2.0 Description of Nuclear Power Plant and Site and Plant Interaction with the Environment

The Surry Power Station, Units 1 and 2, are located in Surry County, Virginia, on the south side of the James River, approximately 40 km (25 mi) upstream of the point where the river enters the Chesapeake Bay. The station consists of two units. Each unit includes a pressurized light-water reactor (LWR) and three steam-driven turbine generators manufactured by Westinghouse. The station and its environs are described in Section 2.1, and the plant's interaction with the environment is presented in Section 2.2.

2.1 Plant and Site Description and Proposed Plant Operation During the Renewal Term

Surry Power Station, Units 1 and 2, are operated by the Virginia Electric and Power Company (VEPCo) and are located on approximately 340 ha (840 ac) of VEPCo-owned land in Virginia on Gravel Neck Peninsula. Figures 2-1 and 2-2 show the site location and features within 80 km and 10 km (50 mi and 6 mi), respectively. The exclusion area, which is entirely within the site boundary, is bounded by a circle of 500-m (1650-ft) radius centered at the Unit 1 reactor containment building.

Gravel Neck Peninsula is at the upstream limit of saltwater incursion to the James River; upstream of Gravel Neck is tidal river and downstream is an estuary. The 340-ha (840-ac) site extends as a band across the peninsula. Steep bluffs drop to the river on either side and to the tip of the peninsula. Hog Island Wildlife Management Area (HIWMA), a Commonwealth wildlife management area, is located on the tip of the peninsula.

The site is 10 km (7 mi) south of Colonial Williamsburg and 13 km (8 mi) east-northeast of the town of Surry. Jamestown Island, part of the Colonial National Historic Park, is to the northwest on the northern shore of the James River. The area within 16 km (10 mi) of the site includes Surry, Isle of Wight, York, and James City Counties, and parts of the cities of Newport News and Williamsburg. The counties surrounding Surry are predominantly rural, characterized by farmland, woods, and marshy wetlands. East and south of the site, at distances between 16 and 48 km (10 and 30 mi), are the urban areas of Hampton, Newport News, Norfolk, and Portsmouth, Virginia, and others, collectively known as Hampton Roads.

The region surrounding Surry was identified in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, as being located in a high population area (NRC 1996, Appendix C, Table C.2).

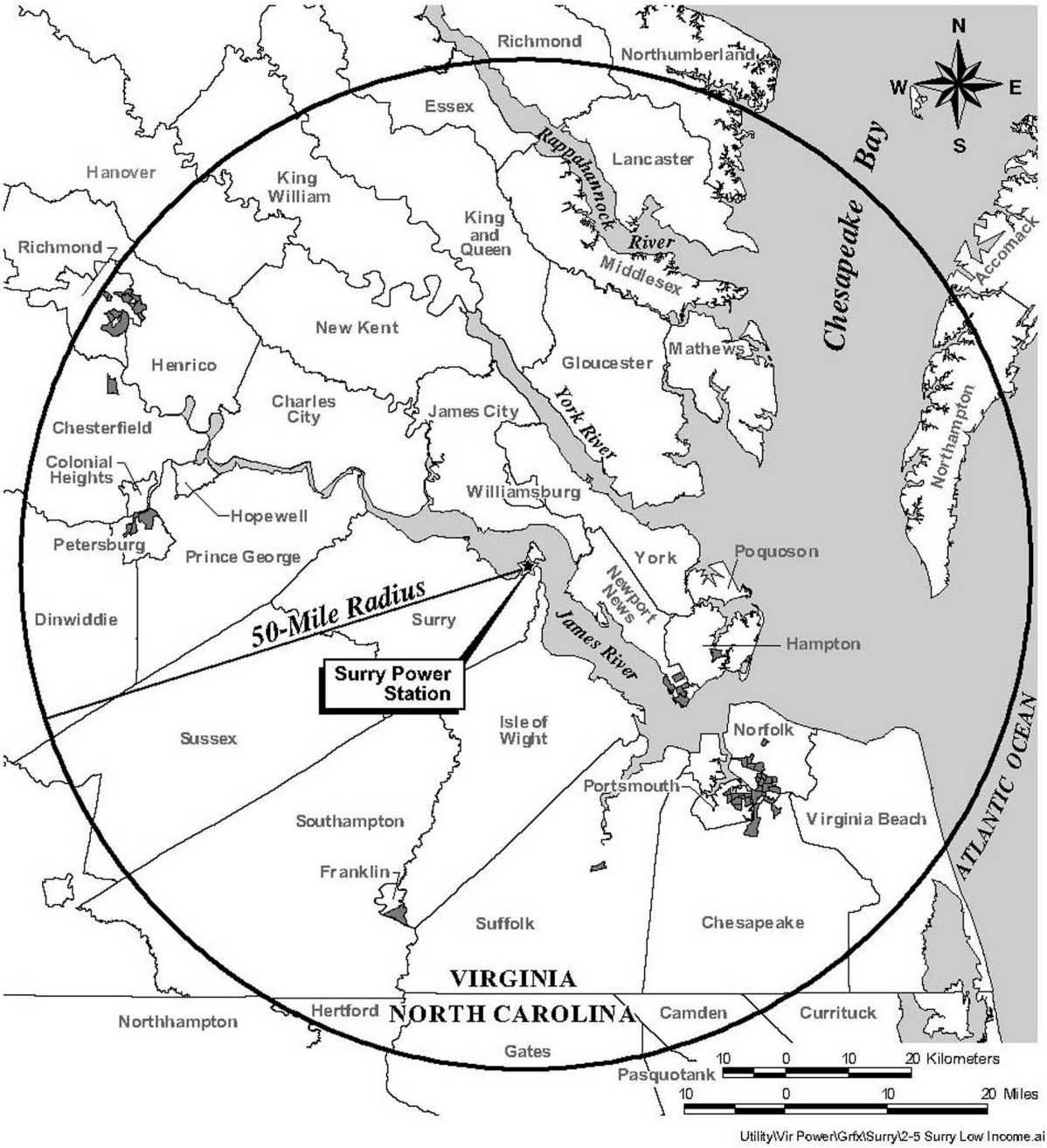

Figure 2-1. Location of Surry Power Station, 80-km (50-mi) Region

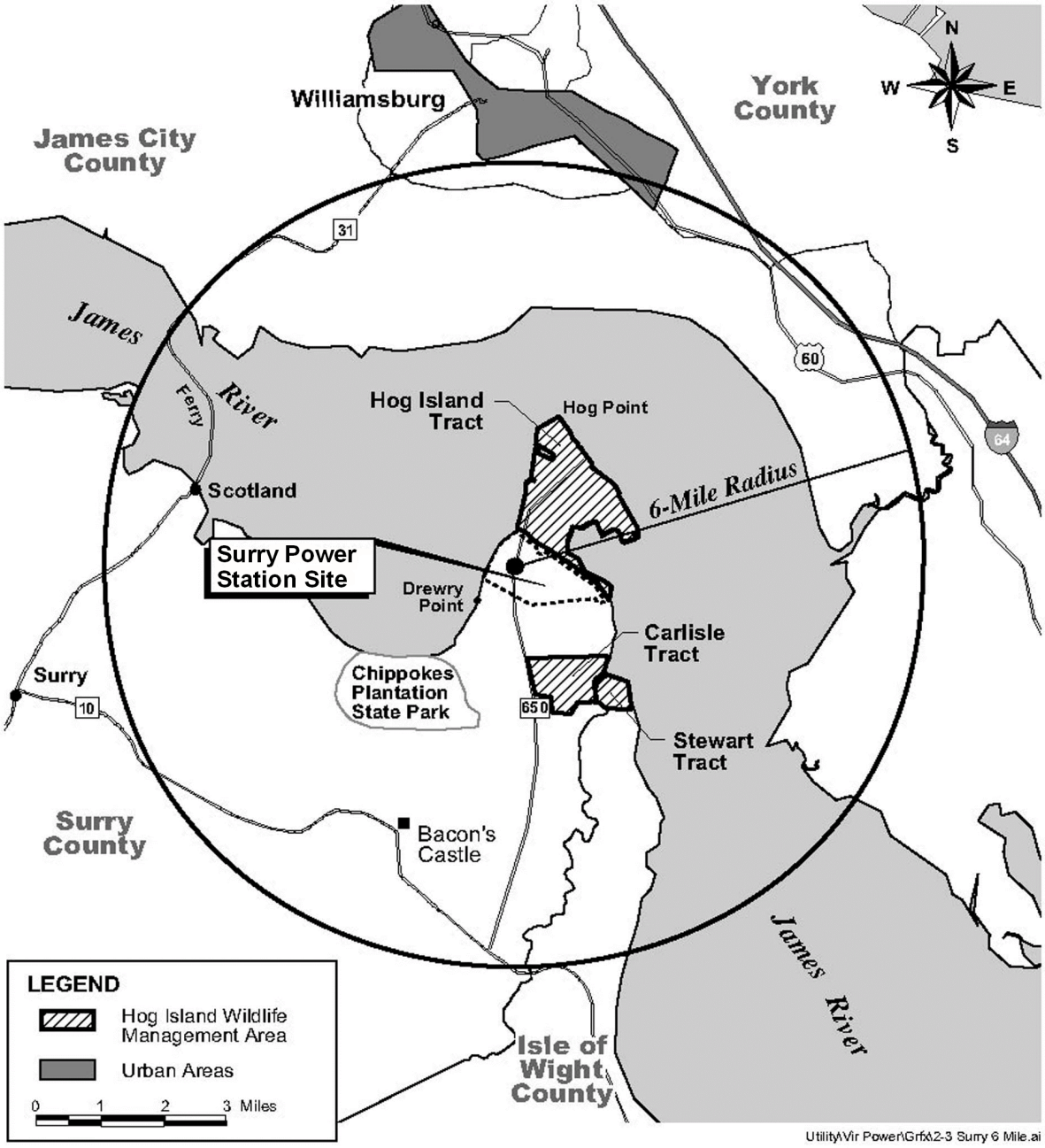

Figure 2-2. Location of Surry Power Station, 10-km (6-mi) Region

2.1.1 External Appearance and Setting

Distinctive features of the Surry Power Station include the 40-m (135-ft) diameter cylindrical containment buildings with hemispherical domes, and the cooling canal. When the plant was designed, there was a concern about the containment structures being visible from historic Jamestown Island; therefore, the containment buildings were designed so the elevation would be so low as to blend with the surrounding forest (VEPCo 1970).

In addition to the two nuclear reactors and their turbine building, intake and discharge canals, and auxiliary buildings, the site is the location of the Gravel Neck Combustion Turbines Station, a switchyard, and an Independent Spent Fuel Storage Installation (ISFSI) (Figure 2-3).

The geology around Surry Power Station lies within the Coastal Plain Physiographic Province and is underlain by approximately 400 m (1300 ft) of relatively unconsolidated Cretaceous to Holocene sand, silty sand, gravel, marl, and clay. There was no evidence of faulting during the exploratory drilling and construction of the facility. All available information indicates that the crystalline basement beneath the site has been tectonically dormant since the Cretaceous period.

2.1.2 Reactor Systems

| Surry Power Station, Units 1 and 2, and support facilities are shown in Figure 2-4. Each unit includes a pressurized LWR and three steam-driven turbine generators manufactured by Westinghouse. The balance of each unit was designed by VEPCo, with the assistance of its agent, Stone & Webster Engineering Corporation (VEPCo 2000c). Each unit was designed for an output of 2441 megawatts-thermal (MW[t]), with a corresponding gross electrical output of 822.6 megawatts-electric (MW[e]). Units 1 and 2 achieved commercial operation in December 1972 and May 1973, respectively. In 1995, based on an NRC-prepared environmental assessment and a Finding of No Significant Impact, both units were up-rated to a core power output of 2546 MW[t] with a calculated gross output of 855.4 MW[e] each. Average net capacity is 1602 MW[e] for the plant (VEPCo 2001c).

Each reactor containment structure is a steel-lined, reinforced-concrete cylinder of 40 m (135 ft) diameter with a hemispheric dome and a flat reinforced-concrete foundation mat. Each
| containment structure is designed to withstand an internal pressure of 410 kPa (45 psig) above atmospheric pressure. Air pressure inside the containment structure is maintained at about
| 140 kPa (5 psig) below atmospheric pressure for routine operation. Together with its engineered safety features, each containment structure is designed to provide adequate radiation protection for both normal operation and unlikely accidents, such as earthquakes, tornadoes, or loss of coolant. Surry Power Station fuel is slightly enriched uranium dioxide;

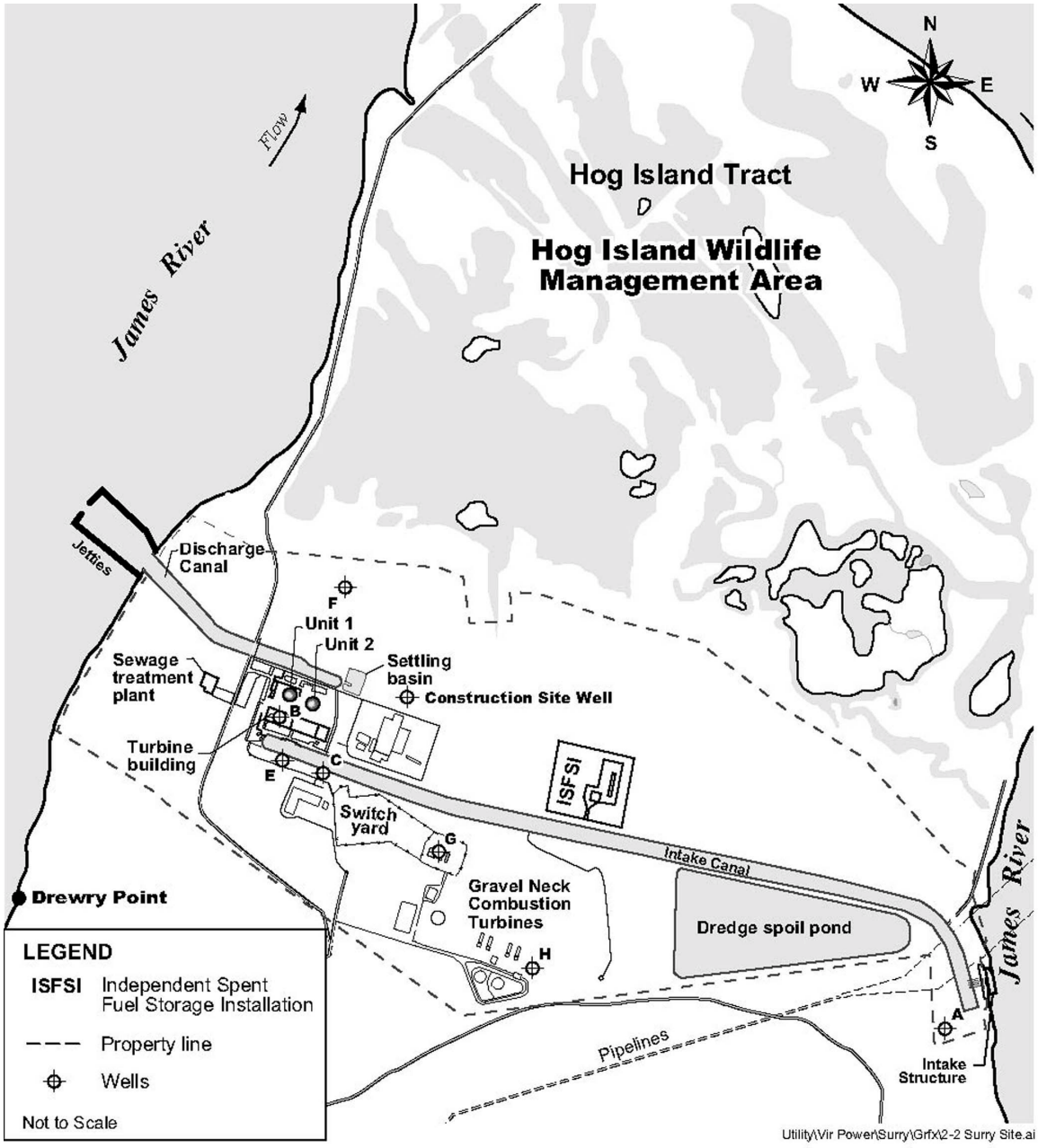

Figure 2-3. Site of Surry Power Station

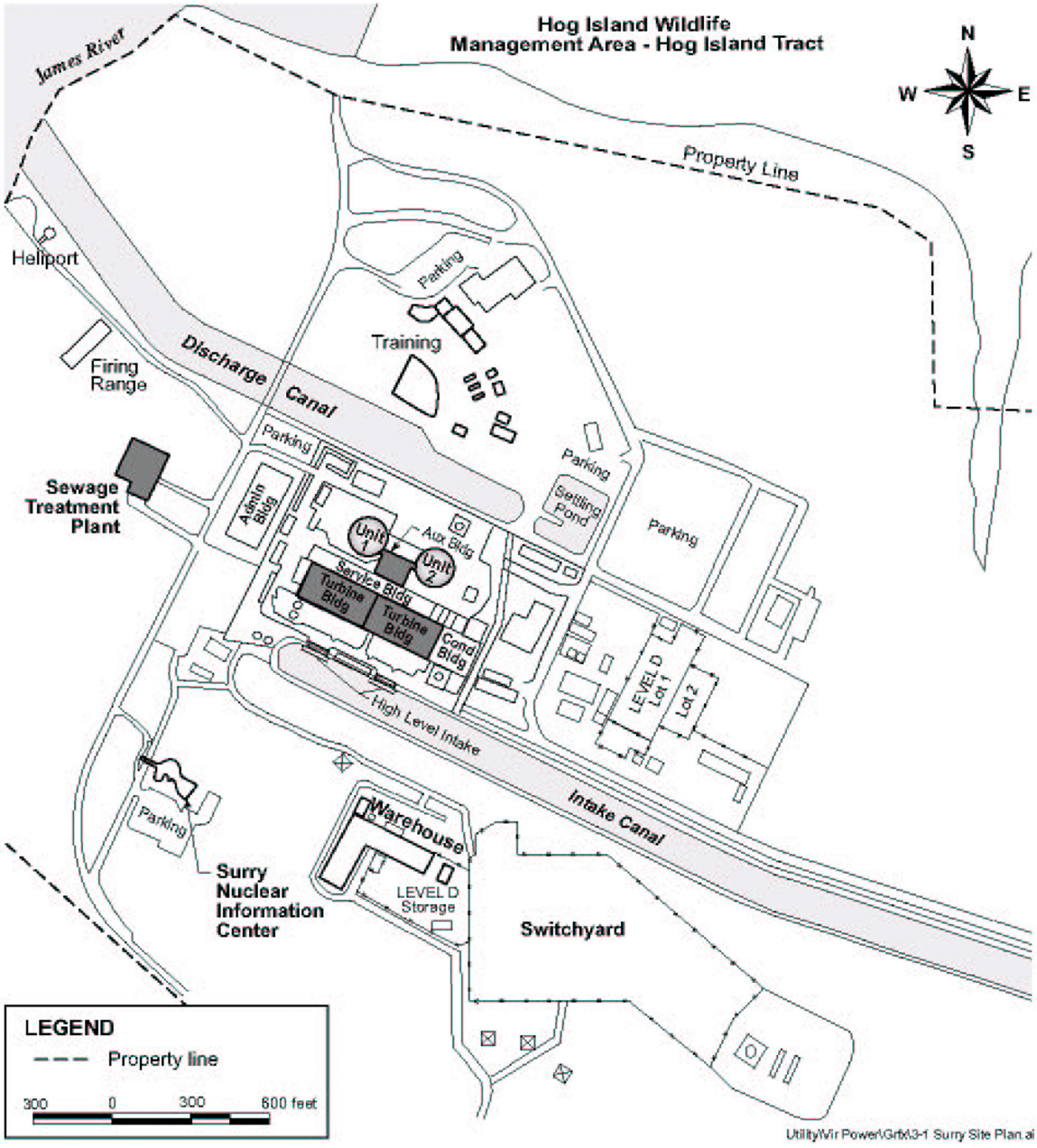

Figure 2-4. Surry Power Station, Showing Locations of Reactors and Other Buildings

the current enrichment is 3.20 percent by weight uranium-235. VEPCo operates the reactors at a region average fuel discharge burn-up rate of 45,000 megawatt-days per metric ton uranium (VEPCo 2001c).

2.1.3 Cooling and Auxiliary Water Systems

Surry Power Station has a once-through heat dissipation system that withdraws brackish water from the James River, pumps the water through the condenser, and returns heated water to the James River at a point about 10 km (6 mi) upriver from the withdrawal point. Two isolated, sealed cooling loops carry heat from the reactor to the condenser. Under normal conditions, there is no exchange of water between the two sealed loops or between the sealed loops and cooling water from the river.

Cooling water is withdrawn through a channel dredged in the bottom of the river between the main river channel and the eastern shore of Gravel Neck Peninsula and then into a low-level intake structure that has eight reinforced-concrete bays. When both Units 1 and 2 are operating at full power, eight pumps (one for each bay) pump a total of 106 m^3/s (1.68 million gpm) into the intake canal, which transports circulating water by gravity flow from the intake structure to the high-level intake structure at the reactors. This canal is about 3 km (2 mi) long. Cooling water then moves into two high-level four-bay structures and then passes through the turbine steam condensers. After passing through the condensers, the cooling water flows through a tunnel into the head of a 800-m (2900 ft) discharge canal, and from the canal flows back into the James River. A rock-filled jetty extends the discharge canal about 340 m (1100 ft) into the river.

The low-level intake structure is equipped with specially designed Ristroph traveling screens that rotate continuously to return impinged fish to the James River quickly. Use of a low-pressure spray to wash impinged fish from the screens into a return sluice to the river reduces injuries to the fish.

At full power, Surry Power Station discharges about 3490 MW (1.19×10^{10} Btu/hr) into the James River. The Surry Power Station National Pollutant Discharge Elimination System (NPDES) permit (VDEQ 2001a) does not require reporting of the discharge temperatures of the water. However, temperatures greater than 32°C (90°F) at the Surry Power Station outfall normally only occur during the months of June, July, August, and September when Surry Power Station, Units 1 and 2, are operating at full power. The highest water temperature in the discharge canal was 37.7°C (99.9°F), which was recorded in 1975. Even in extreme cases, temperatures in the James River decrease rapidly downstream of the canal outfall. At distances of about 900 m (3000 ft) or more from the outfall, the increase in temperature in river water is rarely greater than 2.8°C (5°F). The river water is fully mixed and has returned to ambient temperature by the time it returns to the vicinity of the plant intake.

Service water is diverted and withdrawn from the system before the water enters the condensers. It is used in a variety of applications, including component cooling (e.g., pump bearings and spent fuel pool water) and air conditioning.

Seven wells provide water for domestic uses, for the fire protection system, and for irrigation. Makeup water for the reactor cooling loops also comes from these wells.

2.1.4 Radioactive Waste Management Systems and Effluent Control Systems

VEPCo uses liquid, gaseous, and solid radioactive waste management systems to collect and process the liquid, gaseous, and solid wastes that are the by-products of the operation of Surry Power Station. These systems process radioactive liquid, gaseous, and solid effluents to maintain releases to the environment within regulatory limits. The Surry Power Station waste disposal system meets the design objectives of 10 CFR Part 50, Appendix I ("Numerical guides for design objective, and limiting conditions for operation to meet the criterion 'As Low as is Reasonably Achievable' for radioactive material in light-water-cooled nuclear power reactor effluents") and controls the processing, disposal, and release of radioactive liquid, gaseous, and solid wastes. Radioactive material in the reactor coolant is the source of gaseous, liquid, and solid radioactive wastes in LWRs. Radioactive fission products build up within the fuel as a consequence of the fission process. These fission products are contained in the sealed fuel rods, but small quantities escape from the fuel rods and contaminate the reactor coolant. Neutron activation of the primary coolant system is also responsible for coolant contamination.

Nonfuel solid wastes result from treating and separating radionuclides from gases and liquids and from removing contaminated material from various reactor areas. Solid wastes also consist of reactor components, equipment, and tools removed from service, as well as contaminated protective clothing, paper, rags, and other trash generated from plant design modifications and operations and routine maintenance activities. Solid wastes are shipped to a waste processor for volume reduction before disposal at a licensed burial site. Spent resins and filters are stored or packaged for shipment to a licensed offsite processing or disposal facility (VEPCo 2000c).

Fuel rods that have exhausted a certain percentage of their fuel and are removed from the reactor core for disposal are called spent fuel. Surry Power Station currently operates on a staggered 18-month refueling cycle per unit. Spent fuel is stored onsite in the spent fuel pool in the fuel handling building (VEPCo 2000c) or in containers located in the Surry ISFSI. Spent fuel has been stored in the Surry ISFSI since 1986 under a separate license.

The waste disposal system used for processing liquid, gaseous, and solid wastes is common to Units 1 and 2, with the exception of the primary drain transfer tanks and the gaseous drain system in each reactor containment (VEPCo 2000c).

The Offsite Dose Calculation Manual (ODCM) (VEPCo 2000b) describes the methods used for calculating radioactivity concentrations in the environment and the estimated potential offsite doses associated with liquid and gaseous effluents from Surry Power Station. The ODCM also specifies controls for release of liquid and gaseous effluents to ensure compliance with the following:

- The concentration of radioactive liquid effluents released from the site to the unrestricted area will not exceed 10 times the concentration specified in 10 CFR Part 20, Appendix B, Table 2, Column 2, for radionuclides other than dissolved or entrained gases. For dissolved or entrained noble gases, the concentration shall not exceed 7.4 Bq/mL (0.0002 µCi/mL).

- The dose or dose commitment per reactor to a member of the public from any radioactive materials in liquid effluents released to unrestricted areas shall be limited to the design objectives of 10 CFR Part 50, Appendix I; (1) less than or equal to 0.015 mSv (1.5 mrem) to the total body and less than or equal to 0.05 mSv (5 mrem) to any organ during any calendar quarter, and (2) less than or equal to 0.03 mSv (3 mrem) to the total body and less than or equal to 0.1 mSv (10 mrem) to any organ during any calendar year.

- The dose rate due to radioactive materials released in gaseous effluents from the site to areas at and beyond the site boundary shall be limited to (1) less than or equal to 5 mSv/yr (500 mrem/yr) to the total body and less than or equal to 30 mSv/yr (3000 mrem/yr) to the skin due to noble gases, and (2) less than or equal to 15 mSv/yr (1500 mrem/yr) to any organ due to iodine-131, iodine-133, tritium, and for all radioactive materials in particulate form with half-lives greater than 8 days (see NUREG-1301, NRC 1991).

- The air dose per reactor to areas at and beyond the site boundary due to noble gases released in gaseous effluents shall be limited to the design objectives of 10 CFR Part 50, Appendix I, of less than or equal to 0.1 mGy (10 mrad) for gamma radiation and less than or equal to 0.2 mGy (20 mrad) for beta radiation during any calendar year.

- The dose to any individual member of the public from the nuclear facility operations will not exceed the maximum limits of 40 CFR Part 190 (<0.25 mSv [25 mrem] in a year) and 10 CFR Part 20 ($\leq$5 mSv [0.5 rem] in a year and $\leq$0.02 mSv [2 mrem] in any hour).

2.1.4.1 Liquid Waste Processing Systems and Effluent Controls

Potentially radioactive liquid wastes originating from the containment sump, auxiliary building sump, fuel building sump, safeguards building sump, component cooling water heat exchanger sump, decontamination building drains, and the laboratory drain are collected in waste drain tanks located in the auxiliary building (VEPCo 2000c). Liquid wastes in the waste drain tanks are transferred to liquid waste collection tanks in the Surry Radwaste Facility (VEPCo 2000c). Liquid wastes are then processed through the radwaste facility's liquid waste reverse osmosis and demineralizer system, which removes radioactive material and dissolved solids. The processed liquid waste is collected in one of two liquid-waste monitor tanks and sampled prior to release to the discharge canal via the radwaste facility liquid-effluent release line. A radiation monitor is located on this line (VEPCo 2000c).

Potentially radioactive liquid wastes originating from the laundry and personal decontamination shower and sink are collected in contaminated drain tanks located in the auxiliary building (VEPCo 2000c). From the contaminated drain tanks, liquid waste flows through the laundry drain filter in the Surry Radwaste Facility. Filtered waste is collected in one of two laundry waste monitor tanks where liquids are sampled and released to the discharge canal via the radwaste facility liquid-effluent release line (VEPCo 2000c).

The ODCM prescribes the alarm/trip setpoints for the liquid-effluent radiation monitors, which are derived from 10 times the effluent concentration limits provided in 10 CFR Part 20, Appendix B, Table 2, Column 2. There are liquid-effluent radiation monitors located on the radwaste facility liquid-effluent release line, the service water system effluent line, and the condenser circulating water line. The alarm/trip setpoint for each liquid-effluent monitor is based on the measurements of radioactivity in a batch of liquid to be released or in the continuous liquid discharge (VEPCo 2000b).

During 2000, there was a total volume of 2.82×10^8 L (7.45×10^7 gal) of liquid waste released prior to dilution for the two units (VEPCo 2001a). In this liquid waste, there was a total fission and activation product activity of 0.0044 TBq (0.12 Ci) and total tritium activity of 30 TBq (814 Ci). These volumes and activities are typical of past years. The liquid waste holdup capacity is approximately 1.7×10^5 L (45,000 gal) in four waste-holdup tanks located in the radwaste facility. The actual liquid waste generated is reported in the *Annual Radioactive Effluent Release Report for the Surry Power Station* (VEPCo 2001a).

VEPCo does not anticipate any increase in liquid waste releases during the renewal period.

2.1.4.2 Gaseous Waste Processing Systems and Effluent Controls

Potentially high-activity waste gases are regulated by the process vent subsystem of the gaseous waste disposal system and released to the environment through the process vent located on top of the Unit 1 containment structure (VEPCo 2000c). Gaseous wastes entering this subsystem originate from the waste gas decay tanks, the boron recovery system, the containment vacuum system, the vent and drain system, and various pressure relief valves (VEPCo 2000c). Waste gases collected in the waste gas decay tanks originate from reactor coolant letdown and include hydrogen, nitrogen, and small quantities of fission products gases (i.e., xenon and krypton) (VEPCo 2000c). These gases are allowed to decay in one of two double-walled waste decay tanks. Prior to release of gases from the waste decay tanks to the process vent, contents are sampled and released at a permissible rate and activity, as prescribed by the ODCM (VEPCo 2000b). Once released to the process vent, these gases are mixed with dilution air and combined with gases from the other paths (i.e., boron recovery system, containment vacuum system, vent and drain system, and various pressure relief valves). Prior to release to the environment, the combined-process vent waste stream is passed through a charcoal filter and high-efficiency particulate air (HEPA) filters and monitored by a particulate and gas monitor.

Potentially low-activity waste gases are regulated by either the ventilation vent or the radwaste facility vent subsystem of the gaseous waste disposal system.

- Gaseous wastes from the ventilation vent subsystem are released to the environment through either (1) ventilation vent no. 1 located on the top of the service building or (2) ventilation vent no. 2 located on the roof of the auxiliary building (VEPCo 2000c). Gases from laboratories, a counting room, and the decontamination area located in the service building are exhausted through ventilation vent no. 1. Air from common areas of the auxiliary building, fuel building, decontamination building, and safeguards area are exhausted through ventilation vent no. 2. Individual exhaust paths feeding into these vents are filtered or have the capability to be filtered (e.g., the fuel building exhaust will be diverted through a charcoal filter during refueling) (VEPCo 2000c). Both ventilation vents are continuously monitored for radioactivity (VEPCo 2000c).

- Gaseous wastes from the radwaste facility vent subsystem are released to the environment through the radwaste facility stack. Waste gases from the radwaste facility's tank vent system, process equipment vents, and general area are exhausted through the radwaste facility stack. Gaseous waste streams are filtered through either HEPA filters or a combination of HEPA filters and charcoal filters. The radwaste facility stack is continuously monitored for radioactivity (VEPCo 2000a).

As described above, radioactive gaseous wastes from Surry Power Station are released through four monitored release points: (1) the process vent located on top of the Unit 1 containment structure, (2) ventilation vent no. 1 located on top of the service building, (3) ventilation vent no. 2 located on the roof of the auxiliary building, and (4) the radwaste facility vent. These release points are continuously monitored for noble gases, radioiodines, and particulate activity (VEPCo 2000b). The ODCM prescribes alarm/trip setpoints for these effluent monitors and control instrumentation to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20 for gaseous effluents (VEPCo 2000b). These release points are continuously monitored and provide alarms with automatic valve closure when radiation levels exceed a preset level, thus terminating discharge (VEPCo 2000c).

In addition to the four monitored release points discussed above, a gross activity monitor is located on the Unit 1 and Unit 2 condenser air ejectors. Should a primary-to-secondary leak occur, elevated activity levels will be detected by the air ejector monitor and on a high-activity alarm, the flow is diverted to containment (VEPCo 2000c). The quantity of material discharged from such a release is accounted for using specific procedures in the ODCM (VEPCo 2000b).

During 2000, there was a total fission and activation gas activity of 0.13 TBq (3.57 Ci), a total iodine activity of 3.27×10^{-7} TBq (8.84×10^{-6} Ci), a total particulate activity of 1.40×10^{-6} TBq (3.78×10^{-5} Ci), and a total tritium activity of 1.03 TBq (27.7 Ci) released from the two units. These releases are typical of past years.

VEPCo does not anticipate any increase in gaseous releases during the renewal period.

2.1.4.3 Solid Waste Processing

Solid wastes from Surry Power Station consist of concentrated liquid sludge, spent resin, spent filter cartridges, solid noncompactible and compactible trash, and miscellaneous materials from station and radwaste facility operation and maintenance (VEPCo 2000c). Concentrated liquid sludge is segregated by type, flushed to storage tanks, slurried into an appropriate container, and stored onsite prior to shipment offsite for disposal. Spent resin from the plant's ion exchangers located in the auxiliary building is collected in tanks and then transferred to a high-integrity container for shipment to a burial site (VEPCo 2000c). Spent filter cartridges are placed in prefabricated metal containers and placed in an appropriately shielded location prior to shipment (VEPCo 2000c). Solid noncompactible and compactible trash is placed in appropriate containers and shipped offsite for compacting. Waste compacting is performed offsite by a licensed processing facility. A storage area in the radwaste facility serves as a staging area for waste ready for shipment to offsite processing and disposal facilities (VEPCo 2000c).

Solid wastes from Surry Power Station are either shipped directly to an offsite licensed disposal facility (e.g., spent resins) or consigned to a licensed processing facility for volume-reduction and decontamination activities (e.g., compactible trash). The material that remains after volume reduction is transported by the processing facility to a final disposal facility, depending on the activity limits.

Disposal and transportation of solid wastes are performed in accordance with the applicable requirements of 10 CFR Parts 61 and 71, respectively. There are no releases to the environment from radioactive solid wastes created at Surry Power Station.

In 1999, Surry Power Station made 33 shipments of solid waste with a volume of 690 m^3 (24,400 ft^3) and a total activity of 250 TBq (6700 Ci) (VEPCo 2000a). In 2000, Surry Power Station made 18 shipments of solid waste with a volume of 394 m^3 (13,900 ft^3) and a total activity of 12.4 TBq (335 Ci) (VEPCo 2001a). The large difference in total activity released from 1999 to 2000 was due to the disposal of irradiated components during 1999. These shipments are representative of the shipments made in the past several years and are not expected to change appreciably during the license renewal period.

2.1.5 Nonradioactive Waste Systems

Nonradioactive solid waste generated at Surry Power Station is disposed of at an offsite landfill. Hazardous wastes (e.g., asbestos, oil-contaminated materials) are disposed of by a licensed contractor.

Sanitary wastes are treated by an onsite standard aeration 300-m^3 (80,000-gal) sewage treatment facility. Nonradioactive liquid wastes produced as a result of plant operations and maintenance activities (e.g., water treatment activities, stormwater runoff, housekeeping wastes) are sampled, treated in accordance with the site's NPDES permit (VDEQ 2001a) issued by the Virginia Department of Environmental Quality (VDEQ), and released into the James River. Chemicals used in water treatment activities to prevent accumulation of deposits in cooling system components include sodium hypochlorite**,** sodium bromide, lithium hydroxide, hydrogen peroxide, hydrazine, and sulfuric acid (VEPCo 2001c).

2.1.6 Plant Operation and Maintenance

Routine maintenance performed on plant systems and components is necessary for safe and reliable operation of a nuclear plant. Some of the maintenance activities conducted at Surry Power Station include inspection, testing, and surveillance to maintain the current licensing basis of the plant and to ensure compliance with environmental and public safety requirements. Certain activities can be performed while the reactor is operating. Others require that the plant

be shut down. VEPCo refuels each Surry unit on a staggered 18-month schedule, which means at least one refueling every year and two refuelings every other year. Up to 700 additional contract workers are used for the 30- to 40-day refueling outage.

VEPCo performed an aging management review and developed an integrated plant assessment (IPA) for managing the effects of aging on systems, structures, and components in accordance with 10 CFR Part 54. The aging management program is described in Appendix B of the License Renewal Application (VEPCo 2001c). The IPA identified the programs and inspections that are managing the effects of aging at Surry. Previously, VEPCo performed some major construction activities at Surry Power Station (e.g., steam generator replacement) and the IPA did not identify any need for refurbishment or replacement activities. VEPCo is assuming there may be an additional 60 additional workers to perform all the necessary surveillance, monitoring, inspections, testing, trending, and recordkeeping activities during the license renewal period.

2.1.7 Power Transmission System

VEPCo built nine transmission lines to connect the Surry Power Station to the transmission system. These nine transmission lines leave the Surry Power Station in two corridors. One corridor contains two 230-kV lines to the Hopewell Substation, a 500-kV line to the Chickahominy Substation, and a 500-kV line to the Yadkin Substation. The other corridor contains 230-kV lines to the Chuckatuck, Churchland, Whealton, and Yadkin Substations, and a 500-kV line to the Septa Substation.

The transmission lines are shown in Figure 2-5. The transmission line corridors are primarily rights-of-way, with less than 1 percent owned by VEPCo (VEPCo 2001c). Where possible, the transmission lines share common corridors and even transmission line towers. As a result, the total corridor length of approximately 270 km (170 mi) is significantly less than the 480-km (300-mi) total length of the transmission lines. Transmission-line corridor lengths and widths are listed in Table 2-1. The approximate corridor area for the lines to Hopewell Substation is for the full length, while the areas for the line to the Chickahominy Substation and the 500-kV line to the Yadkin Substation are for the corridors after the lines leave the corridor leading to the Hopewell Substation. Similarly, the area for the corridor from the Surry Power Station to the Septa Substation is for the full length. The area listed for the Chuckatuck Substation is for the corridor from the Septa Substation to the Chuckatuck Substation; the areas listed for the Whealton and Churchland Substations are for the corridors leaving the Chuckatuck Substation, and the area listed for the 230-kV line to the Yadkin Substation is for the corridor leaving the Churchland Substation.

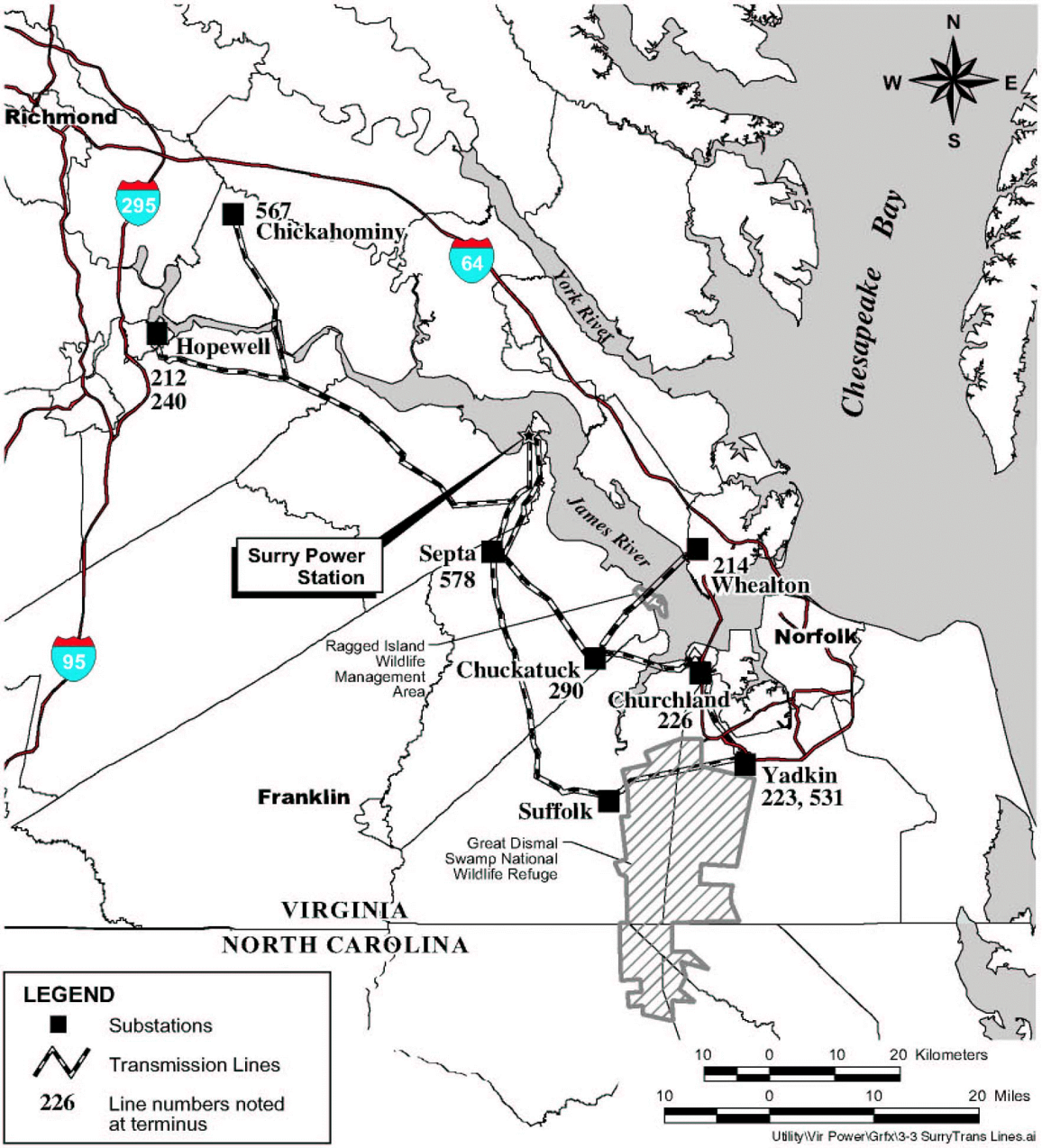

Figure 2-5. Transmission Lines Attributable to the Surry Power Station

Table 2-1. Surry Power Station Transmission Line Corridors

Substation	Number of Lines (line number)	kV	Approximate Distance		Corridor	Corridor Width		Approximate Corridor Area	
			km	(mi)		m	(ft)	ha	(ac)
Chickahominy	1 (567)	500	87	(54)	1	46 to 107	(150 to 350)	110	(270)
Chuckatuck	1 (290)	230	39	(24)	2	90 to 137	(295 to 450)	270	(650)
Churchland	1 (226)	230	63	(39)	2	38 to 137	(125 to 450)	92	(230)
Hopewell	2 (212 and 240)	230	85	(53)	1	37 to 107	(120 to 350)	760	(1900)
Septa	1 (578)	500	19	(12)	2	73 to 107	(240 to 350)	200	(500)
Whealton	1 (214)	230	61	(38)	2	32 to 137	(105 to 450)	72	(180)
Yadkin	2 (223 and 531)	230 500	79 82	(49) (51)	2 1	38 to 137	(125 to 450)	61 330	(150) (820)
Total			480	(300)				2000	(5000)

Source: VEPCo 2001c

VEPCo plans to maintain these transmission lines indefinitely because they are integral to the larger transmission system. All transmission lines were designed and constructed in accordance with the sixth edition (1961) of the National Electrical Safety Code and industry guidance current when the lines were built (VEPCo 2001c).

The transmission line corridors traverse a mixture of cultivated land, grazing land, and managed timber lands (paper and pulp stock). Transmission corridor rights-of-way are generally maintained on a 3-year cycle. Mechanical mowing and selective herbicide applications are the standard methods of corridor maintenance. Handcutting and/or non-restricted use herbicides are used in areas such as wetlands and densely vegetated areas, where mowing is impractical or undesirable. VEPCo requires use of State-licensed applicators for herbicides. Selective handcutting is used in sensitive areas; herbicides are not used on the Suffolk-to-Yadkin corridor, within the Great Dismal Swamp National Wildlife Refuge, or in the Ragged Island Wildlife Management Area (VEPCo 2001c).

2.2 Plant Interaction with the Environment

Sections 2.2.1 through 2.2.8 provide general descriptions of the environment near Surry Power Station. They also provide detailed descriptions where needed to support the analysis of potential environmental impacts of refurbishment and operation during the renewal term, as discussed in Chapters 3 and 4. Section 2.2.9 describes the historic and archaeological resources in the area, and Section 2.2.10 describes possible impacts on other Federal project activities.

2.2.1 Land Use

Surry Power Station is located on Gravel Neck Peninsula in an unincorporated portion of Surry County, Virginia, on the south side of the James River. The site location is approximately 40 km (25 mi) upstream of the point where the river enters the Chesapeake Bay. The town of Surry is located approximately 13 km (8 mi) southwest of the plant site. Surry is the county seat of Surry County. Portions of the cities of Newport News and Williamsburg are within 16 km (10 mi) of Surry Power Station.

Surry Power Station occupies approximately 340 ha (840 ac). The site includes Units 1 and 2 and their associated structures and features, a switchyard, an ISFSI, and the Gravel Neck Combustion Turbines Station.

Surry Power Station is in a district classified as M-2 (General Industrial District) by Surry County (Surry County 1975). Location of nuclear power plants and associated radioactive waste-handling facilities is permitted as a conditional use in this district upon approval by the County Board of Supervisors. VEPCo has received such approval for Surry Units 1 and 2.

Section 307(c)(3)(A) of the Coastal Zone Management Act (16 USC 1456[c][3][A]) requires that applicants for Federal licenses who conduct an activity in a coastal zone are to provide a certification that the proposed activity complies with the enforceable policies of the State's Coastal Zone Program. Surry Power Station is within the Virginia coastal resources management area (VDEQ 2001b). VEPCo submitted a certification to VDEQ that renewal of the OLs for Surry Units 1 and 2 is consistent with the Virginia Coastal Management Program (VEPCo 2001d). VDEQ concurred in this certification in a letter dated February 20, 2002 (VDEQ 2002). A copy of the letter from VDEQ is included in Appendix E. |

2.2.2 Water Use

Surry Power Station uses water from the James River for once-through cooling and the auxiliary cooling system. The water withdrawn from the James River represents about

3 percent of the tidal flow in the James River in the vicinity of the Surry Power Station. After passing through the condensers and service water system, most of the water is returned to the James River; less than 1.4 m^3/s (22,000 gpm) is lost to evaporation (approximately 1 percent of the initial intake) (AEC 1972a and 1972b).

Seven groundwater wells serve the Surry Power Station and another three wells serve the Gravel Neck Combustion Turbines Station. Surry Units 1 and 2 are permitted by VDEQ (Permit No. GW0003900) to withdraw a total of 585,600 m^3 (154.703 million gal) of water per year, or an average of 19 L/s (294 gpm), from the 10 wells. A monthly maximum of 60,200 m^3 (15.89 million gal) is authorized for use as domestic, process, and cooling water. VEPCo operates a non-community waterworks facility at Surry Units 1 and 2 under Permit No. 3181800, which was issued in 1978 and has no expiration date.

The 10 onsite groundwater wells vary in depth from 120 to 130 m (396 to 420 ft). They withdraw water from the upper zone of the Potomac aquifer. The sands of this aquifer are an excellent supply of water for many domestic and some industrial wells in the area. Groundwater use at Surry Units 1 and 2 for 1992 through 1999 averaged about 14 L/s (221 gpm). Three of the wells have a capacity of 12.6 L/s (200 gpm) and produce makeup, domestic, and fire-protection water at Surry Units 1 and 2. One well supplies the Surry Units 1 and 2 Training Center. It is capable of pumping 6.3 L/s (100 gpm). The other onsite wells are less productive. The three wells that supply the Gravel Neck Combustion Turbines Station generators withdraw a maximum of 18 million L (4.7 million gal) of water per year, or an average of about 0.57 L/s (9 gpm).

Sanitary wastes generated at the facility receive treatments provided by an onsite activated sludge treatment plant (design flow or 3.7 L/s [59 gpm]). The wastewater goes through flow equalization, screening, grinding, activated sludge treatment, settling, and disinfection. The treated wastewater is finally discharged into the effluent discharge canal. Sludge is aerobically digested, then pumped and hauled by a local contractor for final disposal.

2.2.3 Water Quality

The U.S. Environmental Protection Agency (EPA) authorized the Commonwealth of Virginia to implement the NPDES within the State. Discharge of cooling water from Surry Units 1 and 2 is currently authorized under NPDES Permit No. VA0004090. The permit, which is renewed every 5 years, expires November 1, 2006. The permit requires VEPCo to take immediate steps to achieve a nondetectable concentration in the final effluent if detectable chlorine concentrations are noted. If chlorine is detected in the effluent, the injection of sodium hypochlorite is discontinued and the concentration is allowed to return to nondetectable levels. Surry Units 1 and 2 are expected to remain in compliance with the permitted chlorine concentrations.

2.2.4 Air Quality

The Surry Power Station is located on the James River, midway between Norfolk and Richmond, Virginia. The site is in a climatological transition region between the maritime climate of Norfolk and the continental climate of Richmond. Daily maximum temperatures range from a low of about 8°C (46°F) in January to a high of about 31°C (87°F) in July, and daily minimum temperatures range from about -2°C (28°F) in January to a high of about 20°C (69°F) in July. Precipitation is rather uniformly distributed throughout the year, with an annual average of about 111 cm (44 in.).[(a)]

Thunderstorms are occasional in the site region, with a normal occurrence of about 37 per year. Most of these storms occur during the months of May through September. From 1886 through 1987, 34 tropical storms and 10 hurricanes passed within 185 km (100 nautical miles) of the site (VEPCo 2000c). Based on statistics for the 30 years from 1954 through 1983 for the 1-degree square containing the Surry Power Station (Ramsdell and Andrews 1986), the probability of a tornado striking the site is expected to be about 4×10^{-6} per year.

The wind-energy resource in the vicinity of the site is limited, with the annual average wind power rated as 2 on a scale of 1 to 7 (Elliott et al. 1986). Areas suitable for wind turbine application (rated Class 3 or higher) in Virginia are limited to the ridges along the Appalachian Mountains and exposed coastal areas.

The Surry Power Station is located within the State Capital Intrastate Air Quality Control Region (40 CFR 81.145). This region is designated as in attainment or unclassified for all criteria pollutants (40 CFR 81.347). The Commonwealth of Virginia, however, has been designated as a nonattainment area for the 1-hour ozone standard. The Commonwealth of Virginia will also be subject to a revised 8-hour ozone standard (40 CFR 50.10; EPA 1997a) and a new ambient air standard for $PM_{2.5}$ (40 CFR 50.7; EPA 1997b), both promulgated by EPA in 1997. $PM_{2.5}$ is an acronym for particles with a diameter of 2.5 micrometers or less. After several years of litigation, the $PM_{2.5}$ and 8-hour ozone standards have recently been upheld. EPA is taking steps to implement the new standards (e.g., developing its approach and collecting the data necessary to designate which areas are in nonattainment). There are no areas designated as mandatory Class 1 Federal areas in which visibility is an important value within 80 km (50 mi) of the site.

Diesel generators, boilers, and other activities and facilities associated with the Surry Power Station emit various pollutants. Installation and operation of the station blackout diesel

(a) Climatological data for Norfolk and Richmond are available at http://www.ncdc.noaa.gov/ol/climate/ climatedata.html (Accessed October 4, 2001).

generators are regulated by a permit issued by VDEQ, dated September 27, 1993. An application has been submitted to VDEQ for a Title V permit for operation of three emergency diesel generators, which have been operating as a grandfathered use. Emissions from other sources are registered with and regulated by the VDEQ (Registration No. 50336). These sources are recertified annually.

The Gravel Neck Combustion Turbines Station is located on the Surry Power Station property and is operated for peaking power. Typically, its operations are limited to a few days each year. It does not affect Surry Units 1 and 2 operations.

2.2.5 Aquatic Resources

Aquatic resources in the vicinity of the Surry Power Station are associated with portions of the James River adjacent to the Surry site, with the once-through cooling system intake channel on the east side of the Gravel Neck Peninsula and the discharge canal on the west side of the Peninsula. The James River is used for a variety of purposes, including navigation, recreation, tourism, and conservation.

The site is located approximately 40 km (25 mi) upstream of the river's confluence with Chesapeake Bay. Around the Gravel Neck Peninsula, the river is approximately 4 km (2.5 mi) wide. The river's flow in the vicinity of the site is complex and composed of three basic components. In decreasing order of volume, the flows include (1) tidal flows, (2) upstream flow of saline water along the river bottom and downstream flow of less-saline water at the river surface, and (3) the outflow of freshwater from the James River Watershed (VEPCo 2001c). The Gravel Neck Peninsula is considered the upstream limit of saltwater incursion into the James River, but this may shift several miles upstream or downstream, depending on river flow conditions (VEPCo 1980). In general, salinities in the vicinity of the discharge canal are between 0.0 and 9.2 ppt, while salinities near the Surry intakes, 10 river km (6 river mi) downstream of the discharge canal, range up to 17 ppt (VEPCo 2001c).

Approximately 80 fish species are known to inhabit the brackish portion of the river downstream of the Surry Power Station and approximately 40 species have been recorded for the freshwater portion of the river upstream (VEPCo 1977). Important commercial and recreational fish species in the James River were described in a letter from J. E. Olney, Virginia Institute of Marine Sciences, to Tony Banks, VEPCo, April 4, 2001 (Olney 2001b). The species include striped bass *(Morone saxatilis)*, Atlantic croaker *(Micropogonias undulatus)*, weakfish *(Cynoscion regalis),* spot *(Leiostomus xanthurus),* American eel *(Anguilla rostrata)*, and white perch (*Morone americana*) (VEPCo 2001c). Primarily recreational fish include the silver perch *(Bairdiella chrysoura)*, American shad *(Alosa sapidissima)*, Atlantic menhaden *(Brevoortia tyrannus)*, blue catfish *(Ictalurus furcatus)*, channel catfish *(I. punctatus)*, common carp *(Cyprinus carpio)*, and inland silverside *(Menidia beryllina)*. This diverse mixture of fishes is

typical for upper estuarine habitat due to the seasonal changes in salinity that occur. In addition to finfish, numerous aquatic invertebrate species are found in the vicinity of Surry Power Station. These include zooplankton (primarily copepods), amphipods (dominated by the scud, *Gammerus* sp.), and benthic organisms (e.g., polychaetes and shellfish) (VEPCo 1977). Shellfish near the Surry Power Station include *Rangia cuneata,* a brackish water clam capable of tolerating a wide range of salinities, and larval stages of *Crassostrea virginica,* the American oyster (AEC 1972a, 1972b). Recent trawl surveys conducted between 1996 and 2000 collected oysters, blue crabs *(Callinectes sapidus)*, spider crabs *(Libinia emarginata)*, eight shrimp species, and five species of clams (Olney 2001a).

Currently, no Federally listed aquatic species is known to occur in the lower James River. Twenty fish species are listed as threatened or endangered by the Commonwealth of Virginia, but only one of these is reported to occur in Surry County (Table 2-2). This species, the blackbanded sunfish *(Enneacanthus chaetodon*), is listed as endangered by the Commonwealth of Virginia.[(a)] However, this sunfish primarily inhabits thickly vegetated ponds, swamps, and pools and is not reported to occur in the James River drainage (Jenkins and Burkhead 1994).

Burkhead and Jenkins (1991) listed only one fish that should be considered for Federal protection in the James River drainage: the orangefin madtom *(Noturus gilberti)*, a relict species native to the upper Roanoke drainage in Virginia and North Carolina and (probably introduced) to the upper James River drainage. This fish is currently listed as threatened by the Commonwealth of Virginia, but occurs only in the James River headwaters and is not present in the vicinity of Surry Power Station (Jenkins and Burkhead 1994).

Table 2-2. Aquatic Species Potentially Occurring in the Lower James River that are Listed Federally and by the Commonwealth of Virginia

Common Name	Scientific Name	Federal Status	State Status
Shortnose sturgeon	*Acipenser brevirostrum*	Endangered	Endangered
Atlantic sturgeon	*Acipenser oxyrhynchus*	Candidate for Federal Listing	Species of Special Concern

The Atlantic sturgeon *(Acipenser oxyrhynchus)* was reported in the vicinity of Surry Power Station site in the early 1970s (AEC 1972a, 1972b). The population declined dramatically, due largely to overfishing, in the early 1900s. Limited spawning has been reported in the James

(a) Virginia Department of Conservation and Recreation National Heritage Program. Available URL: http://www.dcr.state.va.us.dnh/surr.htm

and York Rivers (Murdy et al. 1997). A recent report by the U.S. Fish and Wildlife Service (FWS) also indicated that the Atlantic sturgeon is present in the James, York, and Rappahannock Rivers (FWS 1998).

The shortnose sturgeon (*Acipenser brevirostrum*) is a Federally-listed endangered species and appears on the Virginia Department of Conservation and Recreation (VDCR) list of "Extinct and Extirpated Animals of Virginia" (Table 2-2). It remains on Virginia's list because it is relatively common in drainages to the north and south of the Chesapeake Bay (Dadeswell et al. 1984; Murdy et al. 1997) and could potentially repopulate the region if current restoration efforts are successful. However, it is not known at present nor historically from the James or York River drainages. Although not otherwise recorded in Virginia in over 100 years, a single specimen of shortnose sturgeon was collected in the Rappahannock River, a tributary to the Chesapeake Bay north of the James River, during a recent FWS study (FWS 1998).

2.2.6 Terrestrial Resources

The terrestrial ecosystem of the Surry Power Station and vicinity contains communities similar to those of the majority of the Virginia and North Carolina coastal plain. Forest typical of Surry County has been characterized as loblolly (*Pinus taeda*) and shortleaf pine (*P. echinata*), consisting of 50 percent coniferous species, with oaks, hickory, and gum as broadleaf associates (AEC 1972a, 1972b). The primary terrestrial plant community on the Surry Power Station site consists of remnants of mixed pine-hardwood forest that were used for timber production prior to acquisition by VEPCo (VEPCo 2001c). Loblolly pine and white oak (*Quercus alba*) are the dominant canopy species in this mixed pine-hardwood community, with dogwood (*Cornus florida*) and sourwood (*Oxydendrum arboreum*) as important understory species (AEC 1972a, 1972b).

Of minor importance in the vicinity of the Surry Power Station are marshy forests with swamp communities dominated by black gum (*Nyssa sylvatica*) and bald cypress (*Taxodium distichum*), with ash (*Fraxinus* spp.), elm (*Ulmus* spp.), and red cedar (*Juniperus virginiana*) as common associates. Freshwater reed-marsh communities often occur at the edge of wetland forests, dominated by bulrush (*Scirpus* spp.) and plume grass (*Erianthus* spp.). Along streams and rivers, above the influence of brackish waters, are cattail (*Typha* spp.) and arrowhead (*Sagittaris* spp.) communities (AEC 1972a, 1972b). Major terrestrial flora that occur on and in the vicinity of the Surry Power Station are listed in the Surry Final Environmental Statements (AEC 1972a, 1972b).

Wildlife in the mixed pine-hardwood associations are typical of the upland forests of coastal Virginia (VEPCo 2001c). The most recreationally important species on the Surry Power Station site is the white-tailed deer (*Odocoileus virginianus virginianus*). Forest predators include the gray fox (*Urocyon cinereoargenteus cinereoargenteus*). Small mammals, especially rodents,

occupy more open habitats, as do birds of prey (e.g., hawks and owls). A total of 37 mammal, 194 bird (the majority of which are associated with forest or forest-edge communities), 43 reptile, and 34 amphibian species have been identified as present on, or whose range might include, the Surry Power Station site (AEC 1972a, 1972b).

The Hog Island Tract (HIT) of the HIWMA is adjacent to the northern boundary of the Surry Power Station (Figure 2-2) at the tip of the Gravel Neck Peninsula. The 1200 ha (2900 ac) of the HIT consist primarily of tidal marshes and diked impoundments interspersed with pine forests. The Carlisle and Stewart Tracts of the HIWMA, approximately 410 ha (1000 ac) in extent, are located southeast of the Surry Power Station (Figure 2-2). These consist primarily of upland forested areas, but also contain tidal marshes along Lawnes Creek. All three tracts of the HIWMA are managed by the Virginia Department of Game and Inland Fisheries (VDGIF) and support a rich variety of wildlife. The tidal flats and marshes provide habitat for large numbers and numerous species of migratory shore birds, wading birds, and waterfowl. For example, large numbers of Canada geese (*Branta canadensis*) use the HIWMA as a wintering area. In addition, the HIT provides habitat for numerous amphibians, reptiles, mammals, and upland game birds (VEPCo 2001c).

The transmission corridors (Figure 2-5) described in Section 2.1.7 are situated within the Coastal Plain physiographic province. The transmission lines traverse land-use categories typical of coastal Virginia, such as row crops, pasture, pine plantations, and old fields. In addition, the transmission corridors pass through more natural habitat types, such as pine-hardwood forests, bottomland hardwood forests, and shrub bogs. The Suffolk-to-Yadkin transmission corridor traverses a 4-km (2-mi) portion of the Great Dismal Swamp National Wildlife Refuge, where hardwood swamp comprises the transmission corridor habitat. The Chuckatuck-to-Whealton corridor crosses a 304-m (1000-ft) portion of the Ragged Island Wildlife Management Area, a 622-ha (1537-ac) tract along the lower James River that consists of brackish marsh and pine-covered islands (VEPCo 2001c).

Table 2-3 shows listed species in Surry County and nearby counties that host transmission lines from Surry Power Station. Five Federally-listed and 18 State-listed threatened or endangered species, or species of special concern, that have been reported within 8 km (5 mi) of the site or transmission corridors, are also listed.

There are four active bald eagle *(Haliaeetus leucocephalu*s) nests in the vicinity of Surry Power Station or its transmission corridors. Three are within 4 km (2.5 mi) of the Surry Power Station and one is within 100 m (330 ft) of the transmission corridors and 48 km (30 mi) from the Surry Station. In addition, as many as 50 eagles may forage within the HIWMA and vicinity during spring migration. However, there are no eagle concentration areas (e.g., roost sites, shoreline foraging areas, etc.) currently known on the Surry Power Station site or along the related transmission corridors.

Table 2-3. Federal- and State-Listed Terrestrial Species Potentially Occurring in Surry County and in Counties Crossed by Transmission Lines Associated with Surry Power Station

Scientific Name	Common Name	Federal Status	State Status	Charles City	City of Chesapeake	City of Hampton	City of Portsmouth	City of Suffolk	Isle of Wight	Prince George	Surry
Amphibians											
Ambystoma mabeei	Mabee's salamander		T			X		X	X		
Ambystoma tigrinum	tiger salamander		E						X		
Bufo quercicus	oak toad		SC		X			X			X
Hyla gratiosa	barking tree frog		T						X		X
Birds											
Charadrius melodus	piping plover	T	T			X	X				
Ardea alba	great egret		SC		X	X	X				
Falco peregrinus	peregrine falcon		T	X			X			X	
Haliaeetus leucocephalus	bald eagle	T	T	X		X	X	X	X	X	X
Lanius ludovicianus	loggerhead shrike		T							X	
Limnothlypis swainsonii	Swainson's warbler		SC					X			
Nyctanassa violacea	yellow-crowned night-heron		SC			X					
Picoides borealis	red-cockaded woodpecker	E	E					X			
Sterna antillarum	least tern		SC			X	X				
Insects											
Cicindela dorsalis dorsalis	northeastern beach tiger beetle	T				X					
Mammals											
Corynorhinus rafinesquii macrotis	eastern big-eared bat		E		X			X	X		
Sorex longirostris fisheri	Dismal Swamp southeastern shrew		T		X			X			
Plants											
Aeschynomene virginica	sensitive joint-vetch	T		X							
Bacopa innominata	tropical water-hyssop		E	X						X	X
Helonias bullata	swamp pink			X							
Isotria medeoloides	small whorled pogonia			X							
Reptiles											
Crotalus horridus atricaudatus	canebreak rattlesnake		E		X	X		X			
Deirochelys reticularia	chicken turtle		E						X		

E = Endangered, T = Threatened, SC = Special Concern, i.e., animals that merit special concern according to VDGIF (not a regulatory category), X = Known to Occur in Region.
Source: Based on the August 22, 2001, version of the VDCR Internet site. Available URL: http://www.dcr.state.va.us/dnh/.

Besides the bald eagle, none of the other animal or plant species in Table 2-3 are currently known to occur on the Surry Power Station site or along the related transmission corridors (VEPCo 2001c).

2.2.7 Radiological Impacts

VEPCo has conducted a radiological environmental monitoring program (REMP) around the Surry Power Station site since 1970 (AEC 1972a, 1972b). The radiological impacts to workers, the public, and the environment have been carefully monitored, documented, and compared to the appropriate standards. The two-fold purpose of the REMP is:

- to provide representative measurements of radiation and radioactive materials in the exposure pathways for the radionuclides that have the highest potential for radiation exposures of members of the public and

- to supplement the radiological effluent monitoring program by verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of the effluent measurements and the modeling of the environmental exposure pathways.

Radiological releases are summarized in two annual reports: *Annual Radiological Environmental Operating Report Surry Power Station* (VEPCo 2001b) and *Annual Radioactive Effluent Release Report Surry Power Station* (VEPCo 2000a, 2001a). The limits for all radiological releases are specified in the Surry ODCM, and these limits are designed to meet Federal standards and requirements (VEPCo 2000b). The REMP includes monitoring of the airborne exposure pathway, direct exposure pathway (i.e., ambient radiation), water exposure pathway (i.e., well water and river water), aquatic exposure pathway (i.e., silt and shoreline sediments), and ingestion exposure pathway (i.e., milk, crabs, fish, clams, oysters, and crops) in a 32-km (20-mi) radius of the station (VEPCo 2001b) . In addition, the Virginia Department of Health (VDH) conducts an environmental radiation program that includes continuous monitoring of the air and ambient radiation, and periodic sampling of fish, milk, shellfish, silt, soil, vegetation, and river water (VDH 2001).

Review of historical data on releases and the resultant dose calculations revealed that the doses to maximally exposed individuals in the vicinity of the Surry Power Station site were a small fraction of the limits specified in the EPA's environmental radiation standards in 40 CFR Part 190 as required by 10 CFR 20.1301(d). For 2000 (the most recent year that data were available), dose estimates were calculated based on actual liquid and gaseous effluent release data (VEPCo 2001a). Calculations were performed using the plant effluent release data, onsite meteorological data, and appropriate pathways identified in the ODCM. The maximum dose to an individual located at the station site boundary from liquid and gaseous

effluents released during 2000 was 1 x 10^{-5} mSv (0.001 mrem) (VEPCo 2001b). A breakdown of doses by pathway for the year 2000 is as follows:

- Total body dose from liquid effluents was 3.16 x 10^{-6} mSv (3.16 x 10^{-4} mrem), which is 0.005 percent of the 0.06 mSv (6 mrem) dose limit.(a) The critical organ doses to the gastrointestinal tract and thyroid from liquid effluents were 1.74 x 10^{-5} mSv (1.74 x 10^{-3} mrem) and 1.59 x 10^{-6} mSv (1.59 x 10^{-4} mrem), respectively. These doses were 0.009 percent and 8 x 10^{-4} percent of the 0.20 mSv (20 mrem) dose limit(a) (VEPCo 2001a).

- The air dose due to noble gases in gaseous effluents was 9.26 x 10^{-6} mSv (9.26 x 10^{-4} mrad) gamma (0.005 percent of the 0.20 mGy [20 mrad] gamma dose limit[a]) and 2.41 x 10^{-5} mGy (2.41 x 10^{-3} mrad) beta (0.006 percent of the 0.40 mGy [40 mrad] beta dose limit[a]) (VEPCo 2001a).

- The critical organ dose from gaseous effluents due to iodine-131, iodine-133, tritium, and particulates with half-lives greater than 8 days was 4.06 x 10^{-5} mSv (4.06 x 10^{-3} mrem), which is 0.01 percent of the 0.30 mSv (30 mrem) dose limit(a) (VEPCo 2001a).

VEPCo does not anticipate any significant changes to the radioactive effluent releases or exposures from Surry Power Station operations during the renewal period and, therefore, the impacts to the environment are not expected to change.

2.2.8 Socioeconomic Factors

The staff reviewed the applicant's Environmental Report (ER; VEPCO 2001c) and information obtained from several county, city, and economic development staff during a site visit to the vicinity of Surry Units 1 and 2, from September 17 through 21, 2001. The following information describes the economy, population, and communities near Surry Power Station.

2.2.8.1 Housing

Approximately 990 employees work at Surry Units 1 and 2, (about 110 contract employees and 880 permanent employees). Approximately 60 percent of these employees live in Isle of Wight, James City, Surry Counties, or the independent city of Newport News.(b) This analysis will focus on these areas as the Surry Power Station area of impact. The remaining 40 percent of

(a) The dose limit is twice the 10 CFR Part 50, Appendix I, dose limit because the limit is per unit and Surry has two operating units.
(b) Independent cities are not considered to be within the boundaries of counties.

permanent Surry Power Station employees are spread over 23 other counties and independent cities. Some independent cities are urban areas, and others are not. The residency of permanent employees is shown in Table 2-4 by county and independent city. Transportation, offsite land use, demography, housing, and economics are similar in those areas south of the James River, which are somewhat isolated from the more populous areas to the north.

Table 2-4. Surry Power Station, Units 1 and 2, Permanent Employee Residence by County/Independent City

County/Independent City	Number of Personnel	Percentage of Total Personnel	Cumulative Percentage
Isle of Wight	212	24	24
James City	98	11	35
Newport News*	97	11	46
Surry	90	10	57
Hampton*	71	8	65
Suffolk*	52	6	71
Chesapeake*	42	5	75
Chesterfield	25	3	78
Portsmouth*	23	3	81
Virginia Beach*	21	2	83
York	20	2	85
Prince George	19	2	88
Sussex	18	2	90
Southampton	11	1	91
Others	79	9	100
Total	878	100	

* Independent City
Source: NRC 2001b.

Census data for 2000 describing housing in the study area are presented in Table 2-5. the local governments all have comprehensive land use plans, but they do not otherwise impose growth control measures that limit housing development. Surry County stands out with relatively high owner and rental vacancy rates compared to the surrounding counties.

VEPCo refuels each nuclear unit at Surry Power Station on an 18-month staggered schedule. During these refueling outages, site employment increases by as many as 700 temporary workers for 30 to 40 days. The residences of the temporary workers are assumed to be similarly distributed through the region as Surry Power Station permanent employees.

Table 2-5. Housing Units and Housing Units Vacant (Available) by County During 1990 and 2000

	1990	2000	Approximate Change (%)
ISLE OF WIGHT COUNTY			
Housing Units	9753	12,066	24
Occupied Units	9032	11,319	25
Vacant Units	721	747	4
Percent Vacant	7%	6%	-16
JAMES CITY COUNTY			
Housing Units	14,330	20,772	45
Occupied Units	12,968	19,003	47
Vacant Units	1362	1769	30
Percent Vacant	10%	9%	-10
NEWPORT NEWS INDEPENDENT CITY			
Housing Units	69,728	74,117	6
Occupied Units	63,952	69,686	9
Vacant Units	5776	4431	-23
Percent Vacant	8%	6%	-28
SURRY COUNTY			
Housing Units	2982	3294	10
Occupied Units	2283	2619	15
Vacant Units	699	675	-3
Percent Vacant	23%	20%	-13

Sources: U.S. Census Bureau (USCB 1990, 2000).

2.2.8.2 Public Services

- **Water Supply**

Surry Power Station gets potable water from a series of groundwater wells and is not connected with a municipal system (VEPCo 2001c). Sixty percent of the permanent employees reside in Isle of Wight, James City, or Surry Counties or the City of Newport News; therefore, discussion of public water supply systems will focus on these four areas. Table 2-6 summarizes the characteristics of the water supply systems in these areas.

Isle of Wight County has municipal water supply systems in the towns of Windsor, Smithfield, and Franklin. Permitted groundwater wells supply these systems; Surry County has municipal water supply systems in the towns of Claremont, Dendron, and Surry. A fourth system is under construction at the County's industrial park, 3 km (2 mi) west of the town of Surry, off State Highway 10. These systems are supplied by permitted groundwater wells.

Table 2-6. Major Public Water Supply Systems in Isle of Wight, James City, and Surry Counties, and City of Newport News

Water System	Source	Average Daily Use		Maximum Daily Capacity		Area Served
		1000 L/d	1000 gpd	1000 L/d	1000 gpd	
Windsor	Groundwater	30	9	2000	530	Windsor
Smithfield	Groundwater	110	30	12,000	3200	Smithfield
Franklin	Groundwater	250	65	5700	1500	Franklin
SURRY COUNTY						
Claremont	Groundwater	95	25	190	50	Claremont
Dendron	Groundwater	76	20	230	60	Dendron
Surry	Groundwater	150	40	380	100	Surry
Surry Industrial Park	Groundwater	300	80	570	150	Surry Industrial Park
JAMES CITY COUNTY						
James City Service Authority	Groundwater	14,000	3700	18,000	4780	James City County
CITY OF NEWPORT NEWS						
Newport News Waterworks	Chickahominy River, Descant Creek Reservoir, Little Creek Reservoir, Skiffe's Creek Reservoir, Lee Hall Reservoir, Harwood's Mill Reservoir	170,000	45,000	320,000	85,000	Newport News and James City County

Source: VEPCo 2001c; Virginia Electric and Power Co May 2001; Update of ER data provided by Larry Foster, James City County Service Authority, September 2001, Dave Morris, Newport News Waterworks, telephone communication, January 2002.

The municipal water supply for James City County is provided by the Newport News Waterworks (Waterworks), described below, and the James City Service Authority (JCSA). JCSA's water system consists of the central system with 29 well facilities and six independent water systems with five well facilities. Approximately 443 km (275 mi) of transmission and distribution lines supply about 14 million L/d (3.7 million gpd) to 12,500 customers.[(a)] The JCSA has a groundwater withdrawal permit for 18 million L/d

(a) Personal Communication, Larry Foster, James City County Service Authority, September 2001.

(4.78 million gpd). This amount of water will meet the County's needs through 2008, and an additional 15 million L/d (4 million gpd) will be needed to meet demand through 2040.

The JCSA is pursuing an initiative to meet its long-term water demand by participating in a regional effort to supplement the JCSA groundwater with surface water. James City County has joined Newport News in pursuing the construction of a water supply reservoir on Cohoke Creek in King William County to supply 87 million L/d (23 million gpd). This project is scheduled to be completed in 2010. James City County intends to contract with Newport News to obtain the rights to at least 7.5 million L/d (2 million gpd) and possibly 15 million L/d (4 million gpd) from the project. Water supply needs in the intermediate term will be met with three replacement wells and two new wells to provide an additional 7.5 million L/d (2 million gpd). As an interim measure, a reverse osmosis membrane treatment facility has been constructed. This facility will treat brackish groundwater from two deep confined aquifers within the coastal plain of Virginia. Six production wells will supply 23 million L/d (6 million gpd). The Waterworks has implemented a program aimed at fostering water conservation by system users and has helped to form a regional water conservation team as additional ways to meet future water demands.

Public water supply for Newport News is provided by the Waterworks, one of the 100 largest water utilities in the United States and one of the three largest in the Commonwealth of Virginia. Water is supplied to nearly 400,000 residents of Poquoson, Hampton, and Newport News, and to portions of York and James City Counties. The primary source of raw water is the Chickahominy River. Secondary sources and storage include five reservoirs: Descant Creek, Little Creek, Skiffe's Creek, Lee Hall, and Harwood's Mill. A sixth reservoir is proposed on Cohoke Creek in King William County, as discussed above. The Waterworks operates two water treatment plants: Lee Hall, which has a maximum rated treatment capacity of 204 million L/d (54 million gpd), and Harwood's Mill, which is currently rated to treat 117 million L/d (31 million gpd). Average daily usage is 170 million L/d (45 million gpd). Newport News Waterworks is planning increased capacity, as noted above.

- **Education**

The Surry County School system has just over 1200 students in the 2001-2002 academic year. There currently is no overcrowding in the system. The school system is healthy financially in terms of bonded indebtedness.[(a)] VEPCo partners with the Surry County

(a) Personal Communication with Dr. Marion H. Wilkins, Assistance Superintendent of Schools, Surry County School System, September 2001.

School system in a variety of ways, providing funds and technical help with disabled students, volunteers, computers, and internships.

Institutes of high education in the region include Hampton University, Virginia State University, Norfolk State University, Old Dominion University, William and Mary College, and the Virginia Institute of Marine Science.

- **Transportation**

There are 49 counties and independent cities within an 80-km (50-mi) radius of Surry Power Station, 44 in Virginia and 5 in North Carolina. In two of the latter counties, the 80-km (50-mi) ring just overlaps a 5-km (3-mi) triangular corner (see Figure 2-1). The area around Surry Power Station is served by several major freeways including Interstate 64, which together with U.S. Highway 60, connects the Newport News, Portsmouth, Norfolk area with Richmond, and Interstate 95, which runs in a north-south direction west of Surry County through the region and connects Richmond to Washington, D.C. to the north and North Carolina to the south. See Figure 2-6 for a regional view of major highways and other features in the vicinity of Surry Power Station.

The area is traversed by several other Commonwealth and Federal highways, including U.S. Highway 58, running southwest from Newport News. U.S. Highway 460 connects the Suffolk, Portsmouth, and Norfolk areas with Interstate 95 at Petersburg. U.S. Highway 13 runs approximately north-south and connects the eastern shore of Maryland and Virginia to eastern North Carolina, passing through Norfolk and Portsmouth.

The most direct vehicular access to Surry Power Station from the more populous cities and counties on the north bank of the James River (Williamsburg, Newport News, Hampton, York, and James City County) is via State Highway 31 and the James River Ferry service, operated by the Virginia Department of Transportation 24 hours a day at no cost to motorists. The major northwest-southeast route is State Highway 10 through Prince George, Surry, and Isle of Wight counties; this is the main route between the towns of Surry and Smithfield. Access from the southwest is via State Highways 40 and 31 from Sussex, Southampton, and the surrounding counties.

Part of the isolation of Surry County is the limited-capacity access to the more developed areas to the north via the James River Ferry, operated by the Virginia Department of Transportation between Scotland and Jamestown. Two ferries run 7 days a week and a third ferry is added during the summer months. Ferry traffic has been increasing over the last several years. The Virginia Department of Transportation has implemented schedule adjustments to accommodate the increased use; further adjustments are possible to accommodate future growth in ferry traffic (VEPCo 2001c).

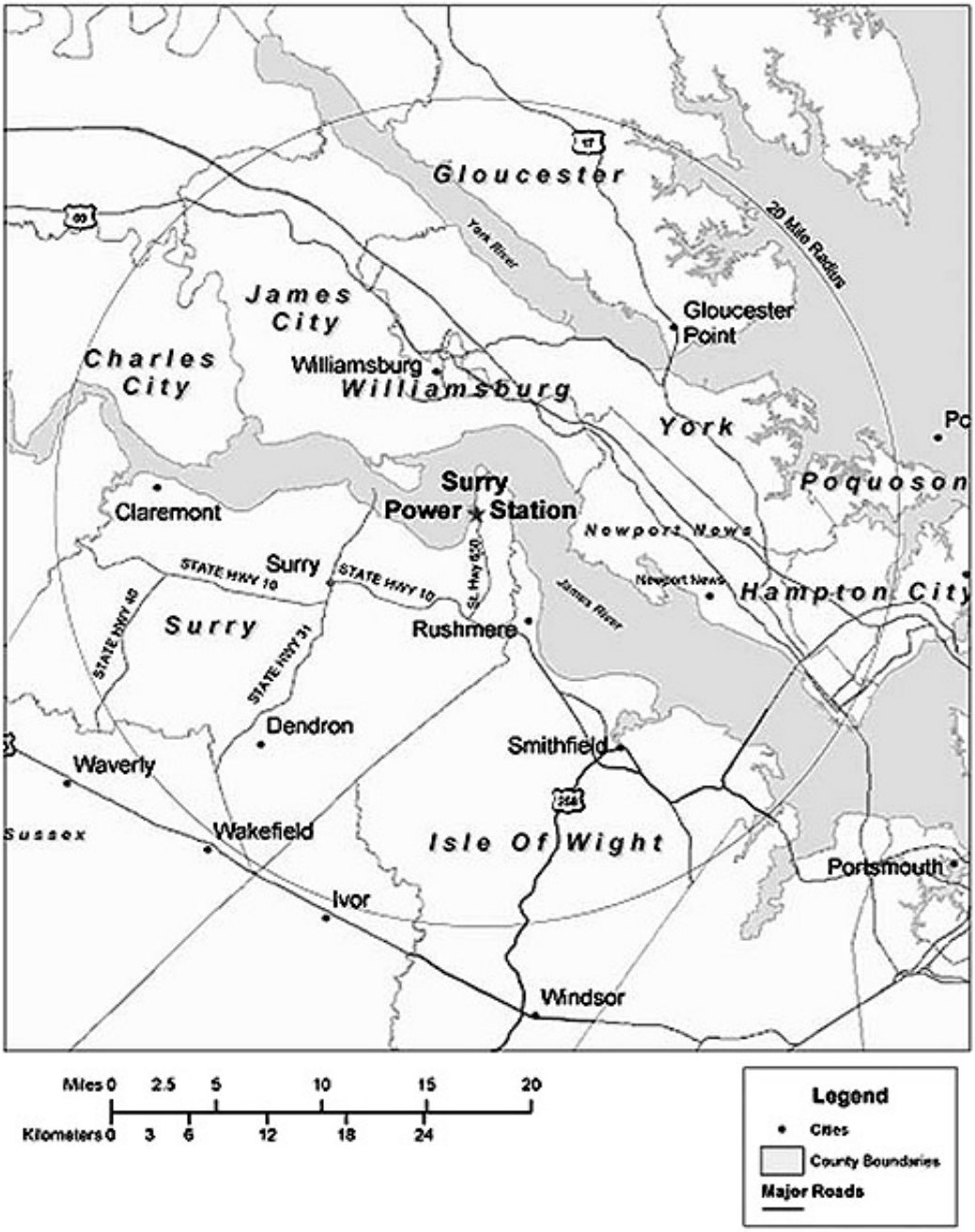

Figure 2-6. Area Within 32-km (20-mi) Radius of Surry Power Station

The principal road access to the Surry Power Station is via State Highway 650, which is a two-lane paved road. State Highway 650 intersects State Highway 10 approximately 8 km (5 mi) from the plant. Much of the road network in Surry and surrounding counties consists of hilly, winding two-lane roads, which are also used as commuting routes to the Surry Power Station.

The Virginia Department of Transportation is addressing the intersection of State Highways 10 and 650, where line-of-sight restrictions exist and where a $1.3-million road-improvement project is scheduled that involves installing turn lanes and other improvements to alleviate this problem.[(a)]

2.2.8.3 Offsite Land Use

The focus of this section is on Surry, Isle of Wight, and James City counties and the independent city of Newport News because 60 percent of the Surry Power Station workforce lives in these four areas.

The Commonwealth of Virginia mandates that cities and counties have comprehensive land use plans. The discussion of demography (Section 2.2.8.5, below) will reinforce that Surry County, along with the counties south of the James River, have experienced isolation and very slow, even at times negative, population growth over many decades.

Surry and surrounding counties south of the James River are predominantly agricultural and rural and characterized by gently rolling hills and some swamp areas. The elevation of Surry County varies from about 30 to 37 m (100 to 120 ft) above sea level (Surry County 1981). The County has 720 km^2 (280 mi^2) of land area and 67 km^2 (26 mi^2) of inland waterways (Surry County 1981). An estimated 75 percent of the county drains through the Blackwater River to the Chowan River and Albemarle Sound on the coast of North Carolina. Streams in the county are very slow running and generally have swampy bottoms (Surry County 1981).

The most recent Surry County Zoning District Map (Surry County 1980) shows that the vast majority of the land area of the county is zoned A-R, or Agricultural-Rural Residence District. The remainder is designated other zones, such as R-2 (Vacation Residence District), H-P (Historic Preservation), R-1 (Urban Residence District), B-1 (Local Business District), B-2 (General Business District), M-1 (Light Industrial District), and M-2 (General Industrial District). The Surry Power Station is in the sole M-2 zone in the county.

(a) Personal communication with Bill Richardson, Mike Tardy, Ron Pierce, and MacFarland Neiblett, Virginia Department of Transportation, September 2001.

In the year 2000, three towns in Surry County (Surry, Dendron, and Claremont) had populations of 262, 297, and 343, respectively, according to the U.S. Census Bureau.

There are several parks and preserves in Surry County, primarily along the south bank of the James River. Immediately adjacent to Surry Power Station is the Hog Island Tract of HIWMA (zoned A-R), at the north end of the peninsula on which Surry Power Station is located. In addition, south of Surry Power Station are the Carlisle and Stewart tracts of HIWMA. To the west, bordering the James River, is Chippokes Plantation State Park, and further west are Swanns Point and Pipsico Reservation, the site of a Boy Scouts of America camp.

Also in the vicinity of Surry Power Station and across the James River are two national parks: 5 km (3 mi) northwest is the Jamestown Colonial National Historical Park, and 14 km (9 mi) east-northeast is the Yorktown Colonial National Historical Park. Both of these parks have adjacent attractions that are not part of the national park system. Other major tourist attractions also across the James River include Busch Gardens (8 km [5 mi] north-northeast), Colonial Williamsburg (11 km [7mi] north), the College of William and Mary (11 km [7 mi] north), and Water Country (13 km [8 mi] north-northeast).

2.2.8.4 Visual Aesthetics and Noise

The Surry Power Station is clearly an industrial site. However, its structures are not visually obtrusive from any vantage point, even from across the James River (see Section 2.1.1). The Surry Power Station is a minimum of 5 km (3 mi) from any point across the James River, and the dense tree stands surrounding the site effectively screen it from all but a few locations. From a distance of 3 to 5 km (2 to 3 mi), Surry Power Station would only become prominent from vessels relatively close toward the south shore of the James River. There is no noise other than from minimal onsite traffic and from materials-handling and construction equipment, when these are in use.

2.2.8.5 Demography

Population was estimated in the region of the Surry Power Station out to 80 km (50 mi) in 16-km (10-mi) concentric rings. Population estimates for the 80-km (50-mi) area surrounding the site are based on information from the Updated Final Safety Analysis Report for Units 1 and 2 (VEPCo 2000c).

- **Resident Population Within 80 km (50 mi)**

  Table 2-7 presents the population distribution within 80 km (50 mi) of Surry Power Station for population estimates in 10-year increments, starting with 1990 and ending with 2030. In 2000, there were 2,378,353 people living within 80 km (50 mi) of Surry Power Station

(USCB 2000). Between 1990 and 2000, the total population within the 80-km (50-mi) radius increased by 21 percent. Between 2000 and 2010, the population is expected to increase by 13.4 percent and continue thereafter in a slight downward trend in growth between 2020 and 2030 at 10.8 percent (VEPCo 2000c). Most of the population is concentrated north of the James River and in the Suffolk/Virginia Beach/Norfolk/Portsmouth/Chesapeake area, east of Isle of Wight County.

Table 2-7. Population Distribution 1990 to 2030 Within 80 km (50 mi) of the Surry Power Station, Based on 1990 Census Data

Year	0 to 16 km (0 to 10 mi)	16 to 32 km (10 to 20 mi)	32 to 48 km (20 to 30 mi)	48 to 64 km (30 to 40 mi)	64 to 80 km (40 to 50 mi)	Total
1990(a)	102,343	249,532	331,536	686,069	600,819	1,970,119
2000 (b)	120,709	297,875	380,774	835,137	743,888	2,387,353
2010 (est.)(a)	139,242	338,472	415,202	944,420	869,648	2,706,984
2020 (est.)(a)	157,775	379,069	449,659	1,053,802	995,707	3,036,012
2030 (est.)(a)	176,308	419,666	484,117	1,163,183	1,121,767	3,365,040

Source: (a) VEPCo 2000c; (b) USCB 2000.

All or parts of 49 counties, and 8 major cities with a population over 50,000, are located within 80 km (50 mi) of Surry Power Station in Virginia and North Carolina. The largest population centers within the 16-km (10-mi) area are the cities of Williamsburg, which lies to the north of Surry Power Station and parts of the city of Newport News, which lies to the northeast. The populations of Williamsburg and Newport News for 2000 were 11,998 and 108,150, respectively (USCB 2000).

Nearly all of the city of Newport News falls within the 32-km (20-mi) radius. The town of Poquoson (population 11,566) lying east of the site, and the cities of Hampton (population 146,437) lying to the east, Portsmouth (population 100,565) lying to the southeast, and Norfolk (population 234,403) lying to the southeast, fall within or on the edge of the 48-km (30-mi) radius. Suffolk (population 63,677), south of Surry Power Station, the Petersburg area including Colonial Heights and Hopewell (population 72,991) lying to the west, Chesapeake (population 199,184) lying to the southeast, and Virginia Beach (population 425,257) also to the southeast, lie within or on the edge of the 64-km (40-mi) radius. The Richmond area, including the adjoining communities of Bon Air, Chester, East Highland

Park, and Highland Springs (population 259,487), lies to the northwest at the edge of the 80-km (50-mi) radius (USCB 2000).

The counties and communities south of the James River are isolated from the more populated areas north of the James River and are rural and very low in population density. Table 2-8 shows the actual (1990 census data) and estimated changes in population for Surry, Isle of Wight, and James City Counties, and the city of Newport News, from 1980 to 2030. Over the past century, Surry County population decreased 19 percent (8469 in 1900; 6829 in 2000 [USCB 2000]).

Table 2-8. Estimated Populations and Annual Growth Rates in Isle of Wight, James City, and Surry Counties, and City of Newport News, 1980-2030, Based on 1990 Census Data

	Surry County		Isle of Wight County		James City County		City of Newport News	
Year	Population	Average Annual Growth (%)	Population	Average Annual Growth (%)	Population	Average Annual Growth (%)	Population	Average Annual Growth (%)
1980	6046	0.3	21,603	1.8	22,763	2.8	144,903	0.5
1990	6145	0.2	25,053	1.6	34,859	5.3	170,045	1.7
2000	6599	0.7	29,499	1.8	48,000	3.8	180,999	0.6
2010	7095	0.8	34,098	1.6	60,000	2.5	189,998	0.5
2020	7594	0.7	38,726	1.3	72,076	2.0	199,054	0.5
2030	8090	0.7	43,325	1.2	84,076	1.7	208,053	0.5

Source: VEPCo 2001c.

- **Transient Population**

The area within the first 16 km (10 mi) of the Surry Power Station is predominantly rural and characterized by farmland, wooded tracts of land, and marshy wetlands. Since there are no significant industrial or commercial facilities in these directions, and none are anticipated, the transient employment population is likely to be out of, rather than into, the area.

Large employers within 16 km (10 mi) of the Surry Power Station site are listed in Table 2-9. Transient population estimates for the tourist attractions, parks, and recreational areas to the north, northeast, and southeast are provided in Table 2-10. These figures were obtained by VEPCo in 1993 from the individual attractions and the Virginia Division of Tourism. Total tourist figures in the Williamsburg area have not changed significantly over the last 10 years. Ticket purchases at Colonial Williamsburg and Jamestown and Yorktown National Historic Parks have collectively decreased. Busch Gardens, located 8 km (5 mi) north-northeast of the Surry Power Station site, with an annual attendance of 2.1 million, is

the largest single tourist attraction in the 16-km (10-mi) area. The resulting estimated total peak daily transient population in the Surry Power Station vicinity is 50,000.

Table 2-9. Major Employment Facilities Within 16 km (10 mi) of the Surry Power Station

Firm	Number of Employees
Fort Eustis	18,200
Anheuser Busch Brewery	1100
Busch Gardens	3000
U.S. Naval Weapons Storage Facility	2650
Colonial Williamsburg	3000

Source: VEPCo 2000c.

Table 2-10. Visitors to Major Events Within 16 km (10 mi) of the Surry Power Station

Facility	Daily Peak Transient Population[(a)]	Annual Usage[(a)]
Busch Gardens	18,000	2,100,000
Jamestown Settlement	1750	373,000
Jamestown Colonial National Historical Park	1400	300,000
Colonial Williamsburg	4000	909,000
Water Country	5000	460,000
Yorktown Colonial National Historical Park	1450	310,000
Chippokes Plantation State Park[(b)]	14,000	115,552
Hog Island Wildlife Management Area[(c)]	N/A	25,000
Hog Island Waterfowl Refuge[(c)]	N/A	4000
Bacon's Castle	50	6500
Carter's Grove Plantation	2000	259,000

(a) Substantial overlap in annual attendance very likely because of close proximity of attractions.
(b) Peak daily use is during 2-day annual Pork, Peanut, and Pine Festival (July)
(c) Peak daily use during winter

Source: VEPCo 2000c.

2.2.8.6 Economy

Forest resources play an important role in the Surry County economy and environment. According to the Surry County Comprehensive Plan, 75 percent of the land area is commercial forestland, of which 99.25 percent is private and the rest is public (Surry County 1980). The dominant land use remains commercial forest. The dominant forest types on these acres are loblolly-shortleaf pine, oak-pine, oak-hickory, and oak-gum-cypress. The County's economic base also includes agricultural production, with peanuts, soybeans, and corn as the primary crops.

The latest (1997) Census of Agriculture data (USDA 1999) show that Surry County, like most of the surrounding counties, is experiencing a consolidation of farms (making fewer, larger farms) and a slight reduction in farmland overall, similar to Sussex and Southampton counties, both of which show similar population and agricultural patterns.

Surry County is in both the Crater Planning and the Hampton Roads Economic Planning District Commissions. According to the VEPCo ER (VEPCo 2001c), the Hampton Roads area has experienced steady growth in population and economic activity during the last decade, as has Surry County to a lesser extent. The Hampton Roads area is the 27th largest metropolitan statistical area in the United States with more than 1.5 million people. It has a transportation network of trucking and railroad terminals, interstate highway access to main east-west and north-south routes, international airports, and an international deepwater, ice-free seaport, giving the area access to both domestic and international markets. Historically, there was a heavy reliance in Hampton Roads on defense-related industry, particularly shipbuilding. In recent years, the regional economy has become more diversified with major business, financial, and health care components, as well as a growing high-tech sector. Regionally, service is now the largest employment sector.

The unemployment rates for the Commonwealth of Virginia, Surry County, and surrounding localities are shown in Table 2-11. The unemployment rates in Surry County and the immediate neighboring counties south of the James River are higher than in localities north of the James River, Virginia, and the U.S. as a whole, a finding consistent with other economic indicators. VEPCo is the major employer in Surry County.

Surry County had a fiscal year 2000-2001 operating budget of $21.8 million, of which $15.6 million came from local property tax (Surry County 2000). For the years 1995 to 2001, the Surry Power Station's property taxes provided between 70 and 76 percent of Surry County's total property tax revenue. Property taxes cover about 68 percent of Surry County's total operating budget. VEPCo projects that the Surry Power Station's annual property taxes will remain constant at about $10 million through the license renewal period (VEPCo 2001c).

Table 2-11. Percent Unemployment, Individual Poverty, and Median Household Income for Surry, Isle of Wight, and James City Counties and City of Newport News

	Unemployment, % of Population (2000)	Poverty, % of Population (Estimated 1997)	Median Household Income (1997 $)
Surry County	4.1	16.0	31,097
Isle of Wight County	2.2	11.6	39,331
James City County	1.8	7.8	51,424
Newport News City	3.7	16.7	54,306

Sources: Virginia Employment Commission (VEC) 2001; USCB 1997.

Table 2-12 shows Surry Power Station's tax payments relative to Surry County property tax revenues and operating budget for the tax years 1995-2001.

Table 2-12. Property Tax Revenues Generated in Surry County by Surry Power Station and Surry County Operating Budgets, 1995-2001

Tax or Fiscal Year	Total Surry County Property Tax Revenues ($)	Property Tax Paid to Surry County for Surry Power Station ($)[(a)]	Property Taxes as a Percentage of Total County Property Tax Revenues	Total County Operating Budget	Property Taxes as a Percentage of Total County Operating Budget
1995	10,929,247	8,339,169	76	16,737,107	50
1996	11,763,226	8,994,835	76	16,818,954	53
1997	12,463,315	9,428,802	76	18,156,965	52
1998	12,208,208	9,154,251	75	18,589,528	49
1999	13,815,798	10,030,159	73	20,409,114	47
2000	14,270,205	10,025,094	70	21,166,592	47
2001	15,567,176	10,944,588	70	21,792,587	50

(a) Includes Surry Power Station, Units 1 and 2, and the Gravel Neck Combustion Turbines Station. Personal communication with Norma Roach, Commissioner of Revenue, Surry County, January 2002.

Source: VEPCo 2001c; updated with data from Melissa D. Rollins, Surry County Tax Collector's Office, January 2002.

At present, due to the location of the Surry Power Station in Surry County, VEPCo has a significant impact on the economic well-being of the County, paying well over 70 percent of the property taxes between 1996 and 2000. The schools within the county have benefitted from the taxes paid by the Surry Power Station and have seen their infrastructure substantially upgraded. If the County were to lose the Surry Power Station tax base, the impacts would be consequential.

2.2.9 Historic and Archaeological Resources

This section discusses the cultural background and the known historic and archaeological resources at the site of Surry Power Station, Units 1 and 2, and in the surrounding area. This section draws heavily on information contained in a report prepared for VEPCo, by the Louis Berger Group, Inc. (2001), as well as from archives and records stored at the Virginia Department of Historic Resources.

2.2.9.1 Cultural Background

This area is part of a region rich in terms of prehistoric and early historic Native American resources, and likewise in terms of historic Euroamerican resources (Bense 1994; Louis Berger Group, Inc. 2001). Virginia has an archaeological sequence that extends back at least 12,000 years before the present. Virginia's cultural history can be divided into four major periods: Paleoindian (10,000 B.C., and perhaps as early as 13,000 B.C., to around 8000 B.C.), Archaic (8000 to 1000 B.C.), Woodland (1000 B.C. to around A.D. 1600), and Historic (A.D. 1607 to the present).

During the Paleoindian period, the native peoples seemingly were organized into small mobile bands with a hunting- and a fishing-based economy. The environment of the Paleoindian period was significantly different from the present. This was at the end of the last ice age, in which the climate was cooler than at present and glaciers covered much of the northern portion of North America.

The subsequent Archaic period witnessed substantial environmental change. As glaciers began to melt, sea levels began to rise. A number of now-submerged Archaic archaeological sites have been documented around the coastal margins of the Chesapeake Bay, including at the mouth of the James River (Blanton 1996). These changing environmental conditions led to a greater dependance on river systems and the beginnings of the use of domesticated plants. Middle and late Archaic archaeological sites typically exhibit greater evidence of sedentary economies, such as the presence of storage pits, extensive refuse middens, and large quantities of fire-cracked rock.

In the Woodland period, Native American cultures reached their modern configurations as noted at the time of initial European contact in the 16th and 17th centuries. The middle of the Woodland period witnessed the establishment of large sedentary base camps in river valleys, with associated smaller resource gathering sites being established in surrounding areas. During the latter half of the Woodland period, Native American villages in southeastern Virginia apparently were organized into chiefdom-level societies (Rountree 1989). The use of long-houses, pallisades, and designated burial grounds are hallmarks of the late Woodland period. By the period of around 1500-1600, the Algonquian-speaking Powhatan chiefdom had become

the dominant center of power in the lower James River area. A large number of Powhatan villages are depicted in Captain John Smith's 1612 map of Virginia (Cumming 1998, Figure 3), including several along the James River. At the time of the founding of Jamestown in 1607, Wahunsonacock (known to the Colonists as "Powhatan") was the leader of the Powhatan confederation, and maintained nominal control over some 30 individual tribes represented by more than 200 individual villages.

The Historic period in Virginia begins with the settlement of Jamestown Island by Captain John Smith of the London Company in 1607. Jamestown Island is approximately 6 km (3.7 mi) to the northwest of Surry Power Station. It is close enough that in 1608, a few settlers moved from Jamestown to Hog Island, in part to manage swine herds, thus giving rise to the name of the island. The area south of Hog Island, including the present location of Surry Power Station, was referred to as the "Maine," that is, the main or non-island portion of the Gravel Neck Peninsula. Settlers moved to this area about the same time as that for Hog Island. In 1619, a small settlement was established adjacent to Lawnes Creek.

Displacement of Native Americans began almost immediately upon the arrival of the Euro-american Colonists. In 1622, Opechancanough, the successor to Wahunsonacock as chief of the Powhatan confederation, staged a general uprising against Euroamerican settlers, which led to the deaths of approximately 350 Colonists. The original attack on the Colonists led to the consolidation of the Euroamerican population closer to Jamestown, including moving some of the survivors to Hog Island. In the Virginia muster records of 1624 and 1625 (Jamestown 1624/1625 Muster Records), a total of 53 individuals (primarily servants) were listed as living at Hog Island in a least four separate houses. The figures for the Maine were 35 individuals and three houses.

Opechancanough and the Powhatan confederation staged a second major attack on the Euroamerican Colonists in 1644, but were themselves quickly routed. In 1646, his successor agreed to a treaty of submission by which the Powhatans abandoned all of their lands below the falls of the James River (near modern Richmond) and Pamunkey River, including the entire region around the vicinity of Jamestown and Gravel Neck Peninsula.

During the remainder of the 17th century and the early part of the 18th century, Hog Island and the Maine were divided into various plantation parcels. Also during this period of time, Lawne's Creek Parish Church, the first church in Surry County, was constructed near Hog Island Creek on a hill that overlooked the James River. The first church structure was used during the period of 1628 to 1650, and was rebuilt and relocated nearby to be used during the period of 1650 to around 1695. At that time, the church was relocated near Bacon's Castle, which is still a standing building, a portion of which was constructed in 1655. Bacon's Castle has the distinction of being among the oldest Euroamerican structures still standing anywhere in the United States today. Also, during the 17th and 18th centuries, a ferry operated across the

James River to Hog Island. As part of the license for this ferry, the operators were required to maintain a bridge across Hog Island Creek, in order to provide easier access from Hog Island to the Maine, where the Surry Power Station is now located.

During the period of 1750 through 1865, Hog Island saw sporadic use for plantations and played at least a small role in some of the key events of the Revolutionary and Civil Wars. Americans crossed the James River at Hog Island in pursuit of British troops immediately before the battle of Yorktown, and Hog Island itself was used as a commissary depot by French and American forces during the siege of Yorktown. During the Civil War, the Confederate military used Hog Island for a signal station.

After the Civil War, a residence was established on the northern portion of Hog Island, that eventually developed into the small postal "town" of Homewood, a town that seemingly never had more than a few residences and other buildings. Between World War I and World War II, a portion of Hog Island was purchased by the Newport News Yacht Club. Shortly after World War II, the Hog Island Waterfowl Refuge was designated by the Commonwealth of Virigina, eventually to become part of the current HIWMA.

Construction of Surry Power Station began in the late 1960s, with Unit 1 starting commercial operation in December 1972, followed by Unit 2 in May 1973. The containment structures at Surry Power Station were purposely constructed partially below grade in order to reduce the visual impact to Jamestown Colonial National Historic Park.

2.2.9.2 Historic and Archaeological Resources at Surry Power Station

Historic and archaeological site file searches were conducted at the Virginia Department of Historic Resources to determine what historic cultural resources may be present at Surry Power Station. Record searches were also conducted for nearby locations such as Chippokes Plantation State Park and the HIWMA (see Figure 2-2) to gain a perspective on the types of historic resources that may be present in the previously undeveloped and unsurveyed portions of the grounds of Surry Power Station.

`Sample archaeological surveys conducted at Chippokes Plantation State Park, before its 1986 nomination as a National Register of Historic Places historic district, resulted in the discovery of 19 prehistoric Native American archaeological sites. These sites included stone-tool manufacturing workshops, small short-term encampments, and base camps. One site dates to the Late Archaic period, while the remainder are from the Woodland period or could not be assigned to a temporal period. In addition to these 19 Native American archaeological sites, there were 37 buildings and structures standing on the property. These included two plantation houses, one dating to approximately 1829-1830 and the other to 1860, outbuildings and slave quarters, as well as a number of early 20th century farm buildings and sharecropper dwellings.

The Hog Island Tract of the HIWMA has not been systematically surveyed for archaeological and historic resources, but does contain four known archaeological sites, along with the remains of a brick smokestack from the Homewood town site. The archaeological sites include two sites with 17th and 18th century domestic artifacts, and two sites with combined historic and prehistoric components. The prehistoric component of one of these sites includes late Archaic and Woodland period artifacts suggestive of habitation. A scatter of eroding prehistoric stone artifacts, referred to as “Area 1" (Louis Berger Group, Inc. 2001) is present along the base of the earthen dike and associated road that forms the western boundary of the Hog Island Creek maintained marshland. These artifacts may be secondarily deposited. Part of the fill removed from the original construction of Surry Power Station was used in roads and dikes at HIWMA to assist in flood and soil management for the waterfowl.[(a)]

An archaeological survey of Gravel Neck Peninsula was not conducted before the original construction of Surry Power Station. However, at least one archaeological site has been identified within the boundaries of the station, while two others are present outside but immediately adjacent to the southern boundary of the station. The site on the grounds of Surry Power Station itself was initially thought to be the location of the original Lawne’s Creek Church. However, extensive testing conducted in 1967 suggests that the structure was instead a domestic house and associated well, seemingly dating to the 18th or 19th centuries. This site has not yet been evaluated for its eligibility for the National Register of Historic Places. The two sites immediately south of the southern boundary of Surry Power Station appear to represent two historic brick kilns of unknown date.

A property plat by W. W. LaPadre and Brothers, dated January 26, 1950, and depicting the area encompassed by the future Surry Power Station, was examined during the preparation of the cultural resource assessment by the Louis Berger Group, Inc. (2001). The plat indicated that with the exception of a shed that stood along the present Route 650 near the entrance to the property, the area that eventually became Surry Power Station was then described as wooded and contained no buildings.

While at present there are no Federally recognized Native American tribes in the Commonwealth of Virginia, there are eight tribes that have received state recognition. These include the Nasemonds, Pamunkeys, Mattaponis (and Upper Mattaponis), Chickahominys (and Eastern Chickahominys) , and the Rappahannocks, who all originally belonged to the Powhatan confederation, along with the Siouan-speaking Monacans. The original Powhatan tribes present when Europeans first arrived in Surry County and the Gravel Neck Peninsula area, such as the Weanocks and the Tappahannas, have since become extinct as tribes. The eight

(a) See the transcript of the September 19, 2001, public scoping meetings, attached to the meeting summary dated October 10, 2001 (NRC 2001a).

tribes recognized by the Commonwealth of Virginia are serviced by the Virginia Council on Indians, a body that formally reports on an annual basis to the Virginia Governor and General Assembly.

2.2.10 Related Federal Project Activities and Consultations

The staff reviewed the possibility that activities of other Federal agencies might impact the renewal of the OLs for Surry Units 1 and 2. Any such activities could result in cumulative environmental impacts and the possible need for the Federal agency to become a cooperating agency for preparing this supplemental environmental impact statement (SEIS) (10 CFR 51.10[b][2]).

The Colonial National Historical Park is the closest Federal site to the Surry Power Station. There are also a number of Department of Defense (DoD) facilities in relatively close proximity to the plant site, the closest major facilities being Fort Eustis and the Yorktown Naval Weapons Station. Smaller DoD facilities are the Cheatham Annex Naval Supply Center, adjacent to the Yorktown portion of Colonial National Historical Park, and the Naval Fuel Terminal in Yorktown. The U.S. Coast Guard operates a training center adjacent to the Naval Supply Center. Other major DoD facilities nearby include the Langley Air Force Base in Hampton, Virginia; the Navy fuel terminal on Craney Island in Portsmouth, Virginia; and the Norfolk Naval Station.

The Colonial National Historical Park encompasses five units, including Jamestown, the first permanent English settlement in North America, and the Yorktown Battlefield, the final major battle of the American Revolutionary War. The Park covers approximately 3800 ha (9300 ac). The closest portion of the Park to Surry Power Station is Jamestown Island, which is located approximately 6 km (4 mi) northwest of the Station.

Fort Eustis is the home of the U.S. Army Transportation Corps. Army officers and enlisted soldiers receive military education and on-the-job training at the Fort in all modes of transportation, aviation maintenance, logistics, and deployment doctrine and research. Fort Eustis is located approximately 8 km (5 mi) east of Surry Power Station.

The Yorktown Naval Weapons Station provides logistic, technical, and materiel support to the Navy fleet in the areas of combat subsystems, equipment, components, and retail ammunition management; it also maintains and operates an explosive outloading facility and provides homeporting services. The Station is located approximately 11 km (7 mi) northeast of Surry Power Station.

The U.S. Central Intelligence Agency operates a training facility at Camp Peary, which is located approximately 16 km (10 mi) north of Surry Power Station.

After reviewing the Federal activities in the vicinity of the Surry Power Station, the staff determined there were no Federal project activities that would make it desirable for another Federal agency to become a cooperating agency for preparing the SEIS.

NRC is required under Section 102 of NEPA to consult with and obtain the comments of any Federal agency that has jurisdiction by law or special expertise with respect to any environmental impact involved. During the preparation of this SEIS, NRC staff consulted with the National Marine Fisheries Service and is currently in consultation with the U.S. Fish and Wildlife Service. Consultation correspondence is included in Appendix E.

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