,000 yds concrete 6,000 tons rebar 13,000,000 linear feet cable 550,000 feet of piping having diameter > 2.5 inches 981 metric tons of uranium
Radiological	Construction worker dose: 12.1 millirem per year (total body) Operation worker dose: 80.7person-rem Maximally exposed individual (public) dose: 0.12 millirem per year (total body) during operation Collective dose to the public: 0.013 person-rem per year during operation Population dose risk from severe accident: 4.2×10^{-2} person-rem per reactor year

Section 10.4 References

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10.5 Cumulative Impacts

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

To determine if cumulative impacts will be expected the existing environment in the region of VEGP (Chapter 2) was considered in association with the environmental impacts presented in Chapters 4 and 5 for operating two new units at VEGP. The section also contemplates renewal of VEGP Units 1 and 2 operating licenses, and the cumulative impacts of four units on the affected environment.

10.5.1 Cumulative Impacts from Construction

Construction activities will require some groundwater in addition to that used by the existing facilities. The maximum withdrawal rate of the combined existing units and construction will be less than withdrawal rate permitted by the State. No other large groundwater users are in the vicinity of VEGP. Therefore, cumulative impacts to groundwater during construction will be small.

Approximately 310 acres of the VEGP property will be required for the new units. An additional transmission corridor will be constructed and will require a total of approximately 2.0 sq mi of land over a distance of approximately 60 miles. Eastern Georgia is predominantly rural and most land is agricultural or forested. SNC is unaware of any large projects that will change the predominant land use in Burke County or the counties the corridor will cross. The construction of Units 1 and 2 did not spur a great amount of growth in Burke County, and SNC expects the impacts of Units 3 and 4 to be similar. The project will not contribute to cumulative impacts of changing land use.

During construction noise levels will increase above those now experienced at VEGP, however, the noise levels will return to ones expected for a power generation facility after construction ceases. No other large construction activities are planned in the vicinity, and so noise from construction will not be cumulative with other industrial sources.

Construction will result in increased air emissions from commuter traffic and the construction equipment. However, as noted, this is the only large construction project planned for the area and the air quality in the vicinity is in attainment with air quality standards. No adverse cumulative impacts to air quality are expected.

The maximum construction workforce will be approximately 4,400 people and the percent of the workforce that will live in Burke County could have short-term moderate impacts to the Burke County housing market and social services, particularly schools and fire protection infrastructure. However, no other construction projects of this magnitude have been identified in the area, and

so there will be no cumulative impacts due to other large construction workforces. No other cumulative impacts due to construction have been identified.

10.5.2 Cumulative Impacts of Operations

After operations begin, the new units will use groundwater for some operational systems. The groundwater use requirements of the new units and the existing units will be less that the withdrawal rate currently permitted by the State. No other significant current or future users of groundwater in the vicinity of VEGP have been identified. Therefore, cumulative impacts to groundwater during operation will be small and not warrant mitigation.

Noise from the existing units is usually indistinguishable from background, and the new units will generate similar levels of noise. One small power generation facility on the Savannah River Site is within 6 miles of VEGP. No other sources of industrial noise occur in the 6-mile vicinity, and so cumulative noise pollution is expected to be minimal.

Operational activities that could impact surface water such as NPDES-permitted discharges will be small. The maximum mixing zone for the existing units' thermal plume was estimated to be 4,300 cu ft with a downstream distance of about 20 feet and a depth of about 10 feet **(AEC 1974)**. Due to the small size of the plume, field verification of the modeled plume would have been difficult to perform and was not required. SNC has no field measured data on actual plume size. However, there is no basis to believe the model of the existing plume is not accurate. In any event, prior to construction and operation, the only way to assess the cumulative impacts of the existing and new units discharge is clearly through the use of modeling. Based on computer modeling, blowdown from the new units' cooling towers, adjusted by the centerline temperature of the existing thermal plume will result in a new thermal plume with a surface area of approximately 300 sq ft, a cross-sectional area of approximately 115 sq ft, and a volume of approximately 800 cu ft. Neither the existing nor the new plume is large enough to significantly affect the water quality or biota of the river. The new discharge will be downstream of the existing discharge plume and the existing plume will mingle with the new plume. This commingling is reflected in the previously described model, which resulted in an additional 800 cu ft. plume associated with the new discharge. This plume impacts less than 11 percent of the bank-to-bank cross-section area. The cumulative impacts of the plumes from the existing discharge and the proposed discharge on the Savannah River will be SMALL and will not warrant mitigation.

Through the operation of the cooling water intake structures, small numbers of adult and juvenile fish and fish eggs and larvae may become impinged or entrained at VEGP. Based on the results of impingement and entrainment studies performed immediately upstream at SRS and design features of the VEGP cooling water intake structures (discussed in Section 5.3), cumulative impacts from the operation of the existing intake and the proposed intake on the Savannah River are essentially additive. That is, the cumulative impacts are equal to the total of the independent impacts from the existing and the new intake structures. At the average river flow, consumptive

use represents approximately 1.4 percent of river flow. At the low flow 7Q10 flow that occurs approximately once per decade, consumptive use represents approximately 3.4 percent of the 7Q10 flow. The impacts of the combined four units consumptive use of water are SMALL and will not warrant mitigation. Even during the extreme low flow event, the impacts remain SMALL. The impacts to both eggs and larval fish at the extreme low flow event are overstated since most of the spawning takes place in Spring and early Summer when flows are high. 7Q10 flows occur in Fall, when the presence of eggs and larval fish is significantly lower.

The new cooling system will withdraw make up water from the Savannah River, as does the existing system. The existing units have a maximum actual consumptive water use of 30,000 gpm (Table 2.9-1) and the new units have a maximum estimated consumptive use of 28,904 gpm. Between VEGP and the nearest downstream users are several large tributary creeks. The cumulative impacts of VEGP water withdrawal on the Savannah River and downstream users will be SMALL and will not warrant mitigation. In recent years, water withdrawal associated with the Savannah River Site (SRS) has decreased dramatically. The decrease in SRS withdrawals offsets the proposed increase in water withdrawal associated with Vogtle Units 3 and 4 by a factor of 20 or more. The cumulative impact to the aquatic community is improved significantly.

Two natural draft cooling towers will join the two existing towers on the local sky-line. The towers will appear to be clustered together so the visual impact will be only slightly different from what it is now. Two additional towers will increase the size of the plume and its visibility from offsite areas, but will not change the nature of the visual experience. Cumulative impacts on the viewscape will be SMALL and will not warrant mitigation.

The distance between the additional pair of cooling towers and the existing pair of towers will be approximately 4,000 feet. A single cooling tower's plume is estimated to have a maximum salt deposition rate of 3.6 pounds per acre per month, and that maximum deposition will occur 1,600 feet from the tower. Salt deposition was not estimated for Units 1 and 2. Even assuming that all four towers deposited the maximum of 3.6 pounds per acre per month, SNC does not believe that salt deposition from all four units warrants mitigation for several reasons. The deposition rate is a calculated maximum rate, and so the actual rate will likely be less. The maximum salt deposition from all four towers will not overlap and combine since the distance between the two sets of towers (approximately 4,000 feet) is greater than twice the distance to the maximum deposition of 1,600 feet. The salt deposition from the Units 3 and 4 towers would overlap since the towers are only 1,100 feet apart. The maximum estimated cumulative salt deposition rate is 7.2 pounds per acre per month at 1,600 feet north of the towers (3.6 pounds per acre per tower; well within the NUREG-1555 significant level of 8.9 pounds per acre per month) and will not constitute an adverse impact.

Impacts to air quality will not be from the reactors, but from support facilities and equipment and cooling towers, as they are now for the existing units. Emissions of criteria pollutants from the new units will be in pounds per year from the emergency diesel generators or the auxiliary boiler.

The SRS D-Area Powerhouse, SCE&G's Urquhardt Station, and Plant Wilson are all fossil-fueled and are located within about 25 miles of VEGP. The greater Augusta area has several large industrial facilities with permitted releases to the air. The Augusta-Aiken Interstate Air Quality Control Region is in attainment for all criteria pollutants. The contribution of the four VEGP units' support facilities to regional air quality pollutants is small and would not require mitigation. Cumulative atmospheric and meteorological impacts are not expected.

New reactor units will release small quantities of radionuclides to the environment. Each AP1000 unit is predicted to have liquid emissions of approximately 1,000 curies annually and gaseous emissions of approximately 11,000 curies annually. These Westinghouse AP1000 doses were derived for the DCD using the PWR-GALE model to demonstrate that the design would meet the 10 CFR 50, Appendix I limits **(Westinghouse 2005)**. The predicted liquid and gaseous doses from the AP1000 units are identified in Chapter 3 (Tables 3.0-1, 3.5-1 and 3.5-2). Predicted doses for the existing units, contained in the VEGP Units 1 and 2 UFSAR, were based on a previous version of the PWR-GALE model resulting in dose values higher than actual measured doses. Subsequently, the latest version of the PWR-GALE model used in the AP1000 DCD is even more conservative than the previous version used for Units 1 and 2. Therefore, this analysis likely does not represent the doses expected from the new units. The existing units annual measured gaseous and liquid emissions, identified in Table 2.9-1, are 115 curies and 1,400 curies respectively. All releases will be within regulatory limits as indicated in Table 5.4-9. In addition to the two existing VEGP units, other existing sources of radionuclide releases to the environment within the 50-mile region include DOE's Savannah River Site; the disposal facility for commercially-generated low-level radioactive waste, Chem-Nuclear in Barnwell, SC; and area hospitals, with the largest contributors the SRS and VEGP.

Both VEGP and the Savannah River Site (SRS) release radionuclides into the atmosphere and the Savannah River. Tritium accounts for nearly all the radioactivity released to the river. The SRS maintains an extensive monitoring program in the Savannah River. In 2004, the average tritium concentration at the Highway 301 bridge, downstream of VEGP and SRS, from all sources, was 0.061 picocuries per milliliter (**WSRC 2005**). The U.S. Environmental Protection Agency maximum contaminant level for maintaining safe drinking water is 20 picocuries of tritium per milliliter. SNC anticipates that the new units will release tritium in concentrations similar to the existing units. The cumulative impacts of tritium released to the Savannah River from the SRS and four VEGP will be small and will not warrant mitigation.

The potential maximally exposed individual all-pathways dose from all SRS releases was 0.15 millirem in 2004 (**WSRC 2005**). The maximally exposed individual dose from the existing VEGP units in 2004 was 0.091 millirem. The conservative (maximum) estimated dose to the maximally exposed individual from the new units is 0.12 millirem per year. Therefore, if the same hypothetical individual was the maximally exposed individual to both SRS and VEGP releases, the total annual dose will be 0.21 millirem per year. The regulatory limit for exposure to an offsite

member of the public is 25 millirem per year. Cumulative impacts to the maximally exposed individual will be small and will not warrant mitigation.

The fuel cycle specific to new units at VEGP will contribute to the cumulative impacts of fuel production, storage and disposal of all nuclear units in the United States, but the cumulative impacts of the fuel cycle for the existing reactors is small and the addition of the impacts of two new units will not change that conclusion. Fuel and waste transportation impacts from two new units also will be small, and will not increase the cumulative impacts of transportation of all nuclear reactor fuel and wastes.

Non-radioactive solid wastes will be disposed in permitted landfills. The volume of additional wastes will be minimized through waste minimization programs, and therefore, cumulative impacts of waste disposal are expected to be small.

Socioeconomic impacts, including increased tax revenues to Burke County, would be cumulative with socioeconomic changes brought about through the construction and operation of the existing units, and changes due to normal population growth. Taxes from the four units will fund new infrastructure that could attract residents to Burke County. However, the construction and operation of the existing units did not result in large changes to tax-driven land use changes in Burke County, and it is not expected that the new units will either. The infrastructure of Burke, Richmond, and Columbia Counties is adequate to support new operations employees. No other projects that would involve immigration of a large workforce have been identified in the area. Cumulative socioeconomic impacts would be small.

In conclusion, the impacts from the construction and operation of one of more units at the VEGP site will not contribute significantly to existing or future cumulative impacts to the vicinity or the region.

Section 10.5 References

(AEC 1974) U.S. Atomic Energy Commission, Final Environmental Statement related to the proposed Alvin W. Vogtle Nuclear Plant Units 1, 2, 3, and 4, Georgia Power Company, Docket Nos. 50-424, 50-425, 50-426, and 50-427, Directorate of Licensing, Washington, D.C., March.

(WSRC 2005) Westinghouse Savannah River Company, 2005, SRS Environmental Report for 2004, WSRC-TR-2005-00005, Aiken, S.C.

(Westinghouse 2005) Westinghouse Electric Company, LLC, AP1000 Design Control Document, Revision 15, Pittsburgh, PA, November 11.