the sites likely would be new. Wildlife habitat would be lost for terrestrial and free-flowing aquatic biota, and additional habitat would be created for some aquatic species. Associated with the loss of land would be some erosion, sedimentation, dust, equipment exhaust, debris from land clearing, probable loss of cultural artifacts, and aesthetic impacts from land clearing and excavating. The construction work force would be fairly large, and socioeconomic impacts likely would be substantial, especially if the dam were constructed in a remote area where inmigrating workers would burden local public services.

Operating impacts from hydroelectric dams are associated predominantly with land and water resources. Land that once was lived on, farmed, ranched, forested, hunted, or mined would be submerged under water indefinitely. The original land uses would be replaced by electricity generation and recreation and, perhaps, residential and business developments that take advantage of the lake environment. Changes in water temperature, currents, and amount of sedimentation would produce a different aquatic environment above and below the dam. Alterations to terrestrial and aquatic habitats could change the risks to threatened and endangered species. Although the hydroelectric dam would create no air quality or solid waste impacts during operation and could serve as a protector of property and lives in preventing floods, lake recreation would likely bring with it a number of drownings and cause water pollution during the facility's operation.

8.3.5 Geothermal

Potentially recoverable geothermal resources are located in the upper 10 miles (16 km) of the earth's crust. These resources exist in the form of hot vapor (steam) or liquid (hydrothermal), geopressurized brines, or hot dry rock. Hydrothermal is the only resource used by current commercial technology. EIA estimates that about 1.5 million quads per year of geothermal resources exist in the United States; however, only about 22,800 quads are accessible and, of these, only approximately 250 quads per year can be economically developed today (DOE/EIA-0561). In 1990, geothermal resources contributed 0.32 quad of primary energy in the western United States. The net geothermal generating capacity in the United States is projected to grow from 15 billion kWh in 1990 to about 60 billion kWh in 2010. In comparison, one 1000-MW(e) nuclear plant operating at 60 percent capacity generates 5.26 billion kWh annually (DOE/EIA-0561). Geothermal has a high capacity factor of approximately 90 percent and can be used to provide reliable, baseload power. A geothermal electricity generating facility consists of a conversion well that brings the geothermal resources to the surface, the conversion system that produces useful energy from the resource, and the injection well that recycles cooled brine back to the underground reservoir (SERI/TP-260-3674).

As shown in Figure 8.4, geothermal plants may be located in the western United States, Alaska, and Hawaii where hydrothermal reservoirs are prevalent. The discrepancy between the vast amount of resource projected to be available (1.5 million quads per year) and projected usage is due primarily to technological problems. Although geothermal plants offer alternative baseload capacity to conventional fossil fuel and nuclear plants, widespread application of geothermal

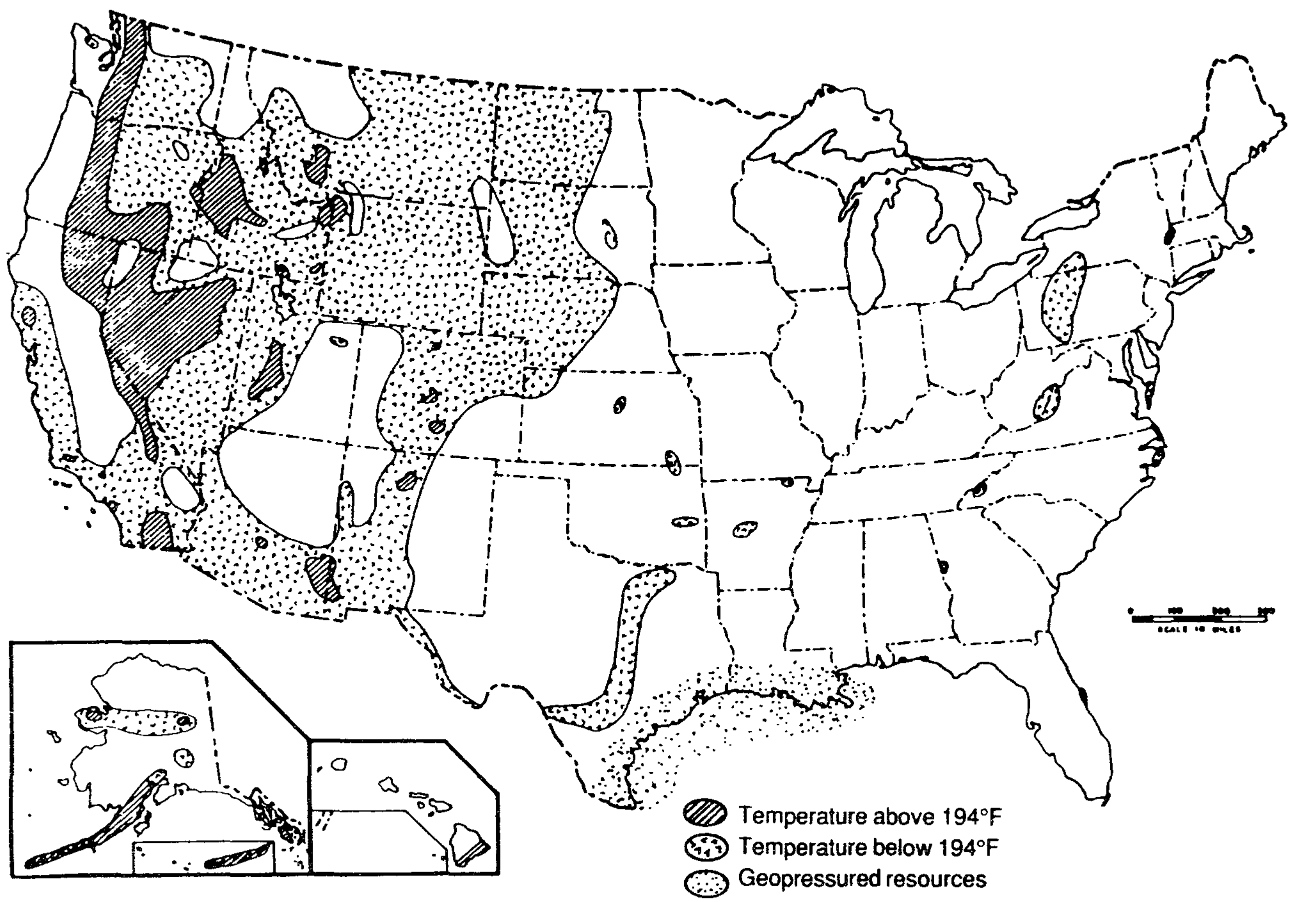

Figure 8.4 U.S. known and potential geothermal energy resources. *Source:* Adapted from DOE/EIA-0562.

energy is constrained by the geographic availability of the resource and the maturity of the technology. The maximum size of geothermal power plants, in their present state of development, is about 110 MW(e) per unit. Geothermal plants, however, could be sited as modular units that would allow for larger generating capacities.

Construction impacts of a geothermal facility would result primarily from disturbance of land to support the large number of geothermal wells and the power plant needed to produce electricity equivalent to that from a 1000-MW(e) plant. Excluding new transmission corridors, which would add to most impacts, an estimated 2800 ha (7000 acres) would be needed even though the generating facility or facilities would only occupy around 25 ha (60 acres). This amount of acreage having appropriate geothermal resources would require a greenfield site or sites, which would imply altering current land uses of farming, ranching, forest, or natural habitat. Clearing this land would damage or destroy much of the existing habitat for wildlife, as well as pose potential adverse consequences for cultural resources. Aesthetic impacts would include extensive vegetation removal and earth moving. Soil erosion and stream sedimentation likely would result in some degree from the early clearing operations. Fugitive dust and exhaust fumes from heavy equipment would reduce air quality temporarily. The moderate-sized work force would create some community impacts, particularly if affected communities were small and had little service infrastructure to accommodate workers who might move into a rural environment to build the plant. Operating impacts would involve those resources most closely associated with the land disturbed in constructing the geothermal facility. Some of the land originally cleared for construction of the geothermal facilities could probably be returned to previous uses, since it would not all have geothermal facilities located on it. Much acreage would still be lost for the life of the plant, however, and this loss could be complicated by subsidence caused by withdrawal of the geothermal fluid. Loss of habitat, impacts to threatened and endangered species, and visual impacts could be mitigated partially by returning much of the land to, or even leaving it in, its original condition. Surface water and groundwater quality could be impacted adversely if waste fluids from wells escaped into the ground water or surface streams or ponds. In addition various toxic gases such as ammonia, methane, and hydrogen sulfide and trace amounts of arsenic, borax, mercury, radon, and benzene would be released to the atmosphere. Noise impacts could be a problem for residents living on the edge of a geothermal site. Socioeconomic impacts should be positive with substantial tax revenues and a considerable number of jobs accruing to local taxing jurisdictions from a geothermal plant.

8.3.6 Wood Waste

The 2.4 quads per year of waste wood energy consumed in the United States generally is apportioned among the following sectors: industrial heat and power—1.6 quads (66 percent), residential space heating—0.8 quads (33 percent), and electric utilities—0.01 quads (1 percent). Industrial wood energy is used in a variety of process heat and cogeneration applications. Nearly half of that wood energy is used in boilers, a little over 40 percent in cogeneration (steam and electricity), and the remainder as process heat. Much of the electricity produced by the industrial sector is sold to utilities. These nonutility generators, along with independent power producers, generated about 31 billion kWh in 1990 from 6 GW(e) of installed wood- and wood-waste-fired capacity. By 2010, installed capacity is expected to increase to over 8 GW(e) and net generation to nearly 60 billion kWh (DOE/EIA-0561).

Wood waste is a sub-category of biomass energy. The category can include residues from forest clearcut and thinning operations, non-commercial tree species, harvests of forests for energy purposes, and wastes from forest product milling operations. The costs of these fuels are highly variable and very site-specific. Costs can be very low if the fuels are collected as part of commercial timber harvest operations or as residues from milling operations. Costs are higher if the biomass has to be collected and removed after forest harvest and thinning operations.

In addition to the costs of competing fuels, many factors affect the viability of wood waste power production. Among the factors influencing the costs of forest residues and wastes are the costs of collecting (harvesting), hauling, storing, and handling feedstocks; fuel characteristics (quality, reliability and variability of supply); levels of economic activity that affect waste generation; technological change in waste generation processes and development of competing uses (e.g., wafer board); and environmental considerations and restrictions as influenced by public perceptions, access, and environmental factors. Because mill wastes are concentrated, uniform, and often of high quality, they are highly desirable for non-energy uses and products. They are becoming fully utilized by forest products and pulp/paper industries, and there is limited availability for energy uses.

Nearly all of the wood-energy–using electricity generation facilities in the United States use steam turbine conversion technology. The technology is relatively simple to operate and it can accept a wide variety of biomass fuels. However, at the scale appropriate for biomass, the technology is expensive and inefficient. Therefore, the technology is relegated to applications where there is a readily available supply of low-, zero-, or negative-cost delivered feedstocks.

The low efficiency of wood-fired power plants, relative to modern coal-fired plants, is due in part to the use of more moderate steam conditions. Biomass steam-turbine plants use lower pressures and temperatures because of the strong scale-dependence of the unit capital cost (dollars per kilowatt). Building biomass plants at modest scales [<50 MW(e)] makes economic sense when conversion facilities have a nearby, reliable supply of low-cost wood wastes and residues. Conversion efficiencies of wood-fired power plants that are being built today are in the 20–25 percent net efficiency range (DOE/CH100093-152). These facilities usually provide baseload power and operate with capacity factors of around 70–80 percent.

Removal of logging slash and forest thinnings may be environmentally significant, particularly when 160,000 to 320,000 ha (400,000 to 800,000 acres) could be affected to support a large wood waste plant. Forest residues left on-site help to create habitat for animals and provide nutrients to forest soil. The presence of forest slash and thinnings can also serve to lessen soil erosion and its concomitant impacts. Forest residues are therefore important to ecosystems, and they must be carefully guarded from overuse (OTA 1993b).

Plant construction impacts should not be significant if the plants are properly sited and designed (ECO Northwest et al. 1986). The overall level of construction impact should be approximately the same as that for a coal-fired plant, although wood-waste-fired facilities will be built at smaller scales. Like coal-fired plants, wood-waste plants require large areas for fuel storage and processing and involve the same type of combustion equipment.

Emissions during plant operations are CO, oxides of nitrogen, SO_x, PM, and CO_2. Relative to coal and other primary fossil-fuel sources of electricity, wood-fired electricity generation has very low levels of SO_x emissions because wood contains very little sulfur. There are also reduced emissions of oxides of nitrogen. The major emissions from wood-fired generation involve the release of particulate matter. However, these emissions are controlled effectively with existing technology. Emissions to land and water resources are associated with soil disturbance and runoff and the disposal of ash. However, ash disposal is not a major concern from wood combustion and the ash may be beneficial as a fertilizer and soil conditioner provided the pH is not excessively high.

8.3.7 Municipal Solid Waste

MSW differs from other biomass energy sources because utilization is primarily a waste management decision, and increased use of MSW is likely to be driven by costs of disposal (i.e., higher tipping fees and reduced landfill space) rather than by energy considerations. Currently, about 15 percent of the MSW produced in this country is burned to produce heat and power. In 1990, MSW was used to generate 10 billion kWh from 2 GW(e) of installed capacity (DOE/EIA-0561). Electricity generation from MSW is projected to grow to 54 billion kWh by 2010 with 11 GW(e) of installed capacity (DOE/EIA-0561).

Population and economic growth, reduced availability of landfill space, and increasing tipping fees are creating strong incentives to reduce the size of the waste stream, change its composition, and find alternative uses, such as energy. However, numerous obstacles and factors may limit the growth in MSW power generation. Chief among them are environmental regulations and public opposition to siting MSW facilities. Others include voluntary recycling, state laws mandating reductions in the MSW going to landfills, efforts to limit packaging, prohibitions against yard wastes and construction and demolition wastes in landfills, and changes in the heat content of MSW given the fate of plastics and wood in waste streams.

MSW conversion facilities use basically the same steam-turbine technology found at wood waste facilities. However, installed capital costs are much greater because of the need for specialized MSW handling and waste separation equipment and stricter environmental emissions controls. MSW facilities typically have high capacity factors (85–90 percent) and provide baseload power.

MSW combustion is a waste disposal option for communities that lack landfill space. Since MSW must be collected regardless of whether it is used for power production, impacts associated with collection and transport are not considered here. The environmental impacts that are relevant are those associated with combustion compared with the actual landfilling of the wastes. Among the more important environmental tradeoffs are decreased landfill requirements and possible improvements in groundwater quality (leachate minimization) versus decreased air quality from MSW combustion (ECO Northwest 1986).

MSW-fired facilities are usually sited and constructed in industrial areas; the overall construction impact is not likely to be significant if plants are sited and built properly (ECO Northwest et al. 1986). Construction impacts are similar to those of coal-fired power plants in terms of the acreage disturbed.

Emissions from MSW combustion facilities include particulates, oxides of nitrogen, acid gases, metals, and organic compounds. These are potentially serious emissions; however, MSW facilities are required to operate with much stricter controls than biomass facilities burning wood and wood wastes. Odors are also a potential impact from MSW combustion. MSW facilities face much public opposition, and siting can be especially problematic.

8.3.8 Energy Crops

Expanding biomass-fired power generation capabilities beyond the size of the waste resource base requires the use of dedicated feedstocks or energy crops (Wright 1994; Hohenstein and Wright 1994). Energy crops appropriate for combustion and power production include short-rotation woody crops (e.g., poplar) and perennial herbaceous crops (e.g., switchgrass). Woody crops typically consist of plantations of closely spaced trees that are harvested on a cutting cycle of 3–10 years. The trees are not managed intensively, requiring only weed control in the first 2–3 years of growth and some fertilization. Woody crops have been developed that produce yields two to three times greater than those achieved by traditional forest management. Growing herbaceous crops is similar to growing hay. They are managed similarly to hay; however, yields are much higher. As with other biomass energy feedstocks, projected energy costs are very site specific and depend greatly on realized yields.

Biomass power based on energy crops and current conversion technology generally is not currently competitive with fossil-fired alternatives in terms of generating costs. The competitiveness of generating electricity from energy crops can be improved by developing conversion technologies that offer higher efficiencies and lower unit capital costs at modest scales appropriate for biomass. One technology under development and testing that offers higher conversion efficiency is Whole Tree Energy (*WTE®*) technology (Lamarre 1994). WTE® is an innovative steam turbine technology that uses an integral fuel drying process. Waste heat, produced by the flue gas at 54°C (130°F), is used to dry wood stacked in a large, air-inflated building for 30 days before it is conveyed to a boiler and burned. Allowing the waste heat to dry the wet whole-tree fuel can result in net plant efficiencies comparable to those of a modern coal-fired plant (35 percent). WTE™ also reduces wood harvesting and handling costs as well as the need for equipment such as hammer mills, screens, and chippers that is used for reducing the size of the wood feedstock.

According to some experts, the most promising technologies for wood-fired power generation lie in the development of gas turbine cycles (Williams and Larson 1993). Gas turbines (or Brayton cycles) have already been developed for natural gas and clean liquid fuels. A key advantage of gas turbine technology is the potential for substantially reduced capital costs, which are relatively insensitive to scale, higher conversion efficiencies (upwards of 45 percent), and greater modularity. Adapting the technology for biomass (i.e., biomass-gasifier/gas turbine—BIG/GT) would require the use of a gasifier to thermochemically convert wood to a gas. The resultant gas would then be cooled and cleaned before being burned in a gas turbine. There are a number of technology choices for both gasification and power generation, ranging from simple cycle gas turbines to gasifier combined cycles and gasifier intercooled steam-injected cycles.

The net environmental impacts of growing energy crops depend on the type of land they occupy and the uses they displace. Energy crops are currently being targeted as alternatives to conventional agriculture. With surpluses in cropland projected, energy crops are seen as a potentially important alternative crop to conventional agriculture. The displacement of certain agricultural row crops (e.g., corn and soybeans) with trees might result in a positive net change in environmental impacts, especially on erosive sites. The production of wood in managed plantations would be much less erosive than row crop production, and the amounts of fertilizers and pesticides used would be much smaller. The conversion of pasture land to tree production might increase soil erosion as trees were being established. However, runoff containing nutrients from animal wastes would not be present. Perhaps the strongest environmental argument for energy crops is the potential to reduce net greenhouse gas emissions by providing a substitute baseload generation source for fossil fuels (Wright 1994).

Plant construction and operating impacts would be identical to those associated with wood-waste-fired facilities.

8.3.9 Coal

Coal-fired steam electric plants provide the bulk of electric generating capacity in the United States, accounting for about 56 percent of the electric utility industry's net generation and 43 percent of its capacity in 1992 [(DOE/EIA-0383(94)]. EIA projects slight changes in these percentages to 58 percent and 42 percent, respectively, by 2010. Conventional coal-fired plants generally include two or more generating units and have total capacities ranging from 100 MW(e) to more than 2000 MW(e). Domestic coal resources are estimated at over 87,000 quads of energy, of which about 38,000 quads constitute accessible resources and 5,300 quads are reserves that can be cost-effectively recovered today. Total U.S. coal consumption in 1990 was about 19 quads, which leads to the conclusion that coal is likely to continue to be a reliable energy source well into the future (DOE/EIA-0561), assuming environmental constraints do not cause a gradual substitution of other fuels.

DOE has encouraged the increased use of coal by electric utilities through its cost sharing of clean coal projects to develop and demonstrate advanced technologies that reduce atmospheric emissions of coal combustion pollutants and improve the environmental acceptability of coal. A description of 22 generic clean coal technologies considered by DOE in the Clean Coal Technology Program, which is being terminated, is provided in DOE/EIS-0146.

A window of opportunity for clean coal technologies may occur in the late 1990s as a result of the aging of currently operating coal-fired power plants and passage of the Clean Air Act Amendments of 1990 (CAAA) and Energy Policy Act of 1992 (EPACT). Utilities will be considering the option of constructing replacement plants, extending the life of existing coal-fired plants, purchasing additional pollution allowances, or even buying electricity from other sources. Repowering is an important alternative that is discussed in Section 8.3.13. It is quite cost effective, increases plant capacity, and offers various financial and institutional benefits under the CAAA and EPACT that enhance a utility's competitiveness (Norton and Gottlieb 1993). With repowering, a utility replaces an obsolete steam generator with an advanced coal technology, such as an atmospheric fluidized-bed boiler or an integrated coal-gasification/combined-cycle (Bretz 1994). To date, utilities have responded to CAAA's SO_2 emissions goals by adding scrubbers and burning a higher proportion of Western low-sulfur coal rather than purchasing pollution allowances, thereby resulting in lower SO_2 emissions (Bohi 1994). DOE also forecasts that by the year 2010, advanced coal technologies—if successfully applied—could have the capability to reduce national CO_2 emissions by 5 to 12 percent (DOE/EIS-0146).

The United States has abundant low-cost coal reserves, and the price of coal for electric generation is likely to increase at a relatively slow rate. Even with recent environmental legislation, new coal capacity is expected to be an affordable technology for reliable, near-term development and for potential use as a replacement technology for retired nuclear power plants.

The environmental impacts of constructing a typical coal-fired steam plant are well known because coal is the most prevalent type of central generating technology in the United States. The impacts of constructing a 1000-MW(e) coal plant at a greenfield site can be substantial, particularly if it is sited in a rural area with considerable natural habitat. An estimated 700 ha (1700 acres) would be needed, and this could amount to the loss of about 8 km^2 (3 square miles) of natural habitat and/or agricultural land for the plant site alone, excluding that required for mining and other fuel cycle impacts. Ecological impacts could be large, and important cultural sites could be encountered, particularly near rivers. With this much land being cleared, some erosion and sedimentation would be expected. Considerable fugitive dust emissions would affect air quality temporarily, and the quantity of construction debris also would be substantial. Aesthetic impacts from such a large construction effort in a rural area could be substantial. Socioeconomic impacts at a rural site would be larger than at an urban site because more of the 1200–2500 peak work force would need to move to the area to work. Such impacts are worst at very remote sites where accommodations may be nonexistent and the large majority of workers must move to work on the plant. Transmission line impacts would add to virtually all these impacts. Siting a new coal-fired plant where a nuclear plant is located would reduce many construction impacts, thereby reducing the initial damage to the environment and eliminating the need for new transmission lines. Such co-locating would depend on factors such as location of load centers, environmental restrictions, and site characteristics.

Operating impacts of new coal plants would be substantial for several resources. Concerns over adverse human health effects from coal combustion have led to important federal legislation in recent years, such as the CAAA. Although the situation appears to be improving, health concerns remain. Air quality would be impacted by the release of CO_2, regulated pollutants, and radionuclides. Public health risks such as cancer and emphysema are considered likely results. CO_2 has been identified as a leading cause of global warming. SO_2 and oxides of nitrogen have been identified with acid rain. Substantial solid waste, especially fly ash and scrubber sludge, would be produced and would require constant management. Losses to aquatic biota would occur through impingement and entrainment and discharge of cooling water to natural water bodies. Socioeconomic benefits can be considerable for surrounding communities in the form of several hundred jobs, substantial tax revenues, and plant spending.

An estimated 8,900 ha (22,000 acres) for mining the coal and disposing of the waste could be committed to supporting a coal plant during its operational life. Air quality impacts from fugitive dust, water quality impacts from acidic runoff, and aesthetic and cultural resources impacts are all potential adverse consequences of coal mining. Socioeconomic benefits from several hundred mining jobs and tax revenues would also accompany the coal mining.

8.3.10 Natural Gas

Natural gas supplied 9.4 percent of this country's net electric utility generation in 1992 and is projected to supply 11.4 percent of electricity in 2010 [DOE/EIA-0383(94)]. Domestic natural gas resources are estimated at 1,700 quads, of which approximately 900 quads are accessible resources and about 230 quads are reserves that currently can be recovered cost-effectively (DOE/EIA-0561). Most of the supply in the continental United States is located in Texas, Louisiana, Oklahoma, New Mexico, and Kansas, locations favored for gas-fired plants because of relatively low gas prices. Although natural gas reserves are fairly large, much of the resource is located in remote areas that are not served by a pipeline infrastructure connected to high-demand centers.

The natural gas fuel cycle consists of exploration/extraction (drilling and production), processing, transportation by pipelines, end use, and waste management. Utilities receive gas at power plants through pipelines on a continuous basis.

Natural gas is used in three technologies: conventional steam, gas-turbine, and combined-cycle. In conventional steam plants, the traditional gas-fired technology, natural gas is burned to produce steam. The process is very similar to that used for coal and oil technologies. Because natural gas can be used more efficiently in gas-turbine and combined-cycle facilities than in a conventional steam plant, the latter technology is no longer being used for new generating stations. In gas-turbine plants, gas (or distillate oil) is burned to produce an exhaust gas that drives the turbine. Combined-cycle plants, which are particularly efficient and are used as intermediate and baseload facilities, combine the gas-turbine technology with a heat recovery system that powers a steam cycle [DOE/EIA-0383(94)]. These combined-cycle systems represent the large majority of the total number of plants currently under construction or planned in the United States. Most of the plants are small and have proved to be popular with nonutility generators (Bergesen 1994). Those using combined-cycle technology can qualify as Public Utility Regulatory Policies Act of 1978 (PURPA) plants if they are no larger than 80 MW(e) and operate as cogenerators.

Most environmental impacts of constructing natural-gas–fired plants should be approximately the same for steam, gas-turbine and combined-cycle plants. These impacts, in turn, generally will be similar to those of other large central generating stations. Land-use requirements for gas-fired plants are small at 45 ha (110 acres) for a 1000-MW(e) plant; thus land-dependent ecological, aesthetic, erosion, and cultural impacts should be small unless site-specific factors should indicate a particular sensitivity for some environmental resource. Siting at a greenfield location would require new transmission lines and increased land-related impacts, whereas co-locating the gas-fired plant with the retired nuclear plant would help reduce land-related impacts. Socioeconomic impacts should not be very noticeable because the highest peak work force of 1200 for steam plants is small for a central generating technology, and gas-fired plants are not usually sited in remote areas where community impacts would be most adverse. Also, gas-fired plants, particularly combined cycle and gas turbine, take much less time to construct than other plants.

The environmental impacts of operating gas-fired plants are generally less than those of other fossil fuel technologies of equal capacity. Consumptive water use is about the same for steam plants as for other technologies. There are potential impacts to aquatic biota through impingement and entrainment and increased water temperatures in receiving water bodies. Water consumption is likely to be less for gas-turbine plants. Generally, air quality impacts for all natural gas technologies are less than for other fossil technologies because fewer pollutants are emitted and SO_2, a contributor to acid precipitation, is not emitted at all. Solid waste should be minimal. The work force of 150 workers would be the lowest of any nonrenewable technology, as would local purchases and local tax revenues. Approximately 1500 ha (3600 acres) of additional land would be required for wells, collection stations, and pipelines to bring the natural gas to the generating facility. Impacts would be typical of those associated with land clearance. Operational impacts should not be severe because most of the land would not be disturbed further once facilities were sited.

8.3.11 Oil

Oil-fired power production was 3.2 percent of the country's total net electricity generation in 1992 and is projected to decline to 2.3 percent by 2010 [DOE/EIA-0383(94)]. Domestic petroleum resources are estimated by the EIA at about 2,800 quads, of which about 1,100 quads are accessible at some price, and about 160 are recoverable at current costs (DOE/EIA-0561). In the 12-year period for which EIA has reported annual oil and gas reserves (1977 through 1988), year-end crude oil reserves decreased by 19.9 percent ([DOE/EIA-0216(88)].

The oil fuel cycle system involves exploration/extraction, processing, transportation, end use, and waste management. The production of electricity from oil combustion is accomplished by the same process used for coal and natural gas. Oil-fired plants provide peak, intermediate, and baseload capacity.

The economics, apart from fuel price, of oil-fired power generation are similar to those of natural gas-fired power generation. Distillate oil can be used to run gas turbines in a combined-cycle system; however, the cost of distillate oil usually makes this combined-cycle system much less competitive where gas is available. Oil-fired power generation has experienced a significant decline since the early 1970s. Increases in world oil prices have forced utilities to use less expensive fuels; however, oil-fired power generation is still important in certain regions of the United States.

Constructing a 1000-MW(e) oil-fired power plant would have the same environmental impacts as constructing other large central generating power stations. Relatively small land requirements of an estimated 50 ha (120 acres), however, would be expected to reduce other resource impacts that tend to follow land-use impacts: ecological, aesthetic, air quality, water quality, and cultural. As land-use requirements decrease, erosion, loss of habitat, and negative aesthetic impacts decrease as well, although very site-specific considerations occasionally enter the picture. Expected socioeconomic impacts should not be high because of the moderate size work force of 1700, and oil-fired plants typically are not sited in remote areas or otherwise away from larger communities that are on pipelines or near where the oil is refined, consumed, or imported. Transmission lines for a greenfield site likely would increase land-dependent impacts in approximate proportion to the transmission/generation acreage. Land-use related impacts could be reduced if the oil-fired plant were colocated with the retired nuclear plant.

Environmental impacts of operating oil-fired power plants are similar to those from comparably sized coal-fired plants. Since they typically use the same cooling systems, water use and related impacts to water quality and aquatic biota would be similar. Air emissions, too, would be typical of coal plants; regulated pollutants, CO_2, and small amounts of radionuclides would be emitted, although in lesser quantities than from an equivalent-size coal-fired plant. Moderate amounts of scrubber sludge would require disposal. Attendant impacts would include acid precipitation, global warming, and some increased risk of health problems, such as emphysema, cancer, and other illnesses associated with combustion of fossil fuels. Employment, tax revenues, and local purchases would be positive socioeconomic impacts for some local communities. Approximately 650 ha (1600 acres) of additional land would be needed for oil wells and support facilities that would provide the generating plant with fuel. Impacts would likely be similar to those of other land clearing activities. Operational impacts should not be severe because, as with gas, the land generally would not be disturbed once the wells were producing.

8.3.12 Advanced Light-Water Reactor

Section 2.1 describes a typical nuclear power plant and its operation. In 1992, nuclear power provided 22 percent of total United States net electric utility generation, a figure that is expected to decline to 18.8 percent by 2010. Nuclear power represented 14.3 percent of this country's 1992 electric utility generation capacity and is projected to decline to 12.2 percent by 2010 [DOE/EIA-0383(94)].

Current American research focuses on the advanced LWR as a viable replacement for existing nuclear plants. Advanced LWR technology differs from current LWR technologies primarily in component design, including passive safety features that reduce the probability of severe accidents (NUREG-1362). Advanced LWRs would require slightly more fuel than current designs, resulting in slight increases in spent fuel generation and lower overall plant efficiencies. Future plants using the advanced LWR technology are expected to require smaller sites and shorter construction periods than current nuclear plants (NUREG-1362). They may also involve smaller, modular plants. The long hiatus in nuclear plant starts is not expected to end soon, however, even with advanced LWR technology, and the EIA projects that no new nuclear plants will be added by 2010 [DOE/EIA-0383(94)].

The environmental impacts of constructing an advanced LWR nuclear plant are expected to be equivalent to the impacts of building any large energy facility. Impacts could be moderated somewhat if the plant were built at a current nuclear plant site rather than at a greenfield site because the prevailing land use would be compatible at the former site. Thus, building a plant on a greenfield site would produce more severe impacts.

Advanced LWRs require perhaps 200 to 400 ha (500 to 1000 acres) excluding transmission lines, which could add hundreds to thousands of ha depending upon the distance of the plant from connecting transmission lines or load centers. Destruction of wildlife habitat would occur, and threatened and endangered species would require special consideration to avoid adverse impacts. Erosion, sedimentation, fugitive dust, aesthetic intrusions, and disturbance to cultural artifacts would tend to be proportional to the amount of land disturbed, but site-specific considerations can enter the picture. Socioeconomic impacts from building a large, complex technology would be substantial. With a relatively large but currently unquantified peak construction work force, employment and local spending would benefit. Public services could be adversely affected if those services were operating at capacity previous to plant construction or if a relatively undeveloped remote community were impacted by a large number of inmigrating, temporary workers.

The environmental impacts of operating advanced LWRs would be similar to those of operating current nuclear plants except that slightly more radioactive waste would be generated and the potential for accidents should be reduced somewhat. The newer technology would have built-in safety features that would shut down the plant automatically and use natural forces to greatly reduce the possibilities that severe accidents could occur. Socioeconomic benefits for local communities normally associated with large energy facilities, including substantial employment, tax revenues, and local purchases, would also result from siting of an advanced LWR. Approximately 400 additional ha (1000 acres) would be committed to uranium mining and processing during the life of the advanced LWR. Impacts should be similar to those of other clearing and land-use operations associated with uranium mines and mills and would involve some adverse air and water quality impacts and health risks.

8.3.13 Delayed Retirement of Existing Non-Nuclear Plants

Another potential alternative to license renewal would be to continue to generate electricity from non-nuclear plants beyond the original date at which they were scheduled to shut down permanently. This alternative would have the effect mainly of substituting coal, gas, oil, or hydropower plants for nuclear facilities.

In recent years electric utilities have given considerable attention to the issue of repowering non-nuclear generating facilities. Repowering is the primary process by which utilities extend the life of their generating plants. It is comparable to refurbishing a nuclear plant. Since the average age of all types of fossil units is over 30 years, utilities have been exploring repowering older fossil units as a way of avoiding even larger capital outlays for new plants (Bretz 1994). As of March 1994, about 30 units with a total capacity of 3000 MW(e) had been proposed for repowering. Assuming regulatory environmental compliance and a successful application of lessons learned from federal clean coal technology demonstrations, DOE estimates that up to 248 GW(e) of generating capacity could be repowered or retrofitted with clean coal technologies by the year 2010 (DOE/EIS-0146). In 1991 DOE estimated that 2500 coal-fired plants were 30 years old or older (making them candidates for repowering) and that this total would rise to 3500 to 3700 in 1998. From a utility's perspective, not only might repowering be cost-effective; but also environmental goals, particularly improved air quality, could be easier to accomplish since improved, less polluting technologies would be installed during repowering.

Repowering involves a major rehabilitation of a generating facility and focuses on replacing the steam generator with an improved steam generating technology. Replacement technologies currently regarded as the most attractive candidates include (1) gas-turbine/generator and heat recovery steam generator, (2) atmospheric fluidized-bed boiler, (3) integrated coal-gasification/combined cycle, and (4) pressurized fluidized-bed combustor/combined cycle. The first candidate, the most favored by utilities to date, is a natural gas technology and the last three are coal-fired technologies (Bretz 1994). The technologies could be sited anywhere in the country where fossil plants are located. Repowering efforts currently under way may produce increases in plant output of 20 percent or more, an improvement that amounts to a substantial increase in generating capacity.

Delaying the retirement of older fossil fuel plants (30 years old) would normally require that such plants be repowered if they are to operate long enough for them to be considered feasible alternatives to relicensed nuclear plants. Because repowering technologies are just being implemented, information about actual environmental impacts is only now becoming available.

The construction required to repower a coal or gas-fired plant would be substantial because much of the plant would be improved. For a large coal plant, the effort would be of the same general magnitude as that required to refurbish a nuclear plant. Gas-fired plants are less complex and would involve less work than coal plants. Little land would be affected that had not already been cleared and built upon in the initial plant construction. Consequently, ecological and cultural impacts would be negligible during repowering, as would impacts to air and water. Socioeconomic impacts would occur but would be smaller than during the original construction of the coal or gas-fired plants.

Major reductions in a plant's airborne emissions should be realized as the most important impact. DOE/EIS-0146 states, "Repowering opens the door to a future of sustained deep reductions in nationwide emissions of SO_2, one of the chief pollutants thought to contribute to acid rainfall" (p. 2-10). SO_2 reductions by conventional coal-fired plants would vary from 90 to 99 percent depending upon the specific technology. Similarly, oxides of nitrogen, one of the emissions associated with global warming, would be reduced between 60 and 92 percent from current emissions from conventional coal-fired plants. On the other hand, solid waste would be increased as the new technologies reduced air pollution by converting what would normally be an air pollutant into solid wastes (DOE/EIS-0146). Recent experience with repowered plants starting to come on line confirms SO_2 and oxides of nitrogen reductions of at least 90 percent in these technologies (Bretz 1994). Gas turbine/generators without heat recovery steam generators are expected to reduce oxides of nitrogen emissions by more than 90 percent. Land use, cultural resources, and socioeconomic resources should not be affected by repowering.

8.3.14 Conservation

A wide variety of conservation technologies could be considered as alternatives to generating electricity at current nuclear plants. These technologies could include hardware, such as more efficient motors in consumer appliances, commercial establishments, or manufacturing processes; more energy-efficient light bulbs; and improved heating, ventilation, and air conditioning systems. Also, structures could be weatherized with better insulation, weather stripping, and storm windows. These measures generally come under the heading of DSM, which is a collection of diverse measures to reduce customers' electricity consumption without adversely affecting service. Other conservation measures a utility could take would be to install more efficient equipment as it retrofits its power plants and improves distribution and transmission technologies. An average of 6.2 percent of an American utility's power is lost before reaching customers (Kelly and Weinberg 1993).

Conservation technologies and measures have proved to be popular with some utilities, public utility commissions and members of the public, who see them as a way of providing economical service while avoiding construction of more electric generating facilities. Increased competition within the utility industry and pressure from public utility commissions and public interest groups have forced utilities to consider conservation technologies as essentially new resources in the utility's portfolio of capabilities and invest in them as they would new generating sources. On a national scale (based on EIA electricity growth projections in DOE's National Energy Strategy and Electric Power Research Institute estimates of DSM savings in 1990), Hirst (1991) calculates that almost half of electricity demand growth from 1990 to 2010 could be eliminated with an "ambitious" DSM program. This growth would eliminate the need for an estimated 430 500-MW(e) power plants or an equivalent 215 1000-MW(e) nuclear plants (Hirst 1991). A study of three New York utilities found that DSM programs could produce energy savings equalling 10–20 percent of each utility's projected demand in the years 2000 and 2008 (Nagel 1993).

Treating energy conservation measures as resource options received a major stimulus in the form of the EPACT, which amended the Public Utility Regulatory Policies Act of 1978 to require each utility to employ up-to-date integrated resource planning as a forecasting tool in cooperation with state regulators and the public. Under Sec. 111 (d)(19), integrated resource planning is defined as "a planning and selection process for new energy resources that evaluates the full ranges of alternatives, including new generating capacity, power purchases, energy conservation and efficiency, cogeneration and district heating and cooling applications, and renewable energy resources, in order to provide adequate and reliable service to its electric customers at the lowest system cost." A major barrier to implementing conservation technologies was the degree to which utilities could recover their costs and earn a profit while reducing growth in electric sales as opposed to selling more power. This barrier was removed under EPACT by ensuring that conservation investments were at least as profitable to utilities as investments in energy generation facilities [Sec. 111(a)(8)].

Environmental impacts of electrical energy conservation programs are not well understood. The Pace report (1991) that surveyed literature assessing indoor air quality impacts of conservation programs, and a 1991 national conference with multiple government, utility, and environmental sponsors that investigated the environmental impacts of utility DSM programs (DSM and the Global Environment) are two noteworthy efforts to address such impacts. Environmental impacts of electrical energy conservation programs should fall into three categories: those resulting from energy demand reduction measures, those resulting from energy supply reduction measures, and those caused by fuel cycle activities.

Energy demand reduction measures are specific procedures or technologies that are undertaken to reduce energy demand. Indoor air quality is considered to be the potential impact of greatest concern from demand reduction technologies. Radon, formaldehyde, and combustion products from cigarette smoking and furnaces are the substances that appear to be the sources of most problems. Another area of concern is mercury used in fluorescent lights and polychlorinated biphenyls (PCBs) used in fluorescent light ballasts.

Pace's (1991) examination of the indoor air quality issue reached the general conclusion that, "there are no significant environmental impacts of DSM." Pace went on to argue that "weatherization programs by themselves are not a primary cause of indoor air pollution problems. Where problems do exist, mitigation measures are available." Pace also notes, however, that the U.S. Environmental Protection Agency warns that indoor air quality can be impaired if energy conservation measures override health considerations. The report also pointed out that a Bonneville Power Administration radon study found that radon was a serious concern in new home construction if mitigation measures were not built in. Cancer cases from radon were estimated to be 335 per 100,000 for baseline homes but as high as 767 cases per 100,000 for new homes with advanced infiltration control but no exhaust or mechanical ventilation.

Current research, according to Pace (1991), indicates that indoor air quality is highly site specific, and the levels of contamination existing before weatherization appear to be a major factor in determining post-weatherization pollution levels. In addition, research indicates that mitigation measures are available to correct problems. It should be noted that no studies have been completed to quantify pollutants associated with weatherization, and more research is called for.

As conservation technologies are implemented and growth in electricity demand is reduced, utilities should expect to build fewer power plants. Cost savings to electric utilities nationwide could be substantial. Hirst (1991) estimates that an ambitious 20 percent conservation-inspired reduction in total demand by 2010 could produce savings in fuel and capital of $370 billion and could reduce utility bills by $61 billion at a total cost to the utilities of $165 billion. Studies for specific utilities have identified savings either in terms of money saved or emissions eliminated. Although a utility might prefer to close a fossil-fired plant that is particularly costly or dirty to operate rather than close a nuclear power plant, the GEIS assumes that conservation technologies produce enough energy savings to permit the closing of a nuclear plant. Should a nuclear plant be closed, the environmental gain, in terms of avoided environmental impacts, would be those discussed in Section 8.3.

The third category of environmental impact of electrical energy conservation programs is the resource recovery, processing, and manufacturing stages associated with producing conservation equipment or material, as well as impacts of disposing of the equipment or material. At this time little assessment has been undertaken of these stages. Resources used in producing conservation technologies are common to many manufacturing processes, and large amounts of resources would not be required. Disposal should involve normal procedures, and some benefits are likely over the long term as troublesome components of current technologies, such as PCBs and chlorofluorocarbons (CFCs) that require special handling, ultimately are eliminated from the waste stream and replaced by more benign components. The amounts of mercury and PCBs in lighting are considered to be small enough and disposal methods sufficiently effective that no adverse health effects should be experienced. Acceleration of CFC releases could occur as some appliances are disposed of earlier than anticipated, but this increase should abate as CFC replacements come on the market.

8.3.15 Imported Electrical Power

Although it is not a technology as such, imported electrical power from Canada or Mexico could constitute an alternative to renewing a nuclear plant's license. Electricity trading has existed between the United States and both countries for many years, and numerous transmission ties exist, particularly with Canada, to facilitate easy exchanges of power. The North American Electric Reliability Council (NERC) was established in 1968 to enhance electricity reliability between the United States and Canada and a small portion of northern Baja California in Mexico. Today this system operates essentially as a single power grid, albeit with limited power exchanges and varying prices (NERC 1993b).

Electricity trading between the United States and Mexico has been quite small, amounting in 1990 to about 2 billion kWh of power imported by the United States (Texas) and about 600 million kWh of power exported to Mexico [DOE/EIA-0531(90)]. [The annual electric generation of a 1000-MW(e) power plant operating at 60 percent capacity is 5.26 billion kWh; thus, 1990 imports from Mexico amounted to the equivalent of about 40 percent of a 1000-MW(e) plant.]

Electricity trading between the United States and Canada is considerably larger and involves exchanges along almost the entire boundary separating the countries. In 1990 American utilities purchased approximately 22.5 billion kWh of electricity [the equivalent of four 1000-MW(e) plants] and sold about 20.5 billion kWh to Canada. These figures exclude power that is exchanged at no cost between utilities in which power moves freely across the border in one direction and is replaced with an equal amount of power moving free of charge in the other direction [DOE/EIA-0531(90)]. In 1990 the largest provincial exporter of power to the United States was British Columbia, which accounted for about 30 percent of the total. The largest provincial importer of power was Ontario, which accounted for almost two-thirds of the total Canadian imports from the United States.

Environmental impacts of importing electrical power to the United States in place of relicensing American nuclear plants should be similar to impacts of operating a mix of coal, hydropower, and nuclear power plants and the associated transmission lines in the United States. Projected capacity margins—essentially the amount of existing and planned generating capacity available for planned maintenance, unplanned electrical outages, and unforeseen growth in demand—are similar in both the United States and Canada, from which most imported power originates. U.S. capacity margins are projected at 20.6 percent of capacity in 1994 and 17.6 percent of capacity in 2002. Canada's capacity margins are projected to be 20.7 percent in 1994 and 16.3 percent in 2002 (NERC 1993a).

Canada's mix of generating technologies is considerably different from that of the United States, with hydroelectric power constituting over half of its capacity and coal constituting a distant second at about 20 percent. Nuclear power accounts for about 16 percent of Canadian capacity, or about the same as in the United States. Oil and gas combined make up only 10 percent of Canadian capacity, or slightly more than one-third the amount they account for in the United States. This mix of generating technologies is not expected to change appreciably through 2002 (NERC 1993a). Electrical power that is exported to the United States could originate almost anywhere in Canada, because the U.S.-Canadian system is essentially a grid in which power can be transmitted to any location from any location. Since transmission is not free and line losses do occur, however, distance is a factor in determining transmission costs and thus feasibility.

Given the generating mix of Canadian power plants, one would expect that hydroelectric dams would be a principal source of exported power to the United States. This point is particularly true when new dam development on the James Bay in northern Quebec is factored into Canadian capacity. Coal and nuclear plants would provide approximately equal amounts of power that would not total the hydropower contribution to exported power. Thus, if environmental impacts of power imported by the United States are distributed among Canadian power plants according to their percentage of the total, environmental impacts of hydroelectric dams (Section 8.2.5) would be the most prevalent types expected. Hydroelectric development in James Bay has been an important environmental dispute in Canada for quite some time, particularly in its impacts on native groups concerned with hunting, fishing, and gathering activities. Impacts of coal and nuclear plants would be expected to follow similar courses as in the United States, which are described in Sections 8.2.9 and 8.2.12, respectively.

Because Canada is engaged in substantial conservation efforts and has adequate generating capacity, it appears unlikely that a major power plant construction effort would have to be undertaken to meet expected American needs in the next 20 years. Similarly, transmission lines are in place within and between the two countries, and any construction of new lines should be a modest effort at best.

8.4 TERMINATION OF NUCLEAR POWER PLANT OPERATIONS AND DECOMMISSIONING

A nuclear power plant that ceases operations and closes permanently must go through a lengthy decommissioning process. In the process certain activities will occur that will have environmental consequences. This section summarizes the impacts of cessation of operations and beginning of decommissioning. The effect of the shutdown of operations is expected to be the same as that of a major scheduled outage, although the effect would be permanent and the loss of employment, local purchases, and most tax revenues would be permanent. All nonradioactive emissions (both airborne and liquid) would cease, as would cooling system impacts, transportation of radioactive materials, and major economic activities. Decommissioning would involve the removal of nuclear components from service and the reduction of residual radioactivity to a level that would allow the eventual release of the property for unrestricted use. Decommissioning does not mean that the plant would be demolished and the site returned to an essentially greenfield status. Rather, decommissioning requires that a nuclear facility be secured in nonoperational storage for a specified period before the next step: dismantlement. The decommissioning methods and their environmental impacts are summarized in Chapter 7. A more detailed evaluation of decommissioning requirements is provided in NUREG-0586.

8.4.1 Land Use

Neither terminating operations nor decommissioning is expected to have any immediate impacts on land use at a plant site, which would generally encompass 80–200 ha (200–500 acres). Because the ultimate objective of decommissioning is to release a site for unrestricted use, the activities that would occur at a site after the eventual completion of decommissioning and dismantlement of the plant would determine the subsequent land-use impacts. For example, it might be feasible to co-locate another power plant on a retired nuclear plant site provided safety requirements could be met and the site were large enough.

8.4.2 Air Quality

Only temporary, localized ambient air quality impacts result from nuclear plant operations. These impacts are not related to power production but instead, to motor vehicle use by plant personnel. Decommissioning activities involving vehicles and gasoline-powered equipment would extend these impacts for a few years past the termination of operations until a plant was in a secure storage configuration (Section 7.3.3). Once storage was in progress and nonsecurity-related activities ceased, these minor air quality impacts would end.

8.4.3 Water Resources

The impacts of nuclear power plant operation on water resources result from consumptive uses (e.g., evaporation associated with the condenser cooling system) and the discharge of chemicals and heat, which affect water quality and biota present in receiving water bodies (Sections 4.2.1 and 4.2.2). These impacts would cease with termination of plant operations. Although liquid releases during decommissioning could result in similar impacts to water quality, they are expected to be temporary and minimal (Section 7.3.4). Standard construction management practices and measures would be taken to minimize worker and public radiation exposure and to protect water quality.

8.4.4 Ecology

When a nuclear plant cooling system ceases operation, an improvement in water quality of the affected water body would be expected to occur; impingement and entrainment effects on aquatic organisms would cease; and drift deposition, icing, and fogging associated with cooling tower operation (if cooling towers are used) would cease. Generally, termination of entrainment and impingement would have positive effects. However, because of compensatory mechanisms that have occurred during the many years of plant operations, the change in aquatic organism populations could be negligible at many sites. Within the cooling water effluent-mixing zone, an aquatic community acclimated to warmer temperatures and biocides will have developed. Some exogenous aquatic organisms may have become established in the zone because of the warmer environment, and these organisms likely would be adversely affected as the water temperature cooled and the original conditions were restored to the water body. Recovery of a community to the normal background composition is a process of variable duration depending on the mobility of the organisms, sources of colonists, rate of growth and maturation of the species, and other factors. In medium-size rivers, most aquatic communities recover within a period of several months, but some groups, such as mollusks, may take more than 2 years to recover (Cairns 1971).

The impacts to a cooling pond that result from plant shutdown depend on whether the pond continues to exist. If cooling ponds were maintained during plant operation by pumping water from another water body, the ponds would revert to a terrestrial system after pumping stopped. Even if ponds are maintained by natural flow, water would probably no longer be impounded. If the ponds continued to exist, the nuclear plant's effects on the ponds described in Section 4.4 would cease. Cooling ponds often remain ice-free during the winter, thereby providing artificial habitat for wildlife. Loss of the heated effluent would change the composition and dynamics of the pond community until it resembled other ponds in the region not used for cooling. This effect is likely to be significant only at Turkey Point (Florida), where the cooling canals serve as habitat for the endangered American crocodile (*Crocodylus acutus*). Changing the temperature in the canal system might adversely affect the crocodile population through loss of that habitat (Gaby et al. 1985, Mazzotti et al.).

Many transmission lines associated with a nuclear power plant would be expected to remain in service even if the plant were shut down. Those lines that are deactivated or removed would no longer produce electromagnetic fields or discharge ozone (Section 4.5). Some rights-of-way would no longer be maintained; therefore, herbicide effects would cease, and forest vegetation and wildlife eventually would predominate in previously cleared portions of corridors (Sections 4.5.3, 4.5.5, and 4.5.6). If lines were removed, they would no longer be collision hazards for birds and would no longer provide perches or nesting sites (Section 4.5.6).

Minimal land disturbance is expected during decommissioning; therefore, no direct impacts to terrestrial biota are expected (Section 7.3.5). Also, measures to protect water quality would prevent toxic effects to aquatic organisms from aqueous effluents.

8.4.5 Radiological Impacts

Radiological impacts to the public from routine existing nuclear plant operations are minimal (Section 4.6). Impacts would be reduced to even lower levels by terminating operations and would be eliminated altogether at the completion of decommissioning. Population radiation doses from decommissioning (from transport of radioactive wastes) would be no greater than 21 person-rem (Section 7.3.1). (A discussion of the Standard International units used in measuring radioactivity and radiation dose is given in Appendix E, Section E.A.3.) Occupational doses would be between 300 and about 1900 person-rem, depending on the decommissioning method (NUREG-0586) (Section 7.3.1). Most of the occupational dose would occur during handling of radioactive materials, and the health risks associated with these dose commitments are within regulatory levels.

8.4.6 Waste Management

Terminating power plant operations eventually would eliminate generation of spent fuel and low-level radioactive waste (LLW). However, decommissioning would require the disposal of up to 19,000 m^3 (670,000 ft^3) of LLW (see Table 7.5), about 30 percent of the amount of LLW generated during the preceding 40 years of operation. Over 90 percent of the LLW would consist of nuclides with short half-life periods that decay to nonhazardous levels within about 100 years. These can be safely disposed of near the earth's surface (Section 7.3.2). At the conclusion of plant operations, no further LLW would be generated.

8.4.7 Socioeconomics

Termination of plant operations and decommissioning could have significant impacts on the economic structure and tax base of communities surrounding the plant. The magnitude of these impacts would be site-specific, depending on the proportion of total local employment, income, and local revenues provided by the plant. Direct employment at a 1000-MW(e) nuclear plant can easily total 700 people, and indirect jobs in the community can total several hundred more. Rural areas with small populations and a narrow economic base would be most impacted by termination of operations. Some jurisdictions may obtain several million dollars in annual tax revenues from plants. If these revenues constitute a substantial portion of the jurisdiction's revenues, the jurisdiction could have difficulty supporting its preclosure level of public services. Similarly, where plant-related employment is a large portion of total local employment, plant shutdown would result in a significant loss of jobs and income. In rural areas, where replacement jobs are not readily available, a loss of so many direct and indirect jobs could result in the out-migration of former plant employees, leading to population decline. In turn, this population decline could result in increased housing vacancies, decreased property values, diminished ability of the community to maintain existing levels of public services, and possibly some gradual changes in area land-use patterns.

Decommissioning would help mitigate temporarily some of the community-wide adverse effects of terminating operations even if the decommissioning work force were smaller than the operations work force and involved different personnel (Section 7.3.7). If the decommissioning work force were substantially larger than the operational work force in a rural area, the net increase could produce some of the problems of rapid economic growth, followed by the adverse effects of terminating plant operations. In effect, decommissioning activities would perpetuate for several years much of the employment and local spending benefits associated with nuclear plant operations. These benefits would cease with the end of decommissioning.

8.4.8 Aesthetics Resources

The primary positive aesthetic impact associated with decommissioning would be elimination of steam plumes from mechanical or natural-draft cooling towers wherever they are used. Other impacts that could be viewed by many people as positive would result from reduced human activities at the site. Since decommissioning would not necessarily lead to dismantlement, aesthetic impacts associated with plant appearance (in particular, large, natural draft cooling towers) might not change except where uncontaminated facilities would be removed. Visual improvements from removal of transmission lines and corridors would occur in those locations where no new plants were built as replacements for decommissioned nuclear plants.

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9. CONCLUSIONS

Table 9.1 summarizes the findings of the GEIS. Ninety-two environmental impacts were analyzed. Most of these were found to be Category 1 issues, which means that the impacts are of small significance at all plants and that no mitigation beyond that already employed at the plants is warranted. Category 2 issues are those for which the significance of the impacts or the appropriateness of mitigation must be determined on a site-specific basis. Because some plants have distinctly different impacts than others, not all conclusions apply to all plants. For this reason, some environmental impacts have Category 1 conclusions for some groups of plants and Category 2 conclusions for other groups of plants. Category definitions are presented in Chapter 1 and in the footnotes to Table 9.1. There remains scientific dispute about the effects of electromagnetic fields from power lines on human health. Consequently, the EIS reaches no conclusion about the significance of that impact. Also, environmental justice was not addressed in this document because guidance on that issue was not available in time to address it in this document.

Table 9.1 Summary of findings on NEPA issues for license renewal of nuclear power plants

Issue	Sections	Category[a]	Findings[b]
Surface Water Quality, Hydrology, and Use (for all plants)			
Impacts of refurbishment on surface water quality	3.4.1	1	SMALL. Impacts are expected to be negligible during refurbishment because best management practices are expected to be employed to control soil erosion and spills.
Impacts of refurbishment on surface water use	3.4.1	1	SMALL. Water use during refurbishment will not increase appreciably or will be reduced during plant outage.
Altered current patterns at intake and discharge structures	4.2.1.2.1 4.3.2.2 4.4.2	1	SMALL. Altered current patterns have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.
Altered salinity gradients	4.2.1.2.2 4.4.2	1	SMALL. Salinity gradients have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.
Altered thermal stratification of lakes	4.2.1.2.3 4.4.2.2	1	SMALL. Generally, lake stratification has not been found to be a problem at operating nuclear power plants and is not expected to be a problem during the license renewal term.
Temperature effects on sediment transport capacity	4.2.1.2.3 4.4.2.2	1	SMALL. These effects have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.
Scouring caused by discharged cooling water	4.2.1.2.3 4.4.2.2	1	SMALL. Scouring has not been found to be a problem at most operating nuclear power plants and has caused only localized effects at a few plants. It is not expected to be a problem during the license renewal term.
Eutrophication	4.2.1.2.3 4.4.2.2	1	SMALL. Eutrophication has not been found to be a problem at operating nuclear power plants and is not expected to be a problem during the license renewal term.

Footnotes at end of table

Table 9.1 Continued

Issue	Sections	Category[a]	Findings[b]
Discharge of chlorine or other biocides	4.2.1.2.4 4.4.2.2	1	SMALL. Effects are not a concern among regulatory and resource agencies and are not expected to be a problem during the license renewal term.
Discharge of sanitary wastes and minor chemical spills	4.2.1.2.4 4.4.2.2	1	SMALL. Effects are readily controlled through NPDES permit and periodic modifications, if needed, and are not expected to be a problem during the license renewal term.
Discharge of metals in waste water	4.2.1.2.4 4.3.2.2 4.4.2.2	1	SMALL. These discharges have not been found to be a problem at operating nuclear power plants with cooling-tower-based heat dissipation systems and have been satisfactorily mitigated at other plants. They are not expected to be a problem during the license renewal term.
Water use conflicts (plants with once-through cooling systems)	4.2.1.3	1	SMALL. These conflicts have not been found to be a problem at operating nuclear power plants with once-through heat dissipation systems.
Water use conflicts (plants with cooling towers and cooling ponds using make-up water from a small river with low flow)	4.3.2.1 4.4.2.1	2	SMALL OR MODERATE. The issue has been a concern at nuclear power plants with cooling ponds and at plants with cooling towers. Impacts on instream and riparian communities near these plants could be of moderate significance in some situations.
		Aquatic Ecology (for all plants)	
Refurbishment	3.5	1	SMALL. During plant shutdown and refurbishment there will be negligible effects on aquatic biota because of a reduction of entrainment and impingement of organisms or a reduced release of chemicals.
Accumulation of contaminants in sediments or biota	4.2.1.2.4 4.3.3 4.4.3 4.4.2.2	1	SMALL. Accumulation of contaminants has been a concern at a few nuclear power plants but has been satisfactorily mitigated by replacing copper alloy condenser tubes with condenser tubes of another metal. It is not expected to be a problem during the license renewal term.

Footnotes at end of table

Table 9.1 Continued

Issue	Sections	Category[a]	Findings[b]
Entrainment of phytoplankton and zooplankton	4.2.2.1.1 4.3.3 4.4.3	1	SMALL. Entrainment of phytoplankton and zooplankton has not been found to be a problem at operating nuclear power plants and is not expected to be a problem during the license renewal term.
Cold shock	4.2.2.1.5 4.3.3 4.4.3	1	SMALL. Cold shock has been satisfactorily mitigated at operating nuclear plants with once-through cooling systems, has not endangered fish populations or been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds, and is not expected to be a problem during the license renewal term.
Thermal plume barrier to migrating fish	4.2.2.1.6 4.4.3	1	SMALL. Thermal plumes have not been found to be a problem at operating nuclear power plants and is not expected to be a problem during the license renewal term.
Distribution of aquatic organisms	4.2.2.1.6 4.4.3	1	SMALL. Thermal discharges may have localized effects but are not expected to affect the larger geographical distribution of aquatic organisms.
Premature emergence of aquatic insects	4.2.2.1.7 4.4.3	1	SMALL. Premature emergence has been found to be a localized effect at some operating nuclear power plants but has not been a problem and is not expected to be a problem during the license renewal term.
Gas supersaturation (gas bubble disease)	4.2.2.1.8 4.4.3	1	SMALL. Gas supersaturation was a concern at a small number of operating nuclear power plants with once-through cooling systems but has been satisfactorily mitigated. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem during the license renewal term.
Low dissolved oxygen in the discharge	4.2.2.1.9 4.3.3 4.4.3	1	SMALL. Low dissolved oxygen has been a concern at one nuclear power plant with a once-through cooling system but has been effectively mitigated. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem during the license renewal term.

Footnotes at end of table

Table 9.1 Continued

Issue	Sections	Category[a]	Findings[b]
Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	4.2.2.1.10 4.4.3	1	SMALL. These types of losses have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.
Stimulation of nuisance organisms (e.g., shipworms)	4.2.2.1.11 4.4.3	1	SMALL. Stimulation of nuisance organisms has been satisfactorily mitigated at the single nuclear power plant with a once-through cooling system where previously it was a problem. It has not been found to be a problem at operating nuclear power plants with cooling towers or cooling ponds and is not expected to be a problem during the license renewal term.
Aquatic Ecology (for plants with once-through and cooling pond heat dissipation systems)			
Entrainment of fish and shellfish in early life stages	4.2.2.1.2 4.4.3	2	SMALL, MODERATE, OR LARGE. The impacts of entrainment are small at many plants but may be moderate or large at a few plants with once-through and cooling-pond cooling systems. Further, ongoing efforts to restore fish populations may increase the numbers of fish susceptible to intake effects during the license renewal period, so that entrainment studies conducted in support of the original license may no longer be valid.
Impingement of fish and shellfish	4.2.2.1.3 4.4.3	2	SMALL, MODERATE, OR LARGE. The impacts of impingement are small at many plants but may be moderate or even large at a few plants with once-through and cooling pond cooling systems.
Heat shock	4.2.2.1.4 4.4.3	2	SMALL, MODERATE, OR LARGE. Because of continuing concerns about heat shock and the possible need to modify thermal discharges in response to changing environmental conditions, the impacts may be of moderate or large significance at some plants.

Footnotes at end of table

Table 9.1 Continued

Issue	Sections	Category[a]	Findings[b]
Aquatic Ecology (continued) (for plants with cooling-tower-based heat dissipation systems)			
Entrainment of fish and shellfish in early life stages	4.3.3	1	SMALL. Entrainment of fish has not been found to be a problem at operating nuclear power plants with this type of cooling system and is not expected to be a problem during the license renewal term.
Impingement of fish and shellfish	4.3.3	1	SMALL. The impingement has not been found to be a problem at operating nuclear power plants with this type of cooling system and is not expected to be a problem during the license renewal term.
Heat shock	4.3.3	1	SMALL. Heat shock has not been found to be a problem at operating nuclear power plants with this type of cooling system and is not expected to be a problem during the license renewal term.
Groundwater Use and Quality			
Impacts of refurbishment on groundwater use and quality	3.4.2	1	SMALL. Extensive dewatering during the original construction on some sites will not be repeated during refurbishment on any sites. Any plant wastes produced during refurbishment will be handled in the same manner as in current operating practices and are not expected to be a problem during the license renewal term.
Groundwater use conflicts (potable and service water; plants that use <100 gpm)	4.8.1.1 4.8.1.2	1	SMALL. Plants using less than 100 gpm are not expected to cause any groundwater use conflicts.
Groundwater use conflicts (potable and service water, and dewatering; plants that use > 100 gpm)	4.8.1.1 4.8.1.2	2	SMALL, MODERATE, OR LARGE. Plants that use more than 100 gpm may cause groundwater use conflicts with nearby groundwater users.

Footnotes at end of table

Table 9.1 Continued

Issue	Sections	Category[a]	Findings[b]
Groundwater use conflicts (plants using cooling towers withdrawing make-up water from a small river)	4.8.1.3	2	SMALL, MODERATE, OR LARGE. Water use conflicts may result from surface water withdrawals from small water bodies during low flow conditions which may affect aquifer recharge, especially if other groundwater or upstream surface water users come on line before the time of license renewal.
Groundwater use conflicts (Ranney wells)	4.8.1.4	2	SMALL, MODERATE, OR LARGE. Ranney wells can result in potential groundwater depression beyond the site boundary. Impacts of large groundwater withdrawal for cooling tower makeup at nuclear power plants using Ranney wells must be evaluated at the time of application for license renewal.
Groundwater quality degradation (Ranney wells)	4.8.2.2	1	SMALL. Groundwater quality at river sites may be degraded by induced infiltration of poor-quality river water into an aquifer that supplies large quantities of reactor cooling water. However, the lower quality infiltrating water would not preclude the current uses of groundwater and is not expected to be a problem during the license renewal term.
Groundwater quality degradation (saltwater intrusion)	4.8.2.1	1	SMALL. Nuclear power plants do not contribute significantly to saltwater intrusion.
Groundwater quality degradation (cooling ponds in salt marshes)	4.8.3	1	SMALL. Sites with closed-cycle cooling ponds may degrade groundwater quality. Because water in salt marshes is brackish, this is not a concern for plants located in salt marshes.
Groundwater quality degradation (cooling ponds at inland sites)	4.8.3	2	SMALL, MODERATE, OR LARGE. Sites with closed-cycle cooling ponds may degrade groundwater quality. For plants located inland, the quality of the groundwater in the vicinity of the ponds must be shown to be adequate to allow continuation of current uses.

Footnotes at end of table

Table 9.1 Continued

Issue	Sections	Category[a]	Findings[b]
Terrestrial Resources			
Refurbishment impacts	3.6	2	SMALL, MODERATE, OR LARGE. Refurbishment impacts are insignificant if no loss of important plant and animal habitat occurs. However, it cannot be known whether important plant and animal communities may be affected until the specific proposal is presented with the license renewal application.
Cooling tower impacts on crops and ornamental vegetation	4.3.4	1	SMALL. Impacts from salt drift, icing, fogging, or increased humidity associated with cooling tower operation have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.
Cooling tower impacts on native plants	4.3.5.1	1	SMALL. Impacts from salt drift, icing, fogging, or increased humidity associated with cooling tower operation have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.
Bird collisions with cooling towers	4.3.5.2	1	SMALL. These collisions have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.
Cooling pond impacts on terrestrial resources	4.4.4	1	SMALL. Impacts of cooling ponds on terrestrial ecological resources are considered to be of small significance at all sites.
Power line right-of-way management (cutting and herbicide application)	4.5.6.1	1	SMALL. The impacts of right-of-way maintenance on wildlife are expected to be of small significance at all sites.
Bird collision with power lines	4.5.6.2	1	SMALL. Impacts are expected to be of small significance at all sites.
Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)	4.5.6.3	1	SMALL. No significant impacts of electromagnetic fields on terrestrial flora and fauna have been identified. Such effects are not expected to be a problem during the license renewal term.

Footnotes at end of table

Table 9.1 Continued

Issue	Sections	Category[a]	Findings[b]
Floodplains and wetland on power line right of way	4.5.7	1	SMALL. Periodic vegetation control is necessary in forested wetlands underneath power lines and can be achieved with minimal damage to the wetland. No significant impact is expected at any nuclear power plant during the license renewal term.
Threatened or Endangered Species (for all plants)			
Threatened or endangered species	3.9 4.1	2	SMALL, MODERATE, OR LARGE. Generally, plant refurbishment and continued operation are not expected to adversely affect threatened or endangered species. However, consultation with appropriate agencies would be needed at the time of license renewal to determine whether threatened or endangered species are present and whether they would be adversely affected.
Air Quality			
Air quality during refurbishment (non-attainment and maintenance areas)	3.3	2	SMALL, MODERATE, OR LARGE. Air quality impacts from plant refurbishment associated with license renewal are expected to be small. However, vehicle exhaust emissions could be cause for concern at locations in or near nonattainment or maintenance areas. The significance of the potential impact cannot be determined without considering the compliance status of each site and the numbers of workers expected to be employed during the outage.
Air quality effects of transmission lines	4.5.2	1	SMALL. Production of ozone and oxides of nitrogen is insignificant and does not contribute measurably to ambient levels of these gases.
Land Use			
On-site land use	3.2	1	SMALL. Projected on-site land use changes would require a small fraction of any nuclear power plant site and would involve land that is controlled by the applicant.
Power line right-of-ways	4.5.3	1	SMALL. Ongoing uses of power line right-of-ways would continue with no change in restrictions. The effects of these restrictions are of small significance.

Footnotes at end of table

Table 9.1 Continued

Issue	Sections	Category[a]	Findings[b]
		Human Health	
Radiation exposures to the public during refurbishment	3.8.1	1	SMALL. During refurbishment, the gaseous effluents would result in doses that are similar to those from current operation. Applicable regulatory dose limits to the public are not expected to be exceeded.
Occupational radiation exposures during refurbishment	3.8.2	1	SMALL. Occupational doses from refurbishment are expected to be within the range of annual average collective doses experienced for pressurized-water reactors and boiling-water reactors. Occupational mortality risks from all causes including radiation is in the mid-range for industrial settings.
Microbiological organisms (occupational health)	4.3.6	1	SMALL. Occupational health impacts are expected to be controlled by continued application of accepted industrial hygiene practices to minimize worker exposures.
Microbiological organisms (public health) (plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river)	4.3.6	2	SMALL, MODERATE, OR LARGE. These organisms are not expected to be a problem at most operating plants except possibly at plants using cooling ponds, lakes, or canals that discharge to small rivers. Without site-specific data, it is not possible to predict the effects generically.
Noise	4.3.7	1	SMALL. Noise has not been found to be a problem at operating plants and is not expected to be a problem at any plant during the license renewal term.
Electromagnetic fields, acute effects (electric shock)	4.5.4.1	2	SMALL, MODERATE, OR LARGE. Electrical shock resulting from direct access to energized conductors or from induced charges in metallic structures have not been found to be a problem at most operating plants and are not expected to be a problem during the license renewal term. However, without review of each nuclear plant's transmission line conformance with National Electric Safety Code criteria, it is not possible to determine the significance of the electric shock potential.

Footnotes at end of table

Table 9.1 Continued

Issue	Sections	Category[a]	Findings[b]
Electromagnetic fields, chronic effects	4.5.4.2	NA[c]	UNCERTAIN. Biological and physical studies of 60-Hz electromagnetic fields have not found consistent evidence linking harmful effects with field exposures. However, because the state of the science is currently inadequate, no generic conclusion on human health impacts is possible.[c]
Radiation exposures to public (license renewal term)	4.6.2	1	SMALL. Radiation doses to the public will continue at current levels associated with normal operations.
Occupational radiation exposures (license renewal term)	4.6.3	1	SMALL. Projected maximum occupational doses during the license renewal term are within the range of doses recently experienced during normal operations and normal maintenance outages, and would be well below regulatory limits.
		Socioeconomics	
Housing impacts	3.7.2 4.7.1	2	SMALL, MODERATE, OR LARGE. Housing impacts are expected to be of small significance at plants located in a medium or high population area and not in an area where growth control measures that limit housing development are in effect. Moderate or large housing impacts of the work force associated with refurbishment may be associated with plants located in sparsely populated areas or in areas with growth control measures that limit housing development.
Public services: public safety, social services, and tourism and recreation	3.7.4 3.7.4.3 3.7.4.4 3.7.4.6 4.7.3 4.7.3.3 4.7.3.4 4.7.3.6	1	SMALL. Impacts to public safety, social services, and tourism and recreation are expected to be of small significance at all sites.

Footnotes at end of table

Table 9.1 Continued

Issue	Sections	Category[a]	Findings[b]
Public services: public utilities	3.7.4.5 4.7.3.5	2	SMALL OR MODERATE. An increased problem with water shortages at some sites may lead to impacts of moderate significance on public water supply availability.
Public services, education (refurbishment)	3.7.4.1	2	SMALL, MODERATE, OR LARGE. Most sites would experience impacts of small significance but larger impacts are possible depending on site- and project-specific factors.
Public services, education (license renewal term)	4.7.3.1	1	SMALL. Only impacts of small significance are expected.
Offsite land use (refurbishment)	3.7.5	2	SMALL OR MODERATE. Impacts may be of moderate significance at plants in low population areas.
Offsite land use (license renewal term)	4.7.4	2	SMALL, MODERATE, OR LARGE. Significant changes in land use may be associated with population and tax revenue changes resulting from license renewal.
Public services, transportation	3.7.4.2 4.7.3.2	2	SMALL, MODERATE, OR LARGE. Transportation impacts are generally expected to be of small significance. However, the increase in traffic associated with the additional workers and the local road and traffic control conditions may lead to impacts of moderate or large significance at some sites.
Historic and archaeological resources	3.7.7 4.7.7	2	SMALL, MODERATE, OR LARGE. Generally, plant refurbishment and continued operation are expected to have no more than small adverse impacts on historic and archaeological resources. However, the National Historic Preservation Act requires the Federal agency to consult with the State Historic Preservation Officer to determine whether there are properties present that require protection.

Footnotes at end of table

Table 9.1 Continued

Issue	Sections	Category[a]	Findings[b]
Aesthetic impacts (refurbishment)	3.7.8	1	SMALL. No significant impacts are expected during refurbishment.
Aesthetic impacts (license renewal term)	4.7.6	1	SMALL. No significant impacts are expected during the license renewal term.
Aesthetic impacts of transmission lines (license renewal term)	4.5.8	1	SMALL. No significant impacts are expected during the license renewal term.
Postulated Accidents			
Design basis accidents	5.3.2 5.5.1	1	SMALL. The NRC staff has concluded that the environmental impacts of design basis accidents are of small significance for all plants.
Severe accidents	5.3.3 5.3.3.2 5.3.3.3 5.3.3.4 5.3.3.5 5.4 5.5.2	2	SMALL. The probability weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to ground water, and societal and economic impacts from severe accidents are small for all plants. However, alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives.
Uranium Fuel Cycle and Waste Management			
Nonradiological waste		1	SMALL. No changes to generating systems are anticipated for license renewal. Facilities and procedures are in place to ensure continued proper handling and disposal at all plants.

Footnotes at end of table

Table 9.1 Continued

Issue	Sections	Category[a]	Findings[b]
Low-level waste storage and disposal		1	SMALL. The comprehensive regulatory controls that are in place and the low public doses being achieved at reactors ensure that the radiological impacts to the environment will remain small during the term of a renewed license. The maximum additional on-site land that may be required for low-level waste storage during the term of a renewed license and associated impacts will be small. Nonradiological impacts on air and water will be negligible. The radiological and nonradiological environmental impacts of long-term disposal of low-level waste from any individual plant at licensed sites are small. In addition, the Commission concludes that there is reasonable assurance that sufficient low-level waste disposal capacity will be made available when needed for facilities to be decommissioned consistent with NRC decommissioning requirements.
Mixed waste storage and disposal		1	SMALL. The comprehensive regulatory controls and the facilities and procedures that are in place ensure proper handling and storage, as well as negligible doses and exposure to toxic materials for the public and the environment at all plants. License renewal will not increase the small, continuing risk to human health and the environment posed by mixed waste at all plants. The radiological and nonradiological environmental impacts of long-term disposal of mixed waste from any individual plant at licensed sites are small. In addition, the Commission concludes that there is reasonable assurance that sufficient mixed waste disposal capacity will be made available when needed for facilities to be decommissioned consistent with NRC decommissioning requirements.
On-site spent fuel		1	SMALL. The expected increase in the volume of spent fuel from an additional 20 years of operation can be safely accommodated on site with small environmental effects through dry or pool storage at all plants if a permanent repository or monitored retrievable storage is not available.

Footnotes at end of table

Table 9.1 Continued

Issue	Sections	Category[a]	Findings[b]
Transportation		2	Table S-4 of 10 CFR 51 contains an assessment of impact parameters to be used in evaluating transportation effects in each case.
		Decommissioning	
Radiation doses	7.3.1 7.4	1	SMALL. Doses to the public will be well below applicable regulatory standards regardless of which decommissioning method is used. Occupational doses would increase no more than 1 man-rem caused by buildup of long-lived radionuclides during the license renewal term.
Waste management	7.3.2 7.4	1	SMALL. Decommissioning at the end of a 20-year license renewal period would generate no more solid wastes than at the end of the current license term. No increase in the quantities of Class C or greater than Class C wastes would be expected.
Air quality	7.3.3 7.4	1	SMALL. Air quality impacts of decommissioning are expected to be negligible either at the end of the current operating term or at the end of the license renewal term.
Water quality	7.3.4 7.4	1	SMALL. The potential for significant water quality impacts from erosion or spills is no greater whether decommissioning occurs after a 20-year license renewal period or after the original 40-year operation period, and measures are readily available to avoid such impacts.
Ecological resources	7.3.5 7.4		SMALL. Decommissioning after either the initial operating period or after a 20-year license renewal period is not expected to have any direct ecological impacts.
Socioeconomic impacts	7.3.7 7.4	1	SMALL. Decommissioning would have some short-term socioeconomic impacts. The impacts would not be increased by delaying decommissioning until the end of a 20-year relicense period, but they might be decreased by population and economic growth.

Footnotes at end of table

Table 9.1 Continued

Issue	Sections	Category[a]	Findings[b]
		Environmental Justice	
Environmental justice	NA[d]	NA[d]	NONE. The need for and content of an analysis of environmental justice will be addressed in plant-specific reviews.

[a]The numerical entries in this column are based on the following category definitions:

Category 1: For the issue, the analysis reported in the Generic Environmental Impact Statement has shown:

(1) The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristics;

(2) A single significance level (i.e., small, moderate, or large) has been assigned to the impacts (except for collective off-site radiological impacts from the fuel cycle and from high-level waste and spent-fuel disposal); and

(3) Mitigation of adverse impacts associated with the issue has been considered in the analysis and it has been determined that additional plant-specific mitigation measures are likely not to be sufficiently beneficial to warrant implementation.

The generic analysis of the issue may be adopted in each plant-specific review.

Category 2: For the issue, the analysis reported in the Generic Environmental Impact Statement has shown that one or more of the criteria of Category 1 can not be met, and therefore additional plant-specific review is required.

[b]The impact findings in this column are based on the definitions of three significant levels. Unless the significance level is identified as beneficial, the impact is adverse, or in the case of "small," may be negligible. The definitions of significance follow:

SMALL—For the issue, environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the Commission has concluded that those impacts that do not exceed permissible levels in the Commission's regulations are considered small as the term is used in this table.

MODERATE—For the issue, environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.

LARGE—For the issue, environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

For issues where probability is a key consideration (i.e. accident consequences), probability was a factor in determining significance.

[c]NA (not applicable). Scientific evidence on the chronic biological effects on humans from exposure to transmission line electric and magnetic fields is inconclusive. If the Commission finds that a consensus has been reached by appropriate Federal health agencies that there are adverse health effects, the Commission will require applicants to submit plant-specific reviews of these health effects.

[d]NA (not applicable). Environmental justice is not addressed in the GEIS because Executive Order 12898 issued on February 11, 1994, and implementation guidance were not available prior to completion of this report.

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THE GENERIC ENVIRONMENTAL IMPACT STATEMENT (GEIS) EXAMINES THE POSSIBLE ENVIRONMENTAL IMPACTS THAT COULD OCCUR AS A RESULT OF RENEWING LICENSES OF INDIVIDUAL NUCLEAR POWER PLANTS UNDER 10 CFR PART 54. THE GEIS, TO THE EXTENT POSSIBLE, ESTABLISHES THE BOUNDS AND SIGNIFICANCE OF THESE POTENTIAL IMPACTS. THE ANALYSES IN THE GEIS ENCOMPASS ALL OPERATING LIGHT-WATER POWER REACTORS. FOR EACH TYPE OF ENVIRONMENTAL IMPACT THE GEIS ATTEMPTS TO ESTABLISH GENERIC FINDINGS COVERING AS MANY PLANTS AS POSSIBLE. THIS GEIS HAS THREE PRINCIPAL OBJECTIVES: (1) TO PROVIDE AN UNDERSTANDING OF THE TYPES AND SEVERITY OF ENVIRONMENTAL IMPACTS THAT MAY OCCUR AS A RESULT OF LICENSE RENEWAL OF NUCLEAR POWER PLANTS UNDER 10 CFR PART 54, (2) TO INDENTIFY AND ASSESS THOSE IMPACTS THAT ARE EXPECTED TO BE GENERIC TO LICENSE RENEWAL, AND (3) TO SUPPORT A RULEMAKING (10 CFR PART 51) TO DEFINE THE NUMBER AND SCOPE OF ISSUES THAT NEED TO BE ADDRESSED BY THE APPLICANTS IN PLANT-BY-PLANT LICENSE RENEWAL PROCEEDINGS. TO ACCOMPLISH THESE OBJECTIVES, THE GEIS MAKES MAXIMUM USE OF ENVIRONMENTAL AND SAFETY DOCUMENTATION FROM ORIGINAL LICENSING PROCEEDINGS AND INFORMATION FROM STATE AND FEDERAL REGULATORY AGENCIES, THE NUCLEAR UTILITY INDUSTRY, THE OPEN LITERATURE, AND PROFESSIONAL CONTACTS.

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ACRONYMS AND ABBREVIATIONS

ADS	automatic depressurization system
AEA	Atomic Energy Act of 1954
AEC	U.S. Atomic Energy Commission
AEO	*Atomic Energy Outlook 1990*
AFUDC	allowance for funds used during construction
AGA	American Gas Association
AGR	advanced gas-cooled reactor
AIRFA	American Indian Religious Freedom Act
ALARA	as low as reasonably achievable
ALI	annual limits on intake
A/m	amps per meter
AML	acute myelogenous leukemia
ANO	Arkansas Nuclear One
ANOVA	analysis of variance
ANSI	American National Standards Institute
AP&L	Arkansas Power and Light
ASME	American Society of Mechanical Engineers
ATWS	anticipated transit without scram
BAU	business-as-usual
BEIR	Biological Effects of Ionizing Radiation
BIG/GT	biomass-gasifier/gas turbine
BRC	below regulatory concern
BSD	Burlington School District
B&W	Babcock and Wilcox
BWR	boiling-water reactor
°C	degrees centigrade (Celsius)
CAA	Clean Air Act
CAAA	Clean Air Act Amendments of 1990
CCC	California Coastal Commission
CDE	committed dose equivalent
CDF	core damage frequencies
CE	Combustion Engineering
CEDE	committed effective dose equivalent
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFC	chlorofluorocarbon
CFR	Code of Federal Regulations
Ci	curie
CML	chronic myelogenous leukemia
CMSA	consolidated metropolitan statistical area
CNS	central nervous system

CO	carbon monoxide
ConEd	Consolidated Edison
CPI	containment performance improvement
CPW	continuous polymer wire
CRAC	Consequence (of) Reactor Accident Code
CRD	control rod drive
CWA	Clean Water Act of 1977
CZMA	Coastal Zone Management Act
DAC	derived air concentrations
DAW	dry active waste
DE	dose equivalent
DECON	a nuclear plant decommissioning method
DER	Florida Department of Environmental Regulation
DFA	direct fluorescent antibody
DMBA	dimethylbenzanthracene
DNR	Florida Department of Natural Resources
DO	dissolved oxygen
DOE	U.S. Department of Energy
DOI	Department of Interior
DRBC	Delaware River Basin Commission
DREF	dose rate effectiveness factor
DRI	Data Resources Incorporated
DSC	dry shielded canister
DSM	demand-side management
E	electric field
EA	environmental assessment
EAB	exclusion area boundary
EDE	effective dose equivalent
EEC	European Economic Community
EEDB	Energy Economic Data Base
EEG	electroencephalogram
EEI	Edison Electric Institute
E-field	electric-field
EI	exposure index
EIA	Energy Information Administration
EIS	environmental impact statement
EKG	electrocardiogram
ELF	extremely low frequency
EM	electromagnetic
EMF	electromagnetic field
ENTOMB	a nuclear plant decommissioning method
EO	Executive Order
EPA	U.S. Environmental Protection Agency
EPACT	Energy Policy Act of 1992

EPCRA	Emergency Planning and and Community Right-to-Know Act
EPRI	Electric Power Research Institute
EPZ	emergency planning zone
ESA	Endangered Species Act
ESEERCO	Empire State Electric Energy Research Corporation
FDA	U.S. Food and Drug Administration
FEMA	U.S. Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FES	final environmental statement
FFCA	Federal Facilities Compliance Agreement
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FIS	federal interim storage
FONSI	finding of low significant impact
FPC	Florida Power Commission
FP&L	Florida Power & Light
FR	Federal Register
FSAR	final safety analysis report
FWCA	Fish and Wildlife Coordination Act
FWS	U.S. Fish and Wildlife Service
GBD	gas bubble disease
GCHWR	gas-cooled heavy-water-moderated reactor
GCR	gas-cooled reactor
GE	General Electric Company
GEIS	generic environmental impact statement
$g/m^2/s$	gallons per square meter per second
GNP	gross national product
GNSI	General Nuclear Systems, Inc.
GPU	General Public Utilities Corporation
GRI	Gas Research Institute
GTCC	greater-than-class-C
GW	gigawatt
GWd	gigawatt-days
HC	hydrocarbons
HL&P	Houston Lighting and Power Company
HLW	high-level radioactive waste
HP	health physics
HPOF	high-pressure oil-filled
HRS	hazard ranking system
HSM	horizontal storage module
HSWA	Hazardous and Solid Waste Amendments of 1984
HWR	heavy-water reactor

ICRP	International Commission on Radiological Protection
IGSCC	intergranular stress-cracking corrosion
IMP	intramembranous protein particle
INIRC	International Non-Ionizing Radiation Protection Association
INPO	Institute of Nuclear Power Operations
IOR	ion exchange resin
IPA	integrated plant assessment
IPE	individual plant examination
IRPA	International Radiation Protection Association
ISFSI	independent spent-fuel storage installation
ISI	in-service inspection
ISTM	inspection, surveillance, testing, and maintenance
kV	kilovolt
kV/m	kilovolts per meter
kW	kilowatt
kWh	kilowatt-hour
LD	Legionnaires' disease
LDR	land disposal restrictions
LDSD	Lower Dauphin School District
LET	linear energy transfer
LLRWPAA	Low-Level Radioactive Waste Policy Amendments Act of 1985
LLW	low-level radioactive waste
LMFBR	liquid-metal first breeder reactor
LOCA	loss-of-coolant accident
LOS	level of service
LPGS	Liquid Pathway Generic Study
LPZ	low population zone
LWR	light-water reactor
m	meter
mA	milliamperes
MACCS	MELCOR Accident Consequence Code System
MANOVA	multivariate analyses of covariance
MAP	Methodologies Applications Program
MASD	Middletown Area School District
mCi	milliCurie
MCLG	maximum contaminant goal levels
MDNR	Maryland Department of Natural Resources
MFD	magnetic flux density
mG	milligauss
mM	millimole
MMPA	Marine Mammals Protection Act
MPC	maximum permissible concentration
MPRSA	Marine Protection, Research, and Sanctuaries Act

MPOB	maximum permissible organ burden
MRC	Marine Review Committee
mrem	millirem
MRS	monitored retrievable storage
m^3/s	cubic meters per second
MSA	metropolitan statistical area
MSW	municipal solid waste
mT	millitesla
MTIHM	metric tons of initial heavy metal
MTU	metric tons of uranium
mV/m	millivolts per meter
MW	megawatt
MWd	megawatt-days
MW(e)	megawatt (electrical)
MW(t)	megawatt (thermal)
MYL	middle year of license
MYR	middle year of relicense
μg/g	micrograms per gram
μm	micron
NAA	nonattainment area
NAAQS	National Ambient Air Quality Standards
NAS	National Academy of Sciences
NBS	National Bureau of Standards (now NIST)
NCA	National Coal Association
NCRP	National Council on Radiation Protection and Measurements
NEC	normalized expected cost
NEPA	National Environmental Policy Act of 1969
NERC	North American Electric Reliability Council
NESC	National Electric Safety Code
NESHAP	National Emission Standards for Hazardous Air Pollutants
NGS	nuclear generating station
NHPA	National Historic Preservation Act of 1966
NIEHS	National Institute of Environmental Health Sciences
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
NLF	normalized latent facility
NMFS	National Marine Fisheries Service
NMR	nuclear magnetic resonance
NO_x	nitrogen oxide(s)
NPA	National Planning Association
NPDES	National Pollutant Discharge Elimination System
NPP	nuclear power plant
NRC	U.S. Nuclear Regulatory Commission
NSPS	new source performance standards

NSSS	nuclear steam supply system
NTD	normalized total dose
NUHOMS	Nutech Horizontal Modular System
NUMARC	Nuclear Utilities Management and Resources Council
NUREG	an NRC reports category
NUS	NUS Corporation
NWPA	Nuclear Waste Policy Act of 1982
NYSDEC	New York State Department of Environmental Conservation
ODC	ornithine decarboxylase
OHMS	hydroxy melatonin sulfate
OL	operating license
O&M	operation and maintenance
ONS	Oconee Nuclear Station
OPEC	Organization of Petroleum Exporting Countries
OR	odds ratio
ORNL	Oak Ridge National Laboratory
OSHA	Occupational Safety and Health Administration
OTA	Office of Technology Assessment
OTEC	ocean thermal energy conversion
PAME	primary amoebic meningoencephalitis
PASNY	Power Authority for the State of New York
PCB	polychlorinated biphenyl
PG&E	Pacific Gas and Electric
pH	hydrogen-ion concentration
PHWR	pressurized heavy-water reactor
PLEX	plant life extension
PM	particulate matter
PMR	proportionate mortality ratios
ppm	parts per million
PSD	prevention of significant deterioration
PRA	probabilistic risk assessment
PTH	parathyroid hormone
PURPA	Public Utility Regulatory Policies Act of 1978
PURTA	Public Utilities Realty Tax Assessment of 1970
PV	solar photovoltaic
PWR	pressurized-water reactor
QA	quality assurance
RBE	relative biological effectiveness
RCB	reactor containment building
RCRA	Resource Conservation and Recovery Act of 1976
RD&D	1. research, design, and development 2. research, development, and demonstration

RERF	Radiation Effects Research Council
RET	renewable energy technology
RF	radio frequency
RHR	residual heat removal
RIMS	Regional Industrial Multiplier System
rms	root mean square
ROW	right(s) of way
RPV	reactor pressure vessel
RRY	reference reactor year
RSD	Russellville (Ark.) School District
RSS	Reactor Safety Study
RV	recreational vehicle
RY	reactor-year
SAFSTOR	a nuclear plant decommissioning method
SAMDA	severe accident mitigation design alternative
SAND	Data Resource Incorporated's detailed electricity sector model
SAND NUPLEX	SAND generating capacity projections
SAR	safety analysis report
SARA	Superfund Amendments and Reauthorization Act
SCE	Southern California Edison
SCM	Surface Compartment Model
SDG&E	San Diego Gas & Electric Company
SDWA	Safe Drinking Water Act
SEA	Science and Engineering Associates, Inc.
SER	safety evaluation report
SERI	Solar Energy Research Institute
SEV	state equalized value
SF	spent fuel
SHPO	state historic preservation office
SI	International System
SIR	standardized incidence ratio
SLB	shallow land burial
SMR	standardized mortality ratio
SMITTR	surveillance, on-line monitoring, inspections, testing, trending, and recordkeeping
SMSA	standard metropolitan statistical area
SO_2	sulfur dioxide
SOK	San Onofre kelp bed
SONGS	San Onofre Nuclear Generating Station
SRBC	Susquehanna River Basin Commission
SSC	systems, structures, and components
t	metric tons
TDE	total dose equivalent

TDS	total dissolved solids
TEDE	total effective dose equivalent
TMI	Three Mile Island (nuclear plant)
TRU	transuranic
TSCA	Toxic Substances Control Act
TVA	Tennessee Valley Authority
UCB	upper confidence bound
UFC	uranium fuel cycle
UHV	ultra-high voltage
UNSCEAR	United Nations Scientific Committee on the Effects of Atomic Radiation
USD	Unified School District
USGS	U.S. Geological Survey
USI	unresolved safety issue
VDT	video display terminal
VR	volume reduction
VRF	volume reduction factor
W	watt
WCGS	Wolf Creek Generating Station
WHO	World Health Organization
WNP-2	Washington Nuclear Project
WTE®	Whole Tree Energy®

Appendix A

General Characteristics and Environmental Settings of Domestic Nuclear Power Plants

General Characteristics and Environmental Settings of Domestic Nuclear Power Plants

This section contains brief descriptions of each nuclear power plant site in the United States. The information was compiled from: (1) the plant safety analysis reports (SARs), (2) the Nuclear Regulatory Commission "Gray Book" (NUREG-0020), (3) site environmental reports, (4) environmental impact statements, (5) environmental assessments used to check data for cooling water system and site information, and (6) WASH-1319 used for selected data. Specific data that could not be found in these six sources were obtained from ORNL-NSIC-55.

Specific data sources are listed on the following page.

Source for General Information

Plant Name: SAR

Location: County and distance and direction from nearest town
or city: NUREG-0020
Latitude and longitude: List provided by R. Rush, ORNL
Licensee: Utility as listed in NUREG-0020

Source for Information on Unit

Docket Number: NUREG-0020
Construction Permit: *Nuclear Safety Journal*, Power Reactor Licensing Activity
Operating License: Table A.1 of SECY-90-160 (NUREG-0020)
Commercial Operation: NUREG-0020
License Expiration: Table A.1 of SECY-90-160 (NUREG-0020)
Licensed Thermal Power [MW(t)]: NUREG-0020
Design Electrical Rating [net MW(e)]: NUREG-0020
Type of Reactor: NUREG-0020
Nuclear Steam Supply System Vendor: NUREG-0020

Source for Information on Cooling Water System

Type: SAR, NUREG-0020
Source: NUREG-0020
Source Temperature Range: SAR, ORNL-NSIC-55
Condenser Flow Rate: SAR, ORNL-NSIC-55
Design Condenser Temperature Rise: SAR, ORNL-NSIC-55
Intake Structure: SAR
Discharge Structure: SAR

Source for Information on Site

Total Area: SAR, WASH-1319
Exclusion Distance: SAR
Low Population Zone: SAR
Nearest City: SAR; 1980 population:*
Site Topography: SAR
Surrounding Area Topography: SAR
Land Use within 8 km (5 miles): SAR
Nearby Features: SAR
Area of Transmission Line Corridor: WASH-1319
Population within an 80-km (50-mile) radius:*

*Population data are taken from population projections developed for NRC by MITRE Corporation and made available to GEIS project.

ARKANSAS NUCLEAR ONE

Location: Pope County, Arkansas
10 km (6 miles) WNW of Russellville
latitude 35.3100°N; longitude 93.2308°W
Licensee: Arkansas Power and Light Co.

Unit Information	Unit 1	Unit 2
Docket Number	50-313	50-368
Construction Permit	1968	1972
Operating License	1974	1978
Commercial Operation	1974	1980
License Expiration	2014	2018
Licensed Thermal Power [MW(t)]	2568	2815
Design Electrical Rating [net MW(e)]	850	912
Type of Reactor	PWR	PWR
Nuclear Steam Supply System Vendor	B&W	CE

Cooling Water System

Type: Unit 1, once through
Source: Dardanelle Reservoir Unit 2, natural draft cooling tower
Source Temperature Range: 4-28°C (40-83°F)
Condenser Flow Rate: 48.3 m^3/s (765,000 gal/min) for Unit 1
26.6 m^3/s (422,000 gal/min) for Unit 2
Design Condenser Temperature Rise: 8.3°C (15°F) for Unit 1
17.1°C (30.7°F) for Unit 2
Intake Structure: 981-m (3220-ft) canal
Discharge Structure: 160-m (520-ft) canal

Site Information

Total Area: 469 ha (1160 acres)
Exclusion Distance: 1.05-km (0.65-mile) radius
Low Population Zone: 6.44-km (4.00-mile) radius
Nearest City: Little Rock; 1980 population: 159,159
Site Topography: flat
Surrounding Area Topography: hilly to mountainous
Land Use within 8 km (5 miles): wooded
Nearby Features: The nearest town is Mill Creek 3 km (2 miles) NE. The size of the Dardanelle Reservoir is 15,000 ha (37,000 acres). The reservoir is part of the Arkansas River. The Missouri Pacific Railroad and U.S. Highway I-40 are just N of the site.
Area of Transmission Line Corridor: 1500 ha (3700 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
200,000	210,000	220,000	250,000	270,000

BEAVER VALLEY POWER STATION

Location: Beaver County, Pennsylvania
40 km (25 miles) NW of Pittsburgh
latitude 40.6219°N; longitude 80.4339°W

Licensee: Duquesne Light Co.

Unit Information	Unit 1	Unit 2
Docket Number	50-334	50-412
Construction Permit	1970	1974
Operating License	1976	1987
Commercial Operation	1976	1987
License Expiration	2016	2027
Licensed Thermal Power [MW(t)]	2652	2652
Design Electrical Rating [net MW(e)]	835	836
Type of Reactor	PWR	PWR
Nuclear Steam Supply System Vendor	WEST	WEST

Cooling Water System

Type: natural draft cooling towers
Source: Ohio River
Source Temperature Range: 1.1-28°C (34-83°F)
Condenser Flow Rate: 30.31 m^3/s (480,400 gal/min) each unit
Design Condenser Temperature Rise: 14°C (26°F)
Intake Structure: concrete structure at river edge
Discharge Structure: at river edge

Site Information

Total Area: 203 ha (501 acres)
Exclusion Distance: 0.45 km (0.28 mile)
Low Population Zone: 5.79 km (3.60 miles)
Nearest City: Pittsburgh; 1980 population: 423,959
Site Topography: flat
Surrounding Area Topography: hilly
Land Use within 8 km (5 miles): industrial and residential
Nearby Features: The nearest town is Midland 1.6 km (1 mile) NW. A large industrial area is about 1.6 km (1 mile) WNW. The Penn Central Railroad is adjacent to the site. Beaver Creek and Raccoon Creek State Parks are within 16 km (10 miles).
Area of Transmission Line Corridor: uses existing corridor
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
3,740,000	3,840,000	3,910,000	4,040,000	4,170,000

BELLEFONTE NUCLEAR PLANT

Location: Jackson County, Alabama
11 km (7 miles) ENE of Scottsboro
latitude 34.7089°N; longitude 85.9275°W
Licensee: Tennessee Valley Authority

Unit Information	Unit 1	Unit 2
Docket Number	50-438	50-439
Construction Permit	1974	1974
Operating License	--	--
Commercial Operation	--	--
License Expiration	--	--
Design Thermal Power [MW(t)]	3760	3760
Design Electrical Rating [net MW(e)]	1213	1213
Type of Reactor	PWR	PWR
Nuclear Steam Supply System Vendor	B&W	B&W

Cooling Water System

Type: natural draft cooling towers
Source: Guntersville Lake
Source Temperature Range: 5-27°C (41-81°F)
Condenser Flow Rate: 26 m^3/s (410,000 gal/min) each unit
Design Condenser Temperature Rise: 20°C (36°F)
Intake Structure: intake channel
Discharge Structure: submerged multi-port diffuser

Site Information

Total Area: 610 ha (1500 acres)
Exclusion Distance: 0.92-km (0.57-mile) minimum
Low Population Zone: 3.22 km (2.00 miles)
Nearest City: Huntsville; 1980 population: 142,513
Site Topography: flat valley
Surrounding Area Topography: hilly out of valley
Land Use within 8 km (5 miles): agricultural and wooded
Nearby Features: The nearest town is Hollywood 5 km (3 miles) WNW. The Widows Creek coal-fired plant is 24 km (15 miles) NE. Guntersville Lake is on the Tennessee River.
Area of Transmission Line Corridor: 1200 ha (2900 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
1,070,000	1,150,000	1,230,000	1,340,000	1,470,000

BIG ROCK POINT NUCLEAR PLANT

Location: Charlevoix County, Michigan
6 km (4 miles) NE of Charlevoix
latitude 45.3592°N; longitude 85.1947°W
Licensee: Consumers Power Co.

Unit Information	Unit 1
Docket Number	50-155
Construction Permit	1960
Operating License	1962
Commercial Operation	1963
License Expiration	2002
Licensed Thermal Power [MW(t)]	240
Design Electrical Rating [net MW(e)]	72
Type of Reactor	BWR
Nuclear Steam Supply System Vendor	GE

Cooling Water System

Type: once through
Source: Lake Michigan
Source Temperature Range: 3-20°C (38-68°F)
Condenser Flow Rate: 3.1 m^3/s (49,000 gal/min)
Design Condenser Temperature Rise: 11°C (20°F)
Intake Structure: underwater crib
Discharge Structure: open discharge canal

Site Information

Total Area: 240 ha (600 acres)
Exclusion Distance: 0.82 km (0.51 mile)
Low Population Zone: 4.02 km (2.50 miles)
Nearest City: Sault Ste. Marie, Canada; 1980 population: 81,048
Site Topography: gently sloping
Surrounding Area Topography: gently sloping
Land Use within 8 km (5 miles): commercial and industrial
Nearby Features: The nearest town is Charlevoix 6 km (4 miles) SW. The C&O Railroad is about 1.6 km (1 mile) SE. Lake Charlevoix is 5 km (3 miles) S.
Area of Transmission Line Corridor:
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
200,000	210,000	210,000	230,000	240,000

BRAIDWOOD STATION

Location: Will County, Illinois
39 km (24 miles) SSW of Joliet
latitude 41.2436°N; longitude 88.2297°W

Licensee: Commonwealth Edison Co.

Unit Information	Unit 1	Unit 2
Docket Number	50-456	50-457
Construction Permit	1975	1975
Operating License	1987	1988
Commercial Operation	1988	1988
License Expiration	2027	2028
Licensed Thermal Power [MW(t)]	3411	3411
Design Electrical Rating [net MW(e)]	1120	1120
Type of Reactor	PWR	PWR
Nuclear Steam Supply System Vendor	WEST	WEST

Cooling Water System

Type: closed cycle cooling pond
Source: Kankakee River
Source Temperature Range: 0-31°C (32-87°F)
Condenser Flow Rate: 46.05 m^3/s (729,800 gal/min) each unit
Design Condenser Temperature Rise: 12°C (21°F)
Intake Structure: concrete structure at lake shore
Discharge Structure: surface discharge flume to lake

Site Information

Total Area: 1804 ha (4457 acres)
Exclusion Distance: 0.48-km (0.30-mile) minimum
Low Population Zone: 1.810 km (1.125 mile) radius
Nearest City: Joliet; 1980 population: 77,956
Site Topography: flat to rolling
Surrounding Area Topography: flat to rolling
Land Use within 8 km (5 miles): agricultural
Nearby Features: The nearest town is Godley 0.8 km (0.5 mile) SW. There are 4 state parks within 16 km (10 miles). Joliet Arsenal is about 13 km (8 miles) NE. Dresden Nuclear Power Station is about 16 km (10 miles) N and La Salle County Station (nuclear) is about 32 km (20 miles) WSW. The Illinois Central Gulf Railroad is just NW. U.S. Highway I-55 is about 3 km (2 miles) NW.
Area of Transmission Line Corridor: 961.5 ha (2376 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
4,510,000	4,650,000	4,750,000	4,920,000	5,090,000

BROWNS FERRY NUCLEAR POWER STATION

Location: Limestone County, Alabama
16 km (10 miles) NW of Decatur
latitude 34.7042°N; longitude 87.1186°W

Licensee: Tennessee Valley Authority

Unit Information	Unit 1	Unit 2	Unit 3
Docket Number	50-259	50-260	50-296
Construction Permit	1967	1967	1968
Operating License	1973	1974	1976
Commercial Operation	1974	1975	1977
License Expiration	2013	2014	2016
Licensed Thermal Power [MW(t)]	3293	3293	3293
Design Electrical Rating [net MW(e)]	1065	1065	1065
Type of Reactor	BWR	BWR	BWR
Nuclear Steam Supply System Vendor	GE	GE	GE

Cooling Water System

Type: once through and helper towers
Source: Tennessee River
Source Temperature Range: 4-32°C (40-90°F)
Condenser Flow Rate: 40 m^3/s (630,000 gal/min) each unit
Design Condenser Temperature Rise: 14°C (25°F)
Intake Structure: concrete structure in small inlet
Discharge Structure: diffuser pipes

Site Information

Total Area: 340 ha (840 acres)
Exclusion Distance: 1.22-km (0.76-mile) radius
Low Population Zone: 11.3 km (7.00 miles)
Nearest City: Huntsville; 1980 population: 142,513
Site Topography: flat
Surrounding Area Topography: flat to rolling
Land Use within 8 km (5 miles): agricultural
Nearby Features: The nearest town is Lawngate 1.6 km (1 mile) NE. The Redstone Arsenal is 40 km (25 miles) E. The Southern Railroad is 10 km (6 miles) S and the Louisville and Nashville Railroad is 10 km (6 miles) E.
Area of Transmission Line Corridor: 546 ha (1350 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
760,000	810,000	850,000	930,000	1,010,000

BRUNSWICK STEAM ELECTRIC PLANT

Location: Brunswick County, North Carolina
26 km (16 miles) S of Wilmington
latitude 33.9583°N; longitude 78.0106°W
Licensee: Carolina Power and Light Co.

Unit Information	Unit 1	Unit 2
Docket Number	50-325	50-324
Construction Permit	1967	1968
Operating License	1976	1974
Commercial Operation	1977	1975
License Expiration	2016	2014
Licensed Thermal Power [MW(t)]	2436	2436
Design Electrical Rating [net MW(e)]	821	821
Type of Reactor	BWR	BWR
Nuclear Steam Supply System Vendor	GE	GE

Cooling Water System

Type: once through
Source: Cape Fear River
Source Temperature Range: 4-30°C (40-86°F)
Condenser Flow Rate: 42.6 m^3/s (675,000 gal/min) each unit
Design Condenser Temperature Rise: 9°C (17°F)
Intake Structure: 5-km (3-mile) canal from Cape Fear River
Discharge Structure: 10-km (6-mile) canal to Atlantic Ocean

Site Information

Total Area: 490 ha (1200 acres)
Exclusion Distance: 0.92 km (0.57 mile)
Low Population Zone: 3.22 km (2.00 miles)
Nearest City: Wilmington; 1980 population: 44,000
Site Topography: flat
Surrounding Area Topography: flat
Land Use within 8 km (5 miles): less than one-half agricultural, remainder swamps or wooded
Nearby Features: Nearest town is Southport 5 km (3 miles) S. Sunny Point Military Ocean Terminal is about 8 km (5 miles) N.
Area of Transmission Line Corridor: 1400 ha (3500 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
230,000	250,000	270,000	300,000	340,000

BYRON STATION

Location: Ogle County, Illinois
27 km (17 miles) SW of Rockford
latitude 42.0750°N; longitude 89.2811°W
Licensee: Commonwealth Edison Co.

Unit Information	Unit 1	Unit 2
Docket Number	50-454	50-455
Construction Permit	1975	1975
Operating License	1985	1987
Commercial Operation	1985	1987
License Expiration	2025	2027
Licensed Thermal Power [MW(t)]	3411	3411
Design Electrical Rating [net MW(e)]	1120	1120
Type of Reactor	PWR	PWR
Nuclear Steam Supply System Vendor	WEST	WEST

Cooling Water System

Type: natural draft cooling towers
Source: Rock River
Source Temperature Range:
Condenser Flow Rate: 39.9 m^3/s (632,000 gal/min) each unit
Design Condenser Temperature Rise: 13°C (24°F)
Intake Structure: concrete structure on river bank
Discharge Structure: discharged to river

Site Information

Total Area: 565.8 ha (1398 acres)
Exclusion Distance: 0.42-km (0.26-mile) minimum
Low Population Zone: 4.83 km (3.00 miles)
Nearest City: Rockford; 1980 population: 139,712
Site Topography: rolling
Surrounding Area Topography: rolling
Land Use within 8 km (5 miles): agricultural
Nearby Features: The nearest town is Byron about 5 km (3 miles) NNE. The Chicago Milwaukee and the St. Paul and Pacific Railroads are about 6 km (4 miles) NNE. White Pines State Park is about 18 km (11 miles) WSW.
Area of Transmission Line Corridor: 800 ha (2000 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
1,000,000	1,030,000	1,060,000	1,100,000	1,140,000

CALLAWAY PLANT

Location: Callaway County, Missouri
16 km (10 miles) SE of Fulton
latitude 38.7622°N; longitude 91.7817°W
Licensee: Union Electric Co.

Unit Information	Unit 1
Docket Number	50-483
Construction Permit	1976
Operating License	1984
Commercial Operation	1984
License Expiration	2024
Licensed Thermal Power [MW(t)]	3565
Design Electrical Rating [net MW(e)]	1171
Type of Reactor	PWR
Nuclear Steam Supply System Vendor	WEST

Cooling Water System

Type: natural draft cooling tower
Source: Missouri River
Source Temperature Range:
Condenser Flow Rate: 33 m^3/s (530,000 gal/min)
Design Condenser Temperature Rise: 17°C (30°F)
Intake Structure: intake from river
Discharge Structure: discharged to river

Site Information

Total Area: 1290 ha (3188 acres)
Exclusion Distance: 1.21-km (0.75-mile) radius
Low Population Zone: 4.02 ha (2.50 miles)
Nearest City: Columbia; 1980 population: 62,061
Site Topography: flat, on a small plateau
Surrounding Area Topography: rolling to hilly
Land Use within 8 km (5 miles): wooded, agricultural, and pasture
Nearby Features: The nearest town is Portland 8 km (5 miles) SE. The Missouri River is about 8 km (5 miles) S. The Missouri, Kansas, and Texas Railroad is about 5 km (3 miles) S and the Missouri Pacific Railroad is about 10 km (6 miles) S. U.S. Highway I-70 is about 16 km (10 miles) N.
Area of Transmission Line Corridor: 461 ha (1140 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
400,000	420,000	430,000	460,000	500,000

CALVERT CLIFFS NUCLEAR POWER PLANT

Location: Calvert County, Maryland
56 km (35 miles) S of Annapolis
latitude 38.4347°N; longitude 76.4419°W
Licensee: Baltimore Gas and Electric Co.

Unit Information	Unit 1	Unit 2
Docket Number	50-317	50-318
Construction Permit	1969	1969
Operating License	1974	1976
Commercial Operation	1975	1977
License Expiration	2014	2016
Licensed Thermal Power [MW(t)]	2700	2700
Design Electrical Rating [net MW(e)]	845	845
Type of Reactor	PWR	PWR
Nuclear Steam Supply System Vendor	CE	CE

Cooling Water System

Type: once through
Source: Chesapeake Bay
Source Temperature Range: 1-31°C (34-87°F)
Condenser Flow Rate: 76 m^3/s (1,200,000 gal/min) each unit
Design Condenser Temperature Rise: 6°C (10°F)
Intake Structure: about 170 m (560 ft) from shore
Discharge Structure: about 260 m (850 ft) from shore

Site Information

Total Area: 459 ha (1135 acres)
Exclusion Distance: 1.08-km (0.67-mile) radius
Low Population Zone:
Nearest City: Washington, D.C.; 1980 population: 638,432
Site Topography: rolling
Surrounding Area Topography: rolling
Land Use within 8 km (5 miles): agricultural and wooded
Nearby Features: The nearest town is Long Beach 1.6 km (1 mile) NNW. Calvert Cliffs State Park is about 6 km (4 miles) SSE. A naval ordnance facility is 11 km (7 miles) SSW. Washington, D.C., is 72 km (45 miles) NW.
Area of Transmission Line Corridor: 805 ha (1990 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
3,030,000	3,140,000	3,260,000	3,480,000	3,720,000

CATAWBA NUCLEAR STATION

Location: York County, South Carolina
10 km (6 miles) NNW of Rock Hill
latitude 35.0514°N; longitude 81.0708°W

Licensee: Duke Power Co.

Unit Information	Unit 1	Unit 2
Docket Number	50-413	50-414
Construction Permit	1975	1975
Operating License	1985	1986
Commercial Operation	1985	1986
License Expiration	2025	2026
Licensed Thermal Power [MW(t)]	3411	3411
Design Electrical Rating [net MW(e)]	1145	1145
Type of Reactor	PWR	PWR
Nuclear Steam Supply System Vendor	WEST	WEST

Cooling Water System

Type: mechanical draft cooling towers
Source: Lake Wylie
Source Temperature Range: 6-28°C (43-83°F)
Condenser Flow Rate: 42 m^3/s (660,000 gal/min) each unit
Design Condenser Temperature Rise: 13°C (24°F)
Intake Structure: skimmer wall on cove of the lake
Discharge Structure: on another cove of the lake

Site Information

Total Area: 158 ha (391 acres)
Exclusion Distance: 0.76-km (0.47-mile) radius
Low Population Zone: 6.12-km (3.80-mile) radius
Nearest City: Charlotte, North Carolina; 1980 population: 315,474
Site Topography: rolling
Surrounding Area Topography: rolling
Land Use within 8 km (5 miles): wooded with recreational and permanent homes along the lake
Nearby Features: The nearest town is Rock Hill 10 km (6 miles) SSE. U.S. Highway I-77 is about 10 km (6 miles) E and I-85 is about 27 km (17 miles) N. The Southern Railway is 8 km (5 miles) S.
Area of Transmission Line Corridor: 236 ha (584 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
1,590,000	1,730,000	1,860,000	2,090,000	2,340,000

CLINTON POWER STATION

Location: De Witt County, Illinois
10 km (6 miles) E of Clinton
latitude 40.1731°N; longitude 88.8342°W
Licensee: Illinois Power Co.

Unit Information	Unit 1
Docket Number	50-461
Construction Permit	1976
Operating License	1987
Commercial Operation	1987
License Expiration	2027
Licensed Thermal Power [MW(t)]	2894
Design Electrical Rating [net MW(e)]	933
Type of Reactor	BWR
Nuclear Steam Supply System Vendor	GE

Cooling Water System

Type: once through
Source: Salt Creek
Source Temperature Range: 0-28°C (32-83°F)
Condenser Flow Rate: 35.8850 m^3/s (568,701 gal/min)
Design Condenser Temperature Rise: 13°C (23°F)
Intake Structure: concrete structure at shoreline of North Fork Salt Creek
Discharge Structure: 5-km (3-mile) flume discharging to Salt Creek

Site Information

Total Area: 5702 ha (14,090 acres)
Exclusion Distance: 0.97-km (0.60-mile) radius
Low Population Zone: 4.02-km (2.50-mile) radius
Nearest City: Decatur; 1980 population: 93,939
Site Topography: flat
Surrounding Area Topography: flat
Land Use within 8 km (5 miles): agricultural
Nearby Features: The nearest town is De Witt 3 km (2 miles) ENE. Weldon Springs State Park is 10 km (6 miles) SW. The Illinois Central Gulf Railroad crosses the site. U.S. Highway I-74 is 18 km (11 miles) NE. A dam on Salt Creek near the site creates the reservoir for the cooling water system.
Area of Transmission Line Corridor: 367 ha (906 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
730,000	770,000	790,000	830,000	870,000

COMANCHE PEAK STEAM ELECTRIC STATION

Location: Somervell County, Texas
64 km (40 miles) SW of Fort Worth
latitude 32.2983°N; longitude 97.7856°W

Licensee: Texas Utilities Electric Co.

Unit Information	Unit 1	Unit 2
Docket Number	50-445	50-446
Construction Permit	1974	1974
Operating License	1990	1993
Commercial Operation	1990	1993
License Expiration	2030	2033
Design Thermal Power [MW(t)]	3411	3411
Design Electrical Rating [net MW(e)]	1150	1150
Type of Reactor	PWR	PWR
Nuclear Steam Supply System Vendor	WEST	WEST

Cooling Water System

Type: once through
Source: Squaw Creek Reservoir
Source Temperature Range:
Condenser Flow Rate: 65 m^3/s (1,030,000 gal/min) each unit
Design Condenser Temperature Rise: 8°C (15°F)
Intake Structure: on shore of reservoir
Discharge Structure: canal to reservoir

Site Information

Total Area: 3104 ha (7669 acres)
Exclusion Distance: 1.54-km (0.96-mile) minimum
Low Population Zone: 6.44-km (4.00-mile) radius
Nearest City: Fort Worth; 1980 population: 385,164
Site Topography: flat with hills rising from the reservoir
Surrounding Area Topography: rolling to hilly
Land Use within 8 km (5 miles): agricultural, farm/ranch land, and range land
Nearby Features: The nearest town is Glen Rose 8 km (5 miles) SSE. Dinosaur Valley State Park is 8 km (5 miles) SW. A 66-cm (26-inch) oil pipeline is very near the site and a 91-cm (36-inch) natural gas line is about 3 km (2 miles) from the site.
Area of Transmission Line Corridor: 185 ha (458 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
1,130,000	1,310,000	1,460,000	1,650,000	1,880,000

DONALD C. COOK NUCLEAR POWER PLANT

Location:	Berrien County, Michigan 16 km (10 miles) S of St. Joseph latitude 41.9761°N; longitude 86.5664°W
Licensee:	Indiana and Michigan Electric Co.

Unit Information	Unit 1	Unit 2
Docket Number	50-315	50-316
Construction Permit	1969	1969
Operating License	1974	1977
Commercial Operation	1975	1978
License Expiration	2014	2017
Licensed Thermal Power [MW(t)]	3250	3411
Design Electrical Rating [net MW(e)]	1030	1100
Type of Reactor	PWR	PWR
Nuclear Steam Supply System Vendor	WEST	WEST

Cooling Water System

Type: once through
Source: Lake Michigan
Source Temperature Range: 1-23°C (34-74°F)
Condenser Flow Rate: 50 m^3/s (800,000 gal/min) each unit
Design Condenser Temperature Rise: 12°C (21°F)
Intake Structure: intake cribs 686 m (2250 ft) from shore
Discharge Structure: 381 m (1250 ft) from shore

Site Information

Total Area: 260 ha (650 acres)
Exclusion Distance: 0.61 km (0.38 mile)
Low Population Zone: 3.22 km (2.00 miles)
Nearest City: South Bend, Indiana; 1980 population: 109,727
Site Topography: rolling
Surrounding Area Topography: flat to rolling
Land Use within 8 km (5 miles): agricultural and wooded
Nearby Features: The nearest town is Livingston 1.6 km (1 mile) SW. The Chesapeake and Ohio Railroad and U.S. Highway I-94 are just E of the site. Warren Dunes State Park is about 8 km (5 miles) SSW.
Area of Transmission Line Corridor: 1340 ha (3300 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
1,250,000	1,310,000	1,350,000	1,440,000	1,530,000

COOPER NUCLEAR STATION

Location: Nemaha County, Nebraska
37 km (23 miles) S of Nebraska City
latitude 40.3619°N; longitude 95.6411°W
Licensee: Nebraska Public Power District

Unit Information

Docket Number	50-298
Construction Permit	1968
Operating License	1974
Commercial Operation	1974
License Expiration	2014
Licensed Thermal Power [MW(t)]	2381
Design Electrical Rating [net MW(e)]	778
Type of Reactor	BWR
Nuclear Steam Supply System Vendor	GE

Cooling Water System

Type: once through
Source: Missouri River
Source Temperature Range: 1-23°C (34-73°F)
Condenser Flow Rate: 39.8 m^3/s (631,000 gal/min)
Design Condenser Temperature Rise: 10°C (18°F)
Intake Structure: at shoreline
Discharge Structure: at shoreline

Site Information

Total Area: 441 ha (1090 acres)
Exclusion Distance: 1.09 (0.68 mile)
Low Population Zone: 1.61-km (1.00-mile) radius
Nearest City: Lincoln; 1980 population: 171,932
Site Topography: flat
Surrounding Area Topography: flat
Land Use within 8 km (5 miles): agricultural
Nearby Features: The nearest town is Nemaha about 1.6 km (1 mile) S. A railroad runs just W of the site. Indian Cave State Park is about 13 km (8 miles) SSE.
Area of Transmission Line Corridor: 2777 ha (6862 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
180,000	190,000	200,000	220,000	230,000

CRYSTAL RIVER NUCLEAR PLANT

Location: Citrus County, Florida
11 km (7 miles) NW of Crystal River
latitude 28.9572°N; longitude 82.6989°W
Licensee: Florida Power Corp.

Unit Information	Unit 3
Docket Number	50-302
Construction Permit	1968
Operating License	1977
Commercial Operation	1977
License Expiration	2017
Licensed Thermal Power [MW(t)]	2544
Design Electrical Rating [net MW(e)]	825
Type of Reactor	PWR
Nuclear Steam Supply System Vendor	B&W

Cooling Water System

Type: once through
Source: Gulf of Mexico
Source Temperature Range: 31°C (87°F) maximum
Condenser Flow Rate: 43 m^3/s (680,000 gal/min)
Design Condenser Temperature Rise: 9.5°C (17.1°F)
Intake Structure: 4900 m (16,000 ft) from shoreline
Discharge Structure: 4000-m (13,000-ft) canal

Site Information

Total Area: 1917 ha (4738 acres)
Exclusion Distance: 1.34-km (0.83-mile) radius
Low Population Zone: 8.05 km (5.00 miles)
Nearest City: Gainesville; 1980 population: 81,371
Site Topography: swamps and marshland
Surrounding Area Topography: flat
Land Use within 8 km (5 miles): wooded and pasture land
Nearby Features: The nearest town is Crystal River about 11 km (7 miles) SE. Units 1 and 2 are coal-fired plants and share a common intake and discharge with the nuclear unit.
Area of Transmission Line Corridor: 866 ha (2140 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
440,000	490,000	550,000	660,000	790,000

DAVIS-BESSE NUCLEAR POWER STATION

Location: Ottawa County, Ohio
34 km (21 miles) E of Toledo
latitude 41.5972°N; longitude 83.0864°W
Licensee: Toledo Edison Co.

Unit Information	Unit 1
Docket Number	50-346
Construction Permit	1971
Operating License	1977
Commercial Operation	1978
License Expiration	2017
Licensed Thermal Power [MW(t)]	2772
Design Electrical Rating [net MW(e)]	906
Type of Reactor	PWR
Nuclear Steam Supply System Vendor	B&W

Cooling Water System

Type: natural draft cooling tower
Source: Lake Erie
Source Temperature Range: 1-23°C (34-74°F)
Condenser Flow Rate: 30 m^3/s (480,000 gal/min)
Design Condenser Temperature Rise: 14°C (26°F)
Intake Structure: submerged intake about 900 m (3000 ft) offshore
Discharge Structure: submerged discharge about 280 m (930 ft) offshore

Site Information

Total Area: 386 ha (954 acres)
Exclusion Distance: 0.72-km (0.45-mile) radius
Low Population Zone: 3.22 km (2.00 miles)
Nearest City: Toledo; 1980 population: 354,635
Site Topography: flat
Surrounding Area Topography: flat
Land Use within 8 km (5 miles): agricultural with marshland around site
Nearby Features: The nearest town is Oak Harbor about 10 km (6 miles) SW. Several wildlife refuge areas are within 8 km (5 miles) of the site.
Area of Transmission Line Corridor: 730 ha (1800 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
1,920,000	1,990,000	2,050,000	2,170,000	2,290,000

DIABLO CANYON NUCLEAR POWER PLANT

Location: San Luis Obispo County, California
19 km (12 miles) W of San Luis Obispo
latitude 35.2117°N; longitude 120.8544°W
Licensee: Pacific Gas and Electric Co.

Unit Information	Unit 1	Unit 2
Docket Number	50-275	50-323
Construction Permit	1968	1970
Operating License	1984	1985
Commercial Operation	1985	1986
License Expiration	2024	2025
Licensed Thermal Power [MW(t)]	3338	3411
Design Electrical Rating [net MW(e)]	1086	1119
Type of Reactor	PWR	PWR
Nuclear Steam Supply System Vendor	WEST	WEST

Cooling Water System

Type: once through
Source: Pacific Ocean
Source Temperature Range: 10-17°C (50-63°F)
Condenser Flow Rate: 54.5 m^3/s (863,000 gal/min) each unit
Design Condenser Temperature Rise: 10°C (18°F)
Intake Structure: reinforced-concrete structure located at shore line in a cove with artificial breakwater wall
Discharge Structure: reinforced-concrete structure drops water in stair step type weir overflow from elevation 21 m (70 ft) to the ocean and discharges on the surface at the shore line

Site Information

Total Area: 300 ha (750 acres)
Exclusion Distance: 0.80 km (0.50 mile)
Low Population Zone: 9.66 km (6.00 miles)
Nearest City: Santa Barbara; 1980 population: 74,542
Site Topography: hilly
Surrounding Area Topography: hilly to mountainous
Land Use within 8 km (5 miles): undeveloped and wooded
Nearby Features: Site is remote, the nearest town being San Luis Obispo 19 km (12 miles) E. Beaches 11-24 km (7-15 miles) ESE have an influx of summer visitors. Pismo Beach State Park and Morro Bay State Park are within 24 km (15 miles). Vandenberg Air Base is 56 km (35 miles) ESE.
Area of Transmission Line Corridor: 2400 ha (6000 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
300,000	330,000	350,000	380,000	420,000

DRESDEN NUCLEAR POWER STATION

Location: Grundy County, Illinois
14 km (9 miles) E of Morris
latitude 41.3897°N; longitude 88.2711°W

Licensee: Commonwealth Edison Co.

Unit Information	Unit 2	Unit 3
Docket Number	50-237	50-249
Construction Permit	1966	1966
Operating License	1969	1971
Commercial Operation	1970	1971
License Expiration	2010	2011
Licensed Thermal Power [MW(t)]	2527	2527
Design Electrical Rating [net MW(e)]	794	794
Type of Reactor	BWR	BWR
Nuclear Steam Supply System Vendor	GE	GE

Cooling Water System

Type: cooling lake & spray canal
Source: Kankakee River
Source Temperature Range: 4-29°C (40-85°F)
Condenser Flow Rate: 29.7 m^3/s (471,000 gal/min) each unit
Design Condenser Temperature Rise:
Intake Structure: canal from Kankakee River to a crib house
Discharge Structure: A canal carries water to a cooling lake of about 520 ha (1275 acres) with a hold-up time of about 3 days. The water then divides, some going to the Illinois River and some returns to the plant. Spray modules are floated in the canals.

Site Information

Total Area: 386 ha (953 acres) plus 516-ha (1275-acre) cooling lake
Exclusion Distance: 0.80-km (0.50-mile) radius
Low Population Zone: 8.00 km (4.97 miles)
Nearest City: Joliet; 1980 population: 77,956
Site Topography: flat
Surrounding Area Topography: rolling prairie
Land Use within 8 km (5 miles): agriculture
Nearby Features: The nearest town is Channahon 5 km (3 miles) NNE. The General Electric Nuclear Power Plant Training Center is S of the site. A large abandoned strip mine is located in the area. Braidwood Station nuclear plant is about 16 km (10 miles) S and La Salle County Station nuclear plant is about 35 km (22 miles) SW. An army ammunition plant is about 11 km (7 miles) E.
Area of Transmission Line Corridor: 911 ha (2250 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
6,820,000	7,050,000	7,200,000	7,450,000	7,710,000

DUANE ARNOLD ENERGY CENTER

Location: Linn County, Iowa
13 km (8 miles) NW of Cedar Rapids
latitude 42.1006°N; longitude 91.7772°W
Licensee: Iowa Electric Light and Power Co.

Unit Information	Unit 1
Docket Number	50-331
Construction Permit	1970
Operating License	1974
Commercial Operation	1975
License Expiration	2014
Licensed Thermal Power [MW(t)]	1658
Design Electrical Rating [net MW(e)]	538
Type of Reactor	BWR
Nuclear Steam Supply System Vendor	GE

Cooling Water System

Type: mechanical draft cooling towers
Source: Cedar River
Source Temperature Range: 0-32°C (32-89°F)
Condenser Flow Rate: 18 m^3/s (290,000 gal/min)
Design Condenser Temperature Rise: 14°C (25°F)
Intake Structure: structure on river shoreline
Discharge Structure: canal to shoreline

Site Information

Total Area: 200 ha (500 acres)
Exclusion Distance: 0.43 km (0.27 mile)
Low Population Zone: 9.66 km (6.00 miles)
Nearest City: Cedar Rapids; 1980 population: 110,243
Site Topography: flat
Surrounding Area Topography: rolling and hilly
Land Use within 8 km (5 miles): agricultural
Nearby Features: The nearest town is Palo about 3 km (2 miles) SW. Several wildlife refuge areas are within 16 km (10 miles) of the site.
Area of Transmission Line Corridor: 469 ha (1160 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
620,000	660,000	690,000	750,000	820,000

JOSEPH M. FARLEY NUCLEAR PLANT

Location: Houston County, Alabama
26 km (16 miles) E of Dothan
latitude 31.2228°N; longitude 85.1125°W
Licensee: Alabama Power Co.

Unit Information	Unit 1	Unit 2
Docket Number	50-348	50-364
Construction Permit	1972	1972
Operating License	1977	1981
Commercial Operation	1977	1981
License Expiration	2017	2021
Licensed Thermal Power [MW(t)]	2652	2652
Design Electrical Rating [net MW(e)]	829	829
Type of Reactor	PWR	PWR
Nuclear Steam Supply System Vendor	WEST	WEST

Cooling Water System

Type: mechanical draft cooling towers
Source: Chattahoochee River
Source Temperature Range: 30°C (86°F) maximum
Condenser Flow Rate: 40.1 m^3/s (635,000 gal/min) each unit
Design Condenser Temperature Rise: 11°C (20°F)
Intake Structure: intake from river bank via a storage pond
Discharge Structure: at river bank

Site Information

Total Area: 749 ha (1850 acres)
Exclusion Distance: 1.26 km (0.78 mile)
Low Population Zone: 3.22 km (2.00 miles)
Nearest City: Columbus, Georgia; 1980 population: 169,441
Site Topography: flat to rolling
Surrounding Area Topography: rolling
Land Use within 8 km (5 miles): agricultural and wooded
Nearby Features: The nearest town is Columbia about 6 km (4 miles) N. Chattahoochee State Park is about 19 km (12 miles) S.
Area of Transmission Line Corridor: 2140 ha (5300 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
390,000	410,000	440,000	490,000	540,000

ENRICO FERMI ATOMIC POWER PLANT

Location: Monroe County, Michigan
48 km (30 miles) SW of Detroit
latitude 41.9631°N; longitude 83.2578°W
Licensee: Detroit Edison Co.

Unit Information	Unit 2
Docket Number	50-341
Construction Permit	1972
Operating License	1985
Commercial Operation	1988
License Expiration	2025
Licensed Thermal Power [MW(t)]	3292
Design Electrical Rating [net MW(e)]	1093
Type of Reactor	BWR
Nuclear Steam Supply System Vendor	GE

Cooling Water System

Type: natural draft cooling towers
Source: Lake Erie
Source Temperature Range: 1-24°C (34-76°F)
Condenser Flow Rate: 52.80 m^3/s (836,700 gal/min)
Design Condenser Temperature Rise: 10°C (18°F)
Intake Structure: at edge of lake
Discharge Structure: to the lake via a 20-ha (50-acre) pond

Site Information

Total Area: 453 ha (1120 acres)
Exclusion Distance: 0.92 km (0.57 mile)
Low Population Zone: 4.83 km (3.00 miles)
Nearest City: Detroit; 1980 population: 1,203,368
Site Topography: flat
Surrounding Area Topography: flat to rolling
Land Use within 8 km (5 miles): mostly agricultural
Nearby Features: The town of Stony Point is adjacent to the site to the S. Sterling State Park and General Custer Historical Site are about 8 km (5 miles) SW.
Area of Transmission Line Corridor: 73 ha (180 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
5,370,000	5,630,000	5,840,000	6,230,000	6,650,000

JAMES A. FITZPATRICK NUCLEAR POWER PLANT

Location: Oswego County, New York
10 km (6 miles) NE of Oswego
latitude 43.5239°N; longitude 76.3983°W
Licensee: Power Authority of the State Of New York

Unit Information

Docket Number	50-333
Construction Permit	1970
Operating License	1974
Commercial Operation	1975
License Expiration	2014
Licensed Thermal Power [MW(t)]	2436
Design Electrical Rating [net MW(e)]	816
Type of Reactor	BWR
Nuclear Steam Supply System Vendor	GE

Cooling Water System

Type: once through
Source: Lake Ontario
Source Temperature Range: 3-19°C (37-67°F)
Condenser Flow Rate: 22.25 m^3/s (352,600 gal/min)
Design Condenser Temperature Rise: 18°C (32°F)
Intake Structure: intake from the lake
Discharge Structure: discharge to the lake

Site Information

Total Area: 284 ha (702 acres)
Exclusion Distance: 0.92 km (0.57 mile)
Low Population Zone: 5.47 km (3.40 miles)
Nearest City: Syracuse; 1980 population: 170,105
Site Topography: flat to rolling
Surrounding Area Topography: rolling
Land Use within 8 km (5 miles): agricultural, industrial, residential, and recreational
Nearby Features: The nearest town is Lakeview about 1.6 km (1 mile) WSW. Fort Ontario is about 8 km (5 miles) SW. Nine Mile Point Nuclear Station is about 0.8 km (0.5 mile) W.
Area of Transmission Line Corridor: 400 ha (1000 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
820,000	810,000	800,000	800,000	810,000

FORT CALHOUN STATION

Location: Washington County, Nebraska
31 km (19 miles) N of Omaha
latitude 41.5208°N; longitude 96.0767°W
Licensee: Omaha Public Power District

Unit Information	Unit 1
Docket Number	50-285
Construction Permit	1968
Operating License	1973
Commercial Operation	1974
License Expiration	2013
Licensed Thermal Power [MW(t)]	1500
Design Electrical Rating [net MW(e)]	478
Type of Reactor	PWR
Nuclear Steam Supply System Vendor	CE

Cooling Water System

Type: once through
Source: Missouri River
Source Temperature Range: 0-27°C (32-80°F)
Condenser Flow Rate: 23 m^3/s (360,000 gal/min)
Design Condenser Temperature Rise: 9.94°C (17.9°F)
Intake Structure: concrete structure at river shore
Discharge Structure: at river shore

Site Information

Total Area: 270 ha (660 acres)
Exclusion Distance: 0.92-km (0.57-mile) minimum
Low Population Zone: 8.05 km (5.00 miles)
Nearest City: Omaha; 1980 population: 313,939
Site Topography: flat to rolling
Surrounding Area Topography: flat and rolling
Land Use within 8 km (5 miles): agricultural
Nearby Features: The nearest town is De Soto 3 km (2 miles) SSE. De Soto National Wildlife Refuge is about 1.6 km (1 mile) E. Wilson Island State Park is about 6 km (4 miles) SE.
Area of Transmission Line Corridor: 75.3 ha (186 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
770,000	800,000	830,000	890,000	950,000

ROBERT EMMETT GINNA NUCLEAR POWER PLANT

Location: Wayne County, New York
32 km (20 miles) NE of Rochester
latitude 43.2778°N; longitude 77.3089°W
Licensee: Rochester Gas and Electric Corp.

Unit Information	Unit 1
Docket Number	50-244
Construction Permit	1966
Operating License	1969
Commercial Operation	1970
License Expiration	2009
Licensed Thermal Power [MW(t)]	1520
Design Electrical Rating [net MW(e)]	470
Type of Reactor	PWR
Nuclear Steam Supply System Vendor	WEST

Cooling Water System

Type: once through
Source: Lake Ontario
Source Temperature Range: 0-27°C (32-80°F)
Condenser Flow Rate: 22.5 m^3/s (356,000 gal/min)
Design Condenser Temperature Rise: 10.9°C (19.6°F)
Intake Structure: Structure is located on lake bottom 940 m (3100 ft) from shore. Water flows to screenhouse via a 3-m (10-ft) diameter tunnel in bedrock.
Discharge Structure: open canal to Lake Ontario

Site Information

Total Area: 137 ha (338 acres)
Exclusion Distance: 0.47-1.38 km (0.29-0.85 mile)
Low Population Zone: 4.83 km (3.00 miles)
Nearest City: Rochester; 1980 population: 241,741
Site Topography: gently rolling to flat
Surrounding Area Topography: sloping
Land Use within 8 km (5 miles): agricultural, orchards
Nearby Features: The nearest town is Lakeside 3 km (2 miles) SW. The N.Y. Central Railroad is about 5 km (3 miles) S.
Area of Transmission Line Corridor: 110 ha (280 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
1,140,000	1,120,000	1,100,000	1,110,000	1,120,000

GRAND GULF NUCLEAR STATION

Location: Claiborne County, Mississippi
40 km (25 miles) S of Vicksburg
latitude 32.0075°N; longitude 91.0475°W
Licensee: System Energy Resources, Inc.

Unit Information	Unit 1
Docket Number	50-416
Construction Permit	1974
Operating License	1984
Commercial Operation	1985
License Expiration	2024
Licensed Thermal Power [MW(t)]	3833
Design Electrical Rating [net MW(e)]	1250
Type of Reactor	BWR
Nuclear Steam Supply System Vendor	GE

Cooling Water System

Type: natural draft cooling towers
Source: Mississippi River
Source Temperature Range: 1-28°C (33-82°F)
Condenser Flow Rate: 36.1 m^3/s (572,000 gal/min)
Design Condenser Temperature Rise: 17°C (30°F)
Intake Structure: a series of radial-collector wells along the shoreline
Discharge Structure: discharge to river via a barge slip

Site Information

Total Area: 850 ha (2100 acres)
Exclusion Distance: 0.69-km (0.43-mile) radius
Low Population Zone: 3.22 km (2.00 miles)
Nearest City: Jackson; 1980 population: 202,895
Site Topography: flat to rolling
Surrounding Area Topography: flat and rolling
Land Use within 8 km (5 miles): wooded and recreational
Nearby Features: The nearest town is Grand Gulf 3 km (2 miles) N. The Natchez Trace Parkway is about 10 km (6 miles) SE. The Grand Gulf Military Park is just N of the site. There are numerous hunting lodges near the site.
Area of Transmission Line Corridor: 930 ha (2300 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
350,000	380,000	410,000	450,000	500,000

HADDAM NECK PLANT (CONNECTICUT YANKEE)

Location: Middlesex County, Connecticut
21 km (13 miles) E of Meriden
latitude 41.4819°N; longitude 72.4992°W
Licensee: Connecticut Yankee Atomic Power Co.

Unit Information

Docket Number	50-213
Construction Permit	1964
Operating License	1967
Commercial Operation	1968
License Expiration	2007
Licensed Thermal Power [MW(t)]	1825
Design Electrical Rating [net MW(e)]	582
Type of Reactor	PWR
Nuclear Steam Supply System Vendor	WEST

Cooling Water System

Type: once through
Source: Connecticut River
Source Temperature Range: 1-29°C (34-85°F)
Condenser Flow Rate: 23.5 m^3/s (372,000 gal/min)
Design Condenser Temperature Rise: 12.4°C (22.4°F)
Intake Structure: at shoreline
Discharge Structure: discharge canal to Connecticut River about 1.6 km (1 mile) downriver

Site Information

Total Area: 212 ha (525 acres)
Exclusion Distance: 0.53 km (0.33 mile)
Low Population Zone: 4.35 km (2.70 miles)
Nearest City: Meriden; 1980 population: 57,118
Site Topography: level with steep slopes up from river
Surrounding Area Topography: mostly hilly
Land Use within 8 km (5 miles): wooded
Nearby Features: The nearest town is Haddam 1.6 km (1 mile) WSW. Haddam Meadows State Park is within 1.6 km (1 mile). The New York, New Haven, and Hartford Railroad runs along the opposite river bank. The Millstone Nuclear Power Station is 32 km (20 miles) SE.
Area of Transmission Line Corridor: 399 ha (985 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
3,630,000	3,770,000	3,910,000	4,140,000	4,380,000

SHEARON HARRIS NUCLEAR POWER PLANT

Location: Wake County, North Carolina
32 km (20 miles) SW Raleigh
latitude 35.6336°N; longitude 78.9564°W

Licensee: Carolina Power and Light Co.

Unit Information	Unit 1
Docket Number	50-400
Construction Permit	1978
Operating License	1987
Commercial Operation	1987
License Expiration	2027
Licensed Thermal Power [MW(t)]	2775
Design Electrical Rating [net MW(e)]	900
Type of Reactor	PWR
Nuclear Steam Supply System Vendor	WEST

Cooling Water System

Type: natural draft cooling tower
Source: Buckhorn Creek
Source Temperature Range: 5-27°C (41-81°F)
Condenser Flow Rate: 30.5 m^3/s (483,000 gal/min)
Design Condenser Temperature Rise: 14.3°C (25.7°F)
Intake Structure: at shoreline of reservoir on Buckhorn Creek
Discharge Structure: discharged to reservoir

Site Information

Total Area: 4348 ha (10,744 acres)
Exclusion Distance: 2.03-km (1.26-miles) minimum
Low Population Zone: 4.83 km (3.00 miles)
Nearest City: Raleigh; 1980 population: 149,771
Site Topography: rolling
Surrounding Area Topography: rolling
Land Use within 8 km (5 miles): mostly wooded with some agricultural Nearby Features: The nearest town is Bonsal 3 km (2 miles) NW. The Seaboard Coast Line Railroad is 3 km (2 miles) NW. Buckhorn Creek feeds into the Cape Fear River.
Area of Transmission Line Corridor: 1400 ha (3500 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
1,430,000	1,570,000	1,690,000	1,890,000	2,120,000

EDWIN I. HATCH NUCLEAR PLANT

Location: Appling County Georgia
18 km (11 miles) N of Baxley
latitude 31.9342°N; longitude 82.3444°W
Licensee: Georgia Power Co.

Unit Information	Unit 1	Unit 2
Docket Number	50-321	50-366
Construction Permit	1969	1972
Operating License	1974	1978
Commercial Operation	1975	1979
License Expiration	2014	2018
Licensed Thermal Power [MW(t)]	2436	2436
Design Electrical Rating [net MW(e)]	776	784
Type of Reactor	BWR	BWR
Nuclear Steam Supply System Vendor	GE	GE

Cooling Water System

Type: mechanical draft cooling towers
Source: Altamaha River
Source Temperature Range: 6-32°C (43-90°F)
Condenser Flow Rate: 35.1 m^3/s (556,000 gal/min) each unit
Design Condenser Temperature Rise: 11°C (20°F)
Intake Structure: at edge of river
Discharge Structure: 37 m (120 ft) from shore

Site Information

Total Area: 908 ha (2244 acres)
Exclusion Distance: 1.26 km (0.78 mile)
Low Population Zone: 1.26 km (0.78 mile)
Nearest City: Savannah; 1980 population: 141,654
Site Topography: flat to rolling
Surrounding Area Topography: flat to rolling
Land Use within 8 km (5 miles): mostly wooded
Nearby Features: The nearest town is Cedar Crossing about 11 km (7 miles) NNW. U.S. Highway 1 is just west of the site.
Area of Transmission Line Corridor: 1898 ha (4691 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
330,000	360,000	380,000	420,000	460,000

HOPE CREEK GENERATING STATION

Location: Salem County, New Jersey
13 km (8 miles) SW of Salem
latitude 39.4678°N; longitude 75.5381°W
Licensee: Public Service Electric and Gas Co.

Unit Information	Unit 1
Docket Number	50-354
Construction Permit	1974
Operating License	1986
Commercial Operation	1986
License Expiration	2026
Licensed Thermal Power [MW(t)]	3293
Design Electrical Rating [net MW(e)]	1067
Type of Reactor	BWR
Nuclear Steam Supply System Vendor	GE

Cooling Water System

Type: natural draft cooling tower
Source: Delaware River
Source Temperature Range: 1-27°C (34-81°F)
Condenser Flow Rate: 34.8 m^3/s (552,000 gal/min)
Design Condenser Temperature Rise: 16°C (28°F)
Intake Structure: at edge of river
Discharge Structure: pipe 3 m (10 ft) offshore

Site Information

Total Area: 300 ha (740 acres)
Exclusion Distance: 0.90-km (0.56-mile) radius
Low Population Zone: 8.05-km (5.00-mile) radius
Nearest City: Wilmington, Delaware; 1980 population: 70,195
Site Topography: flat
Surrounding Area Topography: flat
Land Use within 8 km (5 miles): tidal marshes and grasslands
Nearby Features: The nearest town is Port Penn about 6 km (4 miles) NW in Delaware. The nearest railroad is 13 km (8 miles) NE. The plant is on the same site as the Salem Nuclear Generating Station.
Area of Transmission Line Corridor: 369 ha (912 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
4,850,000	4,960,000	5,050,000	5,230,000	5,420,000

INDIAN POINT STATION

Location: Westchester County, New York
39 km (24 miles) N of New York City
latitude 41.2714°N; longitude 73.9525°W

Licensee: Consolidated Edison Co. of New York, Inc. (Unit 2)
Power Authority of the State of New York (Unit 3)

Unit Information	Unit 2	Unit 3
Docket Number	50-247	50-286
Construction Permit	1966	1969
Operating License	1973	1976
Commercial Operation	1974	1976
License Expiration	2013	2016
Licensed Thermal Power [MW(t)]	2758	3025
Design Electrical Rating [net MW(e)]	873	965
Type of Reactor	PWR	PWR
Nuclear Steam Supply System Vendor	WEST	WEST

Cooling Water System

Type: once through
Source: Hudson River
Source Temperature Range: 0-26°C (32-78°F)
Condenser Flow Rate: 53 m^3/s (840,000 gal/min) each unit
Design Condenser Temperature Rise: 9.2°C (16.6°F)
Intake Structure: concrete structure at river bank
Discharge Structure: discharge channel to river exiting through 12 ports

Site Information

Total Area: 96.7 ha (239 acres)
Exclusion Distance: 0.32-km (0.20-mile) radius
Low Population Zone: 1.05-km (0.65-mile) radius
Nearest City: White Plains; 1980 population: 46,999
Site Topography: hilly
Surrounding Area Topography: hilly to mountainous
Land Use within 8 km (5 miles): residential, parks, military reservations
Nearby Features: The nearest town is Buchannan 3 km (2 miles) ESE. Camp Smith (military) is 1.6 km (1 mile) N and West Point is 13 km (8 miles) N.
Area of Transmission Line Corridor: 4 ha (10 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
15,190,000	15,000,000	14,890,000	15,200,000	15,520,000

KEWAUNEE NUCLEAR POWER PLANT

Location: Kewaunee County, Wisconsin
43 km (27 miles) E of Green Bay
latitude 44.3431°N; longitude 87.5361°W

Licensee: Wisconsin Public Service Corp.

Unit Information

Docket Number	50-305
Construction Permit	1968
Operating License	1973
Commercial Operation	1974
License Expiration	2013
Licensed Thermal Power [MW(t)]	1650
Design Electrical Rating [net MW(e)]	535
Type of Reactor	PWR
Nuclear Steam Supply System Vendor	WEST

Cooling Water System

Type: once through
Source: Lake Michigan
Source Temperature Range: 1-19°C (34-67°F)
Condenser Flow Rate: 27 m^3/s (420,000 gal/min)
Design Condenser Temperature Rise: 11°C (19°F)
Intake Structure: intake crib 4.6 km (15 ft) deep 533 m (1750 ft) from shore
Discharge Structure: at shoreline

Site Information

Total Area: 367 ha (908 acres)
Exclusion Distance: 1.21 km (0.75 mile)
Low Population Zone: 4.83-km (3.00-mile) radius
Nearest City: Green Bay; 1980 population: 87,899
Site Topography: flat to rolling
Surrounding Area Topography: flat to rolling
Land Use within 8 km (5 miles): agricultural and dairy farming
Nearby Features: The nearest town is Two Creeks about 5 km (3 miles) S. Point Beach Nuclear Plant is about 8 km (5 miles) S.
Area of Transmission Line Corridor: 431.4 ha (1066 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
640,000	670,000	690,000	730,000	780,000

LA SALLE COUNTY STATION

Location: La Salle County, Illinois
18 km (11 miles) SE of Ottawa
latitude 41.2439°N; longitude 88.6708°W
Licensee: Commonwealth Edison Co.

Unit Information	Unit 1	Unit 2
Docket Number	50-373	50-374
Construction Permit	1973	1973
Operating License	1982	1984
Commercial Operation	1984	1984
License Expiration	2022	2024
Licensed Thermal Power [MW(t)]	3323	3323
Design Electrical Rating [net MW(e)]	1078	1078
Type of Reactor	BWR	BWR
Nuclear Steam Supply System Vendor	GE	GE

Cooling Water System

Type: cooling pond
Source: Illinois River
Source Temperature Range: 8-29°C (47-85°F)
Condenser Flow Rate: 40.7 m^3/s (645,000 gal/min) each unit
Design Condenser Temperature Rise: 13°C (24°F)
Intake Structure: intake from 832.8-ha (2058-acre) cooling pond, makeup from river
Discharge Structure: discharge to cooling pond

Site Information

Total Area: 1240 ha (3060 acres)
Exclusion Distance: 0.51 km (0.32 mile)
Low Population Zone: 6.41 km (3.98 miles)
Nearest City: Joliet; 1980 population: 77,956
Site Topography: flat
Surrounding Area Topography: flat with hills along river
Land Use within 8 km (5 miles): agricultural
Nearby Features: The nearest town is Seneca about 8 km (5 miles) NNE. Braidwood Station (nuclear plant) is about 32 km (20 miles) ENE and Dresden Nuclear Power Station is about 35 km (22 miles) NE.
Area of Transmission Line Corridor: 921.9 ha (2278 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
1,160,000	1,220,000	1,260,000	1,310,000	1,370,000

LIMERICK GENERATING STATION

Location: Montgomery County, Pennsylvania
34 km (21 miles) NW of Philadelphia
latitude 40.2200°N; longitude 75.5900°W

Licensee: Philadelphia Electric Co.

Unit Information	Unit 1	Unit 2
Docket Number	50-352	50-353
Construction Permit	1974	1974
Operating License	1985	1990
Commercial Operation	1986	1990
License Expiration	2025	2020
Licensed Thermal Power [MW(t)]	3293	3293
Design Electrical Rating [net MW(e)]	1055	1055
Type of Reactor	BWR	BWR
Nuclear Steam Supply System Vendor	GE	GE

Cooling Water System

Type: natural draft cooling towers
Source: Schuylkill River
Source Temperature Range: 6-28°C (42-82°F)
Condenser Flow Rate: 28 m^3/s (450,000 gal/min) each unit
Design Condenser Temperature Rise: 17°C (30°F)
Intake Structure: intake from river
Discharge Structure: discharge to river

Site Information

Total Area: 241 ha (595 acres)
Exclusion Distance: 0.76 km (0.47 mile)
Low Population Zone: 2.09-km (1.30-mile) radius
Nearest City: Reading; 1980 population: 78,686
Site Topography: rolling
Surrounding Area Topography: rolling
Land Use within 8 km (5 miles): agricultural and undeveloped
Nearby Features: The nearest town is Linfield about 1.6 km (1 mile) SE. Valley Forge State Park is 16 km (10 miles) SSE. U.S. Highway I-76 is about 16 km (10 miles) S.
Area of Transmission Line Corridor: 3 ha (7 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
6,970,000	7,070,000	7,170,000	7,390,000	7,620,000

MAINE YANKEE ATOMIC POWER PLANT

Location: Lincoln County, Maine
16 km (10 miles) NE of Bath
latitude 43.9506°N; longitude 69.6961°W
Licensee: Maine Yankee Atomic Power Co.

Unit Information

Docket Number	50-309
Construction Permit	1968
Operating License	1973
Commercial Operation	1972
License Expiration	2013
Licensed Thermal Power [MW(t)	2700
Design Electrical Rating [net MW(e)]	825
Type of Reactor	PWR
Nuclear Steam Supply System Vendor	CE

Cooling Water System

Type: once through
Source: Back River
Source Temperature Range: 3-14°C (37-57°F)
Condenser Flow Rate: 26.9 m^3/s (426,000 gal/min)
Design Condenser Temperature Rise: 14.2°C (25.6°F)
Intake Structure: at river bank
Discharge Structure: to Montsweag Bay on Back River

Site Information

Total Area: 300 ha (740 acres)
Exclusion Distance: 0.61-km (0.38-mile) radius
Low Population Zone: 9.66-km (6.00-mile) radius
Nearest City: Portland; 1980 population: 61,572
Site Topography: flat to rolling
Surrounding Area Topography: rolling
Land Use within 8 km (5 miles): wooded and some idle farm land
Nearby Features: The nearest town is Edgecomb about 5 km (3 miles) E. U.S. Highway 1 and the Maine Central Railroad are about 1.6 km (1 mile) NE.
Area of Transmission Line Corridor: 89 ha (220 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
640,000	700,000	750,000	830,000	920,000

WILLIAM B. MCGUIRE NUCLEAR STATION

Location: Mecklenburg County, North Carolina
27 km (17 miles) NNW of Charlotte
latitude 35.4322°N; longitude 80.9483°W
Licensee: Duke Power Co.

Unit Information	Unit 1	Unit 2
Docket Number	50-369	50-370
Construction Permit	1973	1973
Operating License	1981	1983
Commercial Operation	1981	1984
License Expiration	2021	2023
Licensed Thermal Power [MW(t)]	3411	3411
Design Electrical Rating [net MW(e)]	1180	1180
Type of Reactor	PWR	PWR
Nuclear Steam Supply System Vendor	WEST	WEST

Cooling Water System

Type: once through
Source: Lake Norman
Source Temperature Range: 3-32°C (38-89°F)
Condenser Flow Rate: 42.6 m^3/s (675,000 gal/min) each unit
Design Condenser Temperature Rise: 12.3°C (22.1°F)
Intake Structure: submerged and surface intakes at shoreline
Discharge Structure: 610-m (2000-ft) discharge canal

Site Information

Total Area: 12,100 ha (30,000 acres)
Exclusion Distance: 0.76-km (0.47-mile) radius
Low Population Zone: 8.85 km (5.50 miles)
Nearest City: Charlotte; 1980 population: 315,474
Site Topography: rolling
Surrounding Area Topography: hilly
Land Use within 8 km (5 miles): agricultural and wooded
Nearby Features: The nearest town is Lowesville about 5 km (3 miles) W. The dam forming Lake Norman and a hydro powerplant are adjacent to the site.
Area of Transmission Line Corridor: 25 ha (62 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
1,750,000	1,900,000	2,040,000	2,280,000	2,540,000

MILLSTONE NUCLEAR POWER STATION

Location: New London County, Connecticut
5 km (3 miles) WSW of New London
latitude 41.3086°N; longitude 72.1681°W
Licensee: Northeast Utilities

Unit Information	Unit 1	Unit 2	Unit 3
Docket Number	50-245	50-336	50-423
Construction Permit	1966	1970	1974
Operating License	1970	1975	1986
Commercial Operation	1971	1975	1986
License Expiration	2010	2015	2026
Licensed Thermal Power [MW(t)]	2011	2700	3411
Design Electrical Rating [net MW(e)]	660	870	1154
Type of Reactor	BWR	PWR	PWR
Nuclear Steam Supply System Vendor	GE	CE	WEST

Cooling Water System

Type: once through
Source: Long Island Sound
Source Temperature Range: 2-22°C (36-72°F)
Condenser Flow Rate: 27 m^3/s (420,000 gal/min) for Unit 1
32.97 m^3/s (522,500 gal/min) for Unit 2
57.2108 m^3/s (906,668 gal/min) for Unit 3
Design Condenser Temperature Rise: 12°C (21°F) for Unit 1
13°C (24°F) for Unit 2
9.7°C (17.5°F) for Unit 3
Intake Structure: on shore of Niantic Bay off Long Island Sound
Discharge Structure: discharge to Niantic Bay via holding pond

Site Information

Total Area: 200 ha (500 acres)
Exclusion Distance: 0.55-km (0.34-mile) minimum
Low Population Zone: 3.86-km (2.40-mile) radius
Nearest City: New Haven; 1980 population: 126,089
Site Topography: flat
Surrounding Area Topography: flat to rolling
Land Use within 8 km (5 miles): mostly undeveloped with some recreational, agricultural, and residential
Nearby Features: The nearest town is Niantic 3 km (2 miles) NW. U.S. Highway I-95 is about 6 km (4 miles) NNE. Stone Ranch Military Reservation is about 10 km (6 miles) NW. Harkness Memorial State Park, Bluff Point State Park, and Rocky Neck State Park are within 8 km (5 miles) of the site. The U.S. Dept. of Agriculture Plum Island facility is 16 km (10 miles) S

in Long Island Sound. The Haddam Neck Plant (nuclear) is 32 km (20 miles) NW.

Area of Transmission Line Corridor: 375 ha (927 acres)

Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
2,760,000	2,860,000	2,960,000	3,140,000	3,330,000

MONTICELLO NUCLEAR GENERATING PLANT

Location: Wright County, Minnesota
56 km (35 miles) NW of Minneapolis
latitude 45.3333°N; longitude 93.8483°W
Licensee: Northern States Power Co.

Unit Information

Docket Number	50-263
Construction Permit	1967
Operating License	1970
Commercial Operation	1971
License Expiration	2010
Licensed Thermal Power [MW(t)]	1670
Design Electrical Rating [net MW(e)]	545
Type of Reactor	BWR
Nuclear Steam Supply System Vendor	GE

Cooling Water System

Type: once through and helper towers
Source: Mississippi River
Source Temperature Range: 0-29°C (32-85°F)
Condenser Flow Rate: 18 m^3/s (280,000 gal/min)
Design Condenser Temperature Rise: 14.9°C (26.8°F)
Intake Structure: canal
Discharge Structure: canal

Site Information

Total Area: 860 ha (2150 acres)
Exclusion Distance: 0.48 km (0.30 mile)
Low Population Zone: 1.61 km (1.00 mile)
Nearest City: Minneapolis; 1980 population: 370,951
Site Topography: flat terraces
Surrounding Area Topography: flat to gently sloping
Land Use within 8 km (5 miles): agricultural and dairy farming
Nearby Features: The business district of Monticello is about 3.2 km (2 miles) SE. Sherburne National Wildlife Refuge is about 14 km (9 miles) N. Lake Maria State Park is about 10 km (6 miles) WSW and Sand Dunes State Forest and campground are 14 km (9 miles) NE.
Area of Transmission Line Corridor: 588.4 ha (1454 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
2,170,000	2,360,000	2,520,000	2,820,000	3,150,000

NORTH ANNA POWER STATION

Location: Louisa County, Virginia
64 km (40 miles) NW of Richmond
latitude 38.0608°N; longitude 77.7906°W
Licensee: Virginia Electric and Power Co.

Unit Information	Unit 1	Unit 2
Docket Number	50-338	50-339
Construction Permit	1971	1971
Operating License	1978	1980
Commercial Operation	1978	1980
License Expiration	2018	2020
Licensed Thermal Power [MW(t)]	2893	2893
Design Electrical Rating [net MW(e)]	907	907
Type of Reactor	PWR	PWR
Nuclear Steam Supply System Vendor	WEST	WEST

Cooling Water System

Type: once through
Source: Lake Anna
Source Temperature Range: 9-28°C (48-83°F)
Condenser Flow Rate: 59.33 m^3/s (940,300 gal/min) each unit
Design Condenser Temperature Rise: 8°C (14°F)
Intake Structure: intake on lake shore
Discharge Structure: discharged to lake via a 1400-ha (3400-acre) cooling pond.

Site Information

Total Area: 7545 ha (18,643 acres)
Exclusion Distance: 1.35 km (0.84 mile)
Low Population Zone: 9.66 km (6.00 miles)
Nearest City: Richmond; 1980 population: 219,214
Site Topography: rolling
Surrounding Area Topography: rolling
Land Use within 8 km (5 miles): agricultural and wooded
Nearby Features: The nearest town is Centreville 1.6 km (1 mile) SW. Fredericksburg and Spotsylvania National Military Park is about 24 km (15 miles) NE.
Area of Transmission Line Corridor: 1428 ha (3528 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
1,150,000	1,250,000	1,340,000	1,480,000	1,630,000

NINE MILE POINT NUCLEAR STATION

Location: Oswego County, New York
10 km (6 miles) NE of Oswego
latitude 43.5222°N; longitude 76.4100°W
Licensee: Niagra Mohawk Power Corp.

Unit Information	Unit 1	Unit 2
Docket Number	50-220	50-410
Construction Permit	1965	1974
Operating License	1968	1987
Commercial Operation	1969	1988
License Expiration	2008	2027
Licensed Thermal Power [MW(t)]	1850	3323
Design Electrical Rating [net MW(e)]	620	1080
Type of Reactor	BWR	BWR
Nuclear Steam Supply System Vendor	GE	GE

Cooling Water System

Type: Unit 1 - once through
Unit 2 - natural draft cooling tower
Source: Lake Ontario
Source Temperature Range: 1-25°C (33-77°F)
Condenser Flow Rate: 16 m^3/s (250,000 gal/min) for Unit 1
37 m^3/s (580,000 gal/min) for Unit 2
Design Condenser Temperature Rise: 18°C (32°F) for Unit 1
15°C (27°F) for Unit 2
Intake Structure: separate submerged pipelines about 300 m (1000 ft) offshore
Discharge Structure: diffuser pipe 169 m (555 ft) long serving both units

Site Information

Total Area: 360 ha (900 acres)
Exclusion Distance: 1.19 km (0.74 mile) minimum
Low Population Zone: 6.44 km (4.00 mile) radius
Nearest City: Syracuse; 1980 population: 170,105
Site Topography: flat to rolling
Surrounding Area Topography: rolling
Land Use within 8 km (5 miles): agricultural, industrial, residential, and recreational
Nearby Features: The nearest town is Lakeview about 1.6 km (1 mile) WSW. Fort Ontario is about 10 km (6 miles) SW. James A. FitzPatrick Nuclear Power Plant is 0.8 km (0.5 mile) E.
Area of Transmission Line Corridor: 664 ha (1640 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
820,000	810,000	790,000	800,000	810,000

OCONEE NUCLEAR STATION

Location: Oconee County, South Carolina
42 km (26 miles) W of Greenville
latitude 34.7917°N; longitude 82.8986°W

Licensee: Duke Power Co.

Unit Information	Unit 1	Unit 2	Unit 3
Docket Number	50-269	50-270	50-287
Construction Permit	1967	1967	1967
Operating License	1973	1973	1974
Commercial Operation	1973	1974	1974
License Expiration	2013	2013	2014
Licensed Thermal Power [MW(t)]	2568	2568	2568
Design Electrical Rating [net MW(e)]	887	887	887
Type of Reactor	PWR	PWR	PWR
Nuclear Steam Supply System Vendor	B&W	B&W	B&W

Cooling Water System

Type: once through
Source: Lake Keowee
Source Temperature Range: 7-25°C (44-77°F)
Condenser Flow Rate: 43 m^3/s (680,000 gal/min) for each unit
Design Condenser Temperature Rise: 9.6°C (17.2°F)
Intake Structure: A skimmer wall draws water from depths of 216-223 m (710-733 ft) at a velocity of 0.2 m/s (0.6 ft/s).
Discharge Structure: All three units discharge through one structure near Keowee dam. Discharge is underwater at a depth of 233 m (765 ft).

Site Information

Total Area: 210 ha (510 acres)
Exclusion Distance: 1.61-km (1.00-mile) radius
Low Population Zone: 9.66 km (6.00 miles)
Nearest City: Greenville; 1980 population: 58,242
Site Topography: flat to rolling
Surrounding Area Topography: hilly
Land Use within 8 km (5 miles): wooded
Nearby Features: The nearest town is Six Mile 6 km (4 miles) ENE. Keowee dam is close to the plant. Chattahoochee National Forest is about 24 km (15 miles) W.
Area of Transmission Line Corridor: 3160 ha (7800 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
990,000	1,080,000	1,170,000	1,310,000	1,470,000

OYSTER CREEK NUCLEAR GENERATING STATION

Location: Ocean County, New Jersey
14 km (9 miles) S of Toms River
latitude 39.8142°N; longitude 74.2064°W
Licensee: GPU Nuclear Corp.

Unit Information	Unit 1
Docket Number	50-219
Construction Permit	1964
Operating License	1969
Commercial Operation	1969
License Expiration	2009
Licensed Thermal Power [MW(t)]	1930
Design Electrical Rating [net MW(e)]	650
Type of Reactor	BWR
Nuclear Steam Supply System Vendor	GE

Cooling Water System

Type: once through
Source: Barnegat Bay
Source Temperature Range: 2-28°C (35-83°F)
Condenser Flow Rate: 29 m^3/s (460,000 gal/min)
Design Condenser Temperature Rise: 8°C (14°F)
Intake Structure: Forked River serves as a canal for intake and discharge to Barnegat Bay.
Discharge Structure: Forked River serves as a canal for intake and discharge to Barnegat Bay.

Site Information

Total Area: 573 ha (1416 acres)
Exclusion Distance: 0.40 km (0.25 mile)
Low Population Zone: 3.22 km (2.00 miles)
Nearest City: Atlantic City; 1980 population: 40,199
Site Topography: flat
Surrounding Area Topography: rolling plains to flat lowlands
Land Use within 8 km (5 miles): mostly undeveloped
Nearby Features: The nearest town is Forked River about 3 km (2 miles) N. The Garden State Parkway is 1.6 km (1 mile) W. There is a large influx of people seeking recreation in the summer.
Area of Transmission Line Corridor: 130 ha (322 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
4,030,000	4,190,000	4,300,000	4,560,000	4,840,000

PALISADES NUCLEAR PLANT

Location: Van Buren County, Michigan
56 km (35 miles) W of Kalamazoo
latitude 42.3222°N; longitude 86.3153°W
Licensee: Consumers Power Co.

Unit Information	Unit 1
Docket Number	50-255
Construction Permit	1967
Operating License	1972
Commercial Operation	1973
License Expiration	2012
Licensed Thermal Power [MW(t)]	2530
Design Electrical Rating [net MW(e)]	805
Type of Reactor	PWR
Nuclear Steam Supply System Vendor	CE

Cooling Water System

Type: mechanical draft cooling towers
Source: Lake Michigan
Source Temperature Range: 2-24°C (35-75°F)
Condenser Flow Rate: 25.6 m^3/s (405,000 gal/min)
Design Condenser Temperature Rise: 14°C (25°F)
Intake Structure: intake crib 1000 m (3300 ft) from shore
Discharge Structure: canal 33 m (108 ft) long

Site Information

Total Area: 197 ha (487 acres)
Exclusion Distance: 0.71-km (0.44-mile) radius
Low Population Zone:
Nearest City: Kalamazoo; 1980 population: 79,722
Site Topography: flat to rolling
Surrounding Area Topography: rolling
Land Use within 8 km (5 miles): agricultural, wooded, berry farms, and orchards
Nearby Features: The nearest town is South Haven about 6 km (4 miles) N. Van Buren State Park joins the plant on the north. Many tourists come to the beaches in the summer. The C&O Railway is about 3 km (2 miles) E. Highway I-196 is about 1.6 km (1 mile) E.
Area of Transmission Line Corridor: 910 ha (2250 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
1,170,000	1,220,000	1,260,000	1,340,000	1,420,000

PALO VERDE NUCLEAR GENERATING STATION

Location: Maricopa County, Arizona
55 km (34 miles) W of Phoenix
latitude 33.3881°N; longitude 112.8644°W
Licensee: Arizona Public Service Co.

Unit Information	Unit 1	Unit 2	Unit 3
Docket Number	50-528	50-529	50-530
Construction Permit	1976	1976	1976
Operating License	1985	1986	1987
Commercial Operation	1986	1986	1988
License Expiration	2025	2026	2027
Licensed Thermal Power [MW(t)]	3800	3800	3800
Design Electrical Rating [net MW(e)]	1270	1270	1270
Type of Reactor	PWR	PWR	PWR
Nuclear Steam Supply System Vendor	CE	CE	CE

Cooling Water System

Type: mechanical draft cooling towers treatment plant
Source: Phoenix city sewage
Source Temperature Range:
Condenser Flow Rate: 35 m^3/s (560,000 gal/min) each unit
Design Condenser Temperature Rise: 17.8°C (32.1°F)
Intake Structure: 56-km (35-mile) underground pipeline from Phoenix 91st Avenue Sewage Treatment Plant
Discharge Structure: blowdown from the circulating water system is directed to on-site evaporation ponds without requiring any off-site discharge

Site Information

Total Area: 1640 ha (4050 acres)
Exclusion Distance: 0.87-km (0.54-mile) minimum
Low Population Zone: 6.44-km (4.00-mile) radius
Nearest City: Phoenix; 1980 population: 789,704
Site Topography: flat with hills
Surrounding Area Topography: flat with hills
Land Use within 8 km (5 miles): open desert with some agriculture
Nearby Features: The nearest town is Wintersburg about 5 km (3 miles) N. U.S. Highway I-10 is about 11 km (7 miles) N. The Southern Pacific Railroad is about 8 km (5 miles) SE.
Area of Transmission Line Corridor: 6720 ha (16,600 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
1,180,000	1,330,000	1,450,000	1,690,000	1,970,000

PEACH BOTTOM ATOMIC POWER STATION

Location: York County, Pennsylvania
29 km (18 miles) S of Lancaster
latitude 39.7589°N; longitude 76.2692°W
Licensee: Philadelphia Electric Co.

Unit Information	Unit 2	Unit 3
Docket Number	50-277	50-278
Construction Permit	1968	1968
Operating License	1973	1974
Commercial Operation	1974	1974
License Expiration	2013	2014
Licensed Thermal Power [MW(t)]	3293	3293
Design Electrical Rating [net MW(e)]	1065	1065
Type of Reactor	BWR	BWR
Nuclear Steam Supply System Vendor	GE	GE

Cooling Water System

Type: once through with helper towers
Source: Conowingo Pond
Source Temperature Range: 1-27°C (34-80°F)
Condenser Flow Rate: 47 m^3/s (750,000 gal/min) each unit
Design Condenser Temperature Rise: 11.6°C (20.8°F)
Intake Structure: intake from Conowingo Pond through a small intake pond
Discharge Structure: 1520-m (5000-ft) canal to Conowingo Pond

Site Information

Total Area: 250 ha (620 acres)
Exclusion Distance: 0.82-km (0.51-mile) minimum
Low Population Zone: 2.22 km (1.38 miles)
Nearest City: Lancaster; 1980 population: 54,725
Site Topography: rolling to hilly
Surrounding Area Topography: rolling to hilly
Land Use within 8 km (5 miles): agricultural and wooded
Nearby Features: The nearest town is Slate Hill 3 km (2 miles) SW. Susquehanna State Park is about 5 km (3 miles) N. U.S. Highway I-95 is about 24 km (15 miles) SE. Conowingo Dam, about 13 km (8 miles) SE on the Susquehanna River, forms Conowingo Pond. Unit 1 is a 40 Mwe nuclear plant on the same site and was retired from service in 1974. Three Mile Island Nuclear Station is 56 km (35 miles) upstream on the Susquehanna River.
Area of Transmission Line Corridor: 417 ha (1030 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
4,660,000	4,850,000	5,010,000	5,280,000	5,570,000

PERRY NUCLEAR POWER PLANT

Location: Lake County, Ohio
11 km (7 miles) NE of Painesville
latitude 41.8008°N; longitude 81.1442°W
Licensee: Cleveland Electric Illuminating Co.

Unit Information	Unit 1
Docket Number	50-440
Construction Permit	1977
Operating License	1986
Commercial Operation	1987
License Expiration	2026
Licensed Thermal Power [MW(t)]	3579
Design Electrical Rating [net MW(e)]	1205
Type of Reactor	BWR
Nuclear Steam Supply System Vendor	GE

Cooling Water System

Type: natural draft cooling tower
Source: Lake Erie
Source Temperature Range: 0-26°C (32-79°F)
Condenser Flow Rate: 34.41 m^3/s (545,400 gal/min)
Design Condenser Temperature Rise: 18°C (32°F)
Intake Structure: submerged multiport structure 777 m (2550 ft) offshore
Discharge Structure: submerged diffuser 503 m (1650 ft) offshore

Site Information

Total Area: 450 ha (1100 acres)
Exclusion Distance: 0.89-km (0.55-mile) radius
Low Population Zone: 4.02 km (2.50 miles)
Nearest City: Euclid; 1980 population: 59,999
Site Topography: flat
Surrounding Area Topography: rolling
Land Use within 8 km (5 miles): forest land, agricultural (horticulture), residential, industrial, and some recreational
Nearby Features: The nearest town is North Perry 1.6 km (1 mile) SW. The Penn Central Railroad is about 5 km (3 miles) S. U.S. Highway I-90 is about 8 km (5 miles) S.
Area of Transmission Line Corridor: 610 ha (1500 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
2,480,000	2,530,000	2,570,000	2,670,000	2,770,000

PILGRIM NUCLEAR POWER STATION

Location: Plymouth County, Massachusetts
6 km (4 miles) SE of Plymouth
latitude 41.9444°N; longitude 70.5794°W
Licensee: Boston Edison Co.

Unit Information	Unit 1
Docket Number	50-293
Construction Permit	1968
Operating License	1972
Commercial Operation	1972
License Expiration	2012
Licensed Thermal Power [MW(t)]	1998
Design Electrical Rating [net MW(e)]	655
Type of Reactor	BWR
Nuclear Steam Supply System Vendor	GE

Cooling Water System

Type: once through
Source: Cape Cod Bay
Source Temperature Range: 0-28°C (32-83°F)
Condenser Flow Rate: 19.6 m^3/s (311,000 gal/min)
Design Condenser Temperature Rise: 16°C (29°F)
Intake Structure: concrete structure at edge of bay protected by a breakwater
Discharge Structure: canal about 260 m (850 ft) long

Site Information

Total Area: 209 ha (517 acres)
Exclusion Distance: 0.53 km (0.33 mile)
Low Population Zone: 6.76 km (4.20 miles)
Nearest City: Brockton; 1980 population: 95,172
Site Topography: flat to rolling
Surrounding Area Topography: rolling to hilly
Land Use within 8 km (5 miles): mostly undeveloped
Nearby Features: The nearest town is Plymouth about 6 km (4 miles) NW. Miles Standish State Forest is about 10 km (6 miles) SW. Plymouth Rock and Plimoth Plantation historical sites are about 8 km (5 miles) W.
Area of Transmission Line Corridor: 70 ha (174 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
4,440,000	4,590,000	4,690,000	4,880,000	5,080,000

POINT BEACH NUCLEAR PLANT

Location: Manitowoc County, Wisconsin
21 km (13 miles) NNW of Manitowoc
latitude 44.2808°N; longitude 87.5361°W
Licensee: Wisconsin Electric Power Co.

Unit Information	Unit 1	Unit 2
Docket Number	50-266	50-301
Construction Permit	1967	1968
Operating License	1970	1972
Commercial Operation	1970	1972
License Expiration	2010	2012
Licensed Thermal Power [MW(t)]	1519	1519
Design Electrical Rating [net MW(e)]	497	497
Type of Reactor	PWR	PWR
Nuclear Steam Supply System Vendor	WEST	WEST

Cooling Water System

Type: once through
Source: Lake Michigan
Source Temperature Range:
Condenser Flow Rate: 22 m^3/s (350,000 gal/min) each unit
Design Condenser Temperature Rise: 10.7°C (19.3°F)
Intake Structure: Structure is 533 m (1750 ft) from shore in 7-m (22-ft) deep water. Top elevation is 2.4 m (8 ft) above normal lake level. Intake to plant is through 38 pipes located 1.5 m (5 ft) above lake bed.
Discharge Structure: 2 flumes projecting about 46 m (150 ft) from shore

Site Information

Total Area: 836 ha (2065 acres)
Exclusion Distance: 1.19-km (0.74-mile) radius
Low Population Zone: 9.01 km (5.60 miles)
Nearest City: Green Bay; 1980 population: 87,899
Site Topography: flat to rolling
Surrounding Area Topography: rolling
Land Use within 8 km (5 miles): agricultural, dairy farming, vegetable canning
Nearby Features: The nearest town is Two Creeks 1.6 km (1 mile) NNW. Point Beach State Forest is just S of site. The Kewaunee Nuclear Power Plant is about 8 km (5 miles) N.
Area of Transmission Line Corridor: 1344 ha (3321 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
610,000	640,000	660,000	700,000	740,000

PRAIRIE ISLAND NUCLEAR GENERATING PLANT

Location: Goodhue County, Minnesota
45 km (28 miles) SE of Minneapolis
latitude 44.6219°N; longitude 92.6331°W
Licensee: Northern States Power Co.

Unit Information	Unit 1	Unit 2
Docket Number	50-282	50-306
Construction Permit	1968	1968
Operating License	1973	1974
Commercial Operation	1973	1974
License Expiration	2013	2014
Licensed Thermal Power [MW(t)]	1650	1650
Design Electrical Rating [net MW(e)]	530	530
Type of Reactor	PWR	PWR
Nuclear Steam Supply System Vendor	WEST	WEST

Cooling Water System

Type: mechanical draft and/or once cooling towers
Source: Mississippi River
Source Temperature Range: 0-28°C (32-82°F)
Condenser Flow Rate: 18.6 m^3/s (294,000 gal/min) each unit
Design Condenser Temperature Rise: 15°C (27°F)
Intake Structure: short canal
Discharge Structure: Discharges to a basin then to towers and/or river.

Site Information

Total Area: 230 ha (560 acres)
Exclusion Distance: 0.69-km (0.43-mile) radius
Low Population Zone: 2.41 km (1.50 miles)
Nearest City: Minneapolis; 1980 population: 370,951
Site Topography: flat to rolling
Surrounding Area Topography: rolling
Land Use within 8 km (5 miles): dairy farming and agricultural
Nearby Features: The business district of the town of Red Wing is 9.6 km (6 miles) SE. A railroad line is just SW of the site.
Area of Transmission Line Corridor: 394 ha (973 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
2,290,000	2,490,000	2,650,000	2,960,000	3,310,000

QUAD-CITIES STATION

Location: Rock Island County, Illinois
32 km (20 miles) NE of Moline
latitude 41.7261°N; longitude 90.3100°W
Licensee: Commonwealth Edison Co.

Unit Information	Unit 1	Unit 2
Docket Number	50-254	50-265
Construction Permit	1967	1967
Operating License	1972	1972
Commercial Operation	1973	1973
License Expiration	2012	2012
Licensed Thermal Power [MW(t)]	2511	2511
Design Electrical Rating [net MW(e)]	789	789
Type of Reactor	BWR	BWR
Nuclear Steam Supply System Vendor	GE	GE

Cooling Water System

Type: once through
Source: Mississippi River
Source Temperature Range: 0-29°C (32-85°F)
Condenser Flow Rate: 29.7 m^3/s (471,000 gal/min) each unit
Design Condenser Temperature Rise: 13°C (24°F)
Intake Structure: crib house at edge of river
Discharge Structure: 4300-m (14,000-ft) spray canal

Site Information

Total Area: 317 ha (784 acres)
Exclusion Distance: 0.80 km (0.50 mile)
Low Population Zone: 4.83 km (3.00 miles)
Nearest City: Davenport, Iowa; 1980 population: 103,264
Site Topography: flat
Surrounding Area Topography: flat
Land Use within 8 km (5 miles): agricultural and small industrial park
Nearby Features: The nearest town is Folletts 5 km (3 miles) NW. The Rock Island Railroad is 3 km (2 miles) W and the Chicago, Milwaukee, and St. Paul Railroad is 1.6 km (1 mile) E. The Rock Island Arsenal is about 24 km (15 miles) SW.
Area of Transmission Line Corridor: 570 ha (1400 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
740,000	760,000	780,000	810,000	850,000

RANCHO SECO NUCLEAR GENERATING STATION

Location: Sacramento County, California
40 km (25 miles) SE of Sacramento
latitude 38.3444°N; longitude 121.1200°W
Licensee: Sacramento Municipal Utility District

Unit Information	Unit 1
Docket Number	50-312
Construction Permit	1968
Operating License	1974
Commercial Operation	1975
License Expiration	2014
Licensed Thermal Power [MW(t)]	2772
Design Electrical Rating [net MW(e)]	918
Type of Reactor	PWR
Nuclear Steam Supply System Vendor	B&W

Cooling Water System

Type: natural draft cooling
Source: Folsom Canal towers
Source Temperature Range: 10-21°C (50-70°F)
Condenser Flow Rate: 28.1 m^3/s (446,000 gal/min)
Design Condenser Temperature Rise: 16°C (28°F)
Intake Structure: 5.6-km (3.5-mile) pipeline from Folsom Canal
Discharge Structure: 2.4-km (1.5-mile) pipeline to reservoir

Site Information

Total Area: 1000 ha (2480 acres)
Exclusion Distance: 0.64-km (0.40-mile) radius
Low Population Zone: 8.05 km (5.00 miles)
Nearest City: Sacramento; 1980 population: 275,741
Site Topography: flat to rolling
Surrounding Area Topography: rolling
Land Use within 8 km (5 miles): agricultural and grazing land
Nearby Features: The nearest town is Clay 3 km (2 miles) WSW. The Southern Pacific Railroad is about 1.6 km (1 mile) N.
Area of Transmission Line Corridor: 350 ha (870 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
2,010,000	2,200,000	2,360,000	2,590,000	2,850,000

Note: This plant was shut down as the result of a public referendum in June 1989.

RIVER BEND STATION

Location:	West Feliciana County, Louisiana 39 km (24 miles) NNW of Baton Rouge latitude 30.7569°N; longitude 91.3314°W
Licensee:	Gulf States Utility Co.

Unit Information	Unit 1
Docket Number	50-458
Construction Permit	1977
Operating License	1985
Commercial Operation	1986
License Expiration	2025
Licensed Thermal Power [MW(t)]	2894
Design Electrical Rating [net MW(e)]	936
Type of Reactor	BWR
Nuclear Steam Supply System Vendor	GE

Cooling Water System

Type: mechanical draft cooling towers
Source: Mississippi River
Source Temperature Range:
Condenser Flow Rate: 32.084 m^3/s (508,470 gal/min)
Design Condenser Temperature Rise: 15°C (27°F)
Intake Structure: at river bank
Discharge Structure: pipe extending into the river

Site Information

Total Area: 1352 ha (3342 acres)
Exclusion Distance: 0.92-km (0.57-mile) radius
Low Population Zone: 4.02-km (2.50-mile) radius
Nearest City: Baton Rouge; 1980 population: 220,394
Site Topography: flat
Surrounding Area Topography: flat to rolling
Land Use within 8 km (5 miles): agricultural and forest
Nearby Features: The nearest town is St. Francisville 5 km (3 miles) NW. Audubon Memorial State Park is about 5 km (3 miles) NNE. The Illinois Central Railroad crosses the site.
Area of Transmission Line Corridor: 410 ha (1014 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
800,000	860,000	920,000	1,010,000	1,110,000

H. B. ROBINSON PLANT

Location: Darlington County, South Carolina
42 km (26 miles) NE of Florence
latitude 34.4025°N; longitude 80.1586°W
Licensee: Carolina Power and Light Co.

Unit Information	Unit 2
Docket Number	50-261
Construction Permit	1967
Operating License	1970
Commercial Operation	1971
License Expiration	2010
Licensed Thermal Power [MW(t)]	2300
Design Electrical Rating [net MW(e)]	700
Type of Reactor	PWR
Nuclear Steam Supply System Vendor	WEST

Cooling Water System

Type: once through
Source: Lake Robinson
Source Temperature Range: 8-29°C (46-85°F)
Condenser Flow Rate: 30.42 m^3/s (482,100 gal/min)
Design Condenser Temperature Rise: 10°C (18°F)
Intake Structure: concrete structure on edge of lake
Discharge Structure: 6.8-km (4.2-mile) canal discharging about 6 km (4 miles) upstream from intake

Site Information

Total Area: 2000 ha (5000 acres)
Exclusion Distance: 0.43-km (0.27-mile) radius
Low Population Zone: 7.24 km (4.50 miles)
Nearest City: Columbia; 1980 population: 101,229
Site Topography: rolling
Surrounding Area Topography: rolling
Land Use within 8 km (5 miles): agricultural and wooded, some recreational
Nearby Features: The nearest town is Hartsville 8 km (5 miles) SE. Unit 1 is an adjacent 185 MW(e) capacity coal-fired plant. Sand Hills State Forest is about 6 km (4 miles) N. The Carolina Sandhills National Wildlife Refuge is about 8 km (5 miles) NNW.
Area of Transmission Line Corridor: 414 ha (1024 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
740,000	810,000	880,000	990,000	1,120,000

SALEM NUCLEAR GENERATING STATION

Location: Salem County, New Jersey
13 km (8 miles) SW of Salem
latitude 39.4628°N; longitude 75.5358°W
Licensee: Public Service Electric and Gas Co.

Unit Information	Unit 1	Unit 2
Docket Number	50-272	50-311
Construction Permit	1968	1968
Operating License	1976	1981
Commercial Operation	1977	1981
License Expiration	2016	2021
Licensed Thermal Power [MW(t)]	3411	3411
Design Electrical Rating [net MW(e)]	1115	1115
Type of Reactor	PWR	PWR
Nuclear Steam Supply System Vendor	WEST	WEST

Cooling Water System

Type: once through
Source: Delaware River
Source Temperature Range: 1-26°C (33-79°F)
Condenser Flow Rate: 69 m^3/s (1,100,000 gal/min) each unit
Design Condenser Temperature Rise: 7.6°C (13.6°F)
Intake Structure: 12 bay structure on edge of river
Discharge Structure: submerged pipes extending 150 m (500 ft) into the river

Site Information

Total Area: 280 ha (700 acres)
Exclusion Distance: 1.29 km (0.80 mile)
Low Population Zone: 8.05 km (5.00 miles)
Nearest City: Wilmington, Delaware; 1980 population: 70,195
Site Topography: flat
Surrounding Area Topography: flat
Land Use within 8 km (5 miles): tidal marshes and grasslands
Nearby Features: The nearest town is Port Penn about 6 km (4 miles) NW in Delaware. The nearest railroad is 13 km (8 miles) NE. The plant is on the same site as the Hope Creek Generating Station (nuclear).
Area of Transmission Line Corridor: 1600 ha (3900 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
4,810,000	4,910,000	5,000,000	5,180,000	5,370,000

SAN ONOFRE NUCLEAR GENERATING STATION

Location: San Diego County, California
8 km (5 miles) SE of San Clemente
latitude 33.3703°N; longitude 117.5569°W
Licensee: Southern California Edison Co.

Unit Information	Unit 1	Unit 2	Unit 3
Docket Number	50-206	50-361	50-362
Construction Permit	1964	1973	1973
Operating License	1967	1982	1983
Commercial Operation	1968	1983	1984
License Expiration	2007	2022	2023
Licensed Thermal Power [MW(t)]	1347	3390	3390
Design Electrical Rating [net MW(e)]	436	1070	1080
Type of Reactor	PWR	PWR	PWR
Nuclear Steam Supply System Vendor	WEST	CE	CE

Cooling Water System

Type: once through
Source: Pacific Ocean
Source Temperature Range: 12-23°C (54-73°F)
Condenser Flow Rate: 21.51 m^3/s (340,900 gal/min) for Unit 1
50.3 m^3/s (797,000 gal/min) each for Units 2 & 3
Design Condenser Temperature Rise: 11°C (19°F) for Unit 1
11°C (20°F) For Units 2 & 3
Intake Structure: Unit 1—intake 980 m (3200 ft) from shore; Units 2 & 3—velocity-cap structure about 1040 m (3400 ft) from shore in water 9 m (30 ft) deep
Discharge Structure: Unit 1-discharged 790 m (2600 ft) from shore in water 7.3 m (24 ft) deep; Units 2 & 3-diffuser port systems extending 1160 m to 2590 m (3800 to 8500 ft) from shore

Site Information

Total Area: 34 ha (84 acres)
Exclusion Distance: 0.60 (0.37 mile)
Low Population Zone: 3.14 km (1.95 miles)
Nearest City: Oceanside; 1980 population: 76,698
Site Topography: narrow sloping coastal plain and sea cliffs
Surrounding Area Topography: hilly
Land Use within 8 km (5 miles): military reservation
Nearby Features: The nearest town is San Clemente 8 km (5 miles) NW. The site is surrounded by Camp Pendleton Marine Base. Camps on the base are 2.4 km (1.5 miles) or more from the site. U.S. Highway I-5 and the Atchison, Topeka, and Santa Fe Railroad are adjacent to the site to the east.

Area of Transmission Line Corridor: 450 ha (1100 acres)

Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
5,430,000	5,950,000	6,400,000	7,050,000	7,760,000

SEABROOK STATION

Location: Rockingham County, New Hampshire
21 km (13 miles) SSW of Portsmouth
latitude 42.8983°N; longitude 70.8497°W
Licensee: Public Service Company of New Hampshire

Unit Information	Unit 1
Docket Number	50-443
Construction Permit	1976
Operating License	1990
Commercial Operation	--
License Expiration	2032
Design Thermal Power [MW(t)]	3411
Design Electrical Rating [net MW(e)]	1198
Type of Reactor	PWR
Nuclear Steam Supply System Vendor	WEST

Cooling Water System

Type: once through
Source: Atlantic Ocean
Source Temperature Range: 3-13°C (37-55°F)
Condenser Flow Rate: 25.2 m^3/s (399,000 gal/min)
Design Condenser Temperature Rise: 21°C (38°F)
Intake Structure: 3 structures 15 m (50 ft) below sea level with pipeline submerged about 50 m (175 ft) below mean sea level and extending about 2100 m (7000 ft) offshore
Discharge Structure: submerged pipeline ending in a diffuser located about 1675 m (5500 ft) offshore and about 1525 m (5000 ft) S of intake

Site Information

Total Area: 363 ha (896 acres)
Exclusion Distance: 0.92-km (0.57-mile) minimum
Low Population Zone: 2.01 km (1.25 miles)
Nearest City: Lawrence, Massachusetts; 1980 population: 63,175
Site Topography: flat
Surrounding Area Topography: flat to rolling
Land Use within 8 km (5 miles): undeveloped salt-water marshes with some industrial, residential, and recreational
Nearby Features: The nearest town is Seabrook 1.6 km (1 mile) W. U.S. Highway I-95 is about 1.6 km (1 mile) W. The Boston and Maine Railroad is adjacent to the site. Hampton Beach State Park is 3 km (2 miles) E.
Area of Transmission Line Corridor: 625 ha (1545 acres)

Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
3,760,000	3,900,000	4,010,000	4,220,000	4,450,000

SEQUOYAH NUCLEAR PLANT

Location: Hamilton County, Tennessee
16 km (10 miles) NE of Chattanooga
latitude 35.2233°N; longitude 85.0878°W

Licensee: Tennessee Valley Authority

Unit Information	Unit 1	Unit 2
Docket Number	50-327	50-328
Construction Permit	1970	1970
Operating License	1980	1981
Commercial Operation	1981	1982
License Expiration	2020	2021
Licensed Thermal Power [MW(t)]	3411	3411
Design Electrical Rating [net MW(e)]	1148	1148
Type of Reactor	PWR	PWR
Nuclear Steam Supply System Vendor	WEST	WEST

Cooling Water System

Type: once through and/or natural draft cooling towers
Source: Chickamauga Lake
Source Temperature Range: 6-28°C (42-83°F)
Condenser Flow Rate: 32.9 m^3/s (522,000 gal/min) each unit
Design Condenser Temperature Rise: 17°C (30°F)
Intake Structure: intake from lake
Discharge Structure: discharge to lake

Site Information

Total Area: 212 ha (525 acres)
Exclusion Distance: 0.56 km (0.35 mile)
Low Population Zone: 4.83 km (3.00 miles)
Nearest City: Chattanooga; 1980 population: 169,514
Site Topography: rolling
Surrounding Area Topography: hilly
Land Use within 8 km (5 miles): some residential and recreational
Nearby Features: The nearest town is Shady Grove about 3 km (2 miles) NW. Harrison Bay State Park is 5 km (3 miles) S. The Volunteer Ordnance Works is about 15 km (9 miles) S. Chickamauga Lake is part of the Tennessee River.
Area of Transmission Line Corridor: 510 ha (1260 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
930,000	1,020,000	1,090,000	1,210,000	1,330,000

SHOREHAM NUCLEAR POWER STATION

Location: Suffolk County, New York
19 km (12 miles) NW of Riverhead
latitude 40.9583°N; longitude 72.8667°W

Licensee: Long Island Lighting Co.

Unit Information

Docket Number	50-322
Construction Permit	1973
Operating License	1989
Commercial Operation	--
License Expiration	2013
Design Thermal Power [MW(t)]	2436
Design Electrical Rating [net MW(e)]	819
Type of Reactor	BWR
Nuclear Steam Supply System Vendor	GE

Cooling Water System

Type: once through
Source: Long Island Sound
Source Temperature Range: 2-23°C (36-74°F)
Condenser Flow Rate: 36.19 m^3/s (573,600 gal/min)
Design Condenser Temperature Rise: 11°C (20°F)
Intake Structure: intake canal
Discharge Structure: diffuser system

Site Information

Total Area: 202 ha (499 acres)
Exclusion Distance: 0.31 km (0.19 mile)
Low Population Zone: 3.22 km (2.00 miles)
Nearest City: New Haven, Connecticut; 1980 population: 126,089
Site Topography: flat to rolling
Surrounding Area Topography: rolling to hilly
Land Use within 8 km (5 miles): some residential and recreational
Nearby Features: The nearest town is Shoreham 3 km (2 miles) W. Brookhaven State Park is about 3 km (2 miles) S. Brookhaven National Laboratory is about 11 km (7 miles) S. Grumman Peconic River Airport is about 10 km (6 miles) SE. Wildwood State Park is about 6 km (4 miles) E.
Area of Transmission Line Corridor: 16 ha (39 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
5,390,000	5,400,000	5,420,000	5,550,000	5,690,000

Note: This plant has not been allowed to operate due to litigation concerning emergency response.

SOUTH TEXAS PROJECT

Location: Matagorda County, Texas
19 km (12 miles) SSW of Bay City
latitude 28.7950°N; longitude 96.0481°W

Licensee: Houston Lighting and Power Co.

Unit Information	Unit 1	Unit 2
Docket Number	50-498	50-499
Construction Permit	1975	1975
Operating License	1988	1989
Commercial Operation	1988	1989
License Expiration	2028	2029
Licensed Thermal Power [MW(t)]	3800	3800
Design Electrical Rating [net MW(e)]	1250	1250
Type of Reactor	PWR	PWR
Nuclear Steam Supply System Vendor	WEST	WEST

Cooling Water System

Type: closed cycle cooling reservoir
Source: Colorado River
Source Temperature Range: 14-29°C (58-84°F)
Condenser Flow Rate: 57.26 m^3/s (907,400 gal/min) each unit
Design Condenser Temperature Rise: 11°C (19°F)
Intake Structure: on bank of Colorado River
Discharge Structure: on bank of Colorado River

Site Information

Total Area: 4998 ha (12,350 acres)
Exclusion Distance: 1.43-km (0.89-mile) minimum
Low Population Zone: 4.83 km (3.00 miles)
Nearest City: Galveston; 1980 population: 61,902
Site Topography: flat
Surrounding Area Topography: flat
Land Use within 8 km (5 miles): agricultural
Nearby Features: The nearest town is Matagorda 13 km (8 miles) SE. The Missouri Pacific Railroad is about 8 km (5 miles) NNE. A 40-cm (16-inch) natural gas pipeline is about 3 km (2 miles) NW.
Area of Transmission Line Corridor: 1932 ha (4773 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
270,000	300,000	320,000	350,000	380,000

ST. LUCIE PLANT

Location: St. Lucie County, Florida
11 km (7 miles) SE of Fort Pierce
latitude 27.3486°N; longitude 80.2464°W
Licensee: Florida Power and Light Co.

Unit Information	Unit 1	Unit 2
Docket Number	50-335	50-389
Construction Permit	1970	1977
Operating License	1976	1983
Commercial Operation	1976	1983
License Expiration	2016	2023
Licensed Thermal Power [MW(t)]	2700	2700
Design Electrical Rating [net MW(e)]	830	830
Type of Reactor	PWR	PWR
Nuclear Steam Supply System Vendor	CE	CE

Cooling Water System

Type: once through
Source: Atlantic Ocean
Source Temperature Range: 31°C (87°F) maximum
Condenser Flow Rate: 30.96 m^3/s (490,600 gal/min) each unit
Design Condenser Temperature Rise: 14°C (25°F)
Intake Structure: 370 m (1200 ft) offshore
Discharge Structure: Unit 1 is 370 m (1200 ft) offshore; Unit 2 is a multiport discharge 900 m (3000 ft) offshore; both structures are 730 (2400 ft) from the intake structures.

Site Information

Total Area: 458 ha (1132 acres)
Exclusion Distance: 1.56-km (0.97-mile) radius
Low Population Zone: 1.61 km (1.00 mile)
Nearest City: West Palm Beach; 1980 population: 62,530
Site Topography: flat land and water
Surrounding Area Topography: flat
Land Use within 8 km (5 miles): expanding residential and some recreational
Nearby Features: The nearest town is Ankona 3 km (2 miles) W. The Florida East Coast Railroad is about 3 km (2 miles) W. The plant is on Hutchinson Island which is separated from the mainland by the Indian River which is part of the intercoastal waterway. A causeway to the mainland is about 10 km (6 miles) SSE.
Area of Transmission Line Corridor: 310 ha (760 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
690,000	780,000	860,000	1,040,000	1,250,000

VIRGIL C. SUMMER NUCLEAR STATION

Location: Fairfield County, South Carolina
42 km (26 miles) NW of Columbia
latitude 34.2958°N; longitude 81.3203°W
Licensee: South Carolina Electric and Gas Co.

Unit Information	Unit 1
Docket Number	50-395
Construction Permit	1973
Operating License	1982
Commercial Operation	1984
License Expiration	2022
Licensed Thermal Power [MW(t)]	2775
Design Electrical Rating [net MW(e)]	900
Type of Reactor	PWR
Nuclear Steam Supply System Vendor	WEST

Cooling Water System

Type: once through
Source: Lake Monticello
Source Temperature Range: 11-33°C (52-91°F)
Condenser Flow Rate: 30.6 m^3/s (485,000 gal/min)
Design Condenser Temperature Rise: 14°C (25°F)
Intake Structure: intake at shoreline
Discharge Structure: discharge to lake via a discharge pond

Site Information

Total Area: 890 ha (2200 acres)
Exclusion Distance: 1.63-km (1.01-mile) radius
Low Population Zone: 4.83 (3.00 miles)
Nearest City: Columbia; 1980 population: 101,229
Site Topography: rolling
Surrounding Area Topography: rolling to hilly
Land Use within 8 km (5 miles): mostly wooded with some agricultural
Nearby Features: The nearest town is Jenkinsville 5 km (3 miles) SE. U.S. Highway I-26 is 11 km (7 miles) SSW. The Southern Railroad is 1.6 km (1 mile) W. The Fairfield pumped storage hydrostation is about 1.6 km (1 mile) NW and uses Lake Monticello as well as the Parr Reservoir.
Area of Transmission Line Corridor: 638 ha (1576 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
910,000	990,000	1,080,000	1,220,000	1,390,000

SURRY POWER STATION

Location:	Surry County, Virginia 27 km (17 miles) NW of Newport News latitude 37.1656°N; longitude 76.6983°W
Licensee:	Virginia Electric and Power Co.

Unit Information	Unit 1	Unit 2
Docket Number	50-280	50-281
Construction Permit	1968	1968
Operating License	1972	1973
Commercial Operation	1972	1973
License Expiration	2012	2013
Licensed Thermal Power [MW(t)]	2441	2441
Design Electrical Rating [net MW(e)]	788	788
Type of Reactor	PWR	PWR
Nuclear Steam Supply System Vendor	WEST	WEST

Cooling Water System

Type: once through
Source: James River
Source Temperature Range: 2-29°C (35-84°F)
Condenser Flow Rate: 53 m^3/s (840,000 gal/min) each unit
Design Condenser Temperature Rise: 8°C (14°F)
Intake Structure: 2.7-km (1.7-mile) concrete canal
Discharge Structure: 880-m (2900-ft) canal

Site Information

Total Area: 340 ha (840 acres)
Exclusion Distance: 0.50 km (0.31 mile)
Low Population Zone: 4.83 km (3.00 miles)
Nearest City: Newport News; 1980 population: 144,903
Site Topography: flat
Surrounding Area Topography: flat
Land Use within 8 km (5 miles): agriculture, military reservations, recreation
Nearby Features: The nearest town is Scotland 8 km (5 miles) W. Jamestown Island, a Federal park, is 6 km (4 miles) NW. Chippokes Plantation, a state park, is 5 km (3 miles) WSW. Jamestown National Historical Park is 8 km (5 miles) WNW. Colonial Williamsburg is 11 km (7 miles) NNW. These numerous attractions bring many visitors to the area. Adjacent to the site on the north is Hog Island, a waterfowl refuge. U.S. Highway I-64 is 19 km (12 miles) NW.
Area of Transmission Line Corridor: 1790 ha (4420 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
1,900,000	2,080,000	2,240,000	2,510,000	2,800,000

SUSQUEHANNA STEAM ELECTRIC STATION

Location: Luzerne County, Pennsylvania
11 km (7 miles) NE of Berwick
latitude 41.0922°N; longitude 76.1467°W

Licensee: Pennsylvania Power and Light Co.

Unit Information	Unit 1	Unit 2
Docket Number	50-387	50-388
Construction Permit	1973	1973
Operating License	1982	1984
Commercial Operation	1983	1985
License Expiration	2022	2024
Licensed Thermal Power [MW(t)]	3293	3293
Design Electrical Rating [net MW(e)]	1050	1050
Type of Reactor	BWR	BWR
Nuclear Steam Supply System Vendor	GE	GE

Cooling Water System

Type: natural draft cooling towers
Source: Susquehanna River
Source Temperature Range:
Condenser Flow Rate: 28.3 m^3/s (448,000 gal/min) each unit
Design Condenser Temperature Rise: 8°C (14°F)
Intake Structure: at river bank
Discharge Structure: diffuser pipe 73 m (240 ft) from river bank

Site Information

Total Area: 435 ha (1075 acres)
Exclusion Distance: 0.55-km (0.34-mile) radius
Low Population Zone: 4.83 km (3.00 miles)
Nearest City: Wilkes-Barre; 1980 population 51,551
Site Topography: rolling
Surrounding Area Topography: hilly with flat river valley
Land Use within 8 km (5 miles): wooded and agricultural
Nearby Features: The nearest town is Beach Haven about 1.6 km (1 mile) SW. U.S. Highway I-80 is 8 km (5 miles) S. The ConRail Railroad is 0.8 km (0.5) mile E and the Delaware and Hudson Railroad is 1.6 km (1 mile) E.
Area of Transmission Line Corridor: 730 ha (1800 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
1,500,000	1,510,000	1,530,000	1,550,000	1,580,000

THREE MILE ISLAND NUCLEAR STATION

Location: Dauphin County, Pennsylvania
16 km (10 miles) SE of Harrisburg
latitude 40.1531°N; longitude 76.7250°W
Licensee: Metropolitan Edison Co.

Unit Information	Unit 1
Docket Number	50-289
Construction Permit	1968
Operating License	1974
Commercial Operation	1974
License Expiration	2014
Licensed Thermal Power [MW(t)]	2568
Design Electrical Rating [net MW(e)]	819
Type of Reactor	PWR
Nuclear Steam Supply System Vendor	B&W

Cooling Water System

Type: natural draft cooling towers
Source: Susquehanna River
Source Temperature Range: 1-29°C (33-85°F)
Condenser Flow Rate: 27 m^3/s (430,000 gal/min)
Design Condenser Temperature Rise:
Intake Structure: concrete structure on river bank
Discharge Structure: discharged at the shoreline

Site Information

Total Area: 191 ha (472 acres)
Exclusion Distance: 0.61-km (0.38-mile) radius
Low Population Zone: 3.22 km (2.00 miles)
Nearest City: Harrisburg; 1980 population: 53,264
Site Topography: flat
Surrounding Area Topography: rolling to hilly
Land Use within 8 km (5 miles): agricultural
Nearby Features: The nearest town is Middletown 6 km (4 miles) N. Harrisburg-York airport is 13 km (8 miles) WNW. Unit 2 ceased operation after an accident in 1979. Peach Bottom Atomic Power Station is 56 km (35 miles) downstream.
Area of Transmission Line Corridor: 725 ha (1790 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
2,170,000	2,210,000	2,240,000	2,290,000	2,350,000

TROJAN NUCLEAR PLANT

Location: Columbia County, Oregon
51 km (32 miles) N of Portland
latitude 46.0408°N; longitude 122.8844°W
Licensee: Portland General Electric Co.

Unit Information	Unit 1
Docket Number	50-344
Construction Permit	1971
Operating License	1975
Commercial Operation	1976
License Expiration	2015
Licensed Thermal Power [MW(t)]	3411
Design Electrical Rating [net MW(e)]	1130
Type of Reactor	PWR
Nuclear Steam Supply System Vendor	WEST

Cooling Water System

Type: natural draft cooling tower
Source: Columbia River
Source Temperature Range:
Condenser Flow Rate: 27.04 m^3/s (428,600 gal/min)
Design Condenser Temperature Rise: 25°C (45°F)
Intake Structure: at river bank
Discharge Structure: submerged pipe extending 110 m (350 ft) from river bank

Site Information

Total Area: 257 ha (635 acres)
Exclusion Distance: 0.66-km (0.41-mile) minimum
Low Population Zone: 4.02-km (2.50-mile) radius
Nearest City: Portland; 1980 population: 368,148
Site Topography: flat to rolling
Surrounding Area Topography: hilly to mountainous
Land Use within 8 km (5 miles): wooded
Nearby Features: The nearest town is Prescott 0.8 km (0.5 mile) N. The Burlington Northern Railroad is just W of the site. Gifford Pinchot National Forest and Mount St. Helens National Monument are about 48 km (30 miles) ENE.
Area of Transmission Line Corridor: 510 ha (1260 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
1,850,000	2,160,000	2,430,000	2,820,000	3,780,000

TURKEY POINT PLANT

Location: Dade County, Florida
40 km (25 miles) S of Miami
latitude 25.4350°N; longitude 80.3314°W
Licensee: Florida Power and Light Co.

Unit Information	Unit 3	Unit 4
Docket Number	50-250	50-251
Construction Permit	1967	1967
Operating License	1972	1973
Commercial Operation	1972	1973
License Expiration	2012	2013
Licensed Thermal Power [MW(t)]	2200	2200
Design Electrical Rating [net MW(e)]	693	693
Type of Reactor	PWR	PWR
Nuclear Steam Supply System Vendor	WEST	WEST

Cooling Water System

Type: closed cycle canal
Source: Biscayne Bay
Source Temperature Range: 12-32°C (54-90°F)
Condenser Flow Rate: 39.4 m^3/s (624,000 gal/min) each unit
Design Condenser Temperature Rise: 9°C (16°F)
Intake Structure: intake canal and barge canal
Discharge Structure: canal system covering about 1600 ha (4000 acres)

Site Information

Total Area: 9700 ha (24,000 acres)
Exclusion Distance: 1.27 km (0.79 mile)
Low Population Zone: 8.05 km (5.00 miles)
Nearest City: Miami; 1980 population: 346,681
Site Topography: flat
Surrounding Area Topography: flat
Land Use within 8 km (5 miles): mostly undeveloped
Nearby Features: The nearest town is Florida City about 14 km (9 miles) W. Hawk Missile Base is 1.6 km (1 mile) NW. Homestead recreation park is about 3 km (2 miles) NNW. The Florida East Coast Railroad is about 14 km (9 miles) NW. Units 1 and 2 are coal fired and adjacent to the site.
Area of Transmission Line Corridor: 331 ha (817 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
2,700,000	3,070,000	3,420,000	4,160,000	5,050,000

VERMONT YANKEE NUCLEAR POWER STATION

Location: Windham County, Vermont
8 km (5 miles) S of Brattleboro
latitude 42.7803°N; longitude 72.5158°W
Licensee: Vermont Yankee Nuclear Power Corp.

Unit Information	Unit 1
Docket Number	50-271
Construction Permit	1967
Operating License	1973
Commercial Operation	1972
License Expiration	2013
Licensed Thermal Power [MW(t)]	1593
Design Electrical Rating [net MW(e)]	540
Type of Reactor	BWR
Nuclear Steam Supply System Vendor	GE

Cooling Water System

Type: once through & helper towers
Source: Connecticut River
Source Temperature Range: 0-23°C (32-74°F)
Condenser Flow Rate: 23.1 m^3/s (366,000 gal/min)
Design Condenser Temperature Rise: 11°C (20°F)
Intake Structure: concrete structure at edge of river
Discharge Structure: aerating structure discharging at edge of river

Site Information

Total Area: 50.6 ha (125 acres)
Exclusion Distance: 0.27 km (0.17 mile)
Low Population Zone: 8.05 km (95.00 miles)
Nearest City: Holyoke, Massachusetts: 1980 population: 44,678
Site Topography: flat
Surrounding Area Topography: rolling to hilly
Land Use within 8 km (5 miles): mostly wooded, some agricultural and industrial
Nearby Features: The nearest town is Vernon about 1.6 km (1 mile) W. Vernon Dam is 1 km (0.7 mile) downstream from the site. The Yankee Nuclear Power Station is about 32 km (20 miles) WSW.
Area of Transmission Line Corridor: 627 ha (1550 acres)
Population within an 80-km (50-mile) radius:

1990	2000	2010	2030	2050
1,510,000	1,580,000	1,620,000	1,710,000	1,800,000