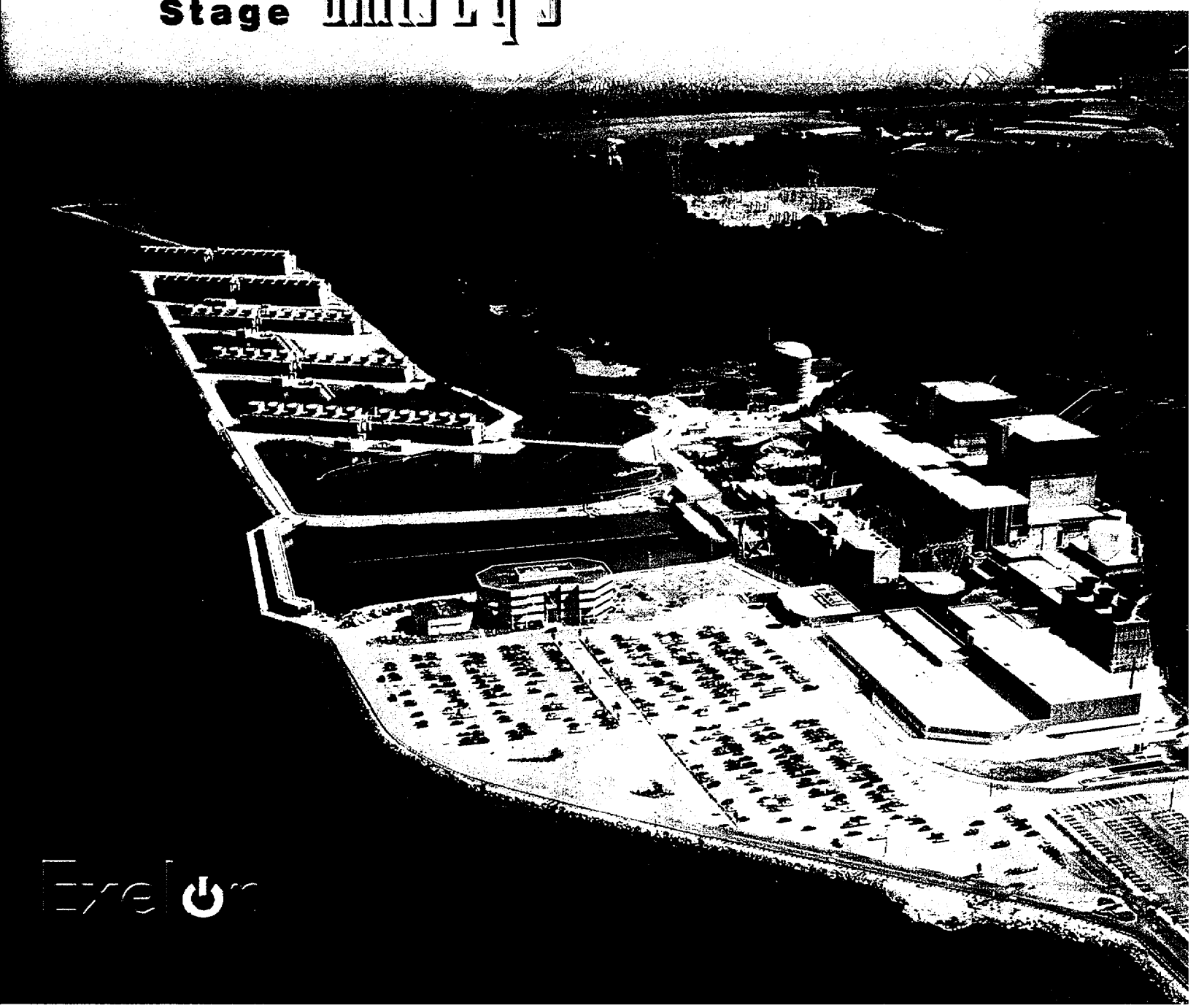
Appendix E - Applicant's Environmental Report

Operating License Renewal Stage

Peach Bottom Atomic Power Station Units 2 & 3



Exelon

Appendix E

Applicant's Environmental Report –
Operating License Renewal Stage
Peach Bottom Atomic Power Station Units 2 and 3

Exelon Generation Company, LLC
Docket Nos. 50-277 and 50-278
License Nos. DPR-44 and DPR-56

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ACRONYMS AND ABBREVIATIONS

ABWR	advanced boiling water reactor
APB	accident progressive bins
AQCR	Air Quality Control Region
BWR	boiling water reactor
CDF	core damage frequency
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
CWA	Clean Water Act
DSM	demand side management
EGC	Exelon Generation Company, LLC
EPA	U.S. Environmental Protection Agency
F	Fahrenheit
FWS	U.S. Fish and Wildlife Service
GEIS	Generic Environmental Impact Statement for License Renewal of Nuclear Plants
GIS	ArcView® Geographic Information System
gpm	gallons per minute
GWH	gigawatt-hours
HPCI	high pressure coolant injection
IPA	integrated plant assessment
IPE	Individual Plant Examination
ISLOCA	Intersystem loss of cooling accident
kV	kilovolt
kWh	kilowatt hour
LERF	large early release frequency
m^2	square meter
MACCS	Melcor Accidents Consequence Code System
MDD	maximum daily demand (water)
MGD	million gallons per day
msl	mean sea level
MW	megawatt
MWe	megawatts-electrical
MWt	megawatts-thermal
NEPA	National Environmental Policy Act
NESC®	National Electrical Safety Code®
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
OECR	offsite economic cost risk
PBAPS	Peach Bottom Atomic Power Station, Units 2 and 3
PDR	population dose risk
PDS	plant damage state

PECO	PECO Energy, formerly Philadelphia Electric Company
psig	pounds per square inch gage
PURTA	Pennsylvania Utility Realty Tax Act
RBCCW	reactor building closed cooling water system
RCIC	reactor core isolation cooling
RCP	reactor coolant pump
SAFSTOR	Safe Storage (of defueled nuclear reactor)
SAMA	Severe Accident Mitigation Alternatives
SHPO	State Historic Preservation Officer
SLC	standby liquid control
SMITTR	surveillance, monitoring, inspections, testing, trending, and recordkeeping
SSCs	systems, structures, and components
TBCCW	turbine building closed cooling water system
USGS	U.S. Geological Survey

1.0 INTRODUCTION

1.1 PURPOSE OF AND NEED FOR ACTION

The U.S. Nuclear Regulatory Commission (NRC) licenses the operation of domestic nuclear power plants in accordance with the Atomic Energy Act of 1954, as amended, and NRC implementing regulations. Exelon Generation Company, LLC (Exelon) operates Peach Bottom Atomic Power Station Units 2 and 3 (PBAPS) pursuant to NRC Operating Licenses DPR-44 and DPR-56, respectively. The Unit 2 license will expire August 8, 2013, and the Unit 3 license will expire July 2, 2014.

Exelon has prepared this environmental report in conjunction with its application to NRC to renew the PBAPS Units 2 and 3 operating licenses, as provided by the following NRC regulations:

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

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

> "...The purpose and need for the proposed action (renewal of an operating license) is to provide an option that allows for power generation capability beyond the term of a current nuclear power plant operating license to meet future system generating needs, as such needs may be determined by State, utility, and, where authorized, Federal (other than NRC) decision makers...." (Ref. 1.1-1, pg. 28472)

The renewed operating licenses would allow for an additional 20 years of plant operation beyond the current PBAPS licensed operating period of 40 years.

1.2 ENVIRONMENTAL REPORT SCOPE AND METHODOLOGY

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

- NRC supplemental information in the *Federal Register* (Refs. 1.1-1, pp. 28467-28497; 1.2-1, pp. 39555-39556; 1.2-2, pp. 66537-66554; and 1.2-3, pp. 48496-48507)
- *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (Refs. 1.2-4 and 1.2-5)
- *Regulatory Analysis for Amendments to Regulations for the Environmental Review for Renewal of Nuclear Power Plant Operating Licenses* (Ref. 1.2-6)
- *Public Comments on the Proposed 10 CFR Part 51 Rule for Renewal of Nuclear Power Plant Operating Licenses and Supporting Documents: Review of Concerns and NRC Staff Response* (Ref. 1.2-7)

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

1.3 PEACH BOTTOM ATOMIC POWER STATION LICENSEE AND OWNERSHIP

The Commonwealth of Pennsylvania has deregulated electricity generation, but not distribution. In response to this, PECO, formerly Philadelphia Electric Company, restructured to separate its generating business, including facilities such as PBAPS, from its transmission and distribution business. In addition, PECO merged its generation business with that of Unicom to form Exelon Generation Company, LLC. This changing ownership necessitated that the operating licenses issued by NRC to operate Units 2 and 3 be transferred to the new owners.

PBAPS is owned by Exelon Generation Company, LLC; PSEG Nuclear, LLC; and Connectiv, and operated by Exelon Generation Company, LLC. Exelon Generation Company, LLC and PSEG Nuclear, LLC each currently own 46.25 percent of PBAPS; Atlantic City Electric Company owns 7.5 percent.

1.4 REFERENCES

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

Ref. 1.1-1 U.S. Nuclear Regulatory Commission. 1996. "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses". *Federal Register.* Vol. 61, No. 109. June 5.

Ref. 1.2-1 U.S. Nuclear Regulatory Commission. 1996. "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses; Correction." *Federal Register.* Vol. 61, No. 147. July 30.

Ref. 1.2-2 U.S. Nuclear Regulatory Commission. 1996. "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses." *Federal Register.* Vol. 61, No. 244. December 18.

Ref. 1.2-3 U.S. Nuclear Regulatory Commission. 1999. "Changes to Requirements for Environmental Review for Renewal of Nuclear Power Plant Operating Licenses; Final Rules." *Federal Register.* Vol. 64, No. 171. September 3.

Ref. 1.2-4 U.S. Nuclear Regulatory Commission. 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS). Volumes 1 and 2. NUREG-1437. Washington, DC.

Ref. 1.2-5 U.S. Nuclear Regulatory Commission. 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS). Section 6.3, "Transportation", and Table 9-1, "Summary of findings on NEPA issues for license renewal of nuclear power plants". NUREG-1437. Volume 1, Addendum 1. Washington, DC.

Ref. 1.2-6 U.S. Nuclear Regulatory Commission. 1996. *Regulatory Analysis for Amendments to Regulations for the Environmental Review for Renewal of Nuclear Power Plant Operating Licenses.* NUREG-1440. Washington, DC.

Ref. 1.2-7 U.S. Nuclear Regulatory Commission. 1996. *Public Comments on the Proposed 10 CFR Part 51 Rule for Renewal of Nuclear Power Plant Operating Licenses and Supporting Documents: Review of Concerns and NRC Staff Response.* Volumes 1 and 2. NUREG-1529. Washington, DC.

TABLE 1-1
ENVIRONMENTAL REPORT RESPONSES TO LICENSE RENEWAL ENVIRONMENTAL REGULATORY REQUIREMENTS

Regulatory Requirement	Responsive Environmental Report Section(s)	
10 CFR 51.53(c)(1)	Entire Document	
10 CFR 51.53(c)(2), Sentences 1 and 2	3.0	Proposed Action
10 CFR 51.53(c)(2), Sentence 3	7.2.2	Environmental Impacts of Alternatives
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(1)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(2)	6.3	Unavoidable Adverse Impacts
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(3)	7.0 8.0	Alternatives to the Proposed Action Comparison of Environmental Impact of License Renewal with the Alternatives
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(4)	6.5	Short-Term Use Versus Long-Term Productivity of the Environment
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(5)	6.4	Irreversible or Irretrievable Resource Commitments
10 CFR 51.53(c)(2) and 10 CFR 51.45(c)	4.0 6.2 7.2.2 8.0	Environmental Consequences of the Proposed Action and Mitigating Actions Mitigation Environmental Impacts of Alternatives Comparison of Environmental Impact of License Renewal with the Alternatives
10 CFR 51.53(c)(2) and 10 CFR 51.45(d)	9.0	Status of Compliance
10 CFR 51.53(c)(2) and 10 CFR 51.45(e)	4.0 6.3	Environmental Consequences of the Proposed Action and Mitigating Actions Unavoidable Adverse Impacts
10 CFR 51.53(c)(3)(ii)(A)	4.1 4.6	Water Use Conflicts Groundwater Use Conflicts (Plants Using Cooling Water Towers Withdrawing Make-Up Water from a Small River)
10 CFR 51.53(c)(3)(ii)(B)	4.2 4.3 4.4	Entrainment of Fish and Shellfish in Early Life Stages Impingement of Fish and Shellfish Heat Shock

TABLE 1-1 (Cont'd)
ENVIRONMENTAL REPORT RESPONSES TO LICENSE RENEWAL ENVIRONMENTAL REGULATORY REQUIREMENTS

Regulatory Requirement	Responsive Environmental Report Section(s)	
10 CFR 51.53(c)(3)(ii)(C)	4.5	Groundwater Use Conflicts (Plants Using >100 gpm of Groundwater)
	4.7	Groundwater Use Conflicts (Plants Using Ranney Wells)
10 CFR 51.53(c)(3)(ii)(D)	4.8	Degradation of Groundwater Quality
10 CFR 51.53(c)(3)(ii)(E)	4.9	Impacts of Refurbishment on Terrestrial Resources
	4.10	Threatened or Endangered Species
10 CFR 51.53(c)(3)(ii)(F)	4.11	Air Quality During Refurbishment (Non-Attainment Areas)
10 CFR 51.53(c)(3)(ii)(G)	4.12	Impact on Public Health of Microbiological Organisms
10 CFR 51.53(c)(3)(ii)(H)	4.13	Electromagnetic Fields – Acute Effects
10 CFR 51.53(c)(3)(ii)(I)	4.14	Housing Impacts
	4.15	Public Utilities: Public Water Supply Availability
	4.16	Education Impacts from Refurbishment
	4.17	Offsite Land Use
10 CFR 51.53(c)(3)(ii)(J)	4.18	Transportation
10 CFR 51.53(c)(3)(ii)(K)	4.19	Historic and Archaeological Resources
10 CFR 51.53(c)(3)(ii)(L)	4.20	Severe Accident Mitigation Alternatives
10 CFR 51.53(c)(3)(iii)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
	6.2	Mitigation
10 CFR 51.53(c)(3)(iv)	5.0	Assessment of New and Significant Information
10 CFR 51, Appendix B, Table B-1, Footnote 6	2.11	Environmental Justice

2.0 SITE AND ENVIRONMENTAL INTERFACES

2.1 LOCATION AND FEATURES

Peach Bottom Atomic Power Station (PBAPS) is located primarily in Peach Bottom Township, York County, Pennsylvania, on the west side of Conowingo Pond, formed when Conowingo Dam was constructed across the Susquehanna River. The station is approximately 18 miles upstream from the point where the river enters the Chesapeake Bay (Figure 2-1) and 8 miles upstream from Conowingo Dam. This location is latitude 39° 75' 89" North and longitude 76° 26' 92" West (latitude +39.758889 and longitude -76.269167). The PBAPS site consists of 620 acres (Figure 2-2). In addition to the two nuclear reactors and their turbine building, intake and discharge canals, and auxiliary buildings, the site includes two switchyards, an Independent Spent Fuel Storage Installation, a training center, the retired PBAPS Unit 1 (a prototype high-temperature, gas-cooled reactor now SAFSTOR maintained in condition) (Figure 3-1), and a public boat ramp and picnic area (Figure 2-2).

No major metropolitan areas occur within 6 miles of PBAPS (Figure 2-3). The site is 19 miles southwest of Lancaster, Pennsylvania, 30 miles southeast of York, Pennsylvania, and 38 miles north of Baltimore, Maryland (Figure 2-1). The area within 6 miles of the site includes parts of York and Lancaster Counties in Pennsylvania and sections of Harford and Cecil Counties in Maryland (Figure 2-3). The area around PBAPS is predominantly rural, characterized by farmland and woods.

The terrain on either side of Conowingo Pond is steeply hilly. Immediately behind PBAPS is a rock cliff that was created when a hill was cut away to site the Station. It rises to an elevation of about 300 feet above the river.

Section 3.1 describes key features of PBAPS.

2.2 AQUATIC AND RIPARIAN ECOLOGICAL COMMUNITIES

PBAPS withdraws water from and discharges to Conowingo Pond, a Susquehanna River reservoir formed by the Conowingo Dam. Pond aquatic and riparian ecology are influenced by hydrologic complexities introduced by the following:

- Operation of Conowingo Dam and its associated run-of-the-river hydroelectric plant
- Operation of a pumped storage hydroelectric plant on Conowingo Pond
- Operation of upstream dams and run-of-the-river hydroelectric plants

Section 2.2.1 introduces this hydrology as background for the aquatic discussion in Section 2.2.2.

2.2.1 HYDROLOGY

The Susquehanna River flows south more than 420 miles from its source, Lake Otsego in south-central New York, to Havre de Grace, Maryland, where it empties into the Chesapeake Bay (Figure 2-1). It drains an area of about 27,500 square miles and supplies more than half the freshwater inflow to the Bay (Refs. 2.2-1, pg. II-11, and 2.2-2). River flow and water quality in the lower Susquehanna River are directly influenced by flood-control dams on tributaries and larger hydroelectric dams (York Haven [river mile (rm) 45], Safe Harbor [rm 32], Holtwood [rm 24], and Conowingo [rm 10]) on the main stem of the lower river (Figure 2-4).

The upstream U.S. Geological Survey (USGS) gauging station closest to PBAPS is located at Marietta, PA, approximately 27 miles upstream. Exelon has found that water-flow data from this station is unrepresentative of conditions at PBAPS due to variability caused by operation of York Haven Hydroelectric Plant and inflows from a major tributary, Chickies Creek. For this reason, Exelon uses water-flow information from Holtwood Dam, which is located approximately 6 miles upstream of PBAPS.

From 1952 to 1999, the Susquehanna River at Holtwood Dam had a minimum monthly average flow of 1,500 cubic feet per second (cfs), a monthly mean average flow of 38,370 cfs, and a monthly maximum average flow of 941,900 cfs

(Ref. 2.2-3). The monthly mean average flow of 38,370 cfs converts to an approximate annual flow rate of 1.2×10^{12} cubic feet. This is less than the value that NRC uses, 3.15×10^{12}, to define a small river [10 CFR 51.53(c)(3)(ii)(A) and (G)] and is consistent with NRC categorization of PBAPS as being a small river site (Ref. 2.2-4, Table 5.19).

Section 3.5 describes the Conowingo Dam and its associated hydroelectric facility and fish lifts. Conowingo Pond is approximately 14 square miles (9,000 acres) in surface area and ranges from 0.5 to 1.5 miles wide (Ref. 2.2-1, pg. II-11). Normal pond elevation is approximately 109 feet above mean sea level (msl) with a maximum operational drawdown elevation of about 99 feet above msl (Ref. 2.2-5, pg. 1-6). PBAPS is located on the west bank of the reservoir, approximately eight miles upstream from the dam.

Exelon's Muddy Run Pumped Storage Facility lies on the east bank of Conowingo Pond, approximately five miles north of PBAPS. The pumped storage facility typically withdraws water from the Pond at night and releases water to the Pond during daytime periods of peak electric demand. Because of the pumped storage facility operation, the volume of Conowingo Pond varies from 240,000 acre-feet to 322,000 acre-feet (Ref. 2.2-1, pg. II-11), a daily variation of approximately 25 percent.

The City of Baltimore withdraws approximately 5 million gallons of water per day from Conowingo Pond and has infrastructure in place to withdraw more. The City recently lost a court case over the authority of the Susquehanna River Basin Commission to regulate additional City withdrawals (Ref. 2.2-6).

2.2.2 AQUATIC COMMUNITIES

The resident fish of Conowingo Pond are, for the most part, common warm-water species (e.g., gizzard shad, spotfin shiner, channel catfish, tessellated darter, and bluegill) that have a wide distribution from the southeastern U.S. to Canada (Refs. 2.2-7, 2.2-8, and 2.2-9). Conowingo Pond is well known for its largemouth and smallmouth bass fishing, and also provides opportunities for striped bass and walleye fishing. Local and regional fishing clubs and organizations use Conowingo Pond for bass fishing tournaments in the spring, summer, and fall. The heated discharge at PBAPS, which attracts baitfish and game fish in most months of the year, is an especially popular fishing spot in winter.

The species composition of the Conowingo Pond fish community was little changed from the 1966-1974 period, when pre- and post-PBAPS operation fish studies were carried out, to the 1997-1999 period, when studies were conducted to assess the impact of zero-cooling-tower operation at PBAPS (see Section 3.1.2). However, one apparent change was an increase in relative abundance in the 1970s and 1980s of the gizzard shad, inadvertently stocked into Conowingo Pond in 1972 (Ref. 2.2-5, pg. 7.2-2). The gizzard shad is now one of the dominant species in the reservoir in terms of numbers and biomass. Large numbers of gizzard shad are lifted into Conowingo Pond every spring from the lower river, along with river herring and American shad, and are likely to remain an important part of the ecosystem. In 1999, more than 950,000 gizzard shad were trapped below the Conowingo Dam and passed to the Pond (Ref. 2.2-10).

Aside from the increase in gizzard shad numbers, the most striking change in the fish community of Conowingo Pond over the last 25 years (PBAPS began operating commercially in 1974) has been the increase in numbers of anadromous fish (e.g., American shad, blueback herring, alewife, and striped bass) moving through the Pond in spring and fall. No anadromous fish were collected in nine years (1966-1974) of monitoring Conowingo Pond's fish populations to assess potential impacts of the Muddy Run Pumped Storage Facility and PBAPS (Ref. 2.2-5). In 1972, a consortium of federal, regional, and state agencies began trapping and transporting anadromous fish from below Conowingo Dam to up-river locations. Fishways (fish lifts and fish ladders) have been installed at Conowingo and the other mainstem dams and transporting has been discontinued. Completion of the fishway at York Haven Dam in spring 2000, gave migratory shad and river herring access to mainstem spawning areas and tributaries between the York Haven Dam and Harrisburg, Pennsylvania. Large numbers of adult American shad and blueback herring now move through Conowingo Pond in the spring, en route to upstream spawning locations (Ref. 2.2-10). Juvenile shad and herring move downstream through the Pond in the fall en route to the Chesapeake Bay.

The appearance of these anadromous species in Conowingo Pond is an indication of the success of the Susquehanna River anadromous fish restoration program. This program has dramatically increased the numbers of anadromous fish ascending the Susquehanna River in spring to spawn. The number of American shad trapped at Conowingo Dam and transported (prior to 1997) and

lifted (from 1997 to present) upstream increased from 139 in 1980, to 15,964 in 1990 (Ref. 2.2-10), and to more than 150,000 in the year 2000 (Ref. 2.2-11). In addition, large numbers of river herring (more than 130,000 in 1999) and substantial numbers of striped bass (1,231 in 1999) are also passed upstream at the Conowingo fish lift (Ref. 2.2-10).

This anadromous fish restoration program is regarded as a success by most observers. Exelon and the operators of three upstream dams are the largest financial contributors to the program. Exelon and its predecessor companies have provided financial support to anadromous fish restoration efforts since 1928, when the Conowingo Dam was built (Ref. 2.2-12, pp. 48-59 and 154-158). Exelon (as PECO) contributed approximately 12 million dollars in 1991 to the construction of the East Fish Lift at Conowingo Dam, which was the largest fish elevator in the U.S. at that time.

Exelon (as PECO) and its contractors have studied the aquatic resources of Conowingo Pond and the lower Susquehanna River since 1966 (Refs. 2.2-7, 2.2-8, and 2.2-9). Detailed information on the water quality and aquatic biota of Conowingo Pond and their responses to PBAPS operation may be found in a number of impact assessment documents (Ref. 2.2-1), CWA Section 316(a) and (b) studies (Refs. 2.2-5 and 2.2-13), various post-316(a) and (b) and post-operational monitoring studies, more recent studies conducted in support of NPDES permit changes (Refs. 2.2-7, 2.2-8, and 2.2-9), and more than 100 industry reports and scientific journal articles published from 1970 to 1999. Information on the anadromous fish of the lower Susquehanna River and American shad restoration efforts can be found in reports prepared by PECO and its contractors, books (Ref. 2.2-12), monographs (Ref. 2.2-14), scientific journal articles, and the annual reports of the Susquehanna River Anadromous Fish Restoration Cooperative (Ref. 2.2-10).

Only three freshwater mollusc taxa were collected in more than eight years (1967-1974) of pre- and post-operational benthic monitoring conducted in support of PBAPS' CWA Section 316(a) Demonstration (Ref. 2.2-5). They included two common sphaerid genera, *Pisidium* and *Sphaerium*, and a single Unionid (*Utterbackia imbecilis*). Both the sphaerids and *Utterbackia* are common in lakes, reservoirs, and sluggish rivers of the midwest and northeast. The most significant change in the Conowingo Pond mollusc community over the last several decades has been the appearance and rapid colonization since the mid-1980s of the exotic Asiatic clam, *Corbicula fluminea*.

2.3 GROUNDWATER RESOURCES

Conowingo Pond, adjacent to PBAPS, is in the Piedmont physiographic province. The surrounding area is characterized by a surficial water table aquifer in saprolitic soils and shallow fractures in rocks. (Ref. 2.3-1, pp. 21-23). Water flow within saprolitic soils is very slow due to the soils' low porosity and relative impermeability. The soils in the vicinity of the site typically yield less than 20 gallons per minute (Ref. 2.2-1, pg. II-17). Flows follow surface topography, so flow in the vicinity of the Susquehanna River and Conowingo Pond is towards the river. See Section 3.1.2.2 for a discussion of springs on the site.

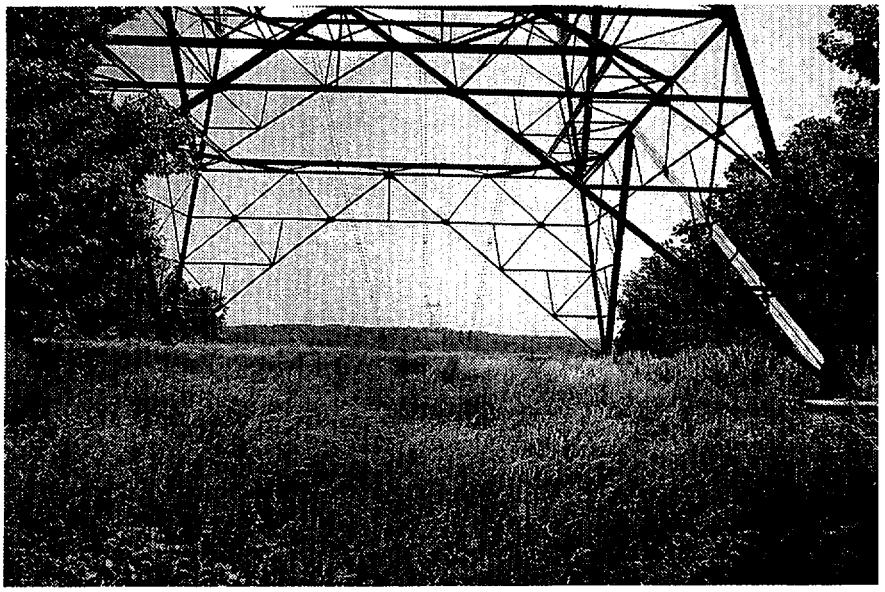
2.4 CRITICAL AND IMPORTANT TERRESTRIAL HABITATS

No areas designated by the U.S. Fish and Wildlife Service as "critical habitat" for endangered species exist at PBAPS or on the Peach Bottom-to-Keeney transmission line.

Much of the 620-acre PBAPS site consists of generation and maintenance facilities, laydown areas, parking lots, roads, and mowed grass. The primary terrestrial habitats at the site are remnants of hardwood (oak-hickory) forest on the ridges and slopes west of the generating and support facilities. Wildlife species found in the forested portions of PBAPS are those typically found in upland forests of southern Pennsylvania. These include a variety of amphibians (e.g., Northern dusky salamander, bullfrog, leopard frog), reptiles (e.g., Eastern hognose snake, copperhead, painted turtle, box turtle), songbirds (e.g., Carolina wren, wood thrush, song sparrow, rufous-sided towhee), woodpeckers (e.g., downy woodpecker, common flicker), birds of prey (e.g., red-tailed hawk, Eastern screech owl, barred owl), and mammals (e.g., gray squirrel, Southern flying squirrel, striped skunk, gray fox, raccoon, white-tailed deer).

The Peach Bottom-to-Keeney transmission line (Section 3.1.3) is situated within the Piedmont physiographic province. Gently rolling hills with a few moderately steep ridges characterize this region. The transmission line traverses land-use categories typical of southern Pennsylvania and Maryland, such as row crops, pasture, and abandoned (old) fields. In addition, the transmission line passes through more natural habitat types, such as hardwood forests.

The Peach Bottom-to-Keeney transmission line does not cross any state or federal parks, wildlife refuges, or wildlife management areas. PECO, in cooperation with the Maryland Nature Conservancy, established two protected areas that are crossed by the transmission corridor. The Rock Springs Powerline Natural Area, a 103-acre parcel near Rock Springs, Maryland, is managed for the preservation of rare plant species. Approximately 0.8 mile (30 acres) of the Peach Bottom-to-Keeney transmission corridor traverses the Rock Springs Powerline Natural Area (Ref. 2.4-1). The Richardsmere Powerline Natural Area, a 55-acre parcel near Richardsmere, Maryland, is also managed for the preservation of rare plant species. The Richardsmere Powerline Natural Area is centered around the Richardsmere Powerline. Approximately 380 feet



The Keeney line runs through wooded and agricultural areas.

(2.5 acres) of the Peach Bottom-to-Keeney transmission corridor traverses the northern portion of Richardsmere Powerline Natural Area (Ref. 2.4-2). Figure 3-2 shows the locations of these natural areas.

The utility's transmission corridors are maintained by trimming and removing undesirable vegetation from the floor and sides of the corridors, and by use of approved herbicides. Unless otherwise needed, trees are trimmed on a five-year cycle. The tree-trimming crews utilize manual climbing techniques and aerial lift trucks. Mowing is conducted as needed. The herbicide schedule typically follows a three-year cycle. Herbicide application includes broadcast foliar applications and basal stem treatments, and is performed by certified applicators according to label specifications (Ref. 2.4-3). Selective hand-cutting, rather than herbicide treatment, is generally used in wetlands. Locations of sensitive areas (e.g., Rock Springs Powerline Natural Area) are marked on maps that the utility maintains for all its transmission lines and that are used by the trimming and herbicide crews.

2.5 ENDANGERED AND THREATENED SPECIES

Terrestrial Species

Animal and plant species that are state-listed or federally classified as endangered or threatened and that occur or could occur (based on habitat and known geographic range) in the vicinity of PBAPS or along the Peach Bottom-to-Keeney transmission line are listed in Table 2-1. The federal and state designations shown in Table 2-1 are those of the U.S. Fish and Wildlife Service, National Marine Fisheries Service, Pennsylvania Department of Conservation and Natural Resources, Pennsylvania Game Commission, Pennsylvania Fish and Boat Commission (Ref. 2.5-1), and the Maryland Department of Natural Resources (Ref. 2.5-2). The transmission line terminates at the Keeney Substation, Delaware, approximately 3.5 miles from the Delaware-Maryland border (see Figure 3-2). The 3.5 miles of the corridor within Delaware consists largely of disturbed grassy and weedy habitats and does not contain habitat suitable for endangered, threatened, and other special-status species. Thus, Delaware-listed species are not included in Table 2-1.

With the exception of the bald eagle (*Haliaeetus leucocephalus*), terrestrial species that are federally listed as endangered or threatened are not known to exist at PBAPS or along the transmission line. At least four bald eagle nests are located on islands within Conowingo Pond as of the time this environmental report was prepared. Exelon cooperates with the Pennsylvania Game Commission and the Pennsylvania Fish and Boat Commission to monitor and protect these nests. The bald eagle is federally classified as threatened and state-listed as endangered. There are no candidate federally threatened or endangered species that Exelon believes might occur at the site or along the Keeney transmission line.

Bog turtles (*Clemmys muhlenbergii*) are known to occur in Lancaster and York Counties, Pennsylvania, and in Cecil County, Maryland (Ref. 2.5-3, pp. 59605-59623). The northern population of the bog turtle is federally listed as threatened, state-listed as endangered in Pennsylvania and Delaware, and threatened in Maryland. Typical bog turtle habitats consist of spring-fed bogs or marshes with shallow surface water or saturated soils year-round, and usually interspersed with dry and wet pockets. The substrate is usually muck or peat. The dominant vegetation is low grasses and sedges (emergent wetland vegetation), often with a scrub-shrub component (Ref. 2.5-4).

These types of habitats are not present on the 620-acre PBAPS site or along the Peach Bottom-to-Keeney transmission line. The absence of bog turtle habitats on the transmission line was determined by a field survey conducted September 21, 2000 (Ref. 2.5-5). The field survey was conducted in accordance with the methods of a "Phase 1 survey" described in *Guidelines for Bog Turtle Surveys* (Ref. 2.5-4). The survey began with a low-altitude helicopter flight along the entire Peach Bottom-to-Keeney transmission line, followed by a ground survey at several locations along the transmission line identified during the flight as possible habitat. Although numerous streams traverse the transmission line, most are incised channels through upland habitats (i.e., no adjacent wetlands are present). Areas along the transmission line do not comprise habitat described by the U.S. Fish and Wildlife Service (Refs. 2.5-4 and 2.5-5) as potential bog turtle habitat.

Vascular plants, such as the serpentine aster (*Aster depauperatus,* state-listed as endangered in Maryland and threatened in Pennsylvania) and the porcupine sedge (*Carex hystericina,* state-listed as endangered in Maryland), occur in the Rock Springs Powerline Natural Area. The reticulated nutrush (*Scleria reticularis,* state-listed in Pennsylvania as endangered), also occurs in the Rock Springs Powerline Natural Area. The whorled mountain mint (*Pycnanthemum verticillatum,* state-listed in Maryland as endangered), occurs in the Richardsmere Powerline Natural Area.

Ospreys (*Pandion haliaetus*) are state-listed in Pennsylvania as threatened, and are commonly observed at Conowingo Pond during the summer breeding season and during migration.

The bird species shown in Table 2-1 are migratory and would occur at PBAPS or along the associated transmission line only during migration or seasonally (winter or summer). For example, migrant peregrine falcons (*Falco peregrinus*) traverse the area and winter in coastal areas. Thus, peregrine falcons could possibly occur at PBAPS or along the transmission line during migration.

The transmission corridor is managed to prevent woody growth from reaching the transmission lines (see Section 3.1.3). The removal of woody species can provide outstanding grassland and bog-like habitat for many rare plant and animal species that depend on open conditions. Exelon cooperates with the Pennsylvania Nature Conservancy and Maryland Heritage Trust to protect sensitive areas within its transmission corridors. Exelon also supports a study

currently being conducted by Pennsylvania State University to determine the effects of various transmission line management techniques on wildlife species.

Aquatic Species

In more than 30 years of monitoring the fish populations of Conowingo Pond, Exelon and its contractors have never collected a federally-listed fish species. The Atlantic sturgeon (*Acipenser oxyrhynchus*), a candidate for federal listing (Ref. 2.5-6, pp. 33466-68), has been captured by anglers in the lower Susquehanna River below the Conowingo Dam in Maryland (Ref. 2.5-7, pp. 187-192), but apparently has not been collected upstream of the Dam in Pennsylvania since the Conowingo Dam was built. The Atlantic sturgeon is listed as endangered by Pennsylvania.

Based on a review of Philadelphia Electric Company and PECO impact assessment documents (Refs. 2.2-1 and 2.2-5), Exelon (as PECO)-funded research and monitoring studies (Refs. 2.2-7, 2.2-8, and 2.2-9), standard fisheries references, journal articles, and government web sites (Ref. 2.5-8), two state-listed fish species (in addition to the Atlantic sturgeon) could be found in Conowingo Pond. One, the anadromous hickory shad (*Alosa mediocris*), is found seasonally below Conowingo Dam, as adults ascend the river to spawn in spring (Ref. 2.5-7). Occasionally, small numbers of hickory shad (32 in 1999) are collected at the Conowingo West Lift (Ref. 2.2-10). Another state-listed species, the cisco (*Coregonus artedi*) has been introduced to the upper Susquehanna River (Harvey's Lake in Luzeme County, Pennsylvania) (Ref. 2.5-9, pg. 57) and the lower Susquehanna River (below the Conowingo Dam in Maryland) (Ref. 2.5-7, Table 1) and has been reported from Conowingo "Reservoir" (Ref. 2.5-8, pg. 2). However, the cisco has not been collected by Exelon or its contractors in Conowingo Pond and is not believed to be present.

State- or federally-listed molluscs have not been found in Conowingo Pond by Exelon or its contractors.

2.6 REGIONAL DEMOGRAPHY

The *Generic Environmental Impact Statement for License Renewal of Nuclear Power Plants* (GEIS) presents a population characterization method that is based on two factors: "sparseness" and "proximity" (Ref. 2.2-4, Section C.1.4). "Sparseness" measures population density and city size within 20 miles of a site and categorizes the demographic information as follows:

DEMOGRAPHIC CATEGORIES BASED ON SPARSENESS

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

Source: Ref. 2.2-4, pg. C-159.

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

DEMOGRAPHIC CATEGORIES BASED ON PROXIMITY

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

Source: Ref. 2.2-4, pg. C-159.

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

GEIS SPARSENESS AND PROXIMITY MATRIX

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

Low Population Area | Medium Population Area | High Population Area

Source: Ref. 2.2-4, pg. C-6.

Exelon used 1990 census data from the U.S. Census Bureau website (Ref. 2.6-1) and geographic information system software (ArcView®) to determine demographic characteristics in the PBAPS vicinity. The Census Bureau provides updated annual projections, in addition to decennial data, for selected portions of its demographic information. However, Section 2.11 (Minority and Low-Income Populations) of this environmental report uses 1990 minority and low-income population demographic information, because updated projections are not available by census tract. Exelon chose to also use 1990 data in this section so the data sets are consistent throughout the PBAPS environmental report.

As derived from Census Bureau information, 481,881 people live within 20 miles of PBAPS. Applying the GEIS sparseness measures, PBAPS has a population density of 383 persons per square mile within 20 miles and falls into the least sparse category, Category 4 (having greater than or equal to 120 persons per square mile within 20 miles).

As estimated from Census Bureau information, 4,469,569 people live within 50 miles of PBAPS. This equates to a population density of 569 persons per square mile within 50 miles. Applying the GEIS proximity measures, PBAPS is classified as being "in close proximity", Category 4 (having greater than or equal to 190 persons per square mile within 50 miles). According to the GEIS sparseness and proximity matrix, the PBAPS ranks of sparseness Category 4 and proximity Category 4 result in the conclusion that PBAPS is located in a high population area.

All or parts of 24 counties are located within 50 miles of PBAPS (Figure 2-1). Of the counties, 10 are in Pennsylvania, 10 are in Maryland, two are in Delaware, and two are in New Jersey. The Baltimore Metropolitan Statistical area is the largest city within 50 miles of PBAPS. Other sizable towns (within 50 miles) include Reading, Harrisburg, Chester, Lancaster, and York, Pennsylvania, and Wilmington, Delaware (Ref. 2.6-2). Approximately 66 percent of PBAPS's employees live in Lancaster and York Counties. The remaining 34 percent is distributed across 18 counties, with numbers ranging from 1 to 99 people. The towns of Red Lion, Delta, Lancaster, Quarryville, and York have the highest numbers of employees in residence, with 7.6, 6.1, 6.0, 5.6, and 5.2 percent, respectively.

Both Lancaster and York Counties' populations are growing at faster rates than that of the Commonwealth of Pennsylvania as a whole. Between 1980 and 1990, the Commonwealth population increased by 0.1 percent, while Lancaster and York Counties increased by 17 and 9 percent, respectively. The Commonwealth of Pennsylvania as a whole is projected by the Census Bureau to have the second smallest (5 percent) population increase of all 50 states during the period from 1995 to 2025 (Ref. 2.6-3). Projections for the period from 2000 through 2020 show Lancaster and York Counties surpassing the Commonwealth rate of growth with population increases of 23 and 9 percent, respectively.

Table 2-2 shows estimated populations and annual growth rates for the two counties with the greatest potential to be affected by license renewal activities. Figure 2-1 shows the locations of these areas.

2.7 ECONOMIC BASE

Lancaster County has experienced steady growth in population and economic activity during the last decade, as has York County but to a lesser extent. Both Lancaster and York Counties are designated as metropolitan statistical areas, ranking 86th and 107th of the 276 metropolitan statistical areas in the country in 1998 (Ref. 2.7-1), with populations of approximately 423,000 and 340,000, respectively. Both Counties are located in south-central Pennsylvania, on the western edge of the highly urbanized and industrial region extending from Boston, Massachusetts, to Washington, DC. Both Counties have ready access to domestic and international markets, with a transportation network consisting of interstate highway access to major north-south and east-west routes, trucking and rail terminals, two international airports, and two international ports (Refs. 2.7-2, 2.7-3, and 2.7-4).

Historically, both Lancaster and York Counties' economies were deeply rooted in agriculture. In recent years, both Counties have become more economically diversified. In Lancaster County, services is now the largest employment sector (26 percent of the labor force) (Ref. 2.7-3), with health services as the leading employment group, closely followed by the eating and drinking establishments group (Ref. 2.7-5). The manufacturing sector employs 25.3 percent of the labor force (Ref. 2.7-3), with the "production of food and related products" as the major employment group within this category (Ref. 2.7-5). Lancaster County has the distinction of being the most productive non-irrigated farming county in the United States, with total agricultural receipts of $938 million annually (Ref. 2.7-5).

In York County, the manufacturing sector leads employment with 29 percent, followed by services at 23.4 percent (Ref. 2.7-6). There are more than 1,000 manufacturing companies that employ nearly 53,000 people (Ref. 2.7-4), with the industrial machinery and equipment industry group in the lead. The health services industry employs the greatest number of the services' sector groups (Ref. 2.7-7).

The 1999 unemployment rate for the Commonwealth of Pennsylvania was 4.4 percent. In comparison, Lancaster and York Counties had 1999 unemployment rates of 2.7 and 3.6 percent, respectively (Ref. 2.7-8).

2.8 TAXES

In the past, PECO paid property taxes to the Commonwealth of Pennsylvania on its generating, transmission, and distribution facilities. Under authority of the Pennsylvania Utility Realty Tax Act (PURTA), property taxes collected from all utilities (water, telephone, electric companies, and railroads) were redistributed to the taxing entities within the Commonwealth. In Pennsylvania, these entities include the counties, cities, townships, boroughs, and school districts. The distribution of PURTA funds is determined by a formula, and is not necessarily based on the individual utility's effect on a particular government entity. PURTA distributions, along with other revenue sources such as residential property taxes and assessments, fund operations of various government entities. In York County, for example, funds from these revenue sources, including PURTA distributions, are used for the Court of Common Pleas, county parks, county corrections facilities, the county nursing home, maintenance of the county real estate appraisal program, and voter registration files (Ref. 2.8-1). Peach Bottom Township uses revenue funds, including PURTA distributions, to maintain township roads, operate and maintain sewage treatment facilities, develop and implement planning and zoning regulations, and issue building permits (Ref. 2.8-2).

Table 2-3 lists annual budget figures for York County, Peach Bottom Township, and the Southeastern School District for the years 1996 through 2000. Although NRC recommends using local county revenues to assess the impacts on the county of the property taxes paid by a utility, Exelon determined that this information would not provide the best assessment of PBAPS' impact for two reasons. First, there is no direct correlation between the taxes paid by a utility to PURTA and the PURTA allocation to the taxing entities. A number of other variables are factored into the PURTA decision-making process when allocating funds to various taxing authorities. Second, PURTA taxes were based on depreciated book value; realty taxes now will be based on assessed value. For these reasons, past revenues are not necessarily a good measure of future property tax payments to a county (or other taxing authority).

Pennsylvania recently changed the basis for calculating PURTA taxes for tax year 1998 and beyond from the utilities' depreciated book value to the local taxing authority's assessed value. In addition, effective January 1, 2000, generating facilities are no longer included in the realty taxes paid to the Commonwealth under PURTA. Utilities will now be required to pay realty taxes

on these facilities directly to the county, township, and school district in which they are located. Distribution and transmission facilities will remain taxable under PURTA. The amounts of property taxes to be paid by Exelon for PBAPS to York County, Peach Bottom Township, and the Southeastern School District have not yet been determined. Until a determination is made, Exelon has agreed to pay York County $151,000 per year, beginning in 2000; Peach Bottom Township $30,000 per year, beginning in 2000; and the Southeastern School District $840,000 per year, beginning in 2000. These funds are non-refundable. In addition, Exelon will pay the school district $420,000 per year, beginning in 2000, that could be refunded, pending the final determination.

2.9 LAND USE PLANNING

Local governments in the Commonwealth of Pennsylvania provide services such as police and fire protection, roads and highways, public sewer and water facilities, parks and open space, planning and zoning, and social services. Counties are the first subdivision below the state level and are further divided into municipalities, including cities, boroughs, and townships. Counties are required by the Commonwealth to prepare and adopt comprehensive plans. Municipalities are authorized, but not required, to have comprehensive plans as well. These municipal comprehensive plans are required to be generally consistent with their respective county comprehensive plans. In Pennsylvania, the municipality is the level of local government with land use decision-making authority. Municipalities may adopt their own zoning and/or subdivision regulations and, in situations where there is conflict, county regulations can be repealed within the municipality's jurisdiction.

This section focuses on the Pennsylvania Counties of York and Lancaster, because approximately 66 percent of the permanent PBAPS workforce lives in these communities (Section 3.4) and Exelon will pay property taxes in York County. In York County, there are 72 municipalities (Ref. 2.9-1) and, in Lancaster County, there are 60 (Ref. 2.9-2). With the involvement of so many jurisdictional authorities, county level planning documents can serve to give an overview of regional concerns, goals, and initiatives with respect to land use. Both York and Lancaster Counties have experienced significant growth in the last decade, and their comprehensive plans reflect planning efforts and public involvement in the planning process undertaken during the 1990s.

Land use planning tools, such as zoning and subdivision regulations, are employed in York and Lancaster Counties to guide growth and development. The comprehensive plans of both Counties share the goal of encouraging growth and development in identified areas. Prevention of suburban sprawl and the preservation of open space and farmland were goals identified in both plans. In York County, proposed growth areas are identified and development is promoted within the areas. This is intended to preserve open space and farmland and encourage efficiency in providing public services and facilities (Ref. 2.9-1). New development beyond growth areas is directed to areas around existing boroughs and villages. In Lancaster County, the designations of "Urban" and "Village Growth Boundaries" have been made to encourage growth around existing

villages and urban areas and to prevent development sprawl into rural areas (Ref. 2.9-3).

York County

With a total land area of 911 square miles, York County's predominant land use is farming (67.6 percent), followed by residential (20.9 percent) (Ref. 2.9-4). York County's population has grown steadily over the last 90 years. The average rate of increase has been 12.7 percent per decade. The rate of growth decreased to 8.5 percent between 1980 and 1990, with projections indicating that growth will continue, but at a slightly slower rate in the decades ahead. This growth is not distributed evenly, but is concentrated in several urban growth areas including the York urban area, the south-central area around Shrewsbury Township, the Hanover/Penn Township area, and the Fairview/Newberry Township area along Interstate 83 North. The areas of growth on the periphery of the County reflect York's position as a bedroom community for larger metropolitan areas such as Harrisburg, Pennsylvania, and Baltimore, Maryland (Ref. 2.9-5).

Although agriculture ranks low in York County in terms of employee numbers, agricultural production contributes substantially to the County's economy and the preservation of farmland is a priority (Ref. 2.9-5). Since 1940, farmland has decreased at a rate of more than six square miles annually. Between 1960 and 1992, some 156,148 acres of farmland were lost (38 percent), the total number of farms decreased by 64 percent, and the average size of farms increased by 71 percent (Ref. 2.9-5).

In response to the growth trends exhibited by population increases, housing has increased accordingly. The total number of housing units in York County increased by 18.4 percent between 1980 and 1990, from 98,261 to 116,354 units. York had 111,779 occupied housing units in 1990, with 78.1 percent owner occupancy and 21.9 percent renter occupancy. The total number of vacant units increased from 5,248 in 1980 to 6,095 in 1990. While the York County housing data was collected in 1990, it remains useful in depicting the community's upward trend in response to population increases and a general availability for future growth (Ref. 2.9-5). Current data provided by the U.S. Bureau of the Census will be available next year.

York County's economy has experienced (1) an overall growth in the number of employees and (2) some shifting among the sectors which lead the County in

economic productivity. Three leading sectors include manufacturing, wholesale/retail, and services. Though manufacturing leads the group with 134,636 jobs in 1992, the sector had experienced a decline from 1980 to 1992 with substantial decreases (22.4 percent) in the number of manufacturing jobs. At the same time, the County experienced increases (71.1 percent) in employment within the wholesale/retail and service sectors (Ref. 2.9-5).

Lancaster County

Lancaster County covers approximately 984 square miles. Like many other rapidly growing areas, Lancaster County is experiencing growth in the form of suburban sprawl. Traditional city functions have been decentralized and spread throughout the suburban townships. Lancaster County's population has grown steadily over the last century. The average rate of increase has been 12.1 percent per decade. The rate of growth increased to 17 percent between 1980 and 1990, with projections indicating that growth will continue, but at a slightly slower rate in the decades ahead. The County has diverse housing. However, during the late 1980s and early 1990s, there was a shortage of affordable housing in suburban areas. While the shortage is not totally rectified, urban municipalities offer the most affordable opportunities for buying a home (Ref. 2.9-3).

Like York County, Lancaster County's predominant land use is agriculture. Lancaster leads the nation in production from non-irrigated land. As of 1996, approximately 320,000 of the 380,000 acres in farm use in the county were protected by effective agricultural zoning. More than 23,600 acres of farmland have been preserved by permanent easement. However, since 1959, the county has lost approximately 102,500 acres of farmland to development – a rate of 2,800 acres per year (Ref. 2.9-3). The preservation of farmland is a priority for Lancaster County.

Lancaster County has one of the strongest economies in the state. The business/industry, agriculture, and tourism sectors are the leaders in economic productivity. The County's business/industry sector is comprised of more than 10,000 separate companies. Leading employers include Fortune 500 companies and strong regional firms. A strong manufacturing sector is prevalent.

Lancaster County's agricultural production grossed more than $844 million dollars in 1995. And, according to 1996 estimates by the Pennsylvania Dutch

Convention and Visitor's Bureau, tourism generated roughly $478 million in revenue (Ref. 2.9-3).

2.10 SOCIAL SERVICES AND PUBLIC FACILITIES

2.10.1 PUBLIC WATER SUPPLY

PBAPS acquires potable water from the Susquehanna River and is not connected to a municipal system. Because 66 percent of the permanent employees of PBAPS reside in York and Lancaster Counties, discussion of public water supply systems will focus on these areas. In Pennsylvania, the counties do not operate public water supply systems; local municipalities, authorities, and private water companies are subject to regulation under the Federal Safe Drinking Water Act and provide drinking water to residents who are not on individual wells.

In York County, approximately 25 percent of the residents obtain drinking water from individual onsite wells or springs. York County has 320 water supply systems. Many of these systems are small, with 34 of the providers serving fewer than 100 people. The remaining systems range in size from the Railroad Borough system (serving approximately 320 people) to the York Water Company (serving over 140,000 people). The primary water sources for the larger systems in the County are surface water, while the smaller systems rely on groundwater. There are over 200 permitted wells and springs used as water sources for water supply systems in York County (Ref. 2.10-1). York County has projected water use through 2010 at roughly 47.96 million gallons per day (MGD). In 1996, the average daily use was approximately 31.72 MGD.

Water systems in York County have been evaluated in the York County Water Supply Plan as to their ability to meet existing and projected water requirements for their respective service populations. These determinations provide the basis for recommended facility improvements, cost estimating, and preparation of regional solutions by the planning commission. Determination has been made of systems' adequacy with regards to source, treatment, treated storage, and transmission/distribution capacities. Of the 80 community systems, 51 are considered adequate to meet existing maximum daily demand (MDD) and 44 are adequate to meet 2010 projected MDD. One system was deemed inadequate to meet treatment capacity for current MDD and eight were inadequate for 2010 MDD. These eight were also projected to experience source capacity problems. Only 36 of the 80 community systems provide adequate treated storage capacity for existing one-day distribution needs. These 36 are also projected to have adequate one-day storage capacity by the year 2010. Only nine of the 43 mobile

home park systems have adequate one-day distribution storage. Only four systems received adequate ratings under all pumping and piping criteria (Ref. 2.10-1). The County found that all York County water systems are currently producing water that meets existing treatment requirements. Most systems, especially the large regional ones, are in good condition and many of the smaller ones are also adequate and viable to meet demand. For those systems in need of improvements, alternatives were evaluated and County-based solutions identified (Ref. 2.10-1).

In Lancaster County, approximately 64 percent of the households are served by public water suppliers, while private on-lot water wells serve the remaining 36 percent. In 1993, approximately 2.2 percent of the County's population was served by one of 75 small water suppliers. Most residents receive their water from one of 34 large community water suppliers. Between 1986 and 1993, water supplied by these systems increased by 12 percent. Although these larger systems draw water from both ground and surface sources, they are increasingly dependent on groundwater to meet growing public demand. To meet these demands, large community water suppliers have completed major system improvements, drilled new wells, and extended service lines. In some cases, new authorities have been created and water systems have merged. Lancaster County has projected water use through 2010 at about 85 MGD. In 1993, average daily consumption was 66.4 MGD. An analysis by the County of the large community water suppliers indicates that approximately one-third have sufficient water to meet 2010 demands. One-third may lack sufficient water for this period, while the remaining systems have an excess supply. About half the systems with insufficient water could interconnect with other systems that have excess water. Others would probably need to find new water sources (Ref. 2.10-2).

Both York and Lancaster Counties anticipate water supply challenges in the future. According to the data, there will be shortages in some areas and excess supply in others. Future industries and residents will be encouraged to locate in areas with an adequate water supply infrastructure.

2.10.2 TRANSPORTATION

Road access to the PBAPS is via State Route 2104 (Lay Road), which is a two-lane paved road. State Route 2104 (Lay Road) intersects State Route 2043 (Flintville Road) approximately two miles from the plant. Employees commuting

to and from work generally use State Route 2104 (Lay Road), State Route 2024 (Paper Mill Road), State Route 2043 (Flintville Road), State Route 2026 (Atom Road), and State Route 2045 (Broad Street Extension), along with principal State Routes 74 and 372. State Route 372 crosses the Susquehanna River north of PBAPS, providing access to Lancaster County. Flintville Road (which becomes Maryland State Route 623) connects with U.S. 1 in Maryland and is used by commuters from the south. The Pennsylvania Department of Transportation does not maintain level-of-service designations for roadways in the Commonwealth. Counts determining the average number of vehicles per day are available for selected state-maintained routes. Table 2-4 lists roadways in the vicinity of PBAPS and the average number of vehicles per day, as determined by the Pennsylvania Department of Transportation.

While the Pennsylvania Department of Transportation does not compute level-of-service determinations on road capacities, local residents and Exelon employees agree that the area is extremely rural and there are no traffic-related issues.

2.11 MINORITY AND LOW-INCOME POPULATIONS

2.11.1 MINORITY POPULATIONS

The NRC guidance for performing environmental justice reviews defines a "minority" population as: American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic (Ref. 2.11-1, Attachment 4). The guidance indicates that a minority population exists if either of the two following conditions exist:

> Exceeds 50 Percent – the minority population of the environmental impact site exceeds 50 percent or
>
> More than 20 Percent Greater – the minority population percentage of the environmental impact site is significantly greater (typically at least 20 percent) than the minority population percentage in the geographic area chosen for comparative analysis.

The NRC performed environmental justice analyses for Calvert Cliffs Nuclear Power Plant and Oconee Nuclear Station license (Refs. 2.11-2, Section 4.4.6; and 2.11-3, Section 4.4.6). In doing so, NRC used a 50-mile radius as the overall area that would contain environmental impact sites and the state as the geographic area for comparative analysis. Exelon has adopted this approach for identifying the PBAPS minority and low-income populations.

The NRC guidance calls for use of the most recent U.S. Census Bureau decennial census data. Exelon used 1990 census data from the U.S. Census Bureau website (Ref. 2.11-4) in determining the percentage of the total population within the States of Delaware, Maryland, and New Jersey, and the Commonwealth of Pennsylvania for each minority category and in identifying minority and low-income populations within 50 miles of PBAPS. The U.S. Census Bureau provides updated annual population projections for selected portions of its demographic information; however, the updated projections are not available for census-tract levels of analysis. Exelon used ArcView® geographic information system (GIS) software to combine U.S. Census Bureau tract data with Environmental Systems Research Institute tract-boundary spatial data to determine the minority and low-income characteristics on a tract-by-tract basis. Exelon included census tracts if at least 50 percent of their area lay within 50 miles of PBAPS. The 50-mile radius includes 1,201 census tracts.

Exelon divided U.S. Census Bureau population numbers for each minority population within each census tract by the total population for the appropriate state to obtain the percent of the total represented by each minority. Table 2-5 shows the result of this calculation and the threshold for determining whether a minority population exists. Because the state percentages are low, the "more than 20 percent greater" criterion is more encompassing than the "exceeds 50 percent" criterion. For example, if 40 percent of a census tract was Black, it would not contain a minority population under the "exceeds 50 percent" criterion. However, under the "more than 20 percent" criterion, such a tract in Pennsylvania would contain a minority population because a 40 percent Black population exceeds the state average of 9 percent by more than 20 percent.

For each of the 1,201 census tracts within 50 miles of PBAPS, Exelon calculated the percent of the population in each minority category and compared the result to the corresponding threshold percent to determine whether minority populations exist. Table 2-5 presents the number of census tracts within each state that exceed the threshold for determining the presence of a minority population.

Based on the "more than 20 percent greater" criterion, Black minority populations exist in 209 census tracts: 21 in Delaware, 136 in Maryland, 4 in New Jersey, and 48 in Pennsylvania. Hispanic minority populations exist in 22 tracts: 2 in Delaware, 1 in Maryland, 1 in New Jersey, and 18 in Pennsylvania. Two tracts contain Native American minority populations, one located in Baltimore and the other in West Chester in eastern Pennsylvania. Figure 2-5 shows the locations of minority populations. Black minority populations tend to be concentrated in urban areas, especially in metropolitan Baltimore and Philadelphia. All Hispanic minority populations, with the exception of five tracts, are located in the Cities of Lancaster and Reading.

2.11.2 LOW-INCOME POPULATIONS

NRC guidance defines "low-income" by using U.S. Census bureau statistical poverty thresholds (Ref. 2.11-1, Attachment 4). The guidance indicates that a low-income population exists if the percentage of households below the poverty level in an environmental impact site is significantly greater (typically at least 20 percent) than the low-income population percentage in the geographic area chosen for comparative analysis. U.S. Census Bureau data (Ref. 2.11-4) characterizes 9 percent of Delaware, 8 percent of Maryland and New Jersey, and 11 percent of Pennsylvania households as low-income. Applying the NRC

criterion (at least 20 percent greater than state), 99 of 1,201 census tracts contain low-income populations. Table 2-5 presents the numbers of census tracts within each state that exceed the threshold for determining the presence of low-income populations. The majority of census tracts (65) containing low-income populations are located in the Baltimore metropolitan area. The remaining 34 census tracts are located in urban areas. In Pennsylvania, eight are in the Philadelphia metropolitan area, six in Harrisburg, five in Reading, three in Lancaster, and three in York. In New Jersey, two are in Salem. In Delaware, seven tracts are in Newark and Wilmington. Figure 2-6 shows the locations of the low-income populations.

2.12 METEOROLOGY AND AIR QUALITY

PBAPS is located in York County, Pennsylvania, which is part of the South Central Pennsylvania Intrastate Air Quality Control Region (AQCR). The AQCR is designated as being in attainment for all criteria pollutants, except ozone. Lancaster County, immediately across the Susquehanna River from PBAPS, is designated as a nonattainment area for ozone and classified marginal. Nearby, the Metropolitan Philadelphia Interstate AQCR includes counties in Pennsylvania (Bucks, Chester, Delaware, Montgomery, and Philadelphia), New Jersey (Burlington, Camden, Gloucester, Mercer, and Salem), and Delaware (New Castle). The Metropolitan Philadelphia Interstate AQCR is designated as nonattainment for ozone (Ref. 2.12-1, Subparts 81.15, 81.105, and 81.339).

The Metropolitan Baltimore Intrastate AQCR is also near PBAPS, and encompasses the following counties in Maryland: Anne Arundel, Baltimore City, Baltimore County, Carroll, Harford, and Howard. All counties in the Metropolitan Baltimore AQCR are designated nonattainment for ozone and several zones within Baltimore City and Baltimore County do not meet primary standards for total suspended particulates (Ref. 2.12-1, Subparts 81.28 and 81.321).

2.13 HISTORIC AND ARCHAEOLOGICAL RESOURCES

The Final Environmental Statement related to operation of PBAPS, prepared in 1973 by the U.S. Atomic Energy Commission, stated that "no artifacts of historical or archaeological significance (were) found within the site boundary" during construction, and none have been discovered in more than 25 years of station operation. An archaeologist from the William Penn Museum conducted an evaluation of the site in 1972 and observed that the impoundment of the Susquehanna River in the 1920s to create Conowingo Pond flooded the floodplain and terrace areas most likely to contain cultural artifacts (Ref. 2.2-1). Within York and Lancaster Counties in Pennsylvania and Harford County in Maryland, there are 78, 198, and 76 sites, respectively, listed on the National Register of Historic Places (Refs. 2.13-1; 2.13-2; and 2.13-3). The nine sites in the vicinity of PBAPS are listed in Table 2-6. The two sites closest to PBAPS, the Coulsontown Cottages Historic District and the Delta Historic District, preserve architectural sites that reflect the role of Welsh immigrants and the slate industry in which they worked in the region during the latter half of the 19th century. Peach Bottom slate, used primarily for roofing material, was world-renowned for its quality; the craftsmanship of the Welsh immigrants who mined and cut it was highly respected (Ref. 2.13-4). The Peach Bottom-to-Keeney transmission line corridor does not cross any listed or known historic sites.

2.14 REFERENCES

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

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TABLE 2-1
SPECIAL-STATUS SPECIES

This table identifies species that are federal- or state-listed as threatened or endangered and that, based on habitat and known geographic range, could occur at Peach Bottom Atomic Power Station or along its Keeney transmission line corridor.

Scientific Name	Common Name	Federal Status[a]	State Status[a] PA	State Status[a] MD
Mammals				
Cryptotis parva	Least shrew	-	E	-
Myotis leibii	Eastern small-footed myotis	-	T	-
Neotoma magister	Eastern woodrat	-	T	E
Sorex fumeus	Smoky shrew	-	-	T
Birds				
Ammodramus henslowii	Henslow's sparrow	-	-	T
Asio flammeus	Short-eared owl	-	E	-
Bartramia longicauda	Upland sandpiper	-	T	E
Botaurus lentiginosus	American bittern	-	T	-
Casmerodius albus	Great egret	-	T	-
Cistothorus platensis	Sedge wren	-	T	T
Dendrocia fusca	Blackburnian warbler	-	-	T
Falco peregrinus	Peregrine falcon	DM	E	E
Haliaeetus leucocephalus	Bald eagle	T	E	E
Ixobrychus exilis	Least bittern	-	T	-
Lanius ludovicianus	Loggerhead shrike	-	E	E
Nyctanssia violacea	Yellow-crowned night heron	-	E	-
Oporornius philadelphia	Mourning warbler	-	-	E
Pandion haliaetus	Osprey	-	T	-
Rallus eleganus	King rail	-	E	-
Amphibians				
Ambystoma tigrinum	Tiger salamander	-	-	E
Pseudotriton montanus	Mud salamander	-	E	-
Reptiles				
Clemmys muhlenbergii	Bog turtle	T	E	T
Opheodrys aestivus	Rough green snake	-	T	-
Pseudemys rubriventris	Red-bellied turtle	-	T	-
Fish				
Acipenser oxyrhynchus	Atlantic sturgeon	Ca	E	-
Alosa mediocris	Hickory shad	-	E	-
Coregonus artedi	Cisco	-	E	-

TABLE 2-1 (Cont'd)
SPECIAL-STATUS SPECIES

Scientific Name	Common Name	Federal Status[a]	State Status[a]	
			PA	MD
Invertebrates				
Speyeria idalia	Regal fritillary	-	E	E
Vascular Plants				
Agrimonia microcarpa	Small-fruited agrimony	-	-	E
Agrimonia striata	Woodland agrimony	-	-	E
Arethusa bulbosa	Swamp-pink	-	E	-
Aster depauperatus	Serpentine aster	-	T	E
Bromus latiglumus	Broad-glumed brome	-	-	E
Carex buxbaumii	Buxbaum's sedge	-	-	T
Carex hitchcockiana	Hitchcock's sedge	-	-	E
Carex hystericina	Porcupine sedge	-	-	E
Carex mesochorea	Midland sedge	-	-	E
Carex polymorpha	Variable sedge	-	E	-
Clematis occidentalis	Purple clematis	-	-	E
Deschampsia caespitosa	Tufled hairgrass	-	-	E
Desmodium rigidum	Rigid tick-trefoil	-	-	E
Dodecatheon amethystinum	Jeweled shooting-star	-	T	-
Euphorbia purpurea	Glade spurge	-	E	E
Gentainopsis crinita	Fringed gentian	-	-	E
Gentiana andrewsii	Fringe-tip closed gentian	-	-	T
Hydrastis canadensis	Goldenseal	-	-	T
Leptochloa fascicularis	Long-awned diplachne	-	-	E
Panicum oligosanthes	Few-flowered panicgrass	-	-	E
Pycnanthemum verticillatum	Whorled mountain mint	-	-	E
Rhynchospora globularis	Grass-like beakrush	-	-	E
Sanguisorba canadensis	Canada burnet	-	-	T
Scleria reticularis	Reticulated nutrush	-	E	-
Scutellaria leonardii	Leonard's skullcap	-	-	T
Scutellaria nervosa	Veined skullcap	-	-	E
Solidago speciosa	Showy goldenrod	-	-	E
Sporobolus heterolepsis	Northern dropseed	-	-	E
Stenanthium gramineum	Featherbells	-	-	T
Talinum teretifolium	Fame Flower	-	-	T
Tomanthera auriculata	Eared false-foxglove	-	E	-

a. T = Threatened; E = Endangered; Ca = Candidate for federal listing; DM = Delisted, monitored for first 5 years; - = Not protected.

TABLE 2-2
REGIONAL DEMOGRAPHIES

	Population and Average Annual Growth Rate (as a percent) during the Previous Decade			
	Lancaster County		York County	
Year	Number	Percent	Number	Percent
1980[a]	362,346	1.3	312,963	1.5
1990[a]	422,822	1.7	339,574	0.9
2000[b]	486,046	1.5	382,047	1.3
2010[b]	540,823	1.1	403,133	0.6
2020[b]	597,975	1.1	415,934	0.3
2030[c]	655,832	0.9	442,813	0.6
2035[c]	684,004	0.9	452,392	0.4

a. Ref. 2.6-4.
b. Ref. 2.6-5.
c. Ref. 2.6-6.

TABLE 2-3
LOCAL GOVERNMENT BUDGETS

Year	Annual Budget for York County[a]	Annual Budget for Peach Bottom Township[b]	Annual Budget for Southeastern School District[b]
1996	$156,503,053	unavailable	$18,508,364
1997	$163,833,299	$1,214,435	$19,420,951
1998	$182,894,802	$1,315,494	$20,314,174
1999	$205,933,243	$1,355,026	$21,772,021
2000	$205,907,177	$1,690,094	$23,330,009

a. Ref. 2.8-3.
b. Ref. 2.8-4.

TABLE 2-4
ROADWAYS IN THE PBAPS VICINITY AND AVERAGE NUMBER OF VEHICLES PER DAY

Roadway	Average Number of Vehicles per Day
State Route 74 at State Route 372	4,885
State Route 74 at State Route 851	4,239
State Route 372 from State Route 74 to Bridge	3,620
State Route 2024 (Paper Mill Road)	94
State Route 2026 (Atom Road)	1,307
State Route 2043 (Flintville Road)	1,493
State Route 2045 (Broad Street Extension)	2,089
State Route 2104 (Lay Road)	1,749
(MD) State Highway 623	1,275[a]

Source: Ref. 2.10-3.
a. Ref. 2.10-4.

TABLE 2-5
MINORITY AND LOW-INCOME POPULATION CENSUS TRACTS

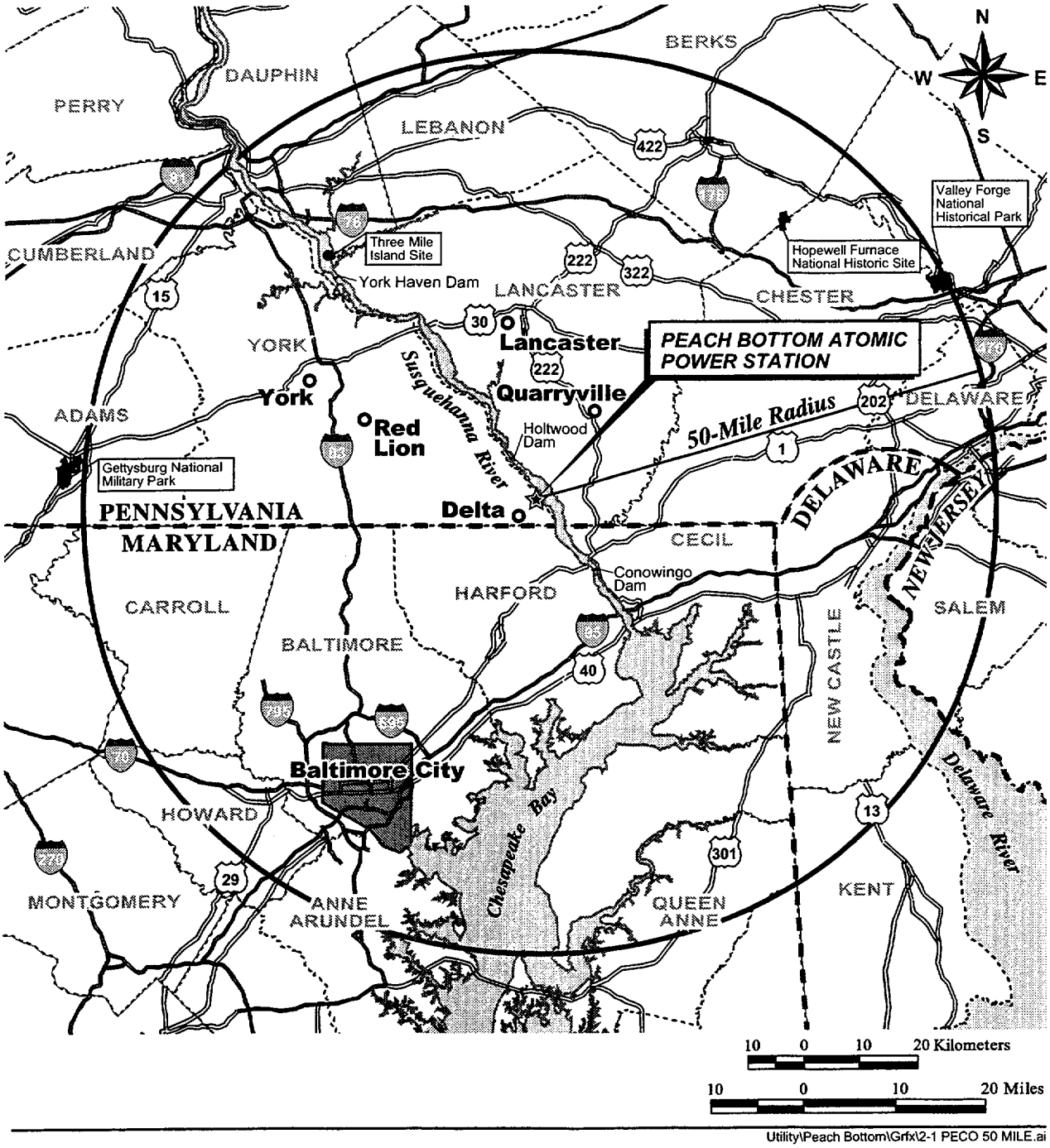
Category[c]	State Average Minority or Low-Income Population (Percent)[a]				Threshold for Minority or Low-Income Population (Percent)[b]				Number of Census Tracts Within 50-mile Radius Exceeding Threshold			
	Delaware	Maryland	Pennsylvania	New Jersey	Delaware	Maryland	Pennsylvania	New Jersey	Delaware	Maryland	Pennsylvania	New Jersey
Minority												
American Indian or Alaskan Native	<1	<1	<1	<1	20	20	20	20	0	1	1	0
Asian or Pacific Islander	1	3	1	4	21	23	21	24	0	0	0	0
Black (non-Hispanic Origin)	17	25	9	13	37	45	29	33	21	136	48	4
Hispanic	2	3	2	10	22	23	22	30	2	1	18	1
Low Income	9	8	11	8	29	28	31	28	7	65	25	2

a. Source: U.S. Census Bureau Website (Ref. 2.11-4).
b. At least 20 percent greater than state average (Ref. 2.11-1, Attachment 4).
c. As defined by Ref. 2.11-1, Attachment 4.

TABLE 2-6
HISTORIC PLACES

This table identifies sites located within 6 miles of Peach Bottom Atomic Power Station that are in the National Register of Historic Places.

Site	Location by County and State
	York County, Pennsylvania
Coulsontown Cottages Historic District	Ridge Road and Main Street, Delta
Delta Historic District	Main Street, Delta
Muddy Creek Bridge, Maryland and Pennsylvania Railroad	Maryland and Pennsylvania RR tracks over Muddy Creek, east of Creek Ridge Road, Peach Bottom and Lower Chanceford Townships, Sunnyburn
Scott Creek Bridge	North Maryland and Pennsylvania Railroad-Maryland and Pennsylvania RR tracks over Scott Creek, west of Watson's Corner and south of PA 851, Peach Bottom Township, Bryansville
	Lancaster County, Pennsylvania
Duncan Island	Address Restricted, Holtwood
Robert Fulton Birthplace	8 miles south of Quarryville on U.S. 222, Quarryville
	Harford County, Maryland
Broad Creek Soapstone Quarries	Address Restricted, Whiteford
Rigbie House	Southeast of Berkley off MD 623
Slate Ridge School	Old Pylesville Road, Whiteford



Utility\Peach Bottom\Grfx\2-1 PECO 50 MILE.ai

FIGURE 2-1
50-Mile Vicinity Map

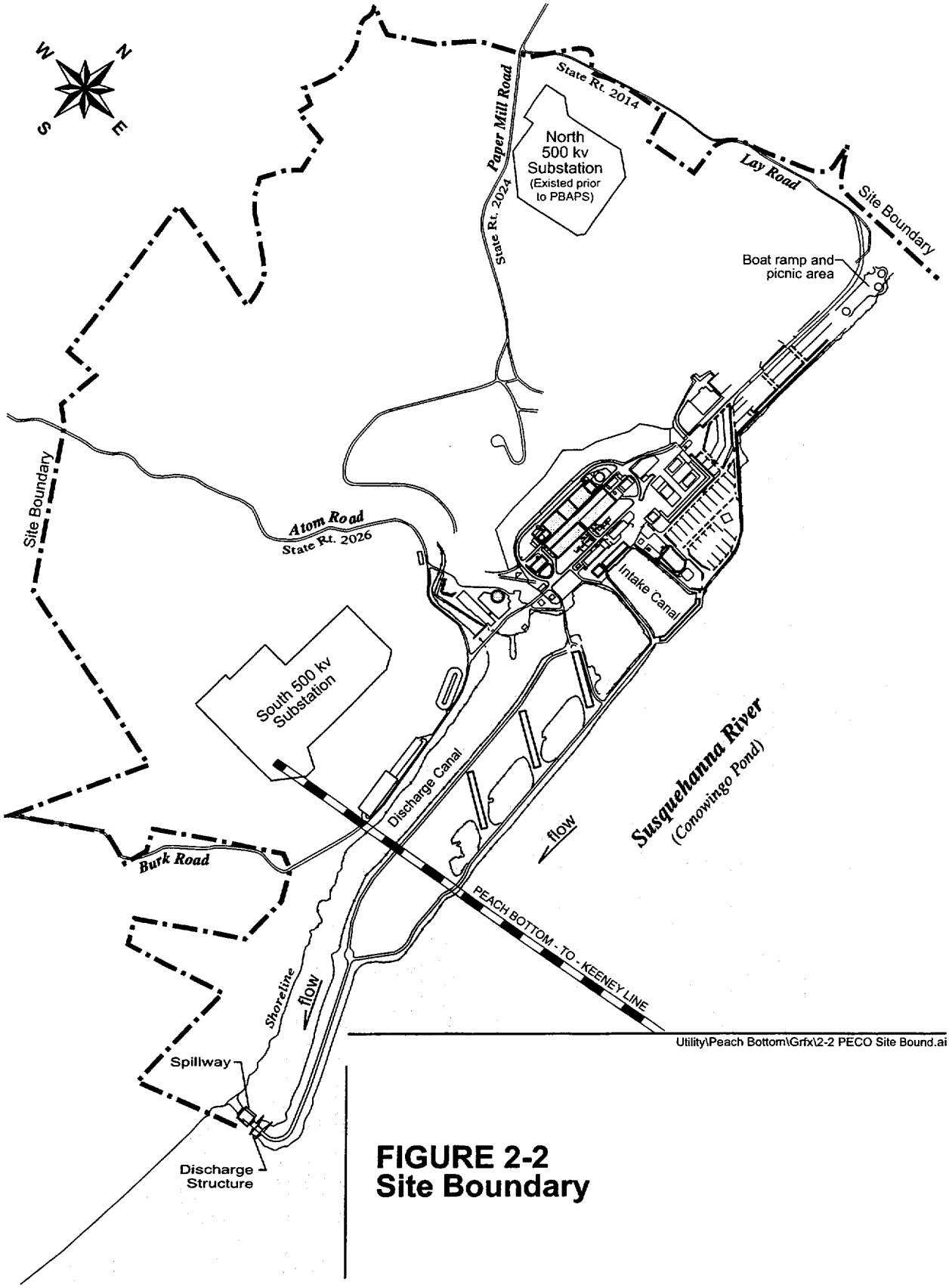


FIGURE 2-2
Site Boundary

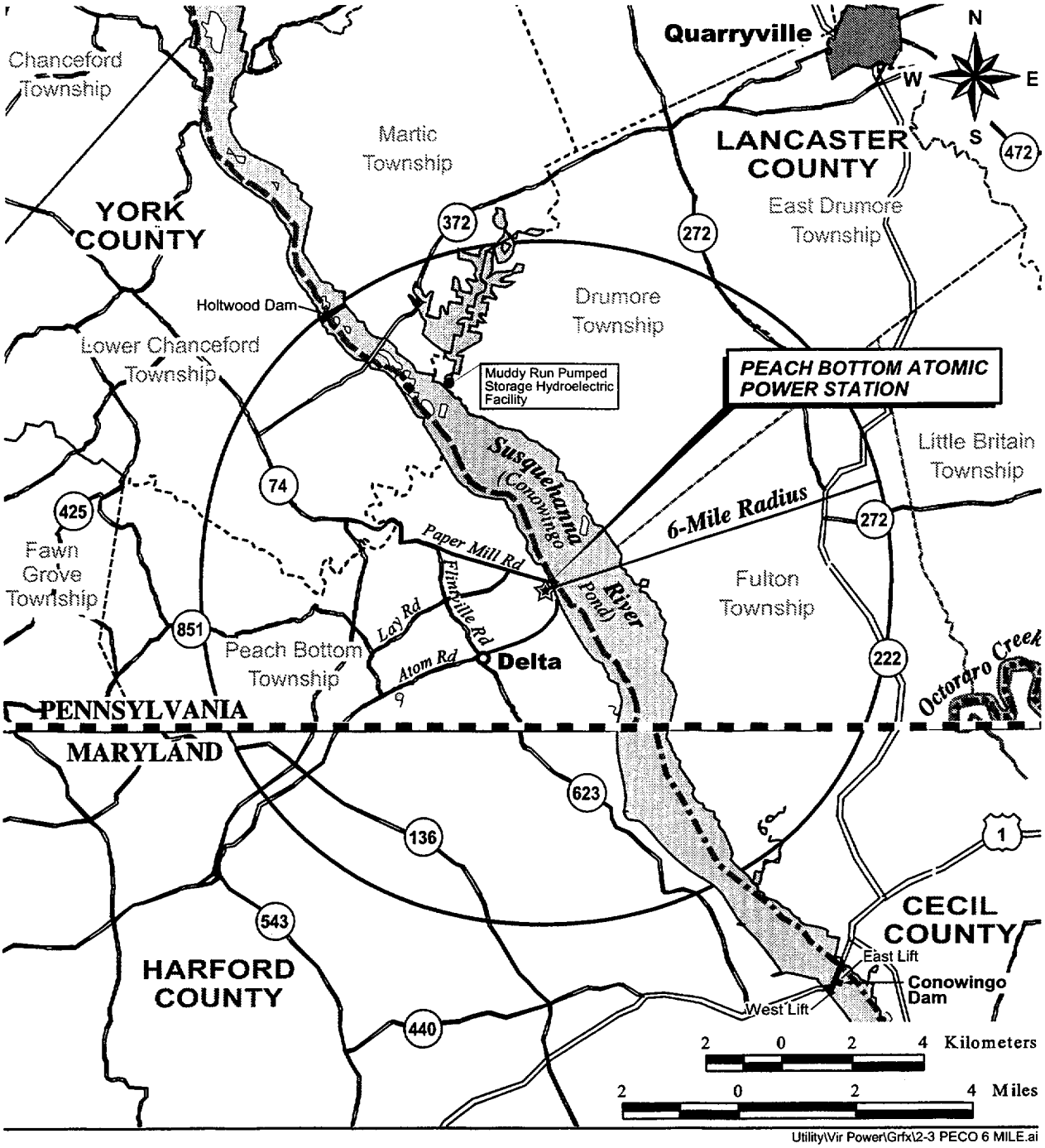
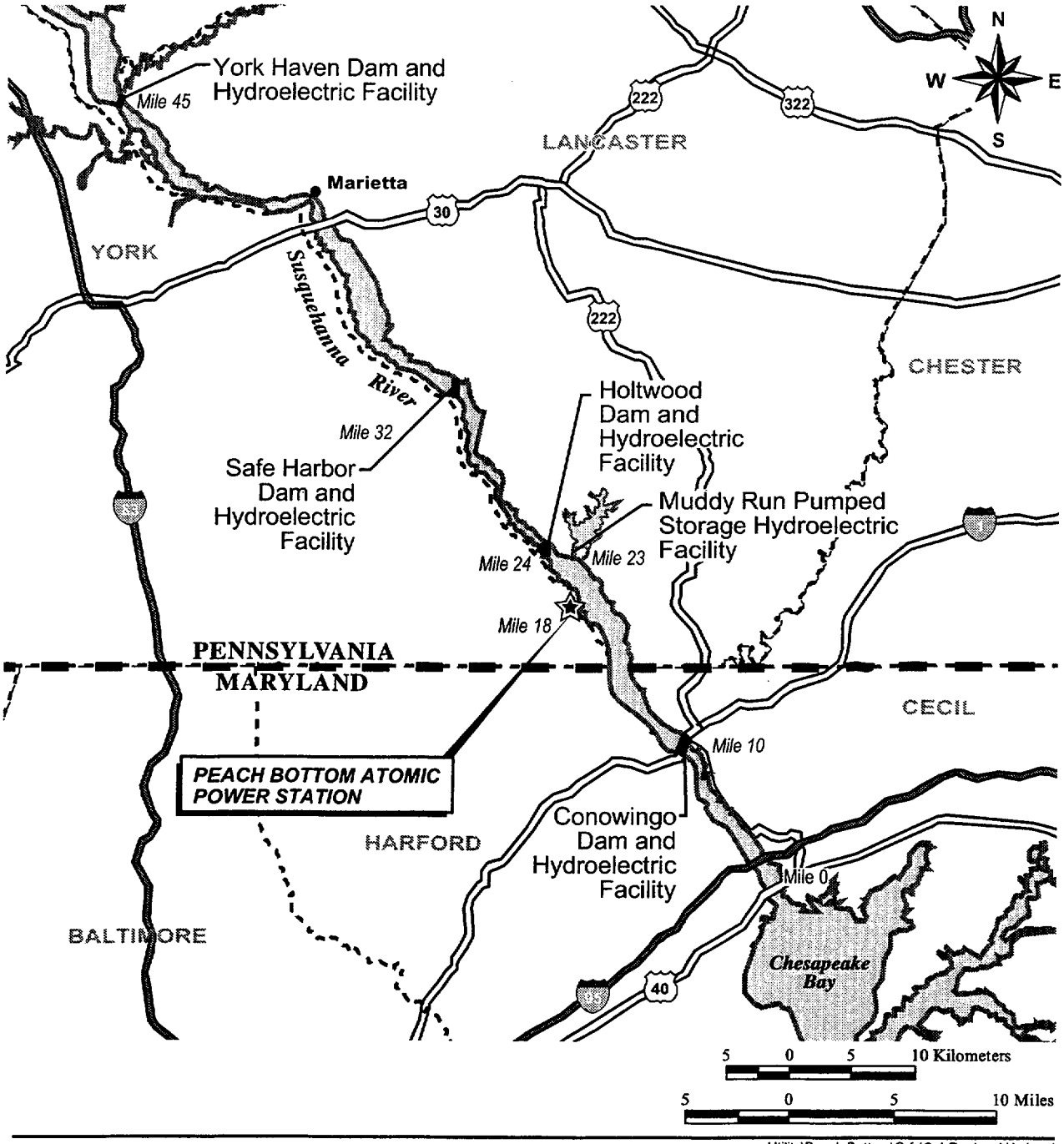


FIGURE 2-3
6-Mile Vicinity Map



Utility\Peach Bottom\Grfx\2-4 Regional Hydro.ai

FIGURE 2-4
Regional Hydrology Map

Mile identification is approximate.

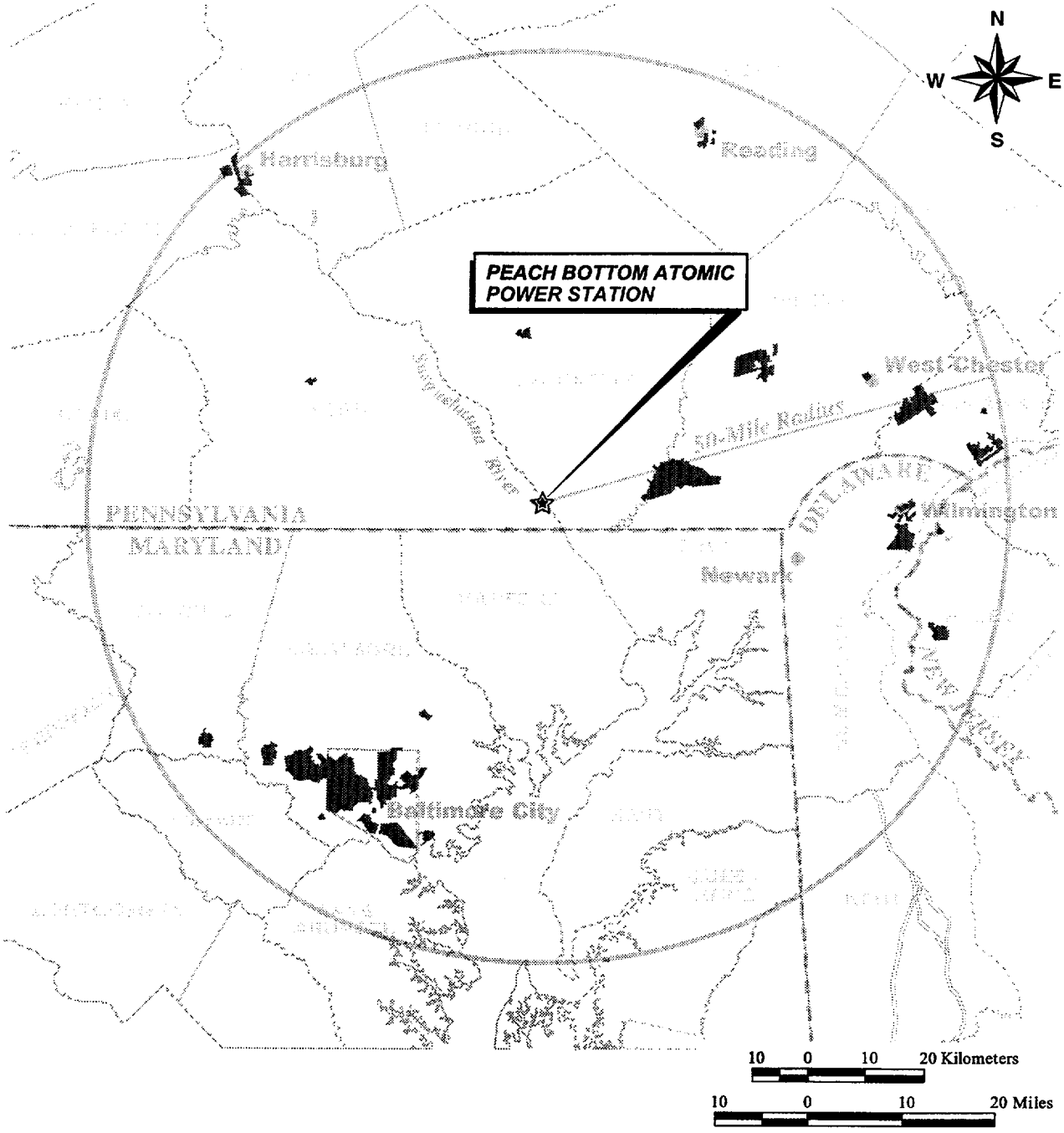


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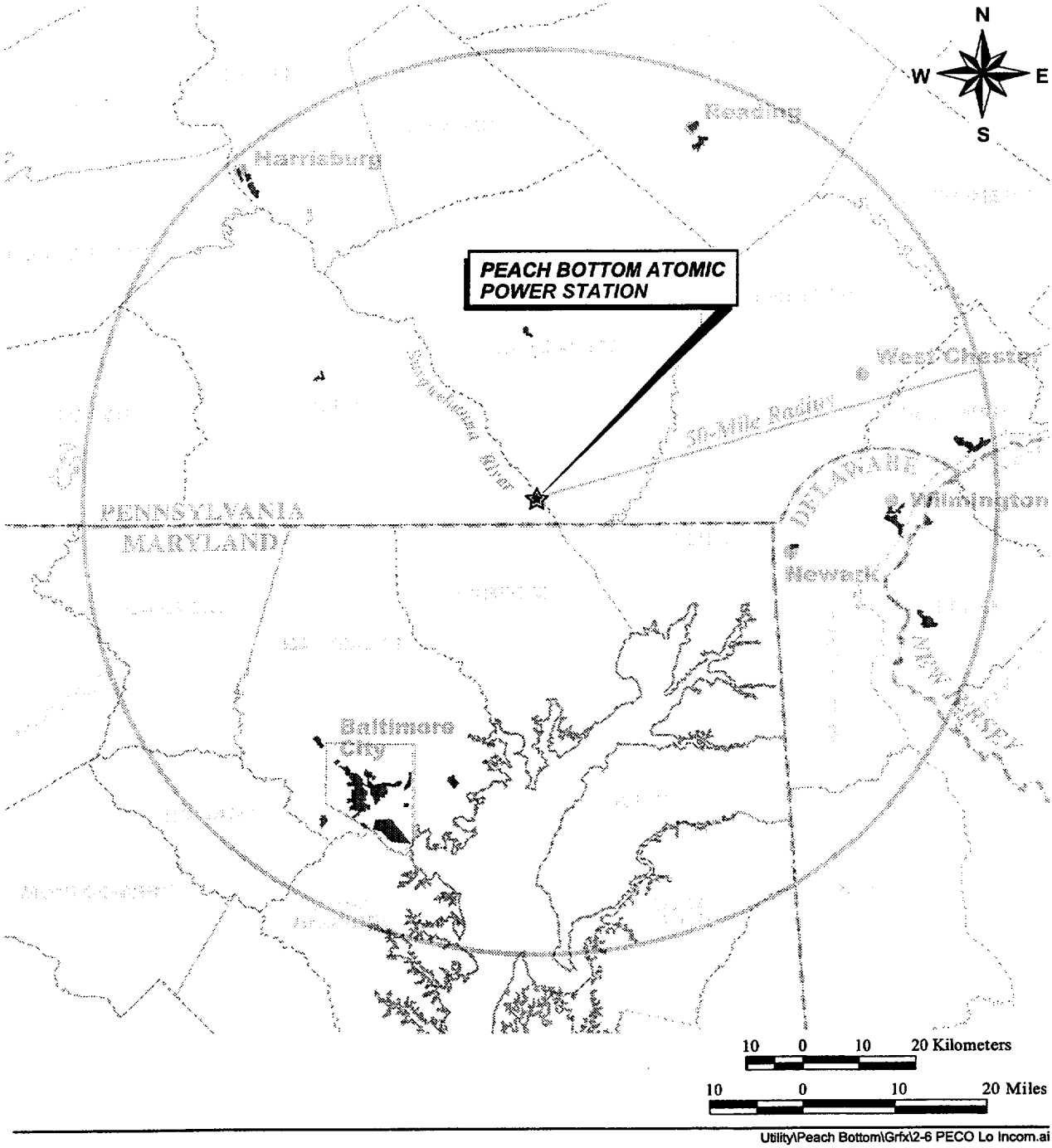
FIGURE 2-5
Minority Populations



Utility\Peach Bottom\Grfx\2-6 PECO Lo Incom.ai

FIGURE 2-6
Low-Income Populations

3.0 PROPOSED ACTION

NRC

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

Exelon Generation Company, LLC (Exelon) proposes that the Nuclear Regulatory Commission (NRC) renew the operating licenses for Peach Bottom Atomic Power Station Units 2 and 3 (PBAPS) for an additional 20 years. Renewal would give Exelon and the Commonwealth of Pennsylvania the option of relying on PBAPS to meet future needs for electricity. Section 3.1 discusses the plant in general. Sections 3.2 through 3.4 address potential changes that could occur as a result of license renewal.

3.1 GENERAL PLANT INFORMATION

General information about PBAPS is available in several documents. In 1973, the U.S. Atomic Energy Commission, the predecessor agency of NRC, prepared a Final Environmental Statement for operation of PBAPS Units 2 and 3 (Ref. 3.1-1). The NRC *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (Ref. 3.1-2) describes PBAPS features and, in accordance with NRC requirements, Exelon maintains an updated Final Safety Analysis Report for the units (Ref. 3.1-3). Exelon has referred to each of these documents while preparing this environmental report for license renewal.

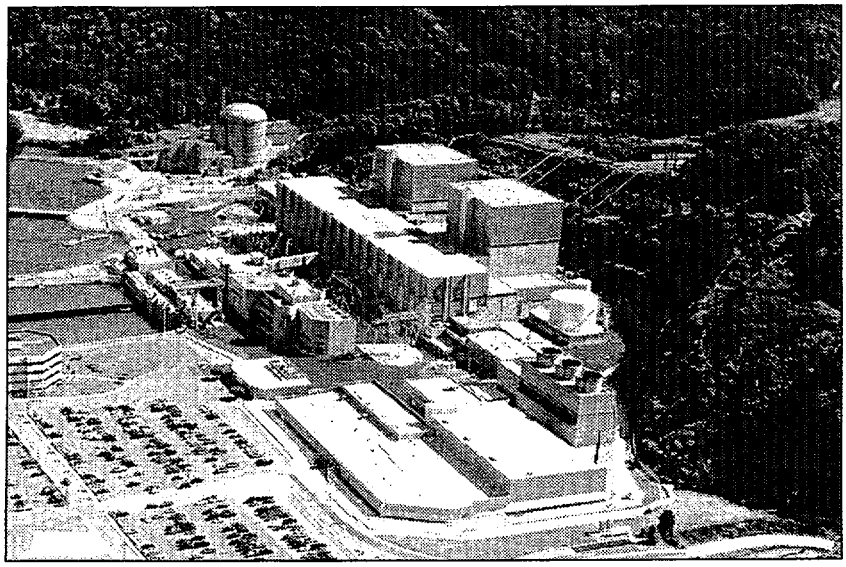
3.1.1 REACTOR AND CONTAINMENT SYSTEMS

PBAPS is a two-unit plant as shown in Figure 3-1. Each unit includes a boiling light-water reactor and a steam-driven turbine generator manufactured by General Electric Company. The architectural engineer and constructor was Bechtel. Each unit was licensed for an output of 3,293 megawatts-thermal (MWt), with a design net electric rating of 1,065 megawatts-electric (MWe). Units 2 and 3 achieved commercial operation in July 1974 and December 1974, respectively. The facility's net generating capacity was subsequently increased by 60 MWe. An NRC-prepared environmental assessment and finding of no significant impact concluded that there were no measurable environmental

impacts associated with the proposed uprate. Both units have been uprated to a core power output of 3,458 MWt (Ref. 3.1-4, pp. 52317-52321). Exelon (as PECO) received its uprate amendment for Unit 2 in 1994 and for Unit 3 in 1995. Each unit's gross output is 1,160 MWe (Ref. 3.1-5). The net capacity of each unit is 1,093 MWe (Ref. 3.1-6).

Each reactor's primary containment is a pressure suppression system consisting of a drywell, pressure suppression chamber, vent system, isolation valves, containment cooling system, and other service equipment. Each containment is designed to withstand an internal pressure of 62 pounds per square inch above atmospheric pressure (62 psig) (Ref. 3.1-3, pg. 5.2-3). Together with its engineered safety features, each containment is designed to provide adequate radiation protection for both normal operation and postulated design-basis, such as earthquakes or loss of coolant (Ref. 3.1-3, Section 5.2). PBAPS fuel is low enriched uranium dioxide with enrichments below 5 percent by weight uranium-235 and fuel burnup levels less than 60,000 megawatt-days per metric ton uranium (Ref. 3.1-4, pg. 15).

Unit 1 is located adjacent to Units 2 and 3. It is a prototype, high-temperature, gas-cooled reactor that had a net electrical output of 40 MW (115 MWt) and operated from 1996 to 1974. Since then it has been maintained in SAFSTOR (i.e., safe storage; continued surveillance, security, and maintenance with no fuel in storage in the fuel pool) and will be decommissioned in the future. It is not part of this license renewal application.



PBAPS Units 1, 2, and 3.

3.1.2 COOLING AND AUXILIARY WATER SYSTEMS

3.1.2.1 Surface Water

PBAPS acquires potable water from the Susquehanna River and is not connected to a municipal water system. The raw river water is treated in a 576,000 gallon-per-day-capacity package plant on site. Current usage is 288,000 to 360,000 gallons per day. No water shortages have been experienced, even during planned outages when the onsite population increases.

PBAPS is equipped with a once-through heat dissipation system that withdraws cooling water from and discharges to Conowingo Pond, a 9,000-acre reservoir on the lower Susquehanna River (see Figure 2-1). When both units are operating, six circulating water pumps (each rated at 250,000 gallons per minute [gpm]) draw water from Conowingo Pond at a total rate of 1,500,000 gallons per minute (gpm), circulate it through the two main condensers, and return it to the reservoir via a cooling basin and a discharge canal (Ref. 3.1-1, pg. III-9). The principal components of the circulating water system are the outer intake structure, two intake basins, (inner) circulating water pump intake structure, condensers, cooling towers, discharge canal, and discharge structure (Figure 3-1).

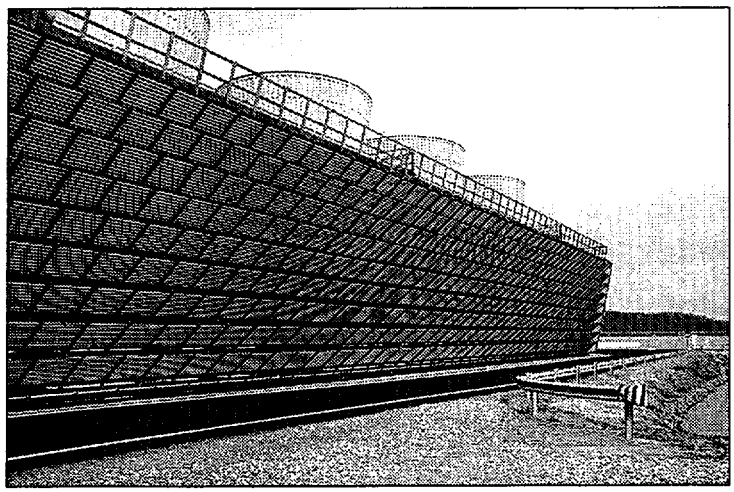
Cooling water is withdrawn at a 487-foot-long outer intake (or "screenwell") structure that lies on the west bank of Conowingo Pond, parallel to the long axis of the reservoir (Ref. 3.1-1, pg. III-10). The 32 outer intake openings are protected by trash racks that prevent large floating debris and ice floes from reaching the travelling screens. The 24 travelling screens, all with 3/8-inch square openings, lie approximately 40 feet behind the outer trash racks in the outer intake structure. These rotating screens are designed to prevent fish and small debris from entering the system. The screens are continually washed during the rotations, with trash and debris removed to a trash collection area. Debris is disposed in an offsite permitted landfill. After passing through the intake structure and travelling screens, cooling water enters two 700-foot-long by 200-foot-wide intake basins (one each for Units 2 and 3) and flows to the circulating water pump intake structure.

There are six circulating water pump intakes in the inner intake structure, three in the south basin for Unit 2 and three in the north basin for Unit 3 (Ref. 3.1-1, pg. III-10). The pump intakes are also protected by travelling screens of the same mesh size (3/8-inch) as those in the outer (Conowingo Pond intake) structure.

Like the outer screens, the inner screens can be washed; the wash water is returned to the intake basin and the screenings are hauled to a sanitary landfill.

After moving through the condensers, cooling water is discharged into a common discharge basin of approximately the same dimensions (700 feet long and 400 feet wide) as the combined intake basins (Ref. 3.1-1, pg. III-12). The temperature of the cooling water can increase as much as 20.8°F (at station design load) as it moves through the condensers (Ref. 3.1-1, pg. III-12). From the discharge basin, heated effluent can flow directly into the discharge canal or be diverted to mechanical-draft "helper" (non-recirculating) cooling towers for additional cooling before being directed to the discharge canal.

The station originally operated with three mechanical-draft "helper" cooling towers designed to cool 57 percent (876,000 gpm) of the circulating water flow (Ref. 3.1-1, pg. III-12). In 1977, two additional mechanical-draft cooling towers were put into service, making it possible to cool the entire circulating water flow, if needed. In 1978, phased operation of these cooling towers was made a condition of the National Pollutant Discharge Elimination System (NPDES) permit for the station and dictated by a "Real Time Management System for Thermal Discharge from Units 2 and 3" (Real Time Management System) that included a cooling tower matrix (Part C.I.G.d of 1995 NPDES permit, Table 1). This cooling tower matrix specified the number of cooling towers that PBAPS was required to operate, based on reactor power levels (MWt), the number of circulating water pumps in service, and intake (Conowingo Pond) water temperatures.



Cooling tower at PBAPS.

In 1997, PECO sought an amendment to the NPDES permit to operate without cooling towers. This proposed change in operation was based on studies in the summer of 1996 that showed cooling tower operation could be curtailed without adversely affecting the balanced indigenous fish community of Conowingo Pond (Ref. 3.1-7, pg. 1). Furthermore, 20 years of operating experience has demonstrated that the actual temperature rise across the condensers was generally lower than the 20.8°F predicted in the (1973) Final Environmental Statement, and that once-through operation with no cooling towers did not cause fish kills in Conowingo Pond downstream of the station's discharge (Refs. 3.1-7, 3.1-8, 3.1-9, and 3.1-10).

The Pennsylvania Department of Environmental Protection allowed PBAPS to operate without cooling towers in the summer of 1996 and issued a major permit amendment in January 1998 that removed the cooling tower matrix from the NPDES permit on the condition that Exelon (as PECO) (1) complete a three-year (1997 through 1999) study on the effect of zero cooling tower operation and (2) ensure that two of the five cooling towers remain operational in the event that circumstances change and the "probability of adverse impacts is high" (1998 NPDES permit amendment, Part C.I.G). PECO submitted its NPDES permit renewal application in January 2000 and the final report on zero cooling tower operation in February 2000. The final report confirms earlier conclusions that zero cooling tower operation does not adversely impact aquatic communities. Exelon began dismantling two of the cooling towers in early 2001, but will retain the capability of diverting approximately 60 percent of the circulating water flow through the remaining three towers. The new NPDES-permit, issued November 3, 2000 requires that two cooling towers be available "in the event that the probability of an adverse impact occurring is high."

The total circulating water flow is discharged to Conowingo Pond via the PBAPS discharge structure, located at the end of the 4,700-foot-long discharge canal (Ref. 3.1-1, pg. 12). The discharge structure contains one permanent opening and three adjustable gates that control the flow of heated effluent to Conowingo Pond. The three regulating gates maintains the velocity of the submerged jet discharge at between 5 and 8 feet per second (Ref. 3.1-8, pg. 2-2). Circulating water moves through the plant (from intake structure to discharge structure) in approximately 88 minutes when no cooling towers are in operation (Ref. 3.1-8, pg. 2-7). The transit time increases to approximately 109 minutes when three cooling towers are operating.

Condensers at PBAPS (one main condenser per nuclear unit) are equipped with a patented (BetzDearborn SIDTEC™) system that circulates polyethylene rocket tube cleaners through the condenser tubes to prevent the accumulation of deposits and biofouling organisms (Ref. 3.1-11). The system is designed to prevent heat degradation, extend tube life, eliminate outages caused by tube blockages, and reduce the station's use of oxidizing biocides, such as sodium hypochlorite. These polyethylene rocket tube cleaners, which are flexible and slightly larger in diameter (1 inch) than the inside diameter of the condenser tubes (0.94 inch), are stored in bins adjacent to the intake canal. They are periodically (10-24 hours a day) emptied into the circulating water pump discharge line, from which they are pumped (along with cooling water) to the condenser water boxes, circulated through the condenser tubes, and passed to the discharge canal, where they are retrieved and reused. One section of a condenser (each condenser has three sections corresponding with the three low-pressure turbines) and two water boxes (each condenser section has two water boxes) are cleaned at a time.

Although tube blockages are normally cleared manually or mechanically, the condensers at PBAPS are also equipped with chlorine injection systems. When the SIDTEC™ system is out of service for an extended period, sodium hypochlorite may be injected into the system to control biofouling. Normally, one section of a condenser is treated with sodium hypochlorite at a time to minimize the amount of chlorine entering the discharge canal and downstream waters. Chlorine is also used in the service water system as needed to control biofouling organisms.

The 2000 PBAPS NPDES permits (No. PA0009733) limits chlorine use to no more than four hours per day per unit between June 1 and September 30, and to two hours per day between October 1 and May 31 "unless it can be demonstrated to the permitting agency that more time is required for macroinvertebrate control" (Part C.I.C. of the NPDES permit in both instances). Further, the NPDES permit limits the total residual chlorine concentration in the outfall to 0.20 milligrams per liter (instantaneous maximum).

The service water system is also treated in spring and fall with Clam-Trol™ (an EPA-approved, ammonium chloride-based molluscicide) to control the Asiatic clam (*Corbicula fluminea*). The NPDES permit indicates that usage rates of Clam-Trol CT-1 and CT-2 (different formulations of ammonium chloride) will be "...limited to the minimum amount necessary to accomplish the intended

purposes", amounts based on manufacturer's recommendations, and specified in the NPDES permit application. Exelon is required to monitor and report Clam-Trol usage when the chemical is being applied to the service water system. Limits are not specified in the permit, but recommended application rates are provided in the NPDES permit application.

3.1.2.2 Groundwater

The small amount of groundwater in the region around Conowingo Pond (Section 2.3) results in wells with low yields. Yields over 100 gpm are virtually unknown and groundwater is therefore not used for commercial or industrial activities (Ref. 3.1-2, pg. III-17). PBAPS has several closed groundwater wells and four wells that provide non-potable water to remote facilities. Because these wells are non-potable, they are not required to be permitted by the Commonwealth. One well is at the North Substation and one is at the Salt Storage Facility at the North Substation. No information is available on the depth or capacity of either well. A third well is in the Hazardous Materials Yard. It is 200 feet deep and provides 6 gpm. It is used occasionally for washing hands or rinsing equipment. The fourth well, at the South Substation, is 300 feet deep and provides 1 gpm to a toilet at the substation.

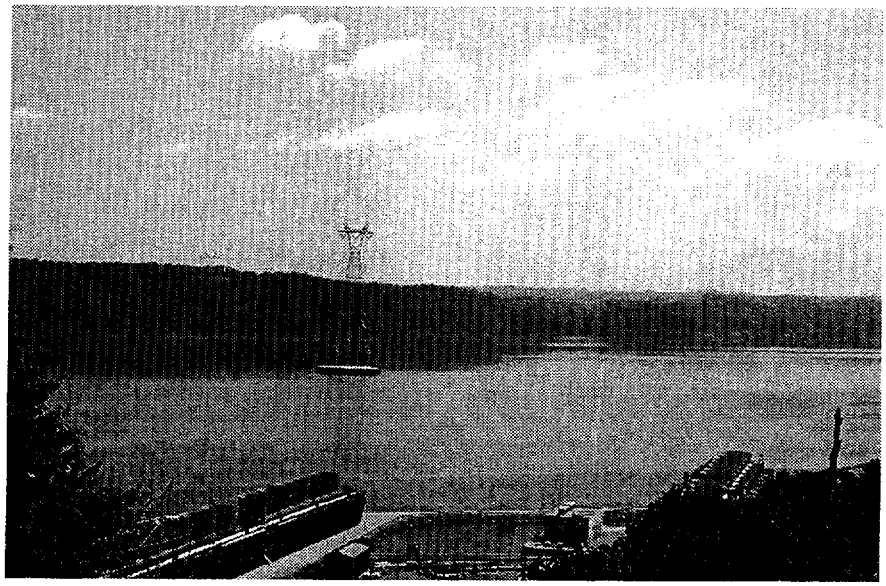
Groundwater seeps intermittently from springs in the cliffs behind PBAPS. Each reactor building and the low-level radioactive waste storage building have sumps that collect this groundwater and discharge it to the river or to the discharge canal. The yard drain sumps are outside the reactor buildings. The water collected in the radioactive waste storage building is monitored for activity prior to release. The discharge is included in the NPDES permit.

3.1.3 TRANSMISSION FACILITIES

Philadelphia Electric Company (now Exelon) built only one transmission line, the Peach Bottom-to-Keeney line, for the specific purpose of connecting PBAPS to the transmission system (Ref. 3.1-1). Beginning at the PBAPS south substation (Figure 2-2), this 500-kilovolt (kV[1]) transmission line (designated as the 5014 line) runs approximately 34 miles eastward to the Keeney substation in northwestern Delaware (see Figure 3-2). The transmission line right-of-way is

[1] A primary characteristic of a transmission line is the voltage, measured in kilovolts (kV). The GEIS (Section 4.5.1, pg. 4-59) indicates that transmission lines use voltages of approximately 115- to 138-kV and higher and that, in contrast, distribution lines use voltages below 115- or 138-kV. The PBAPS transmission line operates at 500-kV.

300 feet (or more) wide and occupies approximately 1,030 acres (Ref. 3.1-1). "Corridor" is a general term used to identify the land over which a transmission line travels. PECO owns approximately 99 percent of the land in the corridor and holds an easement on the remaining 1 percent. The corridor passes through land that is primarily a mixture of farmland and woodlands. These lands generally continue to be used in the same fashion as they were before the line was constructed (Ref. 3.1-1). The transmission corridor also contains other transmission lines, most notably the 230-kV line from the Colora to the Cecil substations, which shares the corridor for approximately 12 miles.



The 500-kV Peach Bottom-to-Keeney line crosses the Susquehanna River at PBAPS.

Exelon designed the 5014 Line in accordance with the 1967 edition of the National Electrical Safety Code® and industry guidance that was current when the line was designed. To ensure that design standards are maintained throughout the life of the transmission line, Exelon conducts transmission line and right-of-way surveillance and maintenance. Routine aerial patrols are conducted twice each year and include checks for encroachments, broken conductors, broken or leaning structures, and signs of burned trees or charred vegetation, any of which would be evidence of clearance problems. Once every three years, all lines are inspected from the ground and measured for clearance at selected locations. Problems noted during any inspection are brought to the attention of the appropriate organizations for corrective action (Ref. 3.1-12). The right-of-way up to the Delaware state line is maintained on a five-year cycle by

mowing and trimming and on a three-year cycle by the use of herbicides (Ref. 3.1-12). In Delaware, the corridor is maintained by Connectiv. Because the 5014 Line is integral to the larger transmission system, it would remain a permanent part of the transmission system even if PBAPS no longer operated.

3.2 REFURBISHMENT ACTIVITIES

NRC

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

"... The incremental aging management activities carried out to allow operation of a nuclear power plant beyond the original 40-year license term will be from one of two broad categories: (1) SMITTR actions, most of which are repeated at regular intervals, and (2) major refurbishment or replacement actions, which usually occur fairly infrequently and possibly only once in the life of the plant for any given item...." Ref. 3.1-2, Section 2.6.3.1, pg. 2-41. (SMITTR defined in Ref. 3.1-2, Section 2.4, pg. 2-30, as surveillance, monitoring, inspections, testing, trending, and recordkeeping.)

Exelon has addressed refurbishment activities in this environmental report in accordance with NRC regulations and complementary information in the NRC GEIS for license renewal (Ref. 3.1-2, Section 2.6.2). NRC requirements for the renewal of operating licenses for nuclear power plants include the preparation of an integrated plant assessment (IPA) (10 CFR 54.21). The IPA must identify and list systems, structures, and components (SSCs) subject to an aging management review. SSCs that are subject to aging and might require refurbishment include, for example, the reactor vessel, piping, supports, and pump casings (see 10 CFR 54.21 for details), as well as those that are not subject to periodic replacement.

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

The PBAPS IPA that Exelon conducted under 10 CFR 54 has not identified the need to undertake any major refurbishment or replacement actions to maintain the functionality of important SSCs during the PBAPS license renewal period. Exelon has included the IPA as part of this application.

3.3 PROGRAMS AND ACTIVITIES FOR MANAGING THE EFFECTS OF AGING

NRC

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

"...The incremental aging management activities carried out to allow operation of a nuclear power plant beyond the original 40-year license term will be from one of two broad categories: (1) SMITTR actions, most of which are repeated at regular intervals, and (2) major refurbishment or replacement actions, which usually occur fairly infrequently and possibly only once in the life of the plant for any given item...." Ref. 3.1-2, Section 2.6.3.1. (SMITTR is defined in Ref. 3.1-2, Section 2.4, as surveillance, monitoring, inspections, testing, trending, and recordkeeping.)

SMITTR Activities

The IPA required by 10 CFR 54.21, identifies the programs and inspections for managing aging effects at PBAPS. These programs are described in the *License Renewal Application for the Peach Bottom Atomic Power Station* Appendix B.

3.4 EMPLOYMENT

Current Workforce

Exelon employs a total workforce of approximately 700 permanent employees and 275 contract employees between both reactor units at PBAPS; this is less than the range of 600 to 800 personnel per reactor unit (1,200 to 1,600 total for a 2-unit plant) estimated in the GEIS (Ref. 3.1-2, Section 2.3.8.1). Approximately 66 percent of the employees live in York or Lancaster Counties in Pennsylvania, with the balance of employees living in various other counties. Figures 2-1 and 2-3 show the locations of these counties.

Exelon refuels each PBAPS nuclear unit on a 24-month schedule, which means one refueling every year. During refueling outages, site employment increases above the 975 permanent and contractor employees usually present by approximately 800 workers for temporary (30 to 40 days) duty. Site employment during outages is approximately 1,800 workers. The GEIS (Ref. 3.1-2, Section 2.3.8.1) provides a range of 200 to 900 temporary workers during outages. PBAPS' projected 800 temporary outage employees are within this range.

License Renewal Increment

As discussed in Section 3.2, Exelon is not planning to undertake any major refurbishment or replacement activities in support of license renewal. Therefore, there will be no impact on the workforce or surrounding population from such activities.

Performing the license renewal activities described in Section 3.3 would necessitate increasing PBAPS staff workload by some increment. The size of this increment would depend on the schedule within which Exelon must accomplish the work and the amount of work involved.

The GEIS (Ref. 3.1-2) assumes that NRC would renew a nuclear power plant license for a 20-year period (plus the number of years remaining on the current license) and that NRC would issue the renewal approximately 10 years prior to license expiration. The GEIS further assumes that the utility would initiate surveillance, monitoring, inspections, testing, trending, and recordkeeping (SMITTR) activities at the time of issuance of the new license and would conduct

license renewal SMITTR activities throughout the remaining 30-year life of the plant, sometimes during full-power operation (Ref. 3.1-2, Section B.3.1.3), but mostly during normal refueling and the 5- and 10-year in-service inspection refueling outages (Ref. 3.1-2, Table B.4).

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

The GEIS estimates that the most additional personnel needed to perform license renewal SMITTR activities would typically be 60 persons during the three-month duration of a 10-year in-service refueling. Having established this upper value for what would be a single event in 20 years, the GEIS uses this number as the expected number of additional permanent workers needed per unit attributable to license renewal. GEIS Section C.3.1.2 uses this approach in order to "...provide a realistic upper bound to potential population-driven impacts...".

Exelon expects that existing "surge" capabilities for routine activities, such as outages, will enable Exelon to perform the increased SMITTR workload without adding PBAPS staff. For the purpose of performing its own analyses in this environmental report, Exelon is adopting the GEIS approach with one alteration. Plant modifications during license renewal would be SMITTR activities that would be performed mostly during outages, and Exelon would generally stagger PBAPS outage schedules so that both units would not be down at the same time. Therefore, Exelon believes it is unreasonable to assume that each unit would need an additional 60 workers. Instead, as a reasonably conservative high estimate, Exelon is assuming that PBAPS would require no more than a total of 60 additional permanent workers to perform license renewal SMITTR activities.

Adding full-time employees to the plant workforce for the license renewal operating term would have the indirect effect of creating additional jobs and related population growth in the community. Exelon has used an employment multiplier for the electric services industry in the Lancaster and York County regions of Pennsylvania (2.35) (Ref. 3.4-1) to calculate the total direct, indirect, and induced jobs in service industries that would be supported by the spending

of the PBAPS workforce. The addition of 60 license renewal employees would generate approximately 81 indirect and induced jobs.

Exelon assumes that the additional employees would be distributed similarly to the current employees at PBAPS – that approximately 66 percent would choose to live in York or Lancaster Counties in Pennsylvania. Because the indirect and induced jobs will most likely be located in the areas in which the new employees would live, Exelon anticipates that the individuals associated with the indirect and induced jobs would be distributed similarly to the Exelon employees.

3.5 CONOWINGO DAM AND HYDROELECTRIC FACILITY

PBAPS is located on Conowingo Pond, a Susquehanna River reservoir that was created in 1928 by construction of Conowingo Dam for a hydroelectric generating facility. The dam and facility were modified in 1964 to bring the total generating capacity to 512 megawatts. As part of a program to restore anadromous fish populations to the river, the dam was further modified by the construction of fish lifts; the East Fish Lift remains in operation. Section 2.2 describes the Pond and restoration program in more detail.

Conowingo Hydroelectric Facility. Tower on right is East Fish Lift which moves migrating fish over the Dam. Tower behind sign on left is West Fish Lift, which is no longer used to move fish upstream.

3.6 REFERENCES

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

Ref. 3.1-1 U.S. Atomic Energy Commission. 1973. *Final Environmental Statement related to operation of Peach Bottom Atomic Power Station Units 2 and 3.* Philadelphia Electric Company. Docket Nos. 50-277 and 50-278. Directorate of Licensing. Washington, DC.

Ref. 3.1-2 U.S. Nuclear Regulatory Commission. 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS). Volumes 1 and 2. NUREG-1437. Washington, DC.

Ref. 3.1-3 PECO Energy. 1995. *Peach Bottom Atomic Power Station Updated Final Safety Analysis Report.* Rev. 13.

Ref. 3.1-4 U.S. Nuclear Regulatory Commission. 1994. "Philadelphia Electric Company, Peach Bottom Atomic Power Station, Units 2 and 3; Environmental Assessment and Finding of No Significant Impact." *Federal Register.* Volume 59, No. 199. October 17.

Ref. 3.1-5 PECO Energy. 2000. "PECO Energy Corporate - Products and Services - Power Generation." Available at http://www.peco.com/corp/corp_products_power_gen.shtml. Accessed June 14, 2000.

Ref. 3.1-6 Energy Information Administration. "Nuclear and Uranium Information at a Glance, By State, Peach Bottom Units 2 & 3." Available at http://www.eia.doe.gov/cneaf/nuclear/page/at_a_glance/reactors/nuke16.html. Accessed July 29, 2000.

Ref. 3.1-7 Normandeau Associates, Inc. 1998. *A Report on the Thermal Conditions and Fish Populations in Conowingo Pond Relative to Zero Cooling Tower Operation at the Peach Bottom Atomic Power Station (June-October 1997).* Prepared for PECO Energy. Philadelphia, PA.

Ref. 3.1-8 Philadelphia Electric Company. 1975. *Section 316(a) Demonstration for Peach Bottom Atomic Power Station Units 2 and 3 on Conowingo Pond.*

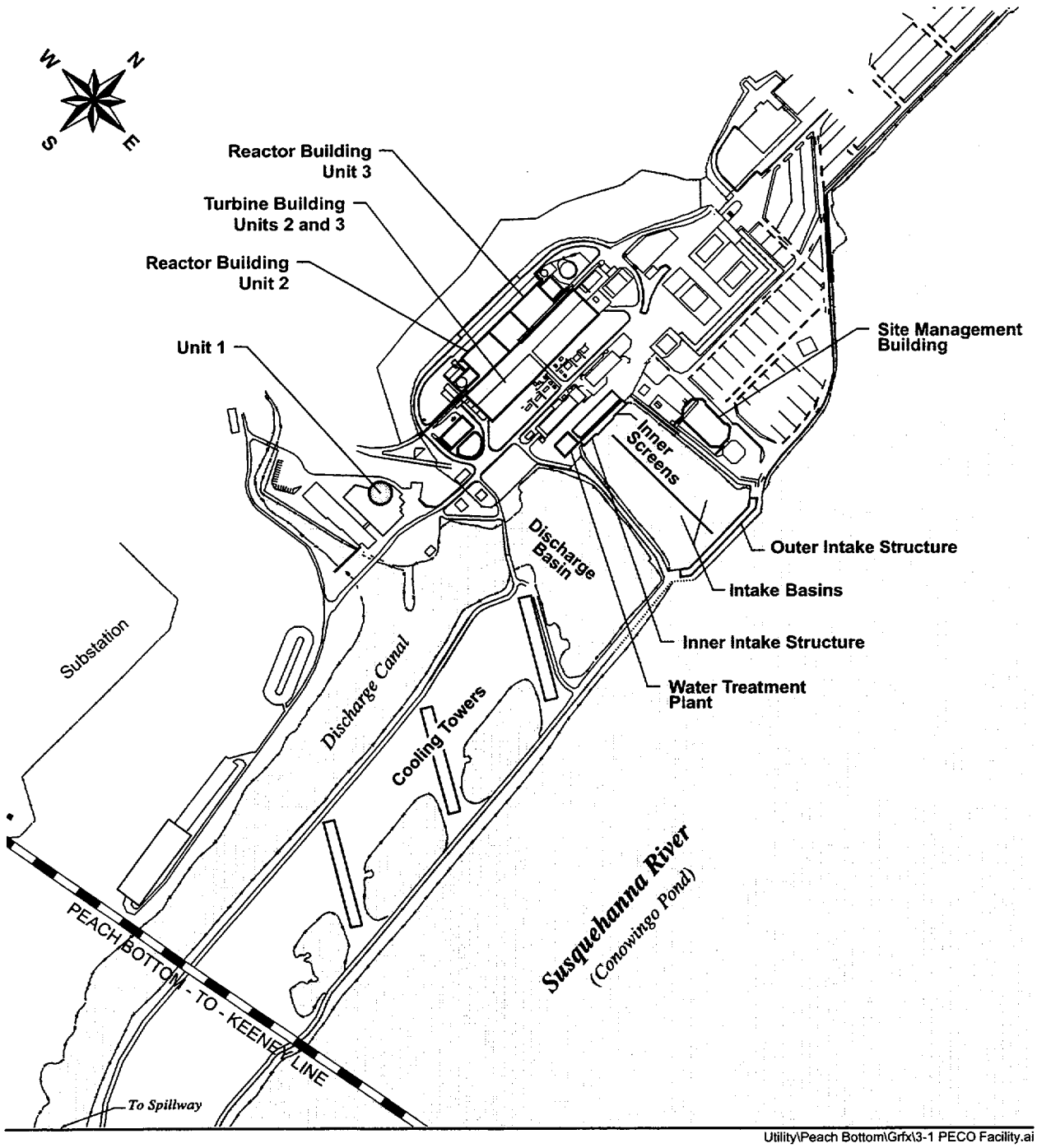
Ref. 3.1-9 Normandeau Associates, Inc. 1999. *A Report on the Thermal Conditions and Fish Populations in Conowingo Pond Relative to Zero Cooling Tower Operation at the Peach Bottom Atomic Power Station (June-October 1998).* Prepared for PECO Energy Company. Philadelphia, PA.

Ref. 3.1-10 Normandeau Associates, Inc. 2000. *A Report on the Thermal Conditions and Fish Populations in Conowingo Pond Relative to Zero Cooling Tower Operation at the Peach Bottom Atomic Power Station (June-October 1999).* Prepared for PECO Energy Company. Philadelphia, PA.

Ref. 3.1-11 BetzDearborn. 1995. Betz' SIDTEC™ On-line Condenser Maintenance Service Program. Bulletin 932. Water Management Group. BetzDearborn, Inc.

Ref. 3.1-12 PECO Energy. 2000. "Vegetation Management Transmission Maintenance Operating Procedures." Berwyn, PA. October 24.

Ref. 3.4-1 De Rooy, J. 2000. "Employment Multipliers for the Lancaster and York Region of Pennsylvania." Institute of State and Regional Affairs, Pennsylvania State University at Harrisburg. June 27.



Utility\Peach Bottom\Grfx\3-1 PECO Facility.ai

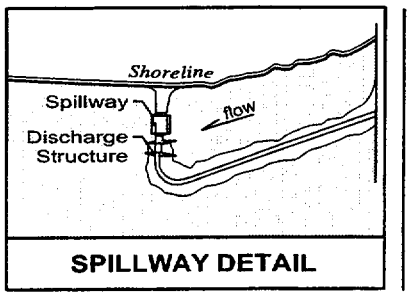
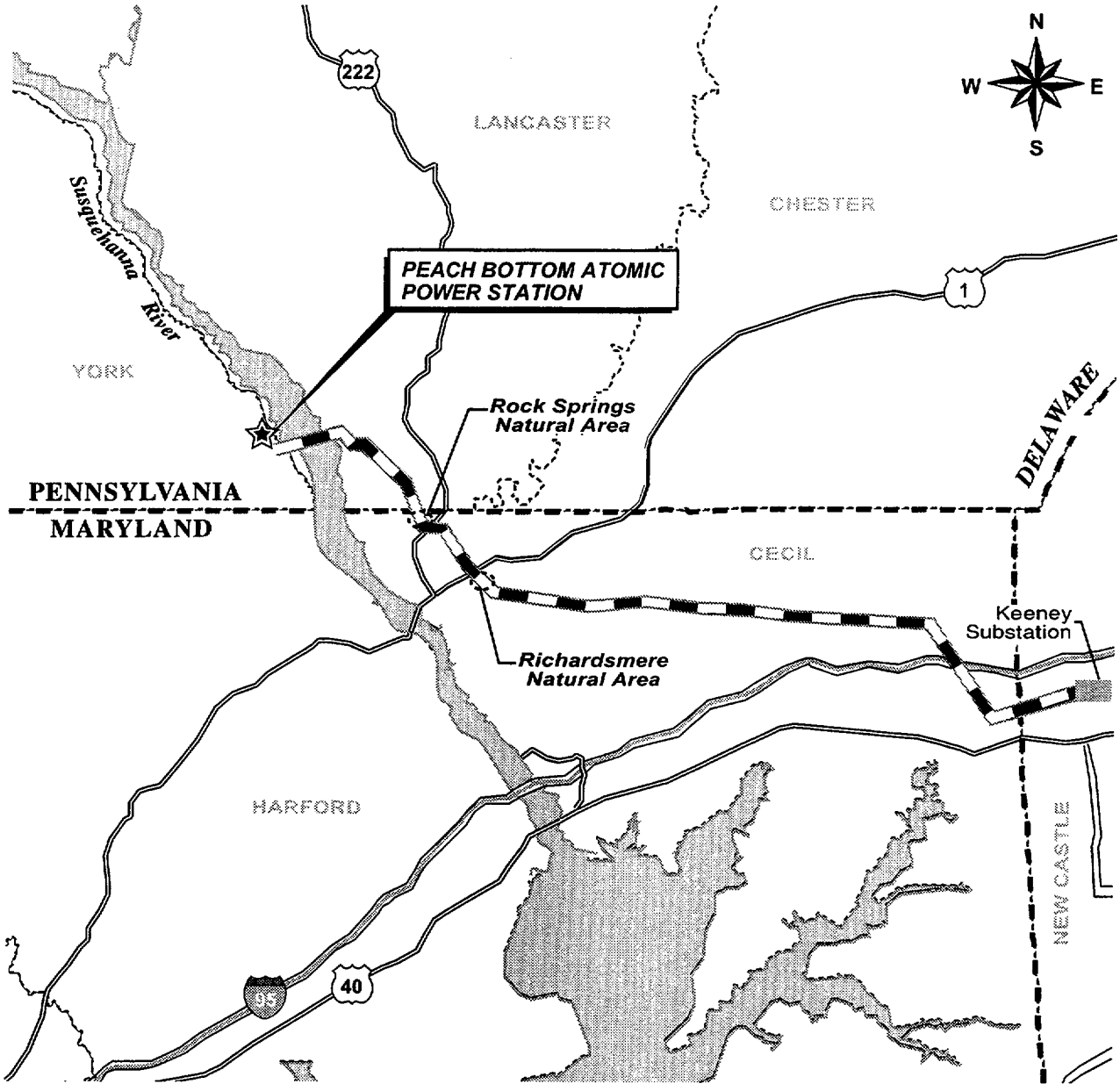


FIGURE 3-1
Peach Bottom Station Layout



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LEGEND

Peach Bottom-to-Keeney Transmission Line

FIGURE 3-2
Transmission Line Map

4.0 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION AND MITIGATING ACTIONS

NRC

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

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

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

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

Chapter 4 presents an assessment of the environmental consequences and potential mitigating actions associated with the renewal of the Peach Bottom Atomic Power Station Units 2 and 3 (PBAPS) operating licenses. The U.S. Nuclear Regulatory Commission (NRC) has identified and analyzed 92 environmental issues that it considers to be associated with nuclear power plant license renewal and has designated the issues as Category 1, Category 2, or NA (not applicable). NRC designated an issue as Category 1 if, based on the result of its analysis, the following criteria were met:

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

- a single significance level (i.e., small, moderate, or large) has been assigned to the impacts that would occur at any plant, regardless of which plant is being evaluated (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent-fuel disposal); and

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

If the NRC analysis concluded that one or more of the Category 1 criteria could not be met, NRC designated the issue as Category 2. NRC requires plant-specific analysis for Category 2 issues. NRC designated two issues as NA, signifying that the categorization and impact definitions do not apply to these issues. NRC rules do not require analyses of Category 1 issues that NRC resolved using generic findings (10 CFR 51, Appendix B, Table B-1) as described in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (Ref. 4.0-1). An applicant may reference the generic findings or GEIS analyses for Category 1 issues. Appendix A of this report lists the 92 issues and identifies the Environmental Report section that addresses each issue.

CATEGORY 1 LICENSE RENEWAL ISSUES

NRC

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

"...Absent new and significant information, the analysis for certain impacts codified by this rulemaking need only be incorporated by reference in an applicant's environmental report for license renewal...." (Ref. 4.0-2, pg. 28473).

Exelon has determined that, of the 69 Category 1 issues, 7 do not apply to PBAPS because they apply to design or operational features that do not exist at the facility. In addition, because Exelon does not plan to conduct any refurbishment activities, the NRC findings for the 7 Category 1 issues that apply only to refurbishment do not apply. Table 4-1 lists these 14 issues and explains the Exelon basis for determining that these issues are not applicable to PBAPS.

Table 4-2 lists the 55 Category 1 issues that Exelon has determined to be applicable to PBAPS and also lists the 2 issues for which NRC came to no generic conclusion (Issues 60 and 92). The table includes the findings that NRC codified and references to supporting GEIS analysis. Exelon has reviewed the NRC findings and has identified no new and significant information or become aware of any such information that would make the NRC findings inapplicable to PBAPS. Therefore, Exelon adopts by reference the NRC findings for these Category 1 issues.

CATEGORY 2 LICENSE RENEWAL ISSUES

NRC

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

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

NRC designated 21 issues as Category 2. Sections 4.1 through 4.20 address each of the Category 2 issues, beginning with a statement of the issue. As is the case with Category 1 issues, some Category 2 issues (3) apply to operational features that PBAPS does not have. In addition, some Category 2 issues (4) apply only to refurbishment activities. If the issue does not apply to PBAPS, the section explains the basis for inapplicability.

For the 14 Category 2 issues that Exelon has determined to be applicable to PBAPS, the sections contain the required analyses. These analyses include conclusions regarding the significance of the impacts relative to the renewal of the operating licenses for PBAPS and, when applicable, discuss potential mitigative alternatives to the extent required. Exelon has identified the significance of the impacts associated with each issue as either Small, Moderate, or Large, consistent with the criteria that NRC established in 10 CFR 51, Appendix B, Table B-1, Footnote 3 as follows:

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

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

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

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

"NA" LICENSE RENEWAL ISSUES

NRC determined that its categorization and impact-finding definitions did not apply to Issues 60 and 92; however, Exelon included these issues in Table 4-2. NRC noted that applicants currently do not need to submit information on Issue 60, chronic effects from electromagnetic fields (10 CFR 51, Appendix B, Table B-1, Footnote 5). For Issue 92, environmental justice, NRC does not require information from applicants, but noted that it will be addressed in individual license renewal reviews (10 CFR 51, Appendix B, Table B-1, Footnote 6). Exelon has included environmental justice demographic information in Section 2.11.

4.1 WATER USE CONFLICTS (PLANTS WITH COOLING PONDS OR COOLING TOWERS USING MAKEUP WATER FROM A SMALL RIVER WITH LOW FLOW)

NRC

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

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

The NRC made surface water use conflicts a Category 2 issue because consultations with regulatory agencies indicate that water use conflicts are already a concern at two closed-cycle plants (Limerick and Palo Verde) and may be a problem in the future at other plants. In the GEIS, NRC notes two factors that may cause water use and availability issues to become important for some nuclear power plants that use cooling towers. First, some plants equipped with cooling towers are located on small rivers that are susceptible to droughts or competing water uses. Second, consumptive water loss associated with closed-cycle cooling systems may represent a substantial proportion of the flows in small rivers (Ref. 4.0-1, Section 4.3.2.1).

As discussed in Section 3.1.2, PBAPS operates as a once-through plant, but retains the capability to use 3 cooling towers for approximately 60 percent of its circulating water flow. As discussed in Section 2.2.1, PBAPS is categorized as a small-river site. It is located on Conowingo Pond, a reservoir on the Susquehanna River, whose annual flow rate is less than 3.15×10^{12} cubic feet. Because of the possibility of future operations using cooling towers, Exelon has evaluated the water use conflicts issue.

The Final Environmental Statement estimated that 11,600 gallons per minute (gpm) (25 cubic feet per second [cfs]) would be lost to evaporation if 3 helper cooling towers were operated at PBAPS (Ref. 4.1-1, pg. III-12). The Clean Water Act (CWA) Section 316(a) Demonstration for PBAPS reported total

evaporative losses from 3 cooling towers ranging from 5.5 to 22 cfs, with a mean of 11.9 cfs (Ref. 4.1-2, Table 2.2-2).

Compared to the 50-year historic Susquehanna River low flow of 1,500 cfs (Section 2.2.1), PBAPS evaporative losses of 11.9 cfs would constitute less than 1 percent of the historic low flow through Conowingo Pond. The effect on Pond water elevation would be indiscernible, given daily fluctuations of as much as 25 percent of the Pond's volume due to Muddy Run Pumped Storage Facility operation and the managed nature of the Pond because of Conowingo Dam operation (Section 2.2.1).

For the same reasons, Exelon concludes that impacts to Conowingo Pond instream and riparian ecological communities would be small, if discernible. These communities have adapted to widely fluctuating water-level and flow conditions.

Any incremental change attributable to initiating PBAPS cooling tower operation would be small. Because impacts are not demonstrable, Exelon believes that mitigation measures would be unwarranted.

4.2 ENTRAINMENT OF FISH AND SHELLFISH IN EARLY LIFE STAGES

NRC

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

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

NRC made impacts on fish and shellfish resources resulting from entrainment a Category 2 issue, because it could not assign a single significance level (small, moderate, or large) to the issue. The impacts of entrainment are small at many plants, but they may be moderate or large at others. Also, ongoing restoration efforts may increase the number of fish susceptible to intake effects during the license renewal period (Ref. 4.0-1, Section 4.2.2.1.2). Information needing to be ascertained includes: (1) type of cooling system (whether once-through or cooling pond), and (2) current CWA Section 316(b) determination or equivalent state documentation.

As Section 3.1.2 describes, PBAPS has a once-through heat dissipation system that withdraws cooling water from Conowingo Pond, an impoundment on the lower Susquehanna River.

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

Exelon (as PECO) submitted a comprehensive CWA Section 316(b) Demonstration to the U.S. Environmental Protection Agency (EPA) in June 1977

in accordance with the "Special Conditions: Environmental Studies" provision of National Pollutant Discharge Elimination System (NPDES) Permit Pa. 00097733, issued December 31, 1976, and revised April 11, 1977 (Ref. 4.2-1, pg. 1-5). The 316(b) Demonstration noted that no significant detrimental effects had occurred in the population of organisms in Conowingo Pond between the pre- and the post-operational periods of study as a result of PBAPS operation. The 316(b) Demonstration concluded that:

> "the intake structure at Peach Bottom reflects the best technology available for minimizing adverse environmental effects" (Ref. 4.2-1, pp. 1-3 and 1-4).

Subsequent NPDES permits, which constitute the PBAPS CWA 316(b) determination, have required no further entrainment or impingement studies. In compliance with the provisions of the Clean Water Act and Pennsylvania's Clean Streams Law, Pennsylvania issued the current NPDES permit (Appendix B).

Section 2.2 discusses the efforts of state and federal agencies to restore anadromous fish populations in the Susquehanna River. These activities were funded largely by PECO and other operators of hydroelectric facilities on the lower Susquehanna. As a result of these efforts, numbers of adult anadromous fish (particularly American shad and blueback herring) ascending the river in the spring to spawn have increased dramatically. Numbers of post-spawning adults and juveniles (young-of-the-year) moving downstream in the fall have also increased substantially.

Exelon has not evaluated entrainment of anadromous fishes specifically because most (excluding one stretch of river between the Safe Harbor and York Haven dams) shad and herring spawning and nursery areas lie well upstream (above the Holtwood, Safe Harbor, and York Haven hydroelectric dams) of PBAPS. Larval shad grow quickly and develop into 4- to 6-inch juveniles by early fall. They begin to leave nursery areas and migrate downstream in September or October, depending on water temperatures, and pass through the turbines (and, less frequently, the spillway) of hydroelectric facilities enroute to the Chesapeake Bay. These juvenile shad and herring are too large to be entrained in the condenser cooling water at PBAPS.

For these reasons, Exelon concludes that any environmental impact from entrainment of fish and shellfish in early stages is small and does not require further mitigation.

4.3 IMPINGEMENT OF FISH AND SHELLFISH

NRC

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

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

NRC made impacts on fish and shellfish resources resulting from impingement a Category 2 issue, because it could not assign a single significance level to the issue. Impingement impacts are small at many plants, but might be moderate or large at other plants (Ref. 4.0-1, Section 4.2.2.1.3). Information that needs to be ascertained includes: (1) type of cooling system (whether once-through or cooling pond), and (2) current CWA 316(b) determination or equivalent state documentation.

As discussed in Section 4.2, PECO submitted a comprehensive CWA Section 316(b) Demonstration in 1977 that evaluated impingement at PBAPS and concluded that the intake structure represented the best technology available to minimize impacts. The current NPDES permit (Appendix B) constitutes the PBAPS CWA 316(b) determination.

Since 1985, Exelon has conducted studies at PBAPS in the fall of the year to assess the impingement of outmigrating juvenile American shad and river herring. Juvenile American shad in the Susquehanna River above Conowingo Dam are from two sources: natural reproduction of adult spawners and hatchery stockings of larvae (fry) produced in Pennsylvania Fish and Boat Commission or U.S. Fish and Wildlife Service facilities. In 1999, approximately 95 percent of the juveniles examined were produced in hatcheries (Ref. 4.3-1, pp. 4-1 through 4-21).

In 1999, intake screens at PBAPS were examined three times weekly from October 18 through December 20 (23 sample dates). More than 5,000 fish were impinged, including 285 juvenile (young-of-the-year) American shad, 112 juvenile blueback herring, and 2 adult blueback herring (Ref. 4.3-1, pp. ii-vi).

Numbers of American shad impinged in the fall of 1999 were very small compared to the number of American shad fry and fingerlings stocked in the Susquehanna River and its tributaries during the previous summer (14,400,00 fry were stocked in May and June 1999). Numbers of American shad and blueback herring impinged were very small compared to the numbers of spawning adults captured and passed at the Conowingo Dam in the spring of 1999 (69,712 American shad and 130,625 blueback herring), particularly when the reproductive potential of these species is taken into consideration (Ref. 4.3-1, pp. 1-15). Depending on size, age, and condition, each American shad female produces an average of 250,000 eggs. Each blueback herring female produces an average of 80,000 eggs.

Based on 1999 studies, numbers of American shad and blueback herring impinged at PBAPS represent a very small percentage of the total number of outmigrating juvenile and adult fish. These losses are not sufficiently high to adversely affect Susquehanna River shad and river herring populations and do not represent a threat to ongoing anadromous fish restoration efforts. In recent years, 82 (1999) to 98 (1997) percent of all fish impinged at PBAPS have been gizzard shad. Because this is a fast-growing species with high reproductive potential, impingement losses would have no discernible effect on the Conowingo Pond gizzard shad population.

Exelon concludes that this environmental impact is small and does not require further mitigation.

4.4 HEAT SHOCK

NRC

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

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

NRC made impacts on fish and shellfish resources resulting from heat shock a Category 2 issue, because of continuing concerns about thermal discharge effects and the possible need to modify thermal discharges in the future in response to changing environmental conditions (Ref. 4.0-1, Section 4.2.2.1.4). Information to be ascertained includes: (1) type of cooling system (whether once-through or cooling pond), and (2) evidence of a CWA Section 316(a) variance or equivalent state documentation.

As Section 3.1.2 describes, PBAPS has a once-through heat dissipation system. As discussed below, Exelon also has Section 316(a) alternative thermal effluent limits.

Section 316(a) of the CWA establishes a process whereby a thermal effluent discharger can demonstrate that thermal discharge limitations are more stringent than necessary to protect a balanced indigenous population of fish and wildlife, and obtain alternative facility-specific thermal discharge limits (33 USC 1326). PECO submitted a CWA Section 316(a) demonstration for PBAPS in July 1975, which was accepted by the Pennsylvania Department of Environmental Protection and has been periodically reviewed and accepted by that State agency since the initial submittal.

Because PBAPS has a 316(a) alternative thermal effluent limit, no further assessment is required.

4.5 GROUNDWATER USE CONFLICTS (PLANTS USING >100 GPM OF GROUNDWATER)

NRC

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

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

The issue of groundwater use conflicts at plants that pump more than 100 gallons per minute of groundwater does not apply to PBAPS, because the plant does not use groundwater. As Section 3.1.2 describes, the plant obtains all its cooling, process, and potable water from the Susquehanna River.

4.6 GROUNDWATER USE CONFLICTS (PLANTS USING COOLING TOWERS WITHDRAWING MAKEUP WATER FROM A SMALL RIVER)

NRC

"... If the applicant's plant utilizes cooling towers or cooling ponds and withdraws makeup water from a river whose annual flow rate is less than 3.15×10^{12} ft^3 / year.... The applicant shall also provide an assessment of the impact of the withdrawal of water from the river on alluvial aquifers during low flow." 10 CFR 51.53(3)(ii)(A)

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

NRC made groundwater use conflicts a Category 2 issue because rivers often supply alluvial aquifers and large-scale withdrawals (to make up for evaporative loss) could impact the alluvial aquifer during periods of low flow (Ref. 4.0-1, Section 4.8.1.3). Loss of recharge could result in lowering of the aquifer water level and adverse impacts to groundwater users. Information that needs to be ascertained includes: (1) whether the plant uses cooling towers, (2) whether the source of tower makeup water is a small river, and (3) whether the river supplies an alluvial aquifer.

PBAPS operates as a once-through plant, but retains the capability to use 3 cooling towers for approximately 60 percent of its circulating water flow (Section 3.1.2). PBAPS is categorized as a small-river site. It is located on Conowingo Pond, a reservoir on the Susquehanna River, whose annual flow rate is less than 3.15×10^{12} cubic feet per year (Section 2.2.1). However, groundwater flow in the vicinity of the site is toward Conowingo Pond (Ref. 4.6-1, pg. 23). Thus, unlike the situation that NRC envisioned in defining the groundwater use conflicts issue, PBAPS is located on a river that does not supply an alluvial aquifer. Therefore, Exelon concludes that PBAPS would have no impact on an alluvial aquifer.

4.7 GROUNDWATER USE CONFLICTS (PLANTS USING RANNEY WELLS)

NRC

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

"... Ranney wells can result in potential 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...." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 35

The issue of groundwater use conflicts does not apply to PBAPS because the plant does not use Ranney wells. As Section 3.1.2 describes, PBAPS uses a once-through cooling system with helper cooling towers.

4.8 DEGRADATION OF GROUNDWATER QUALITY

NRC

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

"...Sites with closed cycle cooling ponds may degrade water 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...." 10 CFR 51, Subpart A, Appendix B, Table B-1, Issue 39

The issue of groundwater degradation does not apply to PBAPS because the plant does not use cooling ponds. As Section 3.1.2 describes, PBAPS uses a once-through cooling system with helper cooling towers.

4.9 IMPACTS OF REFURBISHMENT ON TERRESTRIAL RESOURCES

NRC

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

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

"...If no important resources would be affected, the impacts would be considered minor and of small significance. If important resources could be affected by refurbishment activities, the impacts would be potentially significant...." Ref. 4.0-1, Section 3.6, pg. 3-6

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

4.10 THREATENED OR ENDANGERED SPECIES

NRC

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

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

NRC made impacts to threatened and endangered species a Category 2 issue because the status of many species is being reviewed, and site-specific assessment is required to determine whether any identified species could be affected by refurbishment activities or continued plant operations through the renewal period. In addition, compliance with the Endangered Species Act requires consultation with the appropriate federal agency (Ref. 4.0-1, Sections 3.9 and 4.1).

Section 2.4 discusses ecological habitats at PBAPS and along the associated transmission line. Section 2.5 discusses terrestrial and aquatic species that occur or may occur at PBAPS or along the Peach Bottom-to-Keeney transmission line that have special state or federal status (i.e., threatened, endangered, or of special concern). As discussed in Section 3.2, Exelon has no plans to conduct refurbishment or construction at PBAPS during the license renewal period. Therefore, there would be no refurbishment-related impacts to special status species, and no further analysis of refurbishment-related impacts is applicable.

Exelon is aware of no resident threatened or endangered species being present at PBAPS or along the transmission line corridor. The presence of transient species is possible, but Exelon is aware of no PBAPS or transmission corridor activities that would adversely impact species that might occur. Exelon has no plans for the license renewal term that would alter the conclusion that PBAPS has no adverse impacts on threatened or endangered species. This conclusion is consistent with the results of Exelon (as PECO) correspondence with cognizant regulatory agencies (see Section 9.1.2 and Appendix C). There being no known impacts, Exelon concludes that mitigation is unwarranted.

See Section 9.1.2 for discussion of threatened and endangered species consultation.

4.11 AIR QUALITY DURING REFURBISHMENT (NONATTAINMENT AREAS)

NRC

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

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

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

4.12 IMPACT ON PUBLIC HEALTH OF MICROBIOLOGICAL ORGANISMS

NRC

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

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

NRC designated impacts on public health from thermophilic organisms a Category 2 issue because NRC did not have sufficient data available for facilities using cooling ponds, lakes, or canals that discharge to small rivers. Information to be determined is: (1) whether the plant discharges to a small river, and (2) whether discharge characteristics (particularly temperature) are conducive to thermophilic organism survival in public waters.

This issue is applicable to PBAPS because the Station ultimately discharges to the Susquehanna River, which is categorized as a small river in the GEIS (Ref. 4.0-1, Section 5.3.3.4.2, Table 19). Also, there is public access to Conowingo Pond, including recreational fishing, boating, and vacation homes. Organisms of concern include the enteric pathogens *Salmonella* and *Shigella*, the *Pseudomonas aeruginosa* bacterium, thermophilic Actinomycetes ("fungi"), the many species of *Legionella* bacteria, and pathogenic strains of the free-living *Naegleria* amoeba.

See Appendix D for copies of correspondence with the Pennsylvania Department of Environmental Protection concerning thermophilic organisms at PBAPS.

4.13 ELECTROMAGNETIC FIELDS - ACUTE EFFECTS

NRC

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

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

NRC made impacts of electric shock from transmission lines a Category 2 issue because, without a review of each plant's transmission line conformance with the National Electrical Safety Code® (NESC®) (Ref. 4.13-1) induced-current criteria, NRC could not determine the significance of the electrical shock potential.

In the case of PBAPS, there have been no previous NRC or NEPA analyses of transmission-line-induced-current hazard. Therefore, this section provides an analysis of the PBAPS transmission line's conformance with the NESC® standard. The analysis is based on data generated for the design and construction of a non-PBAPS transmission line that runs parallel to the PBAPS line.

Objects located near transmission lines can become electrically charged due to the effect of what is commonly called "static electricity", but is more precisely termed "an electrostatic field". This charge results in a current that flows through the object to the ground. The current is called "induced" because there is no direct connection between the line and the object. The induced current can also flow to the ground through the body of a person who touches the object. An object that is particularly well insulated from the ground, such as a car on rubber tires, can store a small electrical charge, becoming what is called "capacitively charged." A person standing on the ground and touching the car receives an electrical shock due to the sudden discharge of the capacitive charge through the

person's body to the ground. The intensity of the shock depends on several factors, including the following:

- the strength of the electrostatic field which, in turn, depends on the voltage of the transmission line
- the height of the line above the ground
- the size of the object on the ground
- the extent to which the object is grounded.

In 1977, the NESC® adopted a provision that describes how to establish minimum vertical clearances to the ground for electric lines having voltages exceeding 98 kilovolt (kV) alternating current to ground.[a] The clearance must limit the induced current[b] due to electrostatic effects to 5 milliamperes if the largest anticipated truck, vehicle, or equipment were short-circuited to ground.[c] The NESC® chose this limit as being protective of the health of a person who wears a heart pacemaker. By way of comparison, the setting of ground fault circuit interrupters used in residential wiring (special breakers for outside circuits or those with outlets around water pipes) is 6 milliamperes; the shock that one feels on a dry day after walking on a carpet or sliding across a car seat and touching an object is the result of approximately 3 milliamperes of current.

As described in Section 3.1.3, there is one 500-kV line that was specifically constructed to distribute power from PBAPS to the PECO grid. Although there are no records of electric field analyses performed specifically for the 5014 Peach Bottom-to-Keeney line, Exelon has analyzed the line in connection with planning for the 230-kV Colora-Cecil line (designated as the 220-74 line), which was placed into service in 1993. Before the 220-74 line was constructed, several spacing and phase configurations were modeled in the segment where the 5014 and the 220-74 lines run along the same corridor (Ref. 4.13-2). After the 220-74 line was placed in service, Exelon performed both field measurements and modeling to validate the efficacy of the computer model used (Ref. 4.13-3). Although Exelon modeled only one location, where lines 5014 and 220-74 run

a. Part 2, Rules 232C1c and 232D3c.
b. The NESC® and the GEIS use the phrase "steady-state current," whereas 10 CFR 51.53(c)(3)(ii)(H) uses the phrase "induced current." The phrases mean the same here.
c. Induced currents can also be caused by electromagnetic fields, but the NESC® provision is limited to electrostatic effects.

parallel, Exelon used conservative assumptions in the calculation and believes that the results are bounding for the entire length of the 5014 line.

The endpoint of Exelon's analyses for the 220-74 and 5014 lines was electric field strength at 1 meter above the ground. These field strengths were then used to calculate the induced current in a maximum vehicle size under the lines as a tractor-trailer 55 feet long, 8.2 feet wide, and an average of 11.8 feet high. The analysis determined that the 5014 line produces an average electric field strength of 6.2 kV per meter over the length of the truck. This electric field strength could induce as much as 4.98 milliamperes of current in a short circuit to ground. Therefore, the PBAPS transmission line conforms to the NESC® provisions for preventing electric shock from induced current (Ref. 4.13-4).

Exelon's assessment concludes that electric shock is of small significance for the PBAPS transmission line. This conclusion would remain valid into the future because Exelon does not anticipate any changes in line use, voltage, current, and maintenance practices or changes in land use under the lines – conditions over which Exelon has control. Exelon surveillance and maintenance procedures (see Section 3.1.3) provide assurance that design ground clearances will not change. Due to the small significance of the issue, mitigation measures are not warranted.

4.14 HOUSING IMPACTS

NRC

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

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

"...[S]mall impacts result when no discernible change in housing availability occurs, changes in rental rates and housing values are similar to those occurring statewide, and no housing construction or conversion occurs." Ref. 4.0-1, Section 4.7.1.1

NRC made housing impacts a Category 2 issue because impact magnitude depends on local conditions that NRC could not predict for all plants at the time of GEIS publication (Ref. 4.0-1, Section 3.7.2). Local conditions that need to be ascertained are: (1) population categorization as small, medium, or high, and (2) applicability of growth control measures.

As described in Section 3.2, Exelon does not plan to perform refurbishment. Exelon concludes that there would be no refurbishment-related impacts to area housing and no analysis is therefore required. Accordingly, the following discussion focuses on impacts of continued operations on local housing availability.

As described in Section 2.6, PBAPS is located in a high population area. As noted in Section 2.9, the area of interest is not subject to growth control measures that limit housing development. In 10 CFR 51, Subpart A, Appendix B, Table B-1, NRC concluded that impacts to housing are expected to be of small significance at plants located in high population areas where growth control measures are not in effect. Therefore, Exelon expects housing impacts to be small.

This conclusion is supported by the following site-specific housing analysis. The maximum impact to area housing is calculated using the following assumptions: (1) all direct and indirect jobs would be filled by in-migrating residents; (2) the residential distribution of new residents would be similar to current worker distribution; and (3) each new job created (direct and indirect) represents one

housing unit. As described in Section 3.4, approximately 66 percent of the PBAPS employees reside in York and Lancaster Counties. Therefore, the focus of the housing impact analysis is on these areas. As described in Section 3.4, Exelon's conservative estimate of 60 license renewal employees could generate the demand for 141 housing units (60 direct and 81 indirect and induced jobs). If it is assumed that 93 households (66 percent of the 141 workers) would locate in these two Counties, consistent with current employee trends, 93 housing units would be required in York and Lancaster Counties. In an area with a population of more than 860,000, and projected annual growth of 0.3 to 1.1 percent between 2000 and 2035, this demand attributable to PBAPS would not create a discernible change in housing availability, rental rates or housing values, or spur appreciable housing construction or conversion. Exelon concludes that impacts to housing availability resulting from plant-related population growth would be small and would not warrant mitigation.

4.15 PUBLIC UTILITIES: PUBLIC WATER SUPPLY AVAILABILITY

NRC

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

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

"Impacts on public utility services are considered small if little or no change occurs in the ability to respond to the level of demand and thus there is no need to add capital facilities. Impacts are considered moderate if overtaxing of facilities during peak demand periods occurs. Impacts are considered large if existing service levels (such as quality of water and sewage treatment) are substantially degraded and additional capacity is needed to meet ongoing demands for services." Ref. 4.0-1, Section 3.7.4.5

NRC made public utility impacts a Category 2 issue because an increased problem with water availability, resulting from pre-existing water shortages, could occur in conjunction with plant demand and plant-related population growth (Ref. 4.0-1, Section 4.7.3.5). Local information needed would be: (1) a description of water shortages experienced in the area, and (2) an assessment of the public water supply system's available capacity.

PBAPS does not use water from a municipal system; therefore, Exelon does not expect PBAPS to have an effect on local water supplies. As discussed in Section 3.2, no refurbishment is planned for PBAPS and therefore no refurbishment impacts are expected. Section 3.4 describes potential population increases, and Section 2.6 describes the distribution of that population in the area associated with license renewal activities at PBAPS. Section 2.10.1 describes the public water supply systems potentially affected by license renewal activities.

The impact to the local water supply systems from plant-related population growth can be determined by calculating the amount of water that would be required by these individuals. The average American uses between 50 and 80 gallons per day for personal use (Ref. 4.15-1, pg. 2). As described in Section 3.4, Exelon's conservative estimate of 60 license renewal employees could generate a total of 141 new jobs, which could result in a population increase of 375 in the area (141 jobs multiplied by 2.66, which is the average number of persons per household in the area (Ref. 4.15-2). Using this

consumption rate, the plant-related population increase would require an additional 30,000 gallons per day (375 people multiplied by 80 gallons per day). If it is assumed that this increase is distributed across the two potentially affected counties, consistent with current employee trends, the increase in water demand would not affect the capacity of the water supply systems in these communities, based on recently completed assessments. The current approximate average daily demand for both counties combined is 98 million gallons per day (MGD), and the projected expected demand in 2010 is 133 MGD. Thirty thousand gallons is 0.03 percent of the current demand and 0.02 percent of the projected demand. As discussed in Section 2.10.1, the area may have water supply challenges in the future. However, the impact of 60 additional employees would not measurably affect the current or projected demand. Exelon concludes that impacts resulting from plant-related population growth to public water supplies would be small, and not warrant mitigation.

4.16 EDUCATION IMPACTS FROM REFURBISHMENT

NRC

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

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

"...[S]mall impacts are associated with project-related enrollment increases of 3 percent or less. Impacts are considered small if there is no change in the school systems' abilities to provide educational services and if no additional teaching staff or classroom space is needed. Moderate impacts are associated with 4 to 8 percent increases in enrollment, and if a school system must increase its teaching staff or classroom space even slightly to preserve its pre-project level of service.... Large impacts are associated with enrollment increases greater than 8 percent...." Ref. 4.0-1, Section 3.7.4.1

This issue is not applicable to PBAPS because, as Section 3.2 discusses, Exelon has no plans for refurbishment at PBAPS.

4.17 OFFSITE LAND USE

4.17.1 REFURBISHMENT

NRC

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

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

"...[I]f plant-related population growth is less than 5 percent of the study area's total population, off-site land-use changes would be small, especially if the study area has established patterns of residential and commercial development, a population density of at least 60 persons per square mile, and at least one urban area with a population of 100,000 or more within 50 miles...." Ref. 4.0-1, Section 3.7.5

This issue is not applicable to PBAPS because, as Section 3.2 discusses, Exelon has no plans for refurbishment at PBAPS.

4.17.2 LICENSE RENEWAL TERM

NRC

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

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

"...[I]f plant-related population growth is less than five percent of the study area's total population off-site land-use changes would be small..." Ref. 4.0-1, Section 3.7.5

"If the plant's tax payments are projected to be small relative to the community's total revenue, new tax-driven land-use changes during the plant's license renewal term would be small, especially where the community has preestablished patterns of development and has provided adequate public services to support and guide development." Ref. 4.0-1, Section 4.7.4.1

NRC made impacts to offsite land use during the license renewal term a Category 2 issue, because land-use changes may be perceived to be beneficial by some community members and adverse by others. Therefore, NRC could not assess the potential significance of site-specific offsite land-use impacts (Ref. 4.0-1, Section 4.7.4.1). Site-specific factors to consider in an assessment of new tax-driven land-use impacts include: (1) the size of plant-related population growth compared to the area's total population, (2) the size of the plant's tax payments relative to the community's total revenue, (3) the nature of the community's existing land-use patterns, and (4) the extent to which the community already has public services in place to support and guide development.

The GEIS presents an analysis of offsite land use for the renewal term that is characterized by two components: population-driven and tax-driven impacts (Ref. 4.0-1, Section 4.7.4.1). Based on the GEIS case-study analysis, NRC concludes that all new population-driven land-use changes during the license renewal term at all nuclear plants would be small. Population growth caused by license renewal would represent a much smaller "percentage of the local area's" total population than the percentage presented by operations-related growth (Ref. 4.0-1, Section 4.7.4.2).

NRC has determined that the significance of tax payments as a source of local government revenue would be large if the payments are greater than 20 percent of revenue (Ref. 4.0-1, Section 4.7.2.1).

NRC defined the magnitude of land-use changes as follows (Ref. 4.0-1, Section 4.7.4):

- Small - very little new development and minimal changes to an area's land-use pattern
- Moderate - considerable new development and some changes to land-use pattern
- Large - large-scale new development and major changes in land-use pattern.

NRC further determined that, if a plant's tax payments are projected to be a dominant source of a community's total revenue (i.e., greater than 20 percent of revenue), new tax-driven land-use changes would be large.

As described in Section 2.8, Exelon (as PECO) has, in the past, paid property taxes to the Commonwealth of Pennsylvania on its generating, transmission, and distribution facilities. The taxes paid by all utilities were then redistributed to the taxing entities within the Commonwealth under the authority of the Pennsylvania Utility Realty Tax Act (PURTA). With the recent revision of PURTA, electricity-generating facilities have been removed from the utilities' PURTA tax basis. As of January 1, 2000, and retroactive to 1998, Exelon is required to pay property taxes for its electric-generating facilities directly to the townships, school districts, and counties in which the facilities are located. At this time, the amount of taxes to be paid by Exelon for PBAPS to Peach Bottom Township, Southeastern School District, and York County has not been determined (see Section 2.8). Therefore, the information needed to analyze the impact of Exelon's tax contribution on land use is not available.

Although the missing tax information could provide a benchmark against which to evaluate PBAPS' impact, it is possible to look at the population, economic, and land-use trends presented in Sections 2.6, 2.7, and 2.9 to put PBAPS' impact on York County into perspective.

York County has seen steady growth. Population has increased at an average rate of more than 12 percent per decade during the last three decades to more than 380,000. Population growth has been greatest in the central and northern parts of the County. Commuting patterns reveal an increasing number of residents traveling outside the County for employment, reflecting York County's growing popularity as a bedroom community. The economy has diversified with

manufacturing, tourism, and most recently, the services and wholesale/retail sectors, providing the bulk of employment for the County. Agriculture is still the predominant land use in the County and is a significant contributor to the County's economy through the market value of products sold (Ref. 4.17-1). As reported by the York County Economic Development Corporation, Exelon is one of the top 100 employers in the County (Ref. 4.17-2). The major employers comprise a variety of business sectors and, as a whole, have impacted land use patterns. PBAPS employs approximately 975 people, or approximately 1.6 percent of the 57,581 people employed by the top 100 companies (Ref. 4.17-2). PBAPS' impact on the local economy is small in relation to the impact of the group of companies as a whole. Therefore, Exelon concludes that impacts to land use during the license renewal term would be small and would not warrant mitigation.

4.18 TRANSPORTATION

NRC

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

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

"Small impacts would be associated with a free flowing traffic stream where users are unaffected by the presence of other users (level of service A) or stable flow in which the freedom to select speed is unaffected but the freedom to maneuver is slightly diminished (level of service B)." Ref. 4.0-1, Section 3.7.4

NRC made impacts to transportation a Category 2 issue because impact significance is determined primarily by road conditions existing at the time of the project, which NRC could not forecast for all facilities (Ref. 4.0-1, Section 3.7.4.2). Local road conditions to be ascertained are: (1) level of service conditions, and (2) incremental increases in traffic associated with refurbishment activities and license renewal staff.

As described in Section 3.2, no refurbishment is planned and no refurbishment impacts to local transportation are therefore anticipated.

Exelon's PBAPS workforce includes 700 permanent and 275 contract employees. Once a year, approximately 800 additional workers join the permanent workforce during the annual refueling outage. A refueling outage typically lasts approximately one month. Exelon's conservative projection of 60 additional employees associated with license renewal for PBAPS represents a 6 percent increase in the current number of employees and an even smaller percentage of employees present onsite during the annual refueling outage. Given these employment projections, the average number of vehicles per day currently using the access road to PBAPS (Table 2-4), and the fact that area traffic is not considered an issue by the local population (with or without additional employees), Exelon concludes that impacts to transportation would be small and mitigative measures would be unwarranted.

4.19 HISTORIC AND ARCHAEOLOGICAL RESOURCES

NRC

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

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

"Sites are considered to have small impacts to historic and archaeological resources if (1) the State Historic Preservation Officer (SHPO) identifies no significant resources on or near the site; or (2) the SHPO identifies (or has previously identified) significant historic resources but determines they would not be affected by plant refurbishment, transmission lines, and license-renewal term operations and there are no complaints from the affected public about the character; and (3) if the conditions associated with moderate impacts do not occur." Ref. 4.0-1, Section 3.7.7

NRC made impacts to historic and archaeological resources a Category 2 issue, because determinations of impacts to historic and archaeological resources are site-specific in nature and the National Historic Preservation Act mandates that impacts must be determined through consultation with the State Historic Preservation Officer (Ref. 4.0-1, Section 4.7.7.3).

Exelon does not plan any land-disturbing refurbishment activities, and no refurbishment-related impacts are therefore anticipated. As described in Section 2.13, no known archaeological or historic sites of significance were threatened during PBAPS's construction in the 1970s. The Peach Bottom-to-Keeney transmission line does not cross any listed or known historic sites. No known archaeological or historic sites of significance have been identified; therefore, continued use of transmission lines and rights-of-way is projected to cause little or no impact to archaeological or historic resources.

Exelon concludes that continued operation of PBAPS would have no adverse impacts to historic resources; hence, there would be no impacts to mitigate. This conclusion is consistent with the results of correspondence between Exelon (as PECO) and cognizant agencies (see Section 9.1.4 and Appendix F).

4.20 SEVERE ACCIDENT MITIGATION ALTERNATIVES

NRC

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

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

The term "accident" in the current context refers to any unintentional event (i.e., outside the normal or expected plant operational parameters) that results in the release or the potential for release of radioactive material to the environment. Generally, NRC categorizes accidents as "design-basis" or "severe." Design-basis accidents are those for which the risk is great enough that an applicant is required to design and construct a plant to prevent unacceptable accident consequences. Severe accidents are those considered too unlikely to warrant design controls.

Historically, NRC has not included in its environmental impact statements or environmental assessments any analysis of alternative ways to mitigate the environmental impact of severe accidents. A 1989 court decision ruled that, in the absence of an NRC finding that severe accidents are remote and speculative, severe accident mitigation alternatives (SAMAs) should be considered in the NEPA analysis (*Limerick Ecology Action v. NRC*, 869 F.d 719 [3rd Cir. 1989]). For most plants, including PBAPS, license renewal is the first licensing action that would necessitate consideration of SAMAs.

The NRC concluded in its generic license renewal rulemaking that the unmitigated environmental impacts from severe accidents meet the Category 1 criteria. However, NRC made consideration of mitigation alternatives a Category 2 issue because ongoing regulatory programs related to mitigation (i.e., Individual Plant Examination [IPE] and Accident Management) were not complete for all plants. Because these programs have identified plant programmatic and procedural improvements (and, in a few cases, minor modifications) as cost-effective in reducing severe accident risks and consequences, NRC thought it premature to draw a generic conclusion as to whether severe accident mitigation

would be required for license renewal. Site-specific information to be presented in the environmental report includes: (1) potential SAMAs; (2) benefits and costs of implementing potential SAMAs; and (3) sensitivity of analysis to changes in key underlying assumptions.

The purpose of this subsection is to summarize the SAMA analysis process and results. Appendix G provides a detailed description of the material presented here.

4.20.1 METHODOLOGY

The methodology selected for this analysis involves identifying those SAMA candidates that have the highest potential for reducing core damage frequency and person-rem risk and determining whether or not the implementation of those candidates is beneficial on a cost-risk reduction basis. This process consists of the following steps:

- Identify potential SAMA candidates based on NRC and industry documents,
- Screen out Phase 1 SAMA candidates that are not applicable to the Peach Bottom Atomic Power Station (PBAPS) design or are of low benefit in Boiling Water Reactors,
- Extend the current Peach Bottom Probabalistic Safety Analysis (PSA) (PB99 Rev 1) results (an update to Ref. 4.20-23) to include both radionuclide releases and the related consequences (a Level 3 analysis). This requires conversion of the PBAPS Level 2 PSA results into the format used in NUREG/CR-4551[d] and scaling the Level 3 output based on those Level 2 PSA results and the demographic information of the surrounding communities at the end of the period of extended operation,
- Determine the maximum averted risk that is possible based on the PBAPS PSA Level 3 results,
- Screen out Phase 2 SAMA candidates whose estimated cost exceeds the maximum possible averted risk,

d. This is a technical report summarizing the input into NUREG-1150. Both NUREG/CR-4551 and NUREG-1150 are analyses sponsored by the NRC.

- Perform a more detailed analysis to determine if the remaining SAMA candidates are desirable modifications or changes. This is based on a comparison of the averted cost-risk associated with implementing the SAMA at the site and the cost required to perform the modification. If the averted cost-risk is greater than the cost of implementation, then the SAMA candidate is considered to be a beneficial modification.

4.20.2 LEVEL 3 PSA ANALYSIS

The SAMA evaluation relies on Level 3 PSA results to measure the effects of potential plant modifications. A Level 3 model was created for PBAPS as part of NUREG-1150 and NUREG/CR-4551 (Refs. 4.20-1 and 4.20-2, respectively); however, while the Level 1 and 2 PSA models have been updated and enhanced to continually reflect plant changes since the publication of these NUREGs, the Level 3 model has not been updated.

Version 1.5 of the Melcor Accidents Consequence Code System (MACCS) code (Ref. 4.20-3) was used to perform the PBAPS Level 3 PSA in NUREG/CR-4551. The analysis was performed specifically for Peach Bottom Unit 2 and includes data unique to that site. While that report provides thorough documentation of the Level 3 analysis, the results are not directly used in the PBAPS SAMA evaluation. Some of the characteristics of the site data have changed since the performance of NUREG/CR-4551 in 1990 and it is considered necessary to account for these changes prior to applying the evaluation to this analysis.

Severe accidents due to external events, such as fire and seismic events, were evaluated in response to Generic Letter 88-20, Supplement 4, "Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities". The fire analysis utilized the Fire Induced Vulnerability Evaluation (FIVE) methodology. The seismic analysis employed the seismic margins methodology. Insights from the PBAPS IPEEE studies have been incorporated and are considered in the SAMA tables.

There are no seismic or fire PSA models that can be used to perform either the baseline SAMA calculation or identify the change in risk that could be attributed to any proposed SAMA. It is judged appropriate to use the internal events PSA as a gauge to effectively describe the risk change that can be attributed to SAMAs.

4.20.2.1 Population

The population estimate for the area surrounding the site used in the NUREG/CR-4551 analysis was originally based on 1980 census information. This SAMA evaluation requires an estimate of the population at the end of the period of extended operation in 2034. For the purposes of this analysis, the 2034 population is estimated using a simple, linear growth approximation for the population density in the surrounding area.

Population data from Table 4.2-2 of NUREG/CR-4551 was extrapolated to 50-miles from the plant (assuming a linear growth in population density away from the plant). The 1990 population estimate was derived from US census data and used in conjunction with the 1980 estimate to determine the increase in population per year. Using the 1990 50 mile population as a starting point, the growth rate (assumed to be constant) was applied over 44 years to approximate the population at the end of plant life in 2034.

The actual number used in the SAMA calculations to adjust the NUREG/CR-4551 results is a ratio of the population density for the area within 50 miles of the plant in the year 2034 to that in 1980. This ratio, P34/80, is calculated as follows:

$$P_{34/80} = \left(\frac{\frac{\left(PD_{50(1990)} - PD_{50(1980)}\right)}{(1990-1980)} * 44\,years + PD_{50(1990)}}{PD_{50(1980)}} \right)$$

Where:

$P_{34/80}$ = Ratio of the population density for the area within 50 miles of the plant in 2034 to the population density for the area within 50 miles of the plant in 1980

$PD_{50(1990)}$ = Population density for the area within 50 miles of the plant in 1990 (based on 1990 US census data)

$PD_{50(1980)}$ = Population density for the area within 50 miles of the plant in 1980 (based on NUREG/CR-4551)

$$PD_{50(1980)} = \frac{\left[\frac{\text{pop. within 100 miles}}{(3.14*100^2)} - \frac{\text{pop. within 30 miles}}{(3.14*30^2)}\right]}{70 \text{ miles}} * 20 \text{ miles} + \frac{\text{pop. within 30 miles}}{(3.14*30^2)}$$

$P_{34/80}$ is used to scale the Population Dose Risk (PDR) within 50 miles to reflect the population characteristics of the site area at the end of the proposed life extension. This affects the Offsite Exposure Cost Risk and the Offsite Economic Cost Risk used in the determination of the Baseline Screening Cost and the averted cost-risk for any proposed SAMAs.

Applying census data for the area around PBAPS results in the following:

$$P_{34/80} = \frac{\left[\frac{(598.5-385)}{(1990-1980)} * 44 + 598.5\right]}{385} = 3.99$$

4.20.2.2 Economy and Agriculture

As part of NUREG/CR-4551, site specific data was collected on the economic and agricultural characteristics surrounding the Peach Bottom site. It is assumed that the relative distribution of these factors has remained constant and that the overall growth in "economy" and "agriculture" is represented by the growth in population. This growth is reflected by means of scaling the Offsite Economic Cost Risk by the increase in population.

4.20.2.3 Other Plant Specific Data

MACCS, as utilized in NUREG/CR-4551, implemented a large, plant specific input file to account for other site aspects. These factors include evacuation characteristics, meteorological data, and core inventories that affect the Level 3 analysis. This data is available, including the economic and agricultural demographics, in Volume 2, Part 7 of NUREG/CR-4551. It is assumed that the remaining plant specific data documented there is constant or is treated by the application of the population growth ratio. No changes have been made to update the original input other than the scaling of the population estimates that is described above.

The Peach Bottom generating capacity has been increased from 3293 $MW_{thermal}$ per unit to 3458 $MW_{thermal}$ per unit since the time the NUREG/CR-4551 analysis was performed. The Peach Bottom PSA accounts for the power uprate in the

application of success criteria and event timing. The Level 3 results have not been modified to account for the change in fuel design that accompanied the power uprate as the corresponding impact on core inventory is considered to be insignificant compared with the variation that occurs within the core during the course of a fuel cycle.

4.20.3 CONVERSION OF PBAPS PSA MODEL RESULTS TO LEVEL 3 OUTPUT

A major factor related to the use of NUREG/CR-4551 in the SAMA evaluation is that the PBAPS PSA has been enhanced to reflect plant changes and new information. While consistent with the Individual Plant Examination, the level of sophistication of the PSA model has increased and the results have changed as modeling techniques have improved. In addition, the results of the PBAPS PSA Level 2 model are not defined in the same terms as reported in NUREG/CR-4551. In order to use the Level 3 model presented in that document, it was necessary to convert the PBAPS PSA Level 2 model results into a format which allowed for the scaling of the Level 3 results based on current Level 2 output. Finally, as mentioned above, the Level 3 results were modified to reflect the expected change in the site demographics at the end of the period of extended operation. This subsection provides a description of the process used to convert the PBAPS PSA Level 2 model results into a form that can be used to generate Level 3 results using the NUREG/CR-4551 documentation. The Unit 2 PSA model, which has a slightly higher core damage frequency (CDF) than the Unit 3 model, is used for the calculations in this study.

4.20.3.1 Identification of Required Parameters

The first step in the conversion of the PBAPS PSA results into a format suitable for updating the NUREG/CR-4551 Level 3 results is to identify the output of the Level 3 model that is required in the cost-benefit calculations, which are described in Section 4.20.4. While the CDF from the Level 1 model is used in these calculations, there are specific Level 3 terms that are needed to complete the analysis. Determination of the Offsite Exposure Cost Risk and the Offsite Economic Cost Risk both require Level 3 input. Offsite Exposure Cost Risk requires an estimate of the Population Dose Risk (0-50 miles) and the Offsite Economic Cost Risk requires the economic cost of an accident. Sections 4.20.3.2 and 4.20.3.3 discuss these elements further.

4.20.3.2 Determination of Population Dose Risk (0-50 Miles)

The basic process that was pursued to obtain Level 3 results based on the PBAPS PSA Level 2 model and NUREG/CR-4551 was to define a useful relationship between the Level 2 and Level 3 results. NUREG/CR-4551 defines the fractional contribution of the 10 collapsed Accident Progression Bins (APBs) to the Population Dose Risk at 50 miles (PDR50). It was also determined that the frequency of each collapsed APB could be calculated based on the information provided in NUREG/CR-4551. Given this relationship, it was possible to determine the PDR50 based on the results of the PBAPS PSA model if those results are reported in terms of the same accident bins. For example, for a given collapsed APB:

$$PDR50_{(PBAPSPSA)} = \frac{PBAPS\,PSA\,Frequency}{NUREG/CR-4551\,Frequency} * Collapsed\,APB\,Fractional\,Contribution * Total\,PDR\,50_{(NUREG/CR-4551)}$$

If this is performed for each of the 10 collapsed APBs and the results are summed, the total is the PDR50 for the PBAPS PSA. In the determination of Offsite Exposure Cost Risk, however, the PDR50 should reflect the site conditions at the end of the period of extended operation in 2034 (which is conservative). This is calculated by scaling the PDR50 results for the PBAPS PSA model by the $P_{34/80}$ ratio to account for the change in population, as described in Section G.2.4.2.

Each sequence of the PBAPS PSA Level 2 model was reviewed and re-categorized into one of the collapsed APBs. The Level 2 model contains a significantly larger amount of information about the accident sequences than what is used in the collapsed APBs in NUREG/CR-4551. Therefore, the re-categorization required simplification of accident progression information and assumptions related to categorizations of certain items.

The complete results of the Level 2 re-categorization are not presented here as there are over 1900 sequences in the containment event trees (CETs)[WDM1]. Appendix G provides a thorough description of the re-binning process. In summary, the baseline PBAPS PSA PDR50 was determined to be 14.7 person-rem per year per plant based on the scaled population data for 2034.

4.20.3.3 Determination of Offsite Economic Cost Risk

The Offsite Economic Cost Risk (OECR) results for the PBAPS PSA model depend on the relationship between the collapsed APBs and the Plant Damage States (PDSs) defined in NUREG/CR-4551. As there is no direct relationship documented between the collapsed APBs and the OECR, it was necessary to develop this relationship. This relationship allowed for the calculation of PBAPS PSA PDS frequencies based on the PBAPS PSA collapsed APB frequencies (the collapsed APB frequencies developed for the PDR50 calculation were also implemented here). A ratio of the PBAPS PSA PDS frequencies to the NUREG/CR-4551 frequencies multiplied by the NUREG/CR-4551 PDS OECR contributions provided the OECR for the PBAPS PSA model. The result was modified to account for the increased population at the end of the period of extended operation (2034) as it was for the PDR50. The following steps summarize the process used to calculate the OECR for the PBAPS PSA:

1. Using Table C-1 of NUREG/CR-4551, calculate the OECR for each source term by multiplying the mean source term frequency by the Economic Cost associated with the source term.

2. Sum the source-term-specific OECR values to get a total OECR for the NUREG/CR-4551 analysis.

3. Calculate the fractional contribution of each PDS to each collapsed APB from NUREG/CR-4551. This number is the fraction of the total collapsed APB frequency contributed by a given PDS.

4. Calculate the PDS frequencies for the PBAPS PSA. These are the sums of the products of the collapsed APB frequency and the fractional contribution of each PDS over all collapsed APBs for all PDSs.

5. Calculate the NUREG/CR-4551 PDS contributions to the OECR. This is the total NUREG/CR-4551 OECR multiplied by the fractional contribution of each PDS.

6. Multiply the PDS specific OECR by the ratio of the PBAPS PSA PDS frequencies to the NUREG/CR-4551 PDS frequencies to obtain the OECR for the PBAPS PSA.

7. Multiply the PBAPS PSA OECR by the P34/80 ratio to obtain the OECR for the Peach Bottom site in 2034. This represents the OECR for a single unit core damage accident (per year).

These steps are discussed in more detail in Appendix G. The result of the process is the PBAPS PSA OECR for the assumed conditions at the end of the period of extended operation in 2034. The cost-risk was determined to be $51,700 for the additional 20 year period of extended operation, and this value is used as input in the cost-benefit analysis.

4.20.4 COST-BENEFIT ANALYSIS

This section explains how PBAPS calculated the monetary value of the status quo (i.e., accident consequences without SAMA implementation). PBAPS also used this analysis to establish the maximum benefit that a SAMA could achieve if it eliminated all PBAPS risk due to at-power internal events.

The cost-benefit analysis described in this section is performed on a site basis. A single unit is examined in the sections below and the results are modified to account for the second unit. SAMA implementation costs, which are derived for use in the screening and detailed cost-benefit analyses, are also developed with the understanding that the SAMA would have to be implemented in each unit. The reason for performing the analysis on a site basis is that the implementation costs for modifications that affect both plants will be properly accounted for. For instance, a procedure enhancement is largely applicable to both units and the cost of its development is relevant to the site while installation of a unit specific piece of hardware should be doubled to account for its installation in both units. It is simply a means of maintaining expenditures on the same scale. The Unit 2 PSA model, which has the slightly higher base CDF of the two units, is used in the cost-risk calculations for the site.

The impact of a dual unit core damage scenario was examined as part of this study, however, a detailed Level 3 consequence analysis was not available for a simultaneous release from both units. A PSA sensitivity calculation was performed assuming the consequences of a dual unit core damage event are twice those of a single unit core damage event. Based on a review of the consequences associated with a factor of 2 increase in the source term releases presented in NUREG/CR-4551, this appears to be a conservative assumption. The results of the sensitivity analysis indicate that the consequences of a dual

unit core damage event would have to be greater than twice those of a single unit core damage event to have any significant impact on the cost-benefit analysis of the proposed plant changes. Therefore, performance of a detailed dual unit core damage evaluation is not considered necessary for the SAMA analysis.

Offsite Exposure Cost Risk

The baseline annual offsite exposure risk was converted to dollars (to yield a cost risk) using the NRC's conversion factor of $2,000 per person-rem (Ref. 4.20-4, Section 5.7.1.2), and discounting to present value using the NRC standard formula (Ref. 4.20-4, Section 5.7.1.3):

$$W_{pha} = C * Z_{pha}$$

Where:

W_{pha} = monetary value of public health risk after discounting

$C = \frac{[1-\exp(-rt_f)]}{r}$

t_f = years remaining until end of facility life = 20 years

r = real discount rate (as fraction) = 0.07/year

Z_{pha} = monetary value of public health (accident) risk per year before discounting ($/year)

The calculated value for C using 20 years and a 7 percent discount rate is 10.76. Therefore, calculating the discounted monetary equivalent of accident risk involves multiplying the dose risk (14.72 person-rem per year) by $2,000 per person-rem and by the C value (10.76 years). The calculated offsite exposure cost risk for the additional 20 year period is $316,945.

Offsite Economic Cost Risk

The baseline PBAPS PSA OECR is $51,700. This cost risk is an annual estimate based on the conditions present at the end of the period of extended operation. The baseline OECR must be discounted to present value as well in order to account for the entire period of extended operation. This is performed in the same manner as for public health risks and uses the same C value. The resulting estimate is $556,854.

Onsite Exposure Cost Risk

PBAPS evaluated occupational health using the NRC methodology in Ref. 4.20-4, Section 5.7.3, which involves separately evaluating "immediate" and "long-term" doses.

Immediate Dose - For the case where the plant is in operation, the equation that the NRC recommends using (Ref. 4.20-4, Sections 5.7.3 and 5.7.3.3) is:

Equation 1:

$$W_{IO} = R\{(FD_{IO})_S - (FD_{IO})_A\} * \left\{\frac{[1 - \exp(-rt_f)]}{r}\right\}$$

Where:

W_{IO} = monetary value of accident risk avoided due to immediate doses, after discounting

R = monetary equivalent of unit dose ($/person-rem)

F = accident frequency (events/yr)

D_{IO} = immediate occupational dose (person-rem/event)

S = subscript denoting status quo (current conditions)

A = superscript denoting after implementation of proposed action

r = real discount rate

t_f = years remaining until end of facility life.

The values used in the PBAPS analysis are:

R = $2,000/person-rem

r = 0.07/year

D_{IO} = 3,300 person-rem/accident (best estimate, from Ref. 4.20-4, Section 5.7.3.1)

t_f = 20 years (license extension period)

F = 4.5E-6 (baseline CDF) events/year

For the basis discount rate, assuming F_A is zero, the best estimate of the immediate dose cost is:

$$W_{10} = R(FD_{IO})_S * \left\{\frac{[1 - \exp(-rt_f)]}{r}\right\}$$

$$= \quad 2000 * (4.5E-6 * 3{,}300) * \left\{\frac{[1 - \exp(-0.07 * 20)]}{0.07}\right\}$$

$$= \quad \$322$$

Long-Term Dose - For the case where the plant is in operation, the NRC equation (Ref. 4.20-4, Sections 5.7.3 and 5.7.3.3) is:

Equation 2:

$$W_{LTO} = R\{(FD_{LTO})_S - (FD_{LTO})_A\} * \left\{\frac{[1 - \exp(-rt_f)]}{r}\right\} * \left\{\frac{[1 - \exp(-rm)]}{rm}\right\}$$

Where:

LTO = monetary value of accident risk avoided long-term doses, after discounting, $

m = years over which long-term doses accrue

The values used in the PBAPS analysis are:

R = $2,000/person-rem

r = 0.07/year

D_{LTO} = 20,000 person-rem/accident (best estimate, Reference 4, Section 5.7.3.1)

m = 10 years (estimate)

t_f = 20 years (license extension period)

F = 4.5E-6 (baseline CDF) events/year

For the basis discount rate, assuming F_A is zero, the best estimate of the long-term dose is:

$$W_{LTO} = R\,(FD_{LTO})_S * \left\{\frac{[1 - \exp(-rt_f)]}{r}\right\} * \left\{\frac{[1 - \exp(-rm)]}{rm}\right\}$$

$$= 2000 * (4.5E-6 * 20{,}000) * \left\{\frac{[1 - \exp(-0.07 * 20)]}{0.07}\right\} * \left\{\frac{[1 - \exp(-0.07 * 10)]}{0.07 * 10}\right\}$$

$$= \$1{,}403$$

Total Occupational Exposure - Combining Equations 1 and 2 above and using the above numerical values, the total accident related on-site (occupational) exposure avoided (W_O) based one unit's contribution to core damage is:

$$W_O = W_{IO} + W_{LTO} = (\$322 + \$1{,}403) = \$1{,}725$$

Onsite Cleanup and Decontamination Cost

The net present value that the NRC provides for cleanup and decontamination for a single event is $1.1 billion, discounted over a 10-year cleanup period (Ref. 4.20-4, Section 5.7.6.1). NRC uses the following equation in integrating the net present value over the average number of remaining service years:

$$U_{CD} = \left[\frac{PV_{CD}}{r}\right][1 - \exp(-rt_f)]$$

Where:

U_{CD} = Net present value of cost of cleanup and decontamination over the life of the facility

PV_{CD} = Net present value of a single event

r = real discount rate

t_f = years remaining until end of facility life.

The values used in the PBAPS analysis are:

PV_{CD} = $1.1E9

r = 0.07/year

t_f = 20 years

The resulting net present value of cleanup integrated over the period of extended operation, $1.18E10, must be multiplied by the baseline CDF of 4.5E-6 to determine the expected value of cleanup and decontamination costs. The resulting monetary equivalent is $53,643.

Replacement Power Cost

Long-term replacement power cost was determined following the NRC methodology in Ref. 4.20-4, Section 5.7.6.2. The net present value of replacement power for a single event, PV_{RP}, was determined using the following equation:

$$PV_{RP} = \left[\frac{\$1.2E8}{r}\right] * [1 - \exp(-rt_f)]^2$$

Where:

PV_{RP} = net present value of replacement power for a single event, ($)

r = 0.07/year

t_f = 20 years (license renewal period)

To attain a summation of the single-event cost over the entire period of extended operation, the following equation is used:

$$U_{RP} = \left[\frac{PV_{RP}}{r}\right] * [1 - \exp(-rt_f)]^2$$

Where:

U_{RP} = net present value of replacement power over life of facility ($-year)

After applying a correction factor to account for PBAPS size relative to the "generic" reactor described in NUREG/BR-0184 that (i.e., 1159 MWe/910 MWe) and multiplying by 2 to account for the assumption that the remaining unit has to shut down after a core damage event, the replacement power costs are determined to be $2.01E10 ($-year). Multiplying this value by the baseline CDF (4.5E-6) results in a replacement power cost of $91,067.

Baseline Screening

The sum of the baseline costs for a single unit core damage event is as follows:

Offsite exposure cost	=	$316,945
Offsite economic cost	=	$556,854
Onsite exposure cost	=	$1,725
Onsite cleanup cost	=	$53,643
Replacement Power cost	=	$91,067
Total cost	=	$1,020,234

To account for the contribution from both units, this total cost is multiplied by 2 to yield $2,040,468.

This combined cost estimate for both Peach Bottom units was used in screening out SAMAs that are not economically feasible; if the estimated cost of implementing a SAMA exceeded $2.04 million, it was discarded from further analysis. Exceeding this threshold would mean that a SAMA would not have a positive net value even if it could eliminate all severe accident costs. On the other hand, if the cost of implementation is less than this value, then a more detailed examination of the potential fractional risk benefit that can be attributed to the SAMA is performed.

4.20.5 PHASE I SAMA ANALYSIS: SAMA CANDIDATES AND SCREENING PROCESS

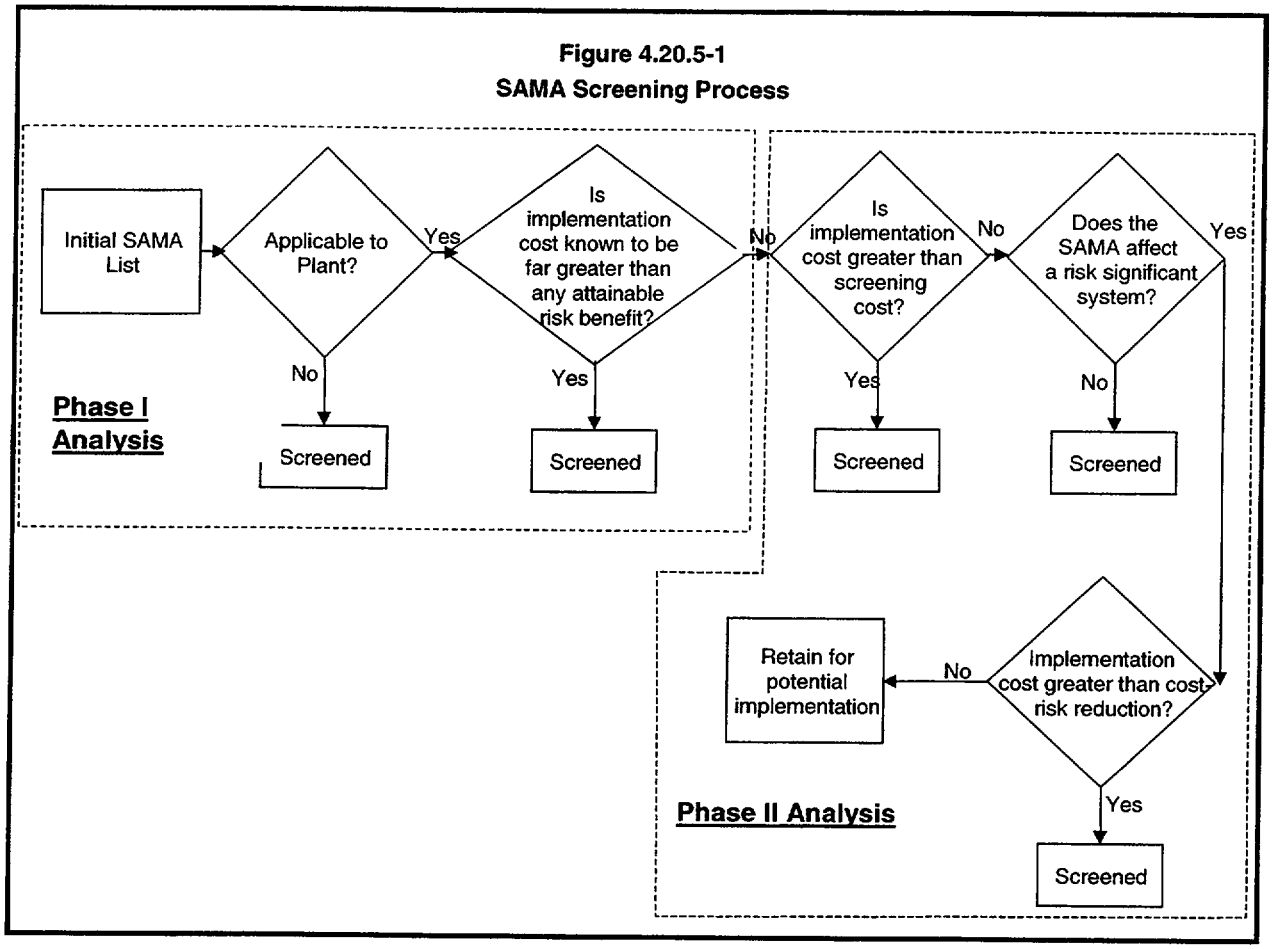
The SAMA screening process is summarized in Figure 4.20.5-1. An initial list of 207 SAMA candidates was developed from lists of Severe Accident Mitigation Alternatives at other nuclear power plants (Refs. 4.20-6, 4.20-10, 4.20-11, 4.20-13, 4.20-15 4.20-18, and 4.20-19), NRC documents (Refs. 4.20-5, 4.20-8, 4.20-9, 4.20-12, 4.20-14, 4.20-21, and 4.20-22), and documents related to advanced power reactor designs (ABWR SAMAs) (Refs. 4.20-7, 4.20-16, and 4.20-17). This initial list was then screened to remove those that were not applicable to Peach Bottom due to design differences. As a result, a majority of the SAMAs were removed from further consideration as they did not apply to the BWR-4/Mark I design used at PBAPS. An additional set of candidates was removed from consideration because all of those within the group were related to

mitigation of an Intersystem Loss of Coolant Accident (ISLOCA). According to NRC Information Notice 92-36 and its supplement, ISLOCA contributes little risk for boiling water reactors because of the lower primary pressures. Review of the PBAPS PSA confirms that ISLOCA is a low contributor to risk (less than 0.1% of the internal CDF and less than 1.5% of internal large early release frequency [LERF]) and the risk benefit associated with improving ISLOCA mitigation in not significant. SAMA candidates related to Reactor Coolant Pump (RCP) seal leakage were also removed from consideration. NUREG-1560 (Ref. 4.20-5) indicates that although RCP seal leakage is important for pressurized water reactors, recirculation pump leakage does not significantly contribute to core damage frequency in boiling water reactors.

The SAMA candidates that were found to be in place at PBAPS were screened from further consideration.

The SAMAs related to design changes prior to construction (primarily consisting of those candidates taken from the ABWR SAMAs) were removed as they were not practicable for an existing plant. For example, using basalfie cement (SAMA 207) would require dismantling of the reactor pedestal structure and replacement of the containment floor. This would result in exorbitant costs to implement. Any candidate known to have an implementation cost that far exceeds any possible risk benefit is screened from further analysis. Any SAMA candidates that were sufficiently similar to other SAMA candidates were treated in the same manner to those that they were related to; either combined or screened from further consideration. This screening left 30 unique SAMA candidates that were potentially applicable to PBAPS and were of potential value in averting the risk of severe accidents. Section 4.20.6 describes the process used to disposition the remaining SAMAs.

Figure 4.20.5-1
SAMA Screening Process



4.20.6 PHASE II SAMA ANALYSIS

A preliminary cost estimate was prepared for each of the remaining candidates to focus on those that had the possibility of having a positive benefit and to eliminate those whose costs were beyond the possibility of any corresponding benefit. When the screening cutoff of $2,040,468 was applied, 18 candidates were eliminated that were more expensive than the maximum postulated benefit associated with the elimination of all risk associated with full power internal events. This left 12 candidates for further analysis. Those SAMAs that required a more detailed cost-benefit analysis were evaluated using the combined methods described in Sections 4.20.3 and 4.20.4. Other SAMA candidates were screened from further analysis based on plant specific insights regarding the risk significance of the systems that would be affected by the proposed SAMAs. The SAMAs related to non-risk significant systems were screened from a detailed cost-benefit analysis as any change in the reliability of these systems is known to have a negligible impact on the PSA evaluation. Refer to Appendix G for a detailed discussion of the screening process.

For each of the remaining SAMA candidates not eliminated based on screening cost or PSA/application insights, a more detailed conceptual design was prepared along with a more detailed estimated cost. This information was then used to evaluate the candidates' effects on the plant safety model.

The final cost-risk based screening method used to determine the desirability of implementing the SAMA is defined by the following equation:

Net Value = (baseline cost-risk of plant operation – cost-risk of plant operation with SAMA implemented) – cost of implementation

If the net value of the SAMA is negative, the cost of implementation is larger than the benefit associated with the SAMA and the SAMA is not considered beneficial. The baseline cost-risk of plant operation was derived using the methodology presented in Section 4.20.4. The cost-risk of plant operation with the SAMA implemented is determined in the same manner with the exception that the PSA results reflect the application of the SAMA to the plant (the baseline input is replaced by the results of a PSA sensitivity with the SAMA change in effect).

Sections 4.20.6.1 to 4.20.6.5 describe the detailed cost-benefit analysis that was used to determine how the remaining candidates were ultimately treated. The results are presented on a site (2 units) basis.

4.20.6.1 Phase II SAMA NUMBER 1, Enhance Procedural Guidance for Use of Cross-tied Component Cooling or Service Water Pumps

Description: In this sensitivity, it was assumed that the guidance would virtually eliminate initiating events related to loss of service water. For PBAPS, this was assumed to relate to the loss of service water initiating event, the loss of turbine building closed cooling water system (TBCCW) initiating event, and the loss of reactor building closed cooling water system (RBCCW) initiating event. This impact was chosen for the study because the importance of these systems from a mitigation perspective is already low and because the impact of improving their reliabilities would maximize the calculated benefit by virtually eliminating these systems as initiating events.

To implement this change, PSA basic event values were changed as indicated in Table G.5.1-1 (from Appendix G) in the PBAPS Unit 2 model to simulate almost totally reliable service water systems from an initiating event perspective.

PSA Model Results (Phase II SAMA Number 1)

The results from this case indicate about a 0.7% reduction in Unit 2 CDF (CDFnew=4.5E-6/yr) and a 0.2% reduction in LERF (LERFnew=6.2E-8/yr). The results of the cost-benefit analysis are shown in Table 4.20.6.1-1.

TABLE 4.20.6.1-1
PHASE II SAMA NUMBER 1 NET VALUE

Base Case: Cost-Risk for the PBAPS Site	SAMA 1: Cost-Risk for the PBAPS Site	Averted Cost-Risk	Cost of Implementation	Net Value
$2,040,468	$2,032,059	$8,409	$50,000	-$41,591

The negative net value of this SAMA candidate indicates that its implementation is not beneficial.

4.20.6.2 Phase II SAMA Number 11, Provide Additional DC Battery Capacity

Description: In this sensitivity, it was assumed that the battery life could be extended to 4 hours each to simulate additional battery capacity. The 4 hour battery life could be obtained by installing improved batteries. This enhancement would impact the loss of offsite power cases with high pressure coolant injection (HPCI) and/or reactor core isolation cooling (RCIC) available. With HPCI or RCIC available, but with no AC power to the corresponding battery charger that supports HPCI or RCIC operation, 2.5 hours is assumed to be available to recover offsite power based on two hours of battery life and one half hour of boildown time. The 2.5-hour assumption is changed to 5 hours in this SAMA case (4 hours of battery life and 1 hour for boildown). Correspondingly, with both HPCI and RCIC available, but no AC power to the corresponding battery chargers, 5 hours is assumed to be available to recover offsite power before both HPCI and RCIC are lost due to loss of DC (4 hours of battery life and 1 hour for boildown). The 5-hour assumption is changed to 10 hours in this SAMA case (8 hours of battery life and 2 hours for boildown. Containment heat removal is also assumed to be necessary).

Table G.5.2-1 (from Appendix G) summarizes the changes made in the PBAPS Unit 2 model to simulate the effects of this SAMA.

PSA Model Results (Phase II SAMA Number 11)

The PSA results for this case indicate about a 19% reduction in Unit 2 CDF (CDF_{new}= 3.7E-6/yr) and a 10% reduction in LERF ($LERF_{new}$=5.6E-8/yr). The results of the cost-benefit analysis for Phase II SAMA 11 are shown in Table 4.20.6.2-1.

TABLE 4.20.6.2-1
PHASE II SAMA NUMBER 11 NET VALUE

Base Case: Cost-Risk for the PBAPS Site	SAMA 11: Cost-Risk for the PBAPS Site	Averted Cost-Risk	Cost of Implementation	Net Value
$2,040,468	$1,775,371	$265,097	$1,600,000	-$1,334,903

The negative net value of this SAMA candidate (installation of new batteries) indicates that its implementation is not beneficial.

4.20.6.3 Phase II SAMA Number 13, Develop Procedures to Repair or Replace Failed 4-kV Breakers

Description: In this model run, it was assumed that the improved procedures to repair or replace failed 4 kV breakers would result in reduced 4 kV breaker "fail to close rates". However, since these failures only manifest themselves in the model for implementation of the PBAPS SE-11 procedure for cross-tying buses, an additional change was also made to the 4 kV bus failure rates to further simulate the improved performance that could be obtained from this SAMA.

To implement this change, basic event values were changed as indicated in Table G.5.3-1 (from Appendix G) in the PBAPS Unit 2 model to simulate alternate 4-kV breaker capability.

PSA Model Results (Phase II SAMA Number 13)

The results from this case indicate about a 0.1% reduction in CDF (CDFnew=4.5E-6/yr) and a 0.1% reduction in LERF (LERFnew=6.2E-6/yr). The results of the cost-benefit analysis are shown in Table 4.20.6.3-1.

TABLE 4.20.6.3-1
PHASE II SAMA NUMBER 13 NET VALUE

Base Case: Cost-Risk for the PBAPS Site	SAMA 13: Cost-Risk for the PBAPS Site	Averted Cost-Risk	Cost of Implementation	Net Value
$2,040,468	$2,040,080	$388	$50,000	-$49,612

The negative net value of this SAMA candidate indicates that its implementation is not beneficial.

4.20.6.4 Phase II SAMA Number 18, Increase the Safety Relief Valve Re-seat Reliability

Description: In this model run, it was assumed that the improved reliability of the Safety Relief Valves (SRVs) would result in reduced "fail to reseat" probabilities for the SRVs. This issue is included to address the risk associated with dilution of boron caused by the failure of the SRVs to re-seat after standby liquid control (SLC) injection. However, the improved reliability would impact non-Anticipated

Transient Without Scram (ATWS) cases as well in reduced consequential stuck open relief valve scenarios, and in stuck open relief valve initiating events.

To implement this change, basic event values were changed as indicated in Table G.5.4-1 (from Appendix G) in the PBAPS Unit 2 model to simulate improved SRV re-seat reliability. Two PSA model sensitivity evaluations were performed: the first, SAMA 18a, decreased the probability of "failing to reseat", the second, SAMA 18b, also included a reduction in the initiating frequency associated with stock open relief valves.

PSA Model Results (Phase II SAMA Number 18a)

The results from this case indicate about a 4% reduction in CDF (CDFnew=4.4E-6/yr) and a 2% reduction in LERF (LERFnew=6.0E-6/yr). The results of the cost-benefit analysis are shown in Table 4.20.6.4-1.

TABLE 4.20.6.4-1
PHASE II SAMA NUMBER 18A NET VALUE

Base Case: Cost-Risk for the PBAPS Site	SAMA 18a: Cost-Risk for the PBAPS Site	Averted Cost-Risk	Cost of Implementation	Net Value
$2,040,468	$1,946,683	$93,785	$2,000,000	-$1,906,215

The negative net value of this SAMA candidate indicates that even if the improved SRV re-seat reliability also leads to a reduction in stuck open relief valve initiating events, its implementation is still not beneficial.

PSA Model Results (Phase II SAMA Number 18b)

The results from this case indicate about a 6% reduction in CDF (CDF_{new}=4.3E-6/yr) and a 2% reduction in LERF ($LERF_{new}$=6.0E-8/yr). The results of the cost-benefit analysis are shown in Table 4.20.6.4-2.

TABLE 4.20.6.4-2
PHASE II SAMA NUMBER 18B NET VALUE

Base Case: Cost-Risk for the PBAPS Site	SAMA 18b: Cost-Risk for the PBAPS Site	Averted Cost-Risk	Cost of Implementation	Net Value
$2,040,468	$1,866,230	$174,238	$2,000,000	-$1,825,762

The negative net value of this SAMA candidate indicates that its implementation is not beneficial.

4.20.6.5 Phase II SAMA Number 21, Install Suppression Pool Jockey Pump for Alternate Injection to the RPV

Description: In this model run, it was assumed that the installation of a suppression pool jockey pump would provide an independent means of providing long term injection to the reactor pressure vessel (RPV). Currently, the PBAPS model includes a simple representation of the fire pump to perform a similar function. Minimal credit is taken for success of the fire pump since it requires installation of separate cross-tie components. To simulate the potential impact of the dedicated jockey pump to perform this role, it was determined that the failure probability for the fire pump could be adjusted.

To implement this change, a basic event value was changed as indicated in Table G.5.5-1 (from Appendix G) in the PBAPS Unit 2 model to simulate the incorporation of a dedicated independent system to provide injection from the suppression pool that could potentially be provided by the addition of a suppression pool jockey pump. The revised value of 0.01 is considered somewhat optimistic for the combined failure rate (including all dependencies and human error contribution) for this system. This optimistic value would lead to the maximum potential benefit from this SAMA.

PSA Model Results (Phase II SAMA Number 21)

The results from this case indicate about an 8% reduction in CDF (CDFnew=4.2E-6/yr) and no reduction in LERF. While the PBAPS PSA results show no decrease in LERF, the translation of the PBAPS PSA model's Level 2 endstates into the collapsed APBs conservatively grouped "late" releases into the

"early" bins due to the definition of the collapsed APBs. This is conservative and results in a more dramatic decrease in cost-risk than would be expected from the installation of the jockey pump considering the PBAPS PSA Level 2 model. The results of the cost-benefit analysis are shown in Table 4.20.6.5-1.

TABLE 4.20.6.5-1
PHASE II SAMA NUMBER 21 NET VALUE

Base Case: Cost-Risk for the PBAPS Site	SAMA 21: Cost-Risk for the PBAPS Site	Averted Cost-Risk	Cost of Implementation	Net Value
$2,040,468	$1,689,512	$350,956	$480,000	-$129,044

The negative net value of this SAMA candidate indicates that its implementation is not beneficial.

4.20.7 PHASE II SAMA ANALYSIS SUMMARY

The SAMA candidates not eliminated from consideration by the baseline screening process or other PSA insights required the performance of a detailed analysis of the averted cost-risk and SAMA implementation costs. SAMA candidates are judged to be justified modifications if the averted cost-risk resulting from the modification is greater that the cost of implementing the SAMA. Table 4.20.7-1 summarizes the results of the detailed analyses that were performed for the SAMA candidates. None of the SAMAs analyzed were found to be cost-beneficial as defined by the methodology used in this study. However, this evaluation should not necessarily be considered a definitive guide in determining the disposition of a plant modification that has been shown to be beneficial by other engineering methods. These results are intended to provide information about the relative estimated risk benefit associated with a plant change or modification compared with its cost of implementation and should be used as an aid in the decision making process.

TABLE 4.20.7-1
SUMMARY OF THE DETAILED SAMA ANALYSES

Phase II SAMA ID	Averted Cost-Risk	Cost of Site Implementation	Net Value
1	$8,409	$50,000	-$41,591
11	$265,097	$1,600,000	-$1,334,903
13	$388	$50,000	-$49,612
18(a)	$93,785	$2,000,000	-$1,906,215
18(b)	$174,238	$2,000,000	-$1,825,762
21	$350,956	$480,000	-$129,044

4.20.8 CONCLUSIONS

The results of this study indicate that none of the SAMA candidates would yield a significant reduction in public risk relative to the cost required to implement the SAMA. No plant changes or modifications have been identified for implementation or further review at PBAPS.

4.21 REFERENCES

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

Ref. 4.0-1 U.S. Nuclear Regulatory Commission. 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS). Volumes 1 and 2. NUREG-1437. Washington, DC.

Ref. 4.0-2 U.S. Nuclear Regulatory Commission. 1996. *"Environmental Review for Renewal of Nuclear Power Plant Operating Licenses." Federal Register.* Vol. 61, No. 109. June 5.

Ref. 4.1-1 U.S. Atomic Energy Commission. 1973. *Final Environmental Statement related to operation of Peach Bottom Atomic Power Station Units 2 and 3.* Philadelphia Electric Company. Docket Nos. 50-277 and 50-278. Directorate of Licensing. Washington, DC.

Ref. 4.1-2 Philadelphia Electric Company. 1975. *Section 316(a) Demonstration for PBAPS Units No. 2 & 3 on Conowingo Pond* and supplementary information.

Ref. 4.2-1 Philadelphia Electric Company. 1977. *Section 316(b) Demonstration for PBAPS Units No. 2 and 3 on Conowingo Pond.*

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Ref. 4.20-2 A. C. Payne, R. J. Breeding, H. –N. Jow, J. C. Helton, L. N. Smith, A. W. Shiver, "Evaluation of Severe Accident Risks: Peach Bottom, Unit 2," NUREG/CR-4551, SAND86-1309, Volume 4, Parts 1 and 2, Sandia National Laboratories, December 1990.

Ref. 4.20-3 D. I. Chanin, J. L. Sprung, L. T. Ritchie and H. –N. Jow, "MELCOR Accident Consequence Code System (MACCS): User's Guide," NUREG/CR-4691, SAND86-1562, Volumes 1-3, Sandia National Laboratories, February 1990.

Ref. 4.20-4 U.S. Nuclear Regulatory Commission, "Regulatory Analysis Technical Evaluation Handbook," NUREG/BR-0184, 1997.

Ref. 4.20-5 NUREG-1560, "Individual Plant Examination Program: Perspectives on Reactor Safety and Plant Performance," Volume 2, NRC, December 1997.

Ref. 4.20-6 Edwin I. Hatch Nuclear Plant Application for License Renewal, Environmental Report, Appendix D, Attachment F, February 2000.

Ref. 4.20-7 General Electric Nuclear Energy, Technical Support Document for the ABWR, 25A5680, Revision 1, January 18, 1995.

Ref. 4.20-8 Letter from Mr. M. O. Medford (Tennessee Valley Authority) to NRC Document Control Desk, dated September 1, 1992, "Watts Bar Nuclear Plant Units 1 and 2 – Generic Letter (GL) – Individual Plant Examination (IPE) for Severe Accident Vulnerabilities – Response".

Ref. 4.20-9 NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," Volume 1, Table 5.36 Listing of SAMDAs considered for the Comanche Peak Steam Electric Station, NRC, May 1996.

Ref. 4.20-10 Letter from Mr. D. E. Nunn (Tennessee Valley Authority) to NRC Document Control Desk, dated October 7, 1994, "Watts Bar Nuclear Plant (WBN) Units 1 and 2 – Severe Accident Mitigation Design Alternatives (SAMDA) – Response to Request for Additional Information (RAI)".

Ref. 4.20-11 "Cost Estimate for Severe Accident Mitigation Design Alternatives, Limerick Generating Station for Philadelphia Electric Company," Bechtel Power Corporation, June 22, 1989.

Ref. 4.20-12 NUREG-1437, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," Volume 1, Table 5.35, Listing of SAMDAs considered for the Limerick, NRC, May 1996.

Ref. 4.20-13 Letter from Mr. W. J. Museler (Tennessee Valley Authority) to NRC Document Control Desk, dated October 7, 1994, "Watts Bar Nuclear Plant (WBN) Units 1 and 2 – Severe Accident Mitigation Design Alternatives (SAMDA)."

Ref. 4.20-14 NUREG-0498, "Final Environmental Statement related to the operation of Watts Bar Nuclear Plant, Units 1 and 2," Supplement No. 1, NRC, April 1995.

Ref. 4.20-15 Letter from Mr. D. E. Nunn (Tennessee Valley Authority) to NRC Document Control Desk, dated June 30, 1994. "Watts Bar Nuclear Plant (WBN) Unit 1 and 2 – Severe Accident Mitigation Design Alternatives (SAMDAs) Evaluation from Updated Individual Plant Evaluation (IPE)."

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Ref. 4.20-17 NUREG-1462, "Final Safety Evaluation Report Related to the Certification of the System 80+ Design," NRC, August 1994.

Ref. 4.20-18 Hatch Individual Plant Examination

Ref. 4.20-19 Hatch Individual Plant Examination of External Events

Ref. 4.20-20 PBAPS Report on Accident Management Insights (includes disposition of IPE/PRA Level 1 and 2 insights and IPEEE insights).

Ref. 4.20-21 GL 88-20, Supplement 1, NUREG-1335, "Individual Plant Examination: Submittal Guidance," August 29, 1989.

Ref. 4.20-22 GL 88-20, Supplement 2, "Accident Management Strategies for Consideration in the IPE Process," April 4, 1990.

Ref. 4.20-23 PBAPS Units 2 & 3 Response to Generic Letter 88-20 (IPE), August 26, 1992.

TABLE 4-1
CATEGORY 1 ISSUES THAT ARE NOT APPLICABLE TO PEACH BOTTOM UNITS 2 AND 3 (PBAPS)[a]

	Issues	Basis for Inapplicability to PBAPS
	Surface Water Quality, Hydrology, and Use (for all plants)	
1.	Impacts of refurbishment on surface water quality	Issue applies to activity, refurbishment, that PBAPS will not undertake.
2.	Impacts of refurbishment on surface water use	Issue applies to activity, refurbishment, that PBAPS will not undertake.
4.	Altered salinity gradients	Issue applies to discharge to a natural water body that has a salinity gradient to alter, not to a freshwater river as at PBAPS.
	Aquatic Ecology (for all plants)	
14.	Refurbishment	Issue applies to activity, refurbishment, that PBAPS will not undertake.
	Groundwater Use and Quality	
31.	Impacts of refurbishment on groundwater use and quality	Issue applies to activity, refurbishment, that PBAPS will not undertake.
32.	Groundwater use conflicts (potable and service water; plants that use < 100 gpm)	Issue applies to a plant feature, groundwater withdrawal, that PBAPS does not have.
36.	Groundwater quality degradation (Ranney wells)	Issue applies to a heat dissipation system feature, Ranney wells, that PBAPS does not have.
37.	Groundwater quality degradation (saltwater intrusion)	Issue applies to a plant feature, groundwater withdrawal, that PBAPS does not have.
38.	Groundwater quality degradation (cooling ponds in salt marshes)	Issue applies to a plant feature, cooling ponds,[b] that PBAPS does not have.
	Terrestrial Resources	
43.	Bird collisions with cooling towers	Issue applies to a plant feature, natural draft cooling towers, that PBAPS does not have.
44.	Cooling pond impacts on terrestrial resources	Issue applies to a plant feature, cooling ponds, that PBAPS does not have.

TABLE 4-1 (Cont'd)
CATEGORY 1 ISSUES THAT ARE NOT APPLICABLE TO PEACH BOTTOM UNITS 2 AND 3 (PBAPS)[a]

	Issues	Basis for Inapplicability to PBAPS
		Human Health
54.	Radiation exposures to the public during refurbishment	Issue applies to activity, refurbishment, that PBAPS will not undertake.
55.	Occupational radiation exposures during refurbishment	Issue applies to activity, refurbishment, that PBAPS will not undertake.
		Socioeconomics
72.	Aesthetic impacts (refurbishment)	Issue applies to activity, refurbishment, PBAPS will not undertake.

< = less than
gpm = gallons per minute
NRC = U. S. Nuclear Regulatory Commission
a. NRC listed the issues in Table B-1 of 10 CFR 51 Appendix B. Exelon added issue numbers for expediency.
b. NRC has defined "cooling pond" as "a manmade impoundment that does not impede the flow of a navigable system and that is used primarily to remove waste heat from condenser water prior to recirculating the water back to the main condenser...." (Ref. 4.0-1, Section 4.4.1.1, page 4-51).

TABLE 4-2
CATEGORY 1 AND "NA" ISSUES THAT ARE APPLICABLE TO PEACH BOTTOM UNITS 2 AND 3 (PBAPS)[a]

	Issue	NRC Findings[b]	GEIS, Ref. 4.0-1 (Section/Page)
	Surface Water Quality, Hydrology, and Use (for all plants)		
3.	Altered current patterns at intake and discharge structures	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.	4.2.1.1/4-4 (once-through) 4.3.2.2/4-31 (cooling tower)
5.	Altered thermal stratification of lakes	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.	4.2.1.2.2./4-4 (once-through)
6.	Temperature effects on sediment transport capacity	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.	4.3.4.2.3/4-6 (once-through)
7.	Scouring caused by discharged cooling water	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.	4.4.2.2/4-53
8.	Eutrophication	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.	4.4.2.2/4-53
9.	Discharge of chlorine or other biocides	SMALL. Effects are not a concern among regulatory and resource agencies, and are not expected to be a problem during the license renewal term.	4.4.2.2/4-53
10.	Discharge of sanitary wastes and minor chemical spills	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.	4.4.2.2/4-53
11.	Discharge of other metals in waste water	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.	4.4.2.2/4-53

TABLE 4-2 (Cont'd)
CATEGORY 1 AND "NA" ISSUES THAT ARE APPLICABLE TO PEACH BOTTOM UNITS 2 AND 3 (PBAPS)[a]

	Issue	NRC Findings[b]	GEIS, Ref. 4.0-1 (Section/Page)
12.	Water use conflicts (plants with once-through cooling systems)	SMALL. These conflicts have not been found to be a problem at operating nuclear power plants with once-through heat dissipation systems.	4.2.1.3/4-13 (once-through)
	Aquatic Ecology (for all plants)		
15.	Accumulation of contaminants in sediments or biota	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 those of another metal. It is not expected to be a problem during the license renewal term.	4.4.3/4-56 4.4.2.2/4-53
16.	Entrainment of phytoplankton and zooplankton	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.	4.4.3/4-56
17.	Cold shock	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.	4.4.3/4-56
18.	Thermal plume barrier to migrating fish	SMALL. Thermal plumes 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.	4.2.2.1.6/4-19 (once-through)
19.	Distribution of aquatic organisms	SMALL. Thermal discharge may have localized effects, but is not expected to affect the larger geographical distribution of aquatic organisms.	4.2.2.1.6/4-19 (once-through)
20.	Premature emergence of aquatic insects	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.	4.4.3/4-56

TABLE 4-2 (Cont'd)
CATEGORY 1 AND "NA" ISSUES THAT ARE APPLICABLE TO PEACH BOTTOM UNITS 2 AND 3 (PBAPS)[a]

	Issue	NRC Findings	GEIS, Ref. 4.0-1 (Section/Page)
21.	Gas supersaturation (gas bubble disease)	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.	4.4.3/4-56
22.	Low dissolved oxygen in the discharge	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.	4.4.3/4-56
23.	Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	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.	4.4.3/4-56
24.	Stimulation of nuisance organisms (e.g., shipworms)	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.	4.4.3/4-56
	Aquatic Ecology (for plants with cooling-tower-based heat dissipation systems)		
28.	Entrainment of fish and shellfish in early life stages	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.	4.3.3/4-44
29.	Impingement of fish and shellfish	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.	4.3.3/4-33

TABLE 4-2 (Cont'd)
CATEGORY 1 AND "NA" ISSUES THAT ARE APPLICABLE TO PEACH BOTTOM UNITS 2 AND 3 (PBAPS)[a]

	Issue	NRC Findings	GEIS, Ref. 4.0-1 (Section/Page)
30.	Heat shock	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.	4.3.3/4-33
		Terrestrial Resources	
41.	Cooling tower impacts on crops and ornamental vegetation	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.	4.3.4/4-34
42.	Cooling tower impacts on native plants	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.	4.3.5.1/4-42
45.	Power line right-of-way management (cutting and herbicide application)	SMALL. The impacts of right-of-way maintenance on wildlife are expected to be of small significance at all sites.	4.5.6.1/4-71
46.	Bird collision with power lines	SMALL. Impacts are expected to be of small significance at all sites.	4.5.6.2/4-74
47.	Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)	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.	4.5.6.3/4-77
48.	Floodplains and wetlands on power line right of way	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.	4.5.7/4-81

TABLE 4-2 (Cont'd)
CATEGORY 1 AND "NA" ISSUES THAT ARE APPLICABLE TO PEACH BOTTOM UNITS 2 AND 3 (PBAPS)[a]

	Issue	NRC Findings	GEIS, Ref. 4.0-1 (Section/Page)
		Air Quality	
51.	Air quality effects of transmission lines	SMALL. Production of ozone and oxides of nitrogen is insignificant and does not contribute measurably to ambient levels of these gases.	4.5.2/4-62
		Land Use	
52.	Onsite land use	SMALL. Projected onsite land use changes required during refurbishment and the renewal period would be a small fraction of any nuclear power plant site and would involve land that is controlled by the applicant.	3.2/3-1
53.	Power line right of way	SMALL. Ongoing use of power line right of ways would continue with no change in restrictions. The effects of these restrictions are of small significance.	4.5.3/4-62
		Human Health	
56.	Microbiological organisms (occupational health)	SMALL. Occupational health impacts are expected to be controlled by continued application of accepted industrial hygiene practices to minimize worker exposures.	4.3.6/4-48
58.	Noise	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.	4.3.7/4-49
60.	Electromagnetic fields, chronic effects	UNCERTAIN. Biological and physical studies of 60-Hz electromagnetic fields have not found consistent evidence linking harmful effects with field exposures. However, research is continuing in this area and a consensus scientific view has not been reached.	4.5.4.2/4-67
61.	Radiation exposures to public (license renewal term)	SMALL. Radiation doses to the public will continue at current levels associated with normal operations.	4.6.2/4-87
62.	Occupational radiation exposures (license renewal term)	SMALL. Projected maximum occupational doses during the license renewal term are within the range of doses experienced during normal operations and normal maintenance outages, and would be well below regulatory limits.	4.6.3/4-95

TABLE 4-2 (Cont'd)
CATEGORY 1 AND "NA" ISSUES THAT ARE APPLICABLE TO PEACH BOTTOM UNITS 2 AND 3 (PBAPS)[a]

	Issue	NRC Findings	GEIS, Ref. 4.0-1 (Section/Page)
		Socioeconomics	
64.	Public services: public safety, social services, and tourism and recreation	SMALL. Impacts to public safety, social services, and tourism and recreation are expected to be of small significance at all sites.	3.7.4/3-14 (refurbishment – public services) 3.7.4.3/3-18 (refurbishment – safety) 3.7.4.4/3-19 (refurbishment – social) 3.7.4.6/3-20 (refurbishment – tourism, recreation) 4.7.3/4-104 (renewal – public services) 4.7.3.3/4-106 (renewal - safety) 4.7.3.4/4-107 (renewal - social) 4.7.3.6/4-107 (renewal - tourism, recreation)
67.	Public services, education (license renewal term)	SMALL. Only impacts of small significance are expected.	4.7.3.1/4-106
73.	Aesthetic impacts (license renewal term)	SMALL. No significant impacts are expected during the license renewal term.	4.7.6/4-111
74.	Aesthetic impacts of transmission lines (license renewal term)	SMALL. No significant impacts are expected during the license renewal term.	4.5.8/4-83
75.	Design basis accidents	SMALL. The NRC staff has concluded that the environmental impacts of design basis accidents are of small significance for all plants.	5.3.2/5-11 (design basis) 5.5.1/5-114 (summary)

TABLE 4-2 (Cont'd)
CATEGORY 1 AND "NA: ISSUES THAT ARE APPLICABLE TO PEACH BOTTOM UNITS 2 AND 3 (PBAPS)[a]

	Issue	NRC Findings	GEIS, Ref. 4.0-1 (Section/Page)
		Postulated Accidents	
		Uranium Fuel Cycle and Waste Management	
77.	Offsite radiological impacts (individual effects from other than the disposal of spent fuel and high level waste)	SMALL. Off-site impacts of the uranium fuel cycle have been considered by the Commission in Table S-3 of this part. Based on information in the GEIS, impacts on individuals from radioactive gaseous and liquid releases including radon-222 and technetium-99 are small.	6.2.4/6-27 6.6/6-87
78.	Offsite radiological impacts (collective effects)	The 100-year environmental dose commitment to the U.S. population from the fuel cycle, high-level waste and spent fuel disposal is calculated to be about 14,800 person rem, or 12 cancer fatalities, for each additional 20-year power reactor operating term. Much of this, especially the contribution of radon releases from mines and tailing piles, consists of tiny doses summed over large populations. This same dose calculation can theoretically be extended to include many tiny doses over additional thousands of years as well as doses outside the U.S. The result of such a calculation would be thousands of cancer fatalities from the fuel cycle, but this result assumes that even tiny doses have some statistical adverse health effect, which will not ever be mitigated (for example, no cancer cure in the next thousand years), and that these dose projections over thousands of years are meaningful. However, these assumptions are questionable. In particular, science cannot rule out the possibility that there will be no cancer fatalities from these tiny doses. For perspective, the doses are very small fractions of regulatory limits, and even smaller fractions of natural background exposure to the same populations.	6.2.4/6-27 6.6/6-88

TABLE 4-2 (Cont'd)
CATEGORY 1 AND "NA" ISSUES THAT ARE APPLICABLE TO PEACH BOTTOM UNITS 2 AND 3 (PBAPS)[a]

	Issue	NRC Findings	GEIS, Ref. 4.0-1 (Section/Page)
		Nevertheless, despite all the uncertainty, some judgment as to the regulatory NEPA implications of these matters should be made and it makes no sense to repeat the same judgment in every case. Even taking the uncertainties into account, the Commission concludes that these impacts are acceptable in that these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the collective effects of the fuel cycle, this issue is considered Category 1.	
79.	Offsite radiological impacts (spent fuel and high level waste disposal)	For the high-level waste and spent fuel disposal component of the fuel cycle, there are no current regulatory limits for offsite releases of radionuclides for the current candidate repository site. However, if we assume that limits are developed along the lines of the 1995 National Academy of Sciences (NAS) report, "Technical Bases for Yucca Mountain Standards," and that in accordance with the Commission's Waste Confidence Decision, 10 CFR 51.23, a repository can and likely will be developed at some site which will comply with such limits, peak doses to virtually all individuals will be 100 millirem per year or less. However, while the Commission has reasonable confidence that these assumptions will prove correct, there is considerable uncertainty since the limits are yet to be developed, no repository application has been completed or reviewed, and uncertainty is inherent in the models used to evaluate possible pathways to the human environment. The NAS report indicated that 100 millirem per year should be considered as a starting point for limits for individual doses, but notes that some measure of consensus exists among national and international bodies that the limits should be a fraction of the 100 millirem per year. The lifetime individual risk from 100 millirem annual dose limit is about 310^{-3}.	6.2.4/6-28 6.6/6-88

TABLE 4-2 (Cont'd)
CATEGORY 1 AND "NA" ISSUES THAT ARE APPLICABLE TO PEACH BOTTOM UNITS 2 AND 3 (PBAPS)[a]

Issue	NRC Findings	GEIS, Ref. 4.0-1 (Section/Page)
	Estimating cumulative doses to populations over thousands of years is more problematic. The likelihood and consequences of events that could seriously compromise the integrity of a deep geologic repository were evaluated by the U.S. Department of Energy in the "Final Environmental Impact Statement: Management of Commercially Generated Radioactive Waste," October 1980. The evaluation estimated the 70-year whole-body dose commitment to the maximum individual and to the regional population resulting from several modes of breaching a reference repository in the year of closure, after 1,000 years, after 100,000 years, and after 100,000,000 years. Subsequently, the NRC and other federal agencies have expended considerable effort to develop models for the design and for the licensing of a high-level waste repository, especially for the candidate repository at Yucca Mountain. More meaningful estimates of doses to population may be possible in the future as more is understood about the performance of the proposed Yucca Mountain repository. Such estimates would involve very great uncertainty, especially with respect to cumulative population doses over thousands of years. The standard proposed by the NAS is a limit on maximum individual dose. The relationship of potential new regulatory requirements, based on the NAS report, and cumulative population impacts has not been determined, although the report articulates the view that protection of individuals will adequately protect the population for a repository at Yucca Mountain. However, (EPA's) generic repository standards in 40 CFR part 191 generally provide an indication of the order of magnitude of cumulative risk to population that could result from the licensing of a Yucca Mountain repository, assuming the ultimate standards will be within the range of standards now under consideration. The standards in 40 CFR part 191 protect the population by imposing "containment requirements" that limit the cumulative amount of radioactive material	

TABLE 4-2 (Cont'd)
CATEGORY 1 AND "NA" ISSUES THAT ARE APPLICABLE TO PEACH BOTTOM UNITS 2 AND 3 (PBAPS)[a]

	Issue	NRC Findings	GEIS, Ref. 4.0-1 Section/Page)
		released over 10,000 years. The cumulative release limits are based on EPA's population impact goal of 1,000 premature cancer deaths worldwide for a 100,000 metric tone (MTHM) repository. Nevertheless, despite all the uncertainty, some judgment as to the regulatory NEPA implications of these matters should be made and it makes no sense to repeat the same judgment in every case. Even taking the uncertainties into account, the Commission concludes that these impacts are acceptable in that these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the impacts of spent fuel and high-level waste disposal, this issue is considered Category 1.	
80.	Nonradiological impacts of the uranium fuel cycle	SMALL. The nonradiological impacts of the uranium fuel cycle resulting from the renewal of an operating license for any plant are found to be small.	6.2.2.6/6-20 (land use) 6.2.2.7/6-20 (water use) 6.2.2.8/6-21 (fossil fuel) 6.2.2.9/6-21 (chemical) 6.6/6-90 (conclusion)
81.	Low-level waste storage and disposal	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 onsite 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	6.4.2/6-36 ("low-level" definition) 6.4.3/6-37 (low-level volume) 6.4.4/6-48 (renewal effects) 6.6/6-90 (conclusion)

TABLE 4-2 (Cont'd)
CATEGORY 1 AND "NA" ISSUES THAT ARE APPLICABLE TO PEACH BOTTOM UNITS 2 AND 3 (PBAPS)[a]

	Issue	NRC Findings	GEIS Ref. 4.0-1 (Section/Page)
		waste disposal capacity will be made available when needed for facilities to be decommissioned consistent with NRC decommissioning requirements.	
82.	Mixed waste storage and disposal	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 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 the is reasonable assurance that sufficient mixed waste disposal capacity will be made available when needed for facilities to be decommissioned consistent with NRC decommissioned consistent with NRC decommissioning requirements.	6.4.5/6-63 6.6/6-91 (conclusion)
83.	On-site spent fuel	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.	6.4.6/6-70 6.6/6-91 (conclusion)
84.	Nonradiological waste	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.	6.5/6-86 6.6/6-92 (conclusion) Addendum 1

TABLE 4-2 (Cont'd)
CATEGORY 1 AND "NA" ISSUES THAT ARE APPLICABLE TO PEACH BOTTOM UNITS 2 AND 3 (PBAPS)[a]

	Issue	NRC Findings	GEIS, Ref. 4.0-1 (Section/Page)
85.	Transportation	SMALL. The impacts of transporting spent fuel enriched up to 5 percent uranium-235 with average burnup for the peak rod to current levels approved by NRC up to 62,000 MWd/MTU and the cumulative impacts of transporting high-level waste to a single repository, such as Yucca Mountain, Nevada are found to be consistent with the impact values contained in 10 CFR 51.52(c), Summary Table S-4-Environmental Impact of Transportation of Fuel and Waste to and from One Light-Water-Cooled Nuclear Power Reactor. If fuel enrichment or burnup conditions are not met, the applicant must submit an assessment of the implications for the environmental impact values reported in §51.52.	Ref. 4.0-2
		Decommissioning	
86.	Radiation doses	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.	7.3.1/7-15
87.	Waste management	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.	7.3.2/7-19 (impacts) 7.4/7-25 (conclusions)
88.	Air quality	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.	7.3.3/7-21 (air) 7.4/7-25 (conclusion)
89.	Water quality	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.	7.3.4/7-21 (water) 7.4/7-25 (conclusion)
90.	Ecological resources	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.	7.3.5/7-21 (ecological) 7.4/7-25 (conclusion)

TABLE 4-2 (Cont'd)
CATEGORY 1 AND "NA" ISSUES THAT ARE APPLICABLE TO PEACH BOTTOM UNITS 2 AND 3 (PBAPS)[a]

	Issue	NRC Findings	GEIS, Ref. 4.0-1 (Section/Page)
91.	Socioeconomic impacts	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.	7.3.7/7-24 (socioeconomic) 7.4/7-25 (conclusion)
92.	Environmental Justice	NONE. The need for and the content of an analysis of environmental justice will be addressed in plant-specific reviews.	Not in GEIS

CFR = Code of Federal Regulations
EPA = U.S. Environmental Protection Agency
GEIS = Generic Environmental Impact Statement
Hz = Hertz
NA = Not applicable
NEPA = National Environmental Policy Act
NPDES = National Pollutant Discharge Elimination System
NRC = U.S. Nuclear Regulatory Commission

a. NRC listed the issues in Table B-1 of 10 CFR 51 Appendix B. Exelon added issue numbers for expediency.
b. NRC has defined SMALL to mean that, for the issue, environmental effects are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, NRC has concluded that those impacts that do not exceed permissible levels in the NRC's regulations are considered small. (10 CFR 51 Appendix B, Table B-1, Footnote 3).
c. NRC published, on September 3, 1999, a GEIS addendum (Ref. 4.0-2) in support of its rulemaking that re-categorized Issue 85 from 2 to 1.

5.0 ASSESSMENT OF NEW AND SIGNIFICANT INFORMATION

NRC Input

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

The U.S. Nuclear Regulatory Commission (NRC) has resolved most license renewal environmental issues generically and only requires an applicant's analysis of the remaining issues. While NRC regulations do not require an applicant's environmental report to contain analyses of the impacts of those environmental issues that have been generically resolved [10 CFR 51.53(c)(3)(i)], the regulations do require that an applicant identify any new and significant information of which the applicant is aware [10 CFR 51.53(c)(3)(iv)].

Exelon performed an analysis to identify the following:

- Information that identifies a significant environmental issue not covered in the GEIS and codified in the regulation, or
- Information that was not covered in the NRC's *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) analyses and that leads to an impact finding different from that codified in the regulation.

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

Exelon is aware of no new and significant information regarding the environmental impacts of PBAPS license renewal.

6.0 SUMMARY OF LICENSE RENEWAL IMPACTS AND MITIGATING ACTIONS

6.1 LICENSE RENEWAL IMPACTS

Exelon has reviewed the environmental impacts from renewing the Peach Bottom Atomic Power Station Units 2 and 3 (PBAPS) operating licenses and has concluded that all of the impacts would be small and would not require mitigation. This environmental report documents the basis for Exelon's conclusion. Section 4.0 incorporates by reference U.S. Nuclear Regulatory Commission (NRC) findings for the 56 Category 1 issues that apply to PBAPS, all of which have impacts that are small (Table 4-2). The rest of Chapter 4 analyzes Category 2 issues, all of which are either not applicable or have impacts that would be small. Table 6-1 identifies the impacts that PBAPS license renewal would have on resources associated with Category 2 issues.

6.2 MITIGATION

NRC

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

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

Current operations include mitigation and monitoring activities that will continue during the term of the license renewal. Exelon performs routine mitigation and monitoring activities associated with environmental permits to ensure the safety of workers, the public, and the environment. These activities include the radiological environmental monitoring program, continuous noble gas emission monitoring, effluent chemistry monitoring, effluent toxicity testing, and monitoring the water quality and aquatic communities in Conowingo Pond. All impacts of license renewal are small and would not require further mitigation.

6.3 UNAVOIDABLE ADVERSE IMPACTS

NRC

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

"The information submitted...should not be confined to information supporting the proposed action but should also include adverse information.... 10 CFR 51.45(e)(3) as adopted by 10 CFR 51.53(c)(2)

This environmental report adopts by reference NRC findings for applicable Category 1 issues, including discussions of any unavoidable adverse impacts (Table 4-2). Exelon examined 21 Category 2 issues and identified the following unavoidable adverse impacts of license renewal:

- Some fish are impinged on the traveling screens at the intake structures.
- Some larval fish and shellfish are entrained at the intake structures.
- For purposes of analysis, Exelon assumed that license renewal would require 60 additional staff, although Exelon does not expect to need that many additional staff. The addition of 93 (from direct and indirect jobs) households to the two counties (York and Lancaster) in which the majority of the current PBAPS workers reside would result in small impacts to housing availability, transportation infrastructure, and public utilities that could be characterized as adverse, but would not be significant.

6.4 IRREVERSIBLE OR IRRETRIEVABLE RESOURCE COMMITMENTS

NRC

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

The continued operation of PBAPS for the license renewal term will result in irreversible and irretrievable resource commitments, including the following:

- nuclear fuel, which is utilized in the reactor and converted to radioactive waste;
- the land required to dispose of spent nuclear fuel, low-level radioactive wastes generated as a result of plant operations, and sanitary wastes generated from normal industrial operations;
- materials that will become radioactive; and
- materials used for the normal industrial operations of the plant that cannot be recovered or recycled or that are consumed or reduced to unrecoverable forms. Exelon works to minimize waste generation and identify recycling opportunities, further reducing the small amount of materials not recovered or recycled.

No major activities during the license renewal term would irreversibly or irretrievably commit additional resources beyond those committed during the construction and operation of PBAPS during the initial license term and the consumption of the materials discussed above.

6.5 SHORT-TERM USE VERSUS LONG-TERM PRODUCTIVITY OF THE ENVIRONMENT

NRC

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

The current balance between short-term use and long-term productivity at the PBAPS site was basically set once the units began operating in the 1970s. The PBAPS Final Environmental Statement (Ref. 6.5-1, Chapter IX) evaluated the impacts of constructing and operating PBAPS on the shore of Conowingo Pond. Approximately 130 acres of the pond was filled or enclosed by plant facilities. It is likely that this acreage will not be recovered. However, this represents a small percentage of the total area of the pond and does not affect the aquatic habitat in any measurable way. Approximately 100 acres of the 620-acre site have been developed. Most of this land could be returned to an undeveloped state after plant operations cease. Long-term productivity of the terrestrial and aquatic habitats in the vicinity of PBAPS is not adversely affected by the plant. Continued operations for an additional 20 years would not alter this conclusion.

6.6 REFERENCES

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

Ref. 6.5-1 U.S. Atomic Energy Commission. 1973. *Final Environmental Statement related to Operation of Peach Bottom Atomic Power Station Units 2 and 3.* Docket Nos. 50-277 and 50-278. Philadelphia Electric Company.

TABLE 6-1
ENVIRONMENTAL IMPACTS RELATED TO LICENSE RENEWAL AT PEACH BOTTOM ATOMIC POWER STATION UNITS 2 AND 3

No.	Issue	Environmental Impact
	Surface Water Quality, Hydrology, and Use (for all plants)	
13	Water use conflicts (plants with cooling ponds or cooling towers using make-up water from a small river with low flow)	**Small.** Evaporative loss through cooling towers, if they operated during the license renewal term, would be less than 3 percent of the natural low flow of the river.
	Aquatic Ecology (for plants with once-through and cooling pond heat dissipation systems)	
25	Entrainment of fish and shellfish in early life stages	**Small.** PBAPS has a current NPDES permit which constitutes compliance with CWA Section 316(b) requirements to provide best available technology to minimize entrainment.
26	Impingement of fish and shellfish in early life stages	**Small.** PBAPS has a current NPDES permit which constitutes compliance with CWA Section 316(b) requirements to provide best available technology to minimize impingement.
27	Heat shock	**Small.** PBAPS has a CWA Section 316(a) alternative thermal effluent limit.
	Groundwater Use and Quality	
33	Groundwater use conflicts (potable and service water, and dewatering; plants that use > 100 gpm)	**None.** This issue does not apply because PBAPS does not use groundwater.
34	Groundwater use conflicts (plants using cooling towers withdrawing makeup water from a small river)	**Small.** The water in Conowingo Pond would distribute any loss due to evaporative cooling from the cooling towers in such a way as to be insignificant to the surrounding aquifer.
35	Groundwater use conflicts (Ranney wells)	**None.** This issue does not apply because PBAPS does not use Ranney wells.
39	Groundwater quality degradation (cooling ponds at inland sites)	**None.** This issue does not apply because PBAPS does not use cooling ponds.
	Terrestrial Resources	
40	Refurbishment impacts	**None.** No impacts are expected because PBAPS will not undertake refurbishment.

TABLE 6-1 (Cont'd)
ENVIRONMENTAL IMPACTS RELATED TO LICENSE RENEWAL AT PEACH BOTTOM ATOMIC POWER STATION UNITS 2 AND 3

No.	Issue	Environmental Impact
		Threatened or Endangered Species
49	Threatened or endangered species	**Small.** No threatened or endangered species are known to occur at PBAPS or in the transmission line corridor. Exelon cooperates with the Commonwealth to monitor and protect bald eagles that nest on Conowingo Pond and works with the Pennsylvania Nature Conservancy and the Maryland Heritage Trust to protect sensitive areas along the transmission corridor.
		Air Quality
50	Air quality during refurbishment (nonattainment and maintenance areas)	**None.** No impacts are expected because PBAPS will not undertake refurbishment.
		Human Health
57	Microbiological organisms (public health) (plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river)	**Small.** The thermal characteristics of the PBAPS discharge and the absence of a seed source or inoculant are such that plant operations should not stimulate growth or reproduction of thermophilic organisms.
59	Electromagnetic fields, acute effects (electric shock)	**Small.** The largest modeled induced current under the PBAPS transmission line would be 4.98 milliamperes. Therefore, the PBAPS transmission line conforms to the National Electric Safety Code® provisions for preventing electric shock from induced current.
		Socioeconomics
63	Housing impacts	**Small.** NRC concluded that housing impacts would be small in medium and high population areas having no growth control measures. PBAPS is located in a high population area that does not have growth control measures.
65	Public services: public utilities	**Small.** Any increase in public water requirements from 93 new households (direct and indirect labor) would not impinge the water supplies of the affected communities.
66	Public services: education (refurbishment)	**None.** No impacts are expected because PBAPS will not undertake refurbishment.
68	Offsite land use (refurbishment)	**None.** No impacts are expected because PBAPS will not undertake refurbishment.

TABLE 6-1 (Cont'd)
ENVIRONMENTAL IMPACTS RELATED TO LICENSE RENEWAL AT PEACH BOTTOM ATOMIC POWER STATION UNITS 2 AND 3

No.	Issue	Environmental Impact
69	Offsite land use (license renewal term)	**Small.** York County has a diversified economy and has had an average population increase of 12 percent per decade for the last three decades. PBAPS has only a small impact on the economic base of the County.
70	Public services: transportation	**Small.** Any additional employees (up to 60) would be fewer than the typical refueling outage workforce of 1,800 people. The access roads are adequate for the increase in traffic as a result of an outage. Because of this, Exelon concludes that the impact of any additional workers would be small.
71	Historic and archaeological resources	**Small.** Continued operation of PBAPS does not require construction at the site or for new transmission lines. Therefore Exelon concludes that license renewal would not adversely affect historic or archaeological resources.
		Postulated Accidents
76	Severe accidents	**Small.** The cost analysis identified no severe accident mitigation alternatives that would avert public risk.[a]

a. NRC determined that risk of severe accidents is small for all plants (10 CFR 51, Subpart A, Appendix B, Table B-1 [Insert F6]) but that alternatives to mitigate severe accidents must be considered for plants that have not considered such alternatives.

7.0 ALTERNATIVES TO THE PROPOSED ACTION

NRC

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

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

"While many methods are available for generating electricity, and a huge number of combinations or mixes can be assimilated to meet a defined generating requirement, such expansive consideration would be too unwieldy to perform given the purposes of this analysis. Therefore, NRC has determined that a reasonable set of alternatives should be limited to analysis of single, discrete electric generation sources and only electric generation sources that are technically feasible and commercially viable..." (Ref. 7.0-1, Section 8.1).

"...The consideration of alternative energy sources in individual license renewal reviews will consider those alternatives that are reasonable for the region, including power purchases from outside the applicant's service area...." (Ref. 7.0-2, Section II.H, page 66541, column 3).

Chapter 7 evaluates alternatives to Peach Bottom Atomic Power Station Units 2 and 3 (PBAPS) license renewal. The chapter also addresses some actions that Exelon has considered, but would not take, and identifies Exelon bases for determining that such actions would be unreasonable.

Exelon divided its alternatives discussion into two categories, "no action" and "alternatives that meet system generating needs." In considering the level of detail and analysis that it should provide for each category, Exelon relied on the U.S. Nuclear Regulatory Commission (NRC) decision-making standard for license renewal:

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

This environmental report must provide sufficient information to clearly indicate whether an alternative would have a smaller, comparable, or greater environmental impact than license renewal. This approach is consistent with regulations of the Council on Environmental Quality, which provide that the consideration of alternatives (including the proposed action) should enable reviewers to evaluate their comparative merits (40 CFR 1500-1508). Exelon

believes that Chapter 7 provides sufficient detail about alternatives to establish the basis for necessary comparisons to the Chapter 4 discussion of impacts from the proposed action.

In characterizing environmental impacts from alternatives, Exelon has used the same definitions of "small," "moderate," and "large" that the Chapter 4 Introduction presents.

7.1 NO-ACTION ALTERNATIVE

Exelon is using "no-action alternative" to refer to a scenario in which the NRC does not renew the PBAPS operating licenses. Components of this alternative include replacing the generating capacity of PBAPS and decommissioning the facility, as described below.

Presently, PBAPS annually provides approximately 16,400 gigawatt hours of electricity (Ref. 7.1-1). (A gigawatt hour is one billion watt hours.) This is approximately 35 percent of the electricity that Exelon provides to its mid-Atlantic service area (Refs. 7.1-2 and 7.1-3) for its wholesale market and that is used by its 1.5 million residential and business customers (Ref. 7.1-4). As provided in 10 CFR 51.53(c)(2), Exelon did not consider the need for power from PBAPS, but instead considered alternatives for replacing power from PBAPS. Replacement options to consider include (1) building new generating capacity, (2) purchasing power, or (3) reducing power requirements through demand reduction. Section 7.2.1 describes each of these alternatives in detail, and Section 7.2.2 describes environmental impacts from feasible alternatives.

The *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (Ref. 7.0-1, pg. 7-1) defines decommissioning as the safe removal of a nuclear facility from service and the reduction of residual radioactivity to a level that permits release of the property for unrestricted use and termination of the license. NRC-evaluated decommissioning options include immediate decontamination and dismantlement and safe storage of the stabilized and defueled facility for a period of time, followed by decontamination and dismantlement. Regardless of the option chosen, decommissioning must be completed within a 60-year period after removal of the facility from service. Under the no-action alternative, Exelon assumes that it would be feasible to continue operating PBAPS until the current licenses expire, then initiate decommissioning activities in accordance with NRC requirements. The GEIS describes decommissioning activities based on an evaluation of an example reactor (the "reference" boiling-water reactor is the 1,155-megawatt electric [MWe] Washington Public Power Supply System's Columbia Nuclear Power Plant). This description is comparable to decommissioning activities that Exelon would conduct at PBAPS, and Exelon notes that the reference unit size is approximately equal to the PBAPS unit size.

As the GEIS notes, NRC has evaluated environmental impacts from decommissioning. NRC-evaluated impacts include: occupational and public radiation dose; impacts of waste management; impacts to air and water quality; and ecological, economic, and socioeconomic impacts. NRC indicated in Section 4.4 of Ref. 7.1-5 that the environmental effects of greatest concern (i.e., radiation dose and releases to the environment) are substantially less than the same effects resulting from reactor operations. Exelon adopts by reference the NRC conclusions regarding environmental impacts of decommissioning.

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

Exelon concludes that the decommissioning impacts under the no-action alternative would not be substantially different from those that would occur following license renewal, as identified in the GEIS (Ref. 7.0-1) and the decommissioning GEIS (Ref. 7.1-5, Section 4.4). These impacts would be temporary and would occur at the same time as the impacts from meeting system generating needs.

7.2 ALTERNATIVES THAT MEET SYSTEM GENERATING NEEDS

The current mix of power generation options in Pennsylvania is one indicator of what is believed to be feasible alternatives within the Commonwealth. In 1998, Pennsylvania's electric utility industry had a total generating capability of 33.8 gigawatts-electric (Ref. 7.2-1, Table 4). This capability includes units fueled by coal (52 percent); nuclear (27 percent); oil (7 percent); hydroelectric (6 percent); gas (2 percent); and dual-fired (e.g., gas and oil) 9 percent (Ref. 7.2-1, Figure 1). Approximately 2.8 gigawatts electric (8 percent of the Commonwealth's generating capability) were from nonutility sources (Ref. 7.2-1, Table 4). Nonutility generators also use a variety of energy sources.

Based on 1998 generation data, utility companies provided 191,000 gigawatt hours of electricity (Ref. 7.2-1, Table 5). Utilities' generation utilization was dominated by coal (61 percent), followed by nuclear (35 percent), oil (2 percent), hydroelectric (1 percent), and gas (0.3 percent) (Ref. 7.2-1, Figure 2). Approximately 17,000 gigawatt hours of electricity (9 percent of the Commonwealth's generation) was provided by nonutility sources (Ref. 7.2-1, Table 5).

The difference between capability and utilization is the result of preferential usage. For example, nuclear energy represented 27 percent of utilities' installed capability, but produced 35 percent of the electricity generated by utilities (Ref. 7.2-1, Figures 1 and 2, respectively). This reflects Pennsylvania's preferential reliance on nuclear energy as a base-load generating source. The difference is offset primarily by diminished reliance on oil; oil-fired units represent 7 percent of utilities' installed capability, but produce only 2 percent of the energy generated by utilities (Ref. 7.2-1, Figures 1 and 2, respectively). Figures 7-1 and 7-2 illustrate Pennsylvania's 1998 utility generating capability and utilization, respectively.

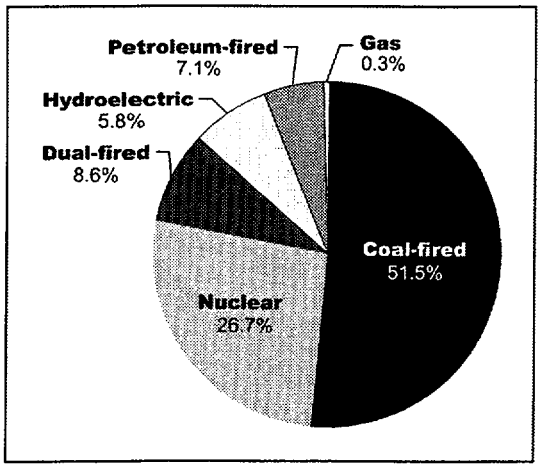

Figure 7-1. Pennsylvania Utility Generating Capability, 1998 (Ref. 7.2-1, Figure 1)

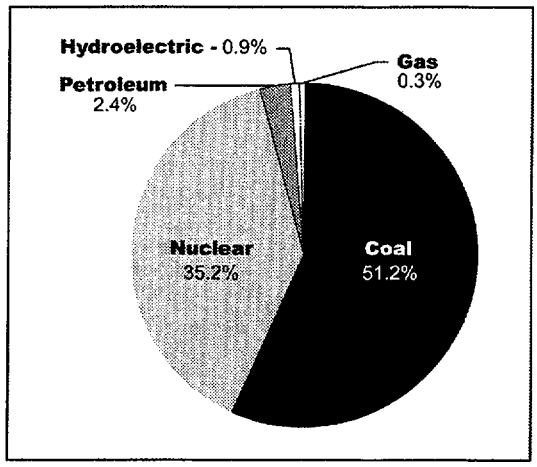

Figure 7-2. Pennsylvania Utility Generation Utilization, 1998 (Ref. 7.2-1, Figure 2)

Figure 7-3 illustrates the Exelon (as PECO) energy capability mix in Pennsylvania in 1996, which differs from the total Commonwealth's utility industry (Figure 7-1). (In late 2000, PECO merged with Unicom to form Exelon. The generation facilities of both PECO and Unicom are now owned and operated by Exelon Generation Company, LLC. This discussion is relevant only to the part of Exelon Generation Company, LLC that was formerly PECO.) Forty-six percent of Exelon's capability comes from nuclear, 23 percent from oil, 16 percent from coal, and 15 percent from hydroelectric and pumped storage. Other contributors are natural gas, landfill gas, and solar power.

Figure 7-4 illustrates the 1997 Exelon (as PECO) utilization by fuel type. Nuclear power generated 70 percent, coal generated 25 percent, hydroelectric generated 3 percent, and oil and gas generated 2 percent (Ref. 7.1-3).

Similar to the Commonwealth's, Exelon's utilization reflects a preference for nuclear energy as a base-load generating source; the difference is offset by diminished reliance on oil-fired units. Nuclear energy represented 46 percent of Exelon's installed capability, but produced 70 percent of the electricity generated by Exelon. Oil-fired capability represented 23 percent of Exelon's installed capability, but produced 2 percent of the energy generated by the utility (Refs. 7.1-3 and 7.2-2).

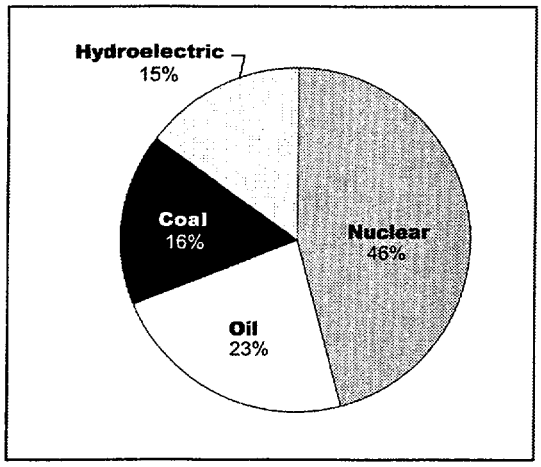

Figure 7-3. PECO's Electricity Generating Capability, 1996 (Ref. 7.2-2)

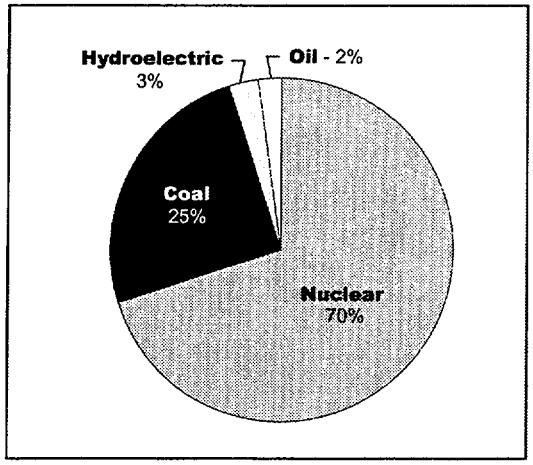

Figure 7-4. PECO's Electricity Utilization, 1997 (Ref. 7.1-3)

7.2.1 ALTERNATIVES CONSIDERED

Technology Choices

Exelon routinely conducts evaluations of alternative generating technologies. The evaluations include consideration of environmental factors, construction and operation cost, and generation purpose (e.g., base-load, peaking). Based on these internal reviews, Exelon identified candidate technologies that would be capable of replacing the net base-load capability of the two nuclear units at PBAPS (1,093 MWe). The Exelon evaluation covered the following topics:

- alternatives not requiring new construction (no action, purchase power, and conservation and load modifications),
- alternatives requiring new generation (joint venture, generation, and cogeneration and independent power production),
- base-load fossil-fueled units (pulverized coal, residual oil, and natural gas-fired combined-cycle combustion turbines), and
- alternative generating technologies (hydroelectric, refuse/biomass, and others).

Based on these and other internal evaluations, Exelon has concluded that the feasible new plant systems that could replace the capacity of the units at PBAPS

are pulverized coal and large gas-fired combined-cycle units for base-load operation. This conclusion is borne out by the generation utilization information in the introduction of Section 7.2 that identifies coal as the most heavily utilized non-nuclear generating technology in Pennsylvania. The high cost of oil has prompted a steady decline in its use for electricity generation and a resulting increase in the use of natural gas. From 1997 to 1998, production by oil dropped by about 11 percent, while production by gas increased approximately 33 percent. For purposes of the PBAPS license renewal environmental report, Exelon has therefore performed a detailed analysis of new generating capacity alternatives to the technologies that it considers most feasible: pulverized coal- and gas-fired units. Exelon chose to evaluate combined-cycle plants in lieu of simple-cycle plants, because standard-size combined-cycle units in the 500 - 600 megawatt (MW) range are available, while simple-cycle units are generally less than 250 MW (Ref. 7.2-3) and are designed to operate as peaking units.

In addition to coal- and gas-fired plants, Exelon considered a number of other alternatives to license renewal. For various reasons (e.g., technical and commercial status, availability in Pennsylvania, environmental impacts), Exelon does not consider these alternatives to be feasible or environmentally preferable to license renewal of PBAPS. Therefore, Exelon has performed a more limited evaluation of these alternatives in Section 7.2.1.4, with references to more detailed analyses in the GEIS (Ref. 7.0-1).

Mixture

The NRC indicated in the GEIS that, while many methods are available for generating electricity and a huge number of combinations or mixes can be assimilated to meet system needs, such expansive consideration would be too unwieldy given the purposes of the alternatives analysis. Therefore, NRC determined that a reasonable set of alternatives should be limited to analysis of single discrete electrical generation sources and only those electric generation technologies that are technically reasonable and commercially viable (Ref. 7.0-1, pg. 8-1). Consistent with the NRC determination, Exelon has not evaluated mixes of generating sources; however, the impacts from all coal- or all gas-fired generation presented in this chapter are expected to bound impacts from any generation mixture of the two technologies.

Deregulation and Reducing Demand

In November 1996, the General Assembly of Pennsylvania enacted the Electricity Generation Customer Choice and Competition Act. The Act would enable all customers of electric distribution companies in the Commonwealth to purchase electricity from their choice of electric generation suppliers by January 1, 2001 (Ref. 7.2-4). As such, electric generation supply would be based on the customers' needs and preferences, the lowest price, or the best combination of prices, services, and incentives (Ref. 7.2-5).

In response, Exelon (as PECO) submitted its restructuring plan and received final approval from the Pennsylvania Public Utility Commission. The restructuring plan allowed all customers to choose among competing power suppliers by January 1, 2000 (Ref. 7.2-6).

With more than 50 suppliers licensed to sell electricity in Pennsylvania, Exelon will not be able to control demand and offering extensive conservation and load modification incentives would not be effective in a competitive market.

As a result, in a deregulated market for generation of electrical power in which the market price of power is a function of supply and demand, Exelon will not be able to offer competitively priced power if it subsidizes demand reduction alternatives. Furthermore, as discussed in Section 7.2.1.3, there is limited potential to reduce loads using unsubsidized demand reduction alternatives. As a result, demand reduction is not a reasonable alternative to license renewal of PBAPS. The Public Utility Commission will ensure that the operation of generating units of incumbent utilities will not inhibit the development of competition within the Commonwealth. Therefore, it is not clear whether Exelon or another competitive supplier would construct new generating units to replace those at PBAPS, if its licenses were not renewed. However, regardless of the entity that constructed and operated the replacement power sources, certain environmental parameters would be constant among replacement power sources. Therefore, this report discusses the impacts of reasonable alternatives to PBAPS, without regard to whether they would be owned by Exelon.

Alternatives

The following sections present fossil-fuel-fired generation (Section 7.2.1.1) and purchase power (Section 7.2.1.2) as reasonable alternatives to license renewal. Section 7.2.1.3 discusses reducing demand and presents the basis for

concluding that it is not a reasonable alternative to license renewal. Section 7.2.1.4 discusses alternative sources of generation that are not feasible or environmentally preferable to license renewal of PBAPS.

7.2.1.1 CONSTRUCT AND OPERATE FOSSIL-FUEL-FIRED GENERATION

Exelon analyzed locating hypothetical new coal- and gas-fired units at the existing PBAPS site. This approach could minimize environmental impacts by building on previously disturbed land and by making the most use possible of existing facilities, such as transmission lines, roads and parking areas, office buildings, and the cooling system. Although this approach could be applied to gas-fired units, locating coal-fired units at PBAPS was rejected due to size and terrain limitations and the environmental impacts of clear-cutting large stands of existing wooded land for disposal of ash and scrubber sludge. Accordingly, Exelon defined the coal-fired alternative as construction at a hypothetical site in the southeastern portion of the Commonwealth of Pennsylvania. To the extent practicable, the site would be located near PBAPS to take advantage of its existing cooling water source (Conowingo Pond), power lines, and other transmission facilities.

For comparability, Exelon selected gas- and coal-fired units of equal electric power and capacity factors. A scenario of, for example, four 546.5-MW units could be assumed to replace the 2,186-MW PBAPS net capacity. However, Exelon's experience indicates that, although customized unit sizes can be built, using standardized sizes is more economical. For example, a manufacturer's standard-sized units include a gas-fired combined-cycle unit of 508-MWe net capacity (Ref. 7.2-3). Accordingly, Exelon evaluated constructing four 508-MW gas-fired units and, for comparability, set the number and the net power of the coal-fired units at four 508 MWe (Tables 7-1 and 7-2). Although this provides less capacity than the existing units, it ensures against overestimating environmental impacts from the alternatives. The shortfall in capacity could be replaced by other methods (see Mixture in Section 7.2.1).

It must be emphasized, however, that these are hypothetical scenarios. Exelon does not have plans for such construction at PBAPS or at a hypothetical site.

Coal-Fired Generation

NRC has evaluated coal-fired generation alternatives for the Calvert Cliffs Nuclear Power Plant (Ref. 7.2-7, Section 8.2.1) and for the Oconee Nuclear

Station (Ref. 7.2-8, Section 8.2.1). For Oconee, NRC analyzed 2,500 MWe of coal-fired generation capacity. Exelon has reviewed the NRC analysis, believes it to be sound, and notes that it analyzed slightly more generating capacity than the 2,032 MWe net (i.e., four 508-MWe units) discussed in this analysis. In defining the coal-fired alternative, Exelon has used Pennsylvania-specific input and has scaled from the NRC analysis, where appropriate.

Table 7-1 presents the basic coal-fired alternative emission control characteristics. Exelon based its emission control technology and percent control assumptions on alternatives that the U.S. Environmental Protection Agency (EPA) has identified as being available for minimizing emissions (Ref. 7.2-9). For purposes of analysis, Exelon has assumed that coal and limestone (or lime) would be delivered by rail via a nearby rail line to a new rail spur leading to the hypothetical site. The new spur would include an onsite access and turnaround system.

Gas-Fired Generation

Based on the PECO Energy Gas Fired Power Plant Guide (Ref. 7.2-3), Exelon has chosen to evaluate gas-fired generation, using combined-cycle turbines. Exelon has determined that the technology is mature, economical, and feasible. The Gas Fired Power Plant Guide indicates that standard-sized gas-fired units of 508 MW are readily available and economical. Therefore, Exelon has analyzed 2,032 MW of net power, consisting of four 508-MW gas-fired units located on PBAPS property. Table 7-2 presents the basic gas-fired alternative characteristics. Exelon realizes that gas availability would be questionable. It would require a new dedicated high-pressure 24-inch pipeline to tie into the nearby (about 3 miles distant) Transco gas pipelines. In the winter, it might become necessary for Exelon to operate on fuel oil, which would have higher costs and more emissions than gas.

7.2.1.2 PURCHASE POWER

Exelon has evaluated conventional and prospective power supply options that could be reasonably implemented before the current PBAPS licenses expire (2013 for Unit 2 and 2014 for Unit 3). Because Pennsylvania is a net exporter of power and would be fully deregulated, Exelon assumes that in-state power could be purchased. For example, in 1997 Pennsylvania exported 137 million kilowatt hours (kWh) (Ref. 7.2-10). This is less than 1 percent of what PBAPS generates

annually (approximately 16,400 gigawatt hours). It would probably require new construction to provide replacement capacity for PBAPS (2,186 MWe net). Power is exported from Pennsylvania because it has been purchased by consumers and is not excess power available to replace existing capacity.

The NRC evaluated the environmental impacts of thirteen alternative energy sources in Section 8.3 of the GEIS. Exelon assumes that the generating technology producing purchased power would be one of the alternatives that NRC analyzed. For this reason, Exelon is adopting by reference, as representative of the purchased power alternative, the GEIS description of the alternative generating technologies. Of these technologies, simple-cycle combustion turbines or combined-cycle facilities fueled by natural gas are found to be the most cost-effective. There has been a corresponding decreased incentive for boilers fired by coal or residual oil.

Although purchased power could provide replacement power for PBAPS, Exelon identified drawbacks to this alternative. They include the following:

- Utility generators providing power to Exelon would need to increase their capacity with new power units. For the reasons discussed in Sections 7.2.1.4 and 7.2.2, construction of a new generating station is not a preferable alternative to license renewal of PBAPS.

- Deregulation in Pennsylvania is expected to be fully in place by 2001. Under deregulation, non-utility generators could compete directly with utility companies for the generation market. This is expected to decrease non-utility generators' incentives to provide wholesale power to utility companies.

7.2.1.3 REDUCE DEMAND

In the past, Exelon (as PECO) has offered the demand-side management (DSM) programs, which either conserve energy or allow the Company to reduce customers' load requirements during periods of peak demands. The four programs are:

Conservation Program

- Homeowner agreements to limit peaking power in specific areas

Load Management Programs

- Change status of currently operating units to standby generation
- Curtailable service (e.g., industry agreements)
- Interruptible service (e.g., electric water heaters)

Exelon annually projects both the summer and winter peak power (MW) and annual energy requirements (gigawatt-hours [GWH]) impacts of DSM. Projections for future DSM programs represent substantial decreases in DSM initiatives that were in effect during past years. Market conditions that provided the initial support for utility-sponsored conservation and load management efforts during the late 1970s and early 1980s can be broadly characterized by:

1. increasing long-term marginal prices for capacity and energy production resources;
2. forecasts projecting increasing demand for electricity across the nation;
3. general agreement that conditions (1) and (2) would continue for the foreseeable future;
4. limited competition in the generation of electricity;
5. economies of scale in the generation of electricity, which supported the construction of large central power plants; and
6. the use of average embedded cost as the basis for setting electricity prices within a regulated context.

These market and regulatory conditions are undergoing dramatic changes that have significantly impacted the cost-effectiveness of utility-sponsored DSM and can be described as follows:

1. a decline in generation costs, due primarily to technological advances that have reduced the cost of constructing new generating units (e.g., combustion turbines); and

2. national energy legislation that has encouraged wholesale competition through open access to the transmission grid, as well as state legislation designed to facilitate retail competition.

Consistent with (1) and (2) above, the utility planning environment features lower capacity and lower energy prices than during earlier periods, shorter planning horizons, lower reserve margins, and increased reliance on market prices to direct utility resource planning. These have greatly reduced the number of cost-effective DSM alternatives.

Other significant changes include:

- Rate design programs that enable customers to make energy choices based on their unique needs and energy costs. An example is Exelon's eight percent reduction in electricity rates and caps on future generation and transmission and distribution rates. Such rate designs will increasingly replace incentive-driven direct load-control programs.

- The adoption of increasingly stringent national appliance standards for most major energy-using equipment and the adoption of energy efficiency requirements in state building codes. These mandates have further reduced the potential for cost-effective utility-sponsored measures.

- Third parties are increasingly providing energy services and products in competitive markets at prices that reflect their value to the customer. Market conditions can be expected to continue this shift among providers of cost-effective load management.

For these reasons, Exelon determined that the remaining DSM programs, which are primarily directed toward load management, are not an effective substitute for any of its large base-load units operating at high-capacity factors, including PBAPS.

7.2.1.4 OTHER ALTERNATIVES

This section identifies alternatives to PBAPS license renewal that are neither feasible nor environmentally preferable as direct replacements for PBAPS and describes why the alternatives are not considered to be feasible or preferable. In evaluating these alternatives, Exelon accounted for the fact that PBAPS is a base-load generator, and that any feasible alternative to PBAPS would also need

to be able to generate base-load power. In performing this evaluation, Exelon relied heavily upon NRC's GEIS for License Renewal of Nuclear Plants (Ref. 7.0-1).

Wind

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

According to the *Wind Energy Resource Atlas of the Untied States* (Ref. 7.2-11) areas suitable for wind energy applications must be wind power class 3 or higher. Approximately 50 percent of the land area in Pennsylvania has a wind power classification of 3 or higher and, therefore, may be suitable for wind energy applications. However, many of the wind power class 3 areas are located in the Appalachian Mountains along sharp ridge lines at the highest elevations, making them unsuitable for wind turbines.

The GEIS estimates a land use of 150,000 acres per 1,000 MWe for wind power. Therefore, replacement of PBAPS generating capacity with wind power, even assuming ideal wind conditions, would require dedication of about 500 square miles. Based on the lack of sufficient wind speeds and the amount of land needed to replace PBAPS, the wind alternative would require a large greenfield site, which would result in a large environmental impact. Additionally, wind plants have aesthetic impacts, generate noise, and harm birds.

Solar

By its nature, solar power is intermittent. Therefore, solar power by itself is not suitable for base-load capacity and is not a feasible alternative to license renewal of PBAPS.

Solar power, in conjunction with energy storage mechanisms, might serve as a means of providing base-load power. However, current energy storage technologies are too expensive to permit solar power to serve as a large base-load generator. Even without storage capacity, solar power technologies

(photovoltaic and thermal) cannot currently compete with conventional fossil-fueled technologies in grid-connected applications, due to high costs per kilowatt of capacity. (Ref. 7.0-1, Sections 8.3.2 and 8.3.3).

Furthermore, solar power is not a technically feasible alternative in Exelon's service area. Southeastern Pennsylvania receives about 3.3 kWh of solar radiation per square meter (m^2) per day, compared with 5 to 7.2 kWh/m^2 per day in areas of the West, such as California, which are most promising for solar technologies (Ref. 7.0-1, Sections 8.3.2 and 8.3.3). Because of the area's low rate of solar radiation and high technology costs, solar power in Pennsylvania is limited to niche applications and is not a feasible base-load alternative to PBAPS license renewal.

Finally, according to the GEIS, land requirements for solar plants are high -- 35,000 acres per 1,000 MWe for photovoltaic and 14,000 acres per 1,000 MWe for solar thermal systems. Neither type of solar electric system would fit at the PBAPS site, and both would have large environmental impacts at a greenfield site.

Hydropower

Approximately 6 percent (about 2,000 MW) of Pennsylvania utility generating capacity (but less than 1 percent of power production) is hydroelectric. As the GEIS, Section 8.3.4, points out, hydropower's percentage of the country's generating capacity is expected to decline because hydroelectric facilities have become difficult to site as a result of public concern over flooding, destruction of natural habitat, and destruction of natural river courses. According to the *U.S. Hydropower Resource Assessment for Pennsylvania* (Ref. 7.2-12), there are no remaining sites in Pennsylvania that would be environmentally suitable for a large hydroelectric facility.

The GEIS, Section 8.3.4, estimates land use of 1,600 square miles per 1,000 MWe for hydroelectric power. Based on this estimate, replacement of PBAPS generating capacity would require flooding more than 3,400 square miles. This would result in a large impact on land use. Further, operation of a hydroelectric facility would alter aquatic habitats above and below the dam, which would impact existing aquatic species.

Geothermal

As illustrated by Figure 8.4 in the GEIS, geothermal plants might be located in the western continental United States, Alaska, and Hawaii where hydrothermal reservoirs are prevalent. However, there are no high-temperature geothermal sites in Pennsylvania.

Wood Energy

The use of wood waste to generate electricity is largely limited to those states with significant wood resources, such as California, Maine, Georgia, Minnesota, Oregon, Washington, and Michigan. Electric power is generated in these states by the pulp, paper, and paperboard industries, which consume wood and wood waste for energy, benefitting from the use of waste materials that could otherwise represent a disposal problem. However, the largest wood waste power plants are 40 to 50 MW in size.

Further, as discussed in Section 8.3.6 of the GEIS, construction of a wood-fired plant would have an environmental impact that would be similar to that for a coal-fired plant, although facilities using wood waste for fuel would be built on smaller scales. Like coal-fired plants, wood-waste plants require large areas for fuel storage, processing, and waste disposal (i.e., ash). Additionally, operation of wood-fired plants has environmental impacts, including impacts on the aquatic environment and air.

Municipal Solid Waste

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

The decision to burn municipal solid waste to generate energy is usually driven by the need for an alternative to landfills, rather than by energy considerations. The use of landfills as a waste disposal option is likely to increase in the near term; however, it is unlikely that many landfills will begin converting waste to energy because of unfavorable economics, particularly with electricity prices declining. Therefore, municipal solid waste would not be a feasible alternative to PBAPS license renewal, particularly at the scale required.

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

Other Biomass-Derived Fuels

In addition to wood and municipal solid waste fuels, there are several other concepts for fueling electric generators, including burning energy crops, converting crops to a liquid fuel such as ethanol (ethanol is primarily used as a gasoline additive), and gasifying energy crops (including wood waste). As discussed in Section 8.3.8 of the GEIS, none of these technologies has progressed to the point of being competitive on a large scale or of being reliable enough to replace a base-load plant such as PBAPS. For these reasons, such fuels do not offer a feasible alternative to PBAPS license renewal.

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

Oil

Exelon has several oil-fired units; however, they produce only about 2 percent of Exelon's power generation. The cost of oil-fired operation is more expensive than nuclear or coal-fired operation. In addition, future increases in oil prices are expected to make oil-fired generation increasingly more expensive than coal-fired generation. The high cost of oil has prompted a steady decline in its use for electricity generation. From 1997 to 1998, production of electricity by oil-fired plants dropped by about 11 percent in Pennsylvania (Ref. 7.2-14). For these reasons, oil-fired generation is not an economically feasible alternative to PBAPS license renewal.

Also, construction and operation of an oil-fired plant would have environmental impacts. For example, Section 8.3.11 of the GEIS estimates that construction of a 1,000-MWe oil-fired plant would require about 120 acres. Additionally,

operation of oil-fired plants would have environmental impacts (including impacts on the aquatic environment and air) that would be similar to those from a coal-fired plant.

Advanced Nuclear Power

Work on advanced reactor designs has continued, and nuclear plant construction continues overseas. However, operation of an advanced reactor would have environmental impacts similar to those of the continued operation of PBAPS, and construction of a new nuclear power plant would entail further environmental impacts and incur capital costs not associated with license renewal of PBAPS. For these reasons, new nuclear plant construction is not considered an economically feasible or environmentally preferable alternative to PBAPS license renewal.

Fuel Cells

Phosphoric acid fuel cells are the most mature fuel cell technology, but they are only in the initial stages of commercialization. Two hundred turn-key plants have been installed in the United States, Europe, and Japan. Recent estimates suggest that a company would have to produce about 100 MW of fuel cell stacks annually to achieve a price of $1,000 to $1,500 per kilowatt. However, the current production capacity of all fuel cell manufacturers only totals about 60 MW per year. Therefore, Exelon considers fuel cells not to be a feasible alternative to license renewal at this time.

Delayed Retirement

PBAPS provides about 23 percent of Exelon's operating group generating capacity and approximately 35 percent of its energy requirements to its mid-Atlantic service area. Even without retiring any generating units, Exelon expects to require additional capacity in the near future. Thus, even if substantial capacity were scheduled for retirement and could be delayed, some of the delayed retirement would be needed just to meet load growth.

PBAPS will be required, in part, to offset any actual retirements that occur. Delayed retirement of other Exelon generating units could not provide a replacement of the power supplied by PBAPS and could not be a feasible alternative to PBAPS license renewal.

7.2.2 ENVIRONMENTAL IMPACTS OF ALTERNATIVES

This section evaluates environmental impacts from the alternatives Exelon has determined to be reasonable to PBAPS license renewal: coal- and gas-fired generation at the PBAPS site and purchased power. Purchased power may not be economically feasible for Exelon, but it is a reasonable alternative under the National Environmental Policy Act.

7.2.2.1 COAL-FIRED GENERATION

The NRC evaluated environmental impacts from coal-fired generation alternatives in the GEIS (Ref. 7.0-1, Section 8.3.9). NRC concluded that construction impacts could be substantial, due in part to the large land area required (which can result in natural habitat loss) and the large workforce needed. Although NRC pointed out that siting a new coal-fired plant where an existing nuclear plant is located would reduce many construction impacts, it is unlikely that the coal-fired unit could fit and be operated efficiently on the PBAPS site. The land available for disposal of emission control waste (fly ash and scrubber sludge) is wooded and elevated substantially above the location of the operating nuclear reactors. There would be associated environmental impacts and disposal would be quite difficult (e.g., pumping or hauling up steep hills). NRC identified adverse impacts from operations as human health concerns associated with air emissions, waste generation, and losses of aquatic biota due to cooling water withdrawals and discharges.

The coal-fired alternative that Exelon has defined in Section 7.2.1.1 would be located at a hypothetical greenfield site near PBAPS, if possible. This could minimize the transmission lines required and allow use of the same cooling water source that PBAPS currently uses (Conowingo Pond). Because Exelon does not have plans for constructing such a site, site-specific information is not available. For the purpose of comparing impacts to those of continuing to operate the PBAPS, Exelon has made optimistic assumptions to ensure that the environmental impacts from this alternative are not overestimated.

Land Use

NRC estimated that 1,700 acres would be required for offices, roads, parking areas, switchyard, and the powerblock of a 1,000-MWe coal-fired plant. The 2,032-MWe PBAPS coal-fired alternative is assumed to require 1,800 acres. The

area for waste disposal would increase linearly, but there would be economies of scale associated with the offices, roads, parking areas, switchyard, and powerblock. For purposes of this analysis, Exelon assumes the site would be near PBAPS and construction would include approximately 15 miles of 350-foot-wide transmission line corridor to tie into the existing transmission lines at PBAPS (640 acres of easement would be required). Also, the project would require constructing or upgrading an assumed 20-mile 100-foot-wide (240 acres) rail spur from an adequate existing rail line. The upgrade would include an offloading approach and a turnaround loop at the site. Exelon concludes that the land use impacts would be small to moderate and would neither destabilize nor noticeably alter any important land use resources. Exelon assumes that both rail spur and transmission line routings would minimize construction over incompatible land uses or sensitive habitats and would result in small impacts on land use.

Overall, Exelon concludes that land use impacts would be small to moderate, depending primarily on the previous land use on the plant site and the rail spur and transmission line rights-of-way.

Ecological Resources

If a greenfield site was required to construct the new facility site, construction would disturb terrestrial habitat that would have to be investigated for the presence of threatened or endangered species. Construction impacts could be large (Ref. 7.0-1, page 8-32), although appropriate siting analysis could reduce this impact. Also depending on siting, plant operation could have small to moderate effects on aquatic resources affected by cooling water intake and discharge, which is necessary for plant operations. If Conowingo Pond can be used as the cooling water source, there would not be a noticeable net effect from discontinuing operations at PBAPS and beginning operations at the site for the coal-fired alternative. Rail and transmission line rights-of-way maintenance practices would exceed those of the preferred alternative of license renewal. Exelon concludes that the coal-fired alternative could have noticeable impacts on ecological resources, resulting in moderate impacts.

Aesthetics

The coal-fired powerblock would be taller than a nuclear plant such as PBAPS and would be relatively visible at a moderate offsite distance, depending on the

area chosen. As discussed in the GEIS, aesthetic resource impacts would be noticeable, but would not exert a destabilizing effect. Exelon concludes that the coal-fired generation aesthetic impacts would be moderate.

Water Quality

Each of the coal-fired units would include a boiler. Exelon assumes that the water source for cooling the circulating water would be a once-through system with cooling towers for extreme thermal conditions. The coal-fired alternative would affect surface water quality through intake and discharge from the once-through cooling system. Intake and discharge would be regulated by Pennsylvania and comply with environmental requirements. Exelon concludes that the water quality impacts would be small and would not noticeably differ from those of the preferred alternative.

Air Quality

Air quality impacts of coal-fired generation are considerably different from those of nuclear power. A coal-fired plant would emit sulfur oxides, nitrogen oxides, particulate matter, and carbon monoxide, all of which are regulated pollutants. As Section 7.2.1.1 indicates, Exelon has assumed a plant design that would minimize air emissions through a combination of boiler technology and post-combustion pollutant removal. Exelon estimates the coal-fired alternative emissions to be as follows:

Sulfur oxides = 13,344 tons per year

Nitrogen oxides = 12,794 tons per year

Carbon monoxide = 1,649 tons per year

Particulates:

Total suspended particulates = 392 tons per year

PM_{10} (particulates having a diameter of less than 10 microns) = 90 tons per year

Table 7-3 shows how Exelon calculated these emissions.

Emissions of sulfur dioxide and nitrogen oxides from Pennsylvania's generators ranked second and fourth highest nationally, respectively. After 1990, emissions of both pollutants declined and are currently less than 1986 levels. The Clean Air Act Amendments of 1990 specified some plants in Pennsylvania to begin compliance with stricter emission controls for sulfur dioxide and nitrogen oxides. These units include 7,674 MW of nameplate capacity at nine plants (Ref. 7.2-1).

NRC did not quantify coal-fired emissions, but implied that air impacts would be substantial. The NRC noted that adverse human health effects from coal combustion have led to important federal legislation in recent years and that public health risks, such as cancer and emphysema, have been associated with coal combustion. The NRC also mentioned global warming and acid rain as potential impacts. Exelon concludes that federal legislation and large-scale concerns, such as global warming and acid rain, are indications of concerns about destabilizing important attributes of air resources. However, sulfur oxide emission allowances, nitrogen oxides emission offsets, low nitrogen oxides burners, overfire air, selective catalytic reduction, fabric filters or electrostatic precipitators, and scrubbers are regulatorily-imposed mitigation measures. As such, Exelon concludes that the coal-fired alternative would have moderate impacts on air quality; the impacts would be clearly noticeable, but would not destabilize air quality in the area.

Waste Management

Exelon concurs with the GEIS assessment that the coal-fired alternative would generate substantial solid waste. The coal-fired plant would annually consume approximately 6,594,715 tons of coal having an ash content of 11.9 percent (Tables 7-3 and 7-1). After combustion, most (99.9 percent) of this ash, approximately 784,000 tons per year, would be collected and disposed. In addition, approximately 728,000 tons of scrubber sludge would be disposed of each year (based on annual lime usage of 246,000 tons). Exelon estimates that ash and scrubber waste disposal over a 40-year plant life would require approximately 800 acres (an area of approximately 1 square mile). The hypothetical site is 1,800 acres. While only half this waste volume and land use would be attributable to the 20-year license renewal period alternative, the total numbers are pertinent as a cumulative impact.

Exelon believes that with proper siting, waste management, and monitoring practices, waste disposal would not destabilize any resources. There would be

space within the site footprint for this disposal. After closure of the waste site and revegetation, the land would be available for other uses. For these reasons, Exelon believes that waste disposal for the coal-fired alternative would have moderate impacts; the impacts would be clearly noticeable, but would not destabilize any important resource and further mitigation would be unwarranted.

Other Impacts

Construction of the powerblock and coal storage area would impact some land area and associated terrestrial habitat. Some of this might be a previously disturbed area (i.e., a brownfield industrial site would be preferentially selected over a greenfield site, if possible); therefore, impacts would be minimal. If such area were available, visual impacts would be consistent with the industrial nature of the site. As with any large construction project, some erosion, sedimentation, and fugitive dust emissions could be anticipated, but would be minimized by using best management practices. Construction debris from clearing and grubbing could be disposed of onsite and municipal waste disposal capacity would be available. Socioeconomic impacts from the construction workforce would be small because worker relocation would not be expected, due to the site's proximity to Philadelphia and Baltimore. Cultural resource impacts would be unlikely, due to the assumed previously disturbed nature of the site.

Impacts to aquatic resources and water quality from operation of the new cooling canal system would be offset by the corresponding shutdown of the PBAPS canal system. The additional stacks, boilers, and rail deliveries would replace the assumed noticeable visual impact of the previous site. Socioeconomic impacts would result from the decrease in operational workforce from approximately 950 employees at PBAPS to approximately 300 employees needed to operate the coal facility. Exelon believes these impacts would be small, due to PBAPS' proximity to large metropolitan areas (Philadelphia and Baltimore).

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

7.2.2.2 GAS-FIRED GENERATION

NRC evaluated environmental impacts from gas-fired generation alternatives in the GEIS, focusing on combined-cycle plants. Section 7.2.1.1 presents Exelon's reasons for defining the gas-fired generation alternative as a combined-cycle plant on the PBAPS site. Land-use impacts from gas-fired units would be less than those from the coal-fired alternative at a hypothetical site. Reduced land requirements, due to construction on the existing site and a smaller facility footprint, would reduce impacts to ecological, aesthetic, and cultural resources as well. A smaller workforce could have adverse socioeconomic impacts. Human health concerns associated with air emissions, and aquatic biota losses due to cooling water withdrawals and discharges would be of concern.

The NRC has evaluated the environmental impacts of constructing and operating four 440-MW combined-cycle gas-fired units as an alternative to a nuclear power plant license renewal (Ref. 7.2-7). This analysis is for a slightly smaller generating capacity than the PBAPS gas-fired alternatives analysis, because Exelon would install four 508-MW units. Exelon has adopted the rest of the NRC analysis with necessary Pennsylvania- and Exelon-specific modifications noted.

Air Quality

Natural gas is a relatively clean-burning fossil fuel and the gas-fired alternative would release similar types of emissions, but in lesser quantities, than the coal-fired alternative. Control technology for gas-fired turbines focuses on nitrogen oxides emissions. Exelon estimates the gas-fired alternative emissions (four units, each with twin 175-MW combustion turbines) to be as follows:

- Sulfur oxides = 185 tons per year
- Nitrogen oxides = 594 tons per year
- Carbon monoxide = 123 tons per year

Particulates = 104 tons per year (all particulates are PM_{10})

Table 7-4 shows how Exelon calculated these emissions.

The Section 7.2.2.1 discussion of regional air quality and Clean Air Act requirements is also applicable to the gas-fired generation alternative. Nitrogen oxides effects on ozone levels, sulfur dioxide allowances, and nitrogen oxides

emission offsets could all be issues of concern for gas-fired combustion. While gas-fired turbine emissions are less than coal-fired boiler emissions, and regulatory requirements are less stringent, the emissions are still substantial. Exelon concludes that emissions from the gas-fired alternative located at PBAPS would noticeably alter local air quality, but would not destabilize regional resources. Air quality impacts would therefore be moderate, but substantially smaller than those of coal-fired generation.

Waste Management

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

Other Impacts

Unlike the coal-fired alternative, the ability to construct the gas-fired alternative on the existing PBAPS site would reduce construction-related impacts. Similarly, constructing the new, approximately 3-mile gas pipeline along 150 feet (approximately 54 acres) of existing previously disturbed easements would minimize impacts. NRC estimated in the GEIS that 110 acres would be needed for a plant site; this much previously disturbed acreage is available at PBAPS, reducing loss of terrestrial habitat. Aesthetic impacts, erosion and sedimentation, fugitive dust, and construction debris impacts would be similar to the coal-fired alternative, but smaller because of the reduced site size. Socioeconomic impacts of construction would be minimal. However, the GEIS estimates a work force of 150 for gas operations, which is approximately half the workforce required for the coal-fired alternative. Exelon believes these impacts would be small and would be mitigated by the site's proximity to the large Baltimore and Philadelphia metropolitan areas. The primary concern under the gas-fired alternative is limited gas availability coupled with increasing demand, which could adversely affect the customer's cost for electricity produced by gas-fired units.

Cultural Resources

Gas pipeline construction could require cultural resource preservation measures. Exelon anticipates that these measures would result in no detectable change in cultural resources, and that the effects along the relatively short easement would be minor and not exert any influence on this resource. Exelon concludes that impacts to cultural resources would be small, if any.

7.2.2.3 PURCHASED POWER

As discussed in Section 7.2.1.2, Exelon assumes that the generating technology used under the purchased power alternative would be one of those that NRC analyzed in the GEIS. Exelon is also adopting by reference, the NRC analysis of the environmental impacts from those technologies. Under the purchased power alternative, therefore, environmental impacts would still occur, but would be located elsewhere within Pennsylvania. Exelon believes that out-of-state imports would not be required.

Although excess generating capacity is available in Pennsylvania, the excess is already committed for out-of-state use and it is unlikely that it would be available to supplant PBAPS. Also, the purchased power alternative would include constructing up to 400 miles of high-voltage (i.e., 500-kV) transmission lines to get power from the remote locations in Pennsylvania to the Exelon network. Exelon believes most of the transmission lines could be routed along existing rights-of-way and assumes that the environmental impacts of transmission line construction would be moderate. Similarly, the environmental impacts of operating coal-fired generating capacity would be similar to the environmental impacts of the coal-fired alternative described here, but construction of gas-fired generating capacity may be required, and operation of gas-fired generating capacity at a new site would exceed impacts of the gas-fired alternative located on the existing PBAPS site.

7.3 REFERENCES

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

Ref. 7.0-1 U.S. Nuclear Regulatory Commission. 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants.* (GEIS) Volumes 1 and 2. NUREG 1437. Washington, DC.

Ref. 7.0-2 U.S. Nuclear Regulatory Commission. 1996. "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses: Final Rule." *Federal Register.* Vol. 61, No. 244. December 18.

Ref. 7.1-1 Energy Information Administration. "Energy data for Pennsylvania, Nuclear Reactors: Peach Bottom 2 and 3. Available at http://www.eia.doe.gov/cneaf/nuclear/page/at_a_glance/reactors/nuke16.html. Accessed June 1, 2000.

Ref. 7.1-2 Energy Information Administration. "Energy data for Pennsylvania, Nuclear Reactors: Limerick 1 and 2." Available at http://www.eia.doe.gov/cneaf/nuclear/page/at_a_glance/reactors/nuke12.html. Accessed June 1, 2000.

Ref. 7.1-3 PECO Energy. 1998. "PECO Environmental Report."

Ref. 7.1-4 PECO. "Products and Services, Power Distribution." Available at http://www.peco.com/corp_products power dis.shtml. Accessed May 30, 2000.

Ref. 7.1-5 U.S. Nuclear Regulatory Commission. 1988. *Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities.* NUREG-0586. Washington, DC.

Ref. 7.2-1 Energy Information Administration. 1999. "State Electricity Profiles." Available at http://www.eia.doe.gov/cneaf/electricity/st_profiles/pennsylvania/pa.html. Accessed July 18, 2000.

Ref. 7.2-2 PECO Energy. 2000. "PECO Energy Corporate-Products and Services - Power Generation." Available at http://www.peco.com/corp/corp_products_power_gen.shtml. Accessed June 6, 2000.

Ref. 7.2-3 PECO Energy Company. 1999. "Gas Fired Power Plant Guide." Prepared by Strategic Energy Services, Inc. February 8.

Ref. 7.2-4 General Assembly of Pennsylvania. 1996. "Electricity Generation Customer Choice & Competition Act." Available at http://puc.paonline.com/electric/elect_comp_act.asp. November. Accessed June 7, 2000.

Ref. 7.2-5 Pennsylvania Public Utility Commission. "Where do you think you are." Available at http://www.electrichoice.com/public/index.html. Accessed June 7, 2000.

Ref. 7.2-6 PECO. 1998. "Pennsylvania PUC Gives Final OK to PECO Energy Restructuring Plan; Company to Cut Rates 8% in January." May 14.

Ref. 7.2-7 U.S. Nuclear Regulatory Commission. 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Calvert Cliffs Nuclear Power Plant.* NUREG-1437, Supplement 1, Final. Office of Nuclear Reactor Regulations, Washington, DC.

Ref. 7.2-8 Nuclear Regulatory Commission. 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants: Oconee Nuclear Station.* NUREG-1437, Supplement 2, Final. Office of Nuclear Reactor Regulations, Washington, DC.

Ref. 7.2-9 U.S. Environmental Protection Agency. 1998. *Air Pollutant Emission Factors.* Vol. 1, *Stationary Point Sources and Area Sources.* Section 1.1, "Bituminous and Subbituminous Coal Combustion." AP-42. Available at http://www.epa.gov/ttn/chief/ap42c1.html. September. Accessed November 23, 1999.

Ref. 7.2-10 Energy Information Administration. 2000. "State Energy Data Report 1997 - Pennsylvania." Available at http://eia.doe.gov/pub/state.data/pdf/PA.pdf. Accessed October 18, 2000.

Ref. 7.2-11 National Renewable Energy Laboratory. 2000. *Wind Energy Atlas of the United States.* Available at http://rredc.nrel.gov/wind/pubs/atlas. Accessed October 9, 2000.

Ref. 7.2-12 Conner, A. M. and J. E. Francfort. 1997. *U.S. Hydropower Resource Assessment for Pennsylvania.* DOE/ID-10430(PA). Idaho National Engineering and Environmental Laboratory, Idaho Falls, Idaho.

Ref. 7.2-13 Energy Information Administration. 1999. Form EIA-767, *Steam Electric Plant Operation and Design Report, Table 28, Average Quality of Fossil Fuels Burned at U.S. Electric Utilities by Census Division and State, 1997 and 1998.* Available at http://www.eia.doe.gov/cneaf/electricity/epav2/epav2t28.txt. Accessed November 23, 1999.

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Ref. 7.2-15 Energy Information Administration. 1997. *Electric Power Annual 1997, Volume II.*

Ref. 7.2-16 U.S. Environmental Protection Agency. 2000. *Air Pollutant Emission Factors.* Vol. 1, *Stationary Point Sources and Area Sources.* Section 3.1, "Stationary Gas Turbines for Electricity Generation." AP-42. Available at http://www.epa.gov/ttn/chief/ap42c3.html. October. Accessed September 1, 2000.

TABLE 7-1
COAL-FIRED ALTERNATIVE

Characteristic	Basis
Unit size = 508 MW ISO rating net[1]	Chosen for comparability to a standard-size gas-fired combined-cycle plant
Unit size = 538 MW ISO rating gross[1]	Calculated based on 6 percent onsite power usage (Exelon experience): 508 MW x 1.06
Number of units = 4	Calculated to be ≤ PBAPS Units 2 and 3 gross capacity of approximately 2,320 MW
Boiler type = tangentially fired, dry-bottom	Minimizes nitrogen oxides emissions (Ref. 7.2-9, Table 1.1-3, pg. 1.1-17)
Fuel type = bituminous, pulverized coal	Typical for coal used in Pennsylvania
Fuel heating value = 12,403 Btu/lb	1998 value for coal used in Pennsylvania (Ref. 7.2-13)
Fuel ash content by weight = 11.9 percent	1998 value for coal used in Pennsylvania (Ref. 7.2-13)
Fuel sulfur content by weight = 2.13 percent	1998 value for coal used in Pennsylvania (Ref. 7.2-13)
Uncontrolled NO_X emission = 9.7 lb/ton Uncontrolled CO emission = 0.5 lb/ton	Typical for pulverized coal, tangentially fired, dry-bottom, pre-NSPS with low-NO_x burner (Ref. 7.2-9, Table 1.1-3, pg. 1.1-17)
Heat rate = 10,200 Btu/Kwh	Typical for coal-fired, single-cycle steam turbines (Ref. 7.2-15, pg. 106)
Capacity factor = 0.85	Typical for large coal-fired units (Exelon experience)
NO_X control = low NO_X burners, overfire air (60 percent reduction)	Best available and widely demonstrated for minimizing NO_x emissions (Ref. 7.2-9, Table 1.1-2, pg. 1.1-14)
Particulate control = fabric filters or electrostatic precipitators (99.9 percent removal efficiency)	Best available for minimizing particulate emissions (Ref. 7.2-9, pp. 1.1-6 and -7)
SO_x control = Wet scrubber-lime/limestone (95 percent removal efficiency)	Best available for minimizing SO_x emissions (Ref. 7.2-9, Table 1.1-1, pg. 1.1-13)

[1]The difference between "net" and "gross" is electricity consumed onsite.

Btu = British thermal unit
ISO rating = International Standards Organization rating at standard atmospheric conditions of 59°F, 60 percent relative humidity, and 14.696 pounds of atmospheric pressure per square inch
Kwh = kilowatt hour
NSPS = New Source Performance Standard
lb = pound
MW = megawatt
NO_X = nitrogen oxides
SO_x = sulfur oxides

TABLE 7-2
GAS-FIRED ALTERNATIVE

Characteristic	Basis
Unit size = 508 MW ISO rating net:[1] Two 168-MW combustion turbines and a 172-MW heat recovery boiler	Manufacturer's standard-size gas-fired combined-cycle plant
Unit size = 528 MW ISO rating gross:[1] Two 175-MW combustion turbines 179-MW heat recovery boiler	Calculated based on 4 percent onsite power
Number of units = 4	Calculated to be ≤ PBAPS Units 2 and 3 gross capacity of approximately 2,320 MW
Fuel type = natural gas	Assumed
Fuel heating value = 1,035 Btu/ft^3	Exelon experience
Fuel sulfur content = 0.0034 lb/MMBtu	Used when sulfur content is not available (Ref. 7.2-16, Table 3.1-2a)
NO_X control = selective catalytic reduction (SCR) with water/steam injection	Best available for minimizing NO_X emissions (Ref. 7.2-16, Table 3.1-2, pg. 3.1-8)
Fuel NO_X content = 0.0109 lb/MMBtu	Typical for large SCR-controlled gas-fired units with water injection (Ref. 7.2-16, Table 3-1, database)
Fuel CO content = 0.00226 lb/MMBtu	Typical for large SCR-controlled gas-fired units with water injection (Ref. 7.2-16, Table 3-1, database)
Fuel particulate content = 0.0019 lb/MMBtu	Typical for stationary gas turbines with water injection (Ref. 7.2-16, Table 3.1-2a)
Heat rate = 6,928 Btu/Kwh	ISO value for manufacturer's standard-size gas-fired combined-cycle plant (Ref. 7.2-14)
Capacity factor = 0.85	Typical for large gas-fired base load units

[1]The difference between "net" and "gross" is electricity consumed onsite.

Btu = British thermal unit
ft^3 = cubic foot
ISO rating = International Standards Organization rating at standard atmospheric conditions of 59°F, 60 percent relative humidity, and 14.696 pounds of atmospheric pressure per square inch
Kwh = kilowatt hour
MM = million
MW = megawatt
NO_X = nitrogen oxides

TABLE 7-3
AIR EMISSIONS FROM COAL-FIRED ALTERNATIVE

Parameter	Calculation	Result
Annual coal consumption	$4\ \text{units} \times \frac{538\ \text{MW}}{\text{unit}} \times \frac{10{,}200\ \text{Btu}}{\text{kW} \times \text{hr}} \times \frac{1{,}000\ \text{kW}}{\text{MW}} \times \frac{\text{lb}}{12{,}403\ \text{Btu}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times 0.85 \times \frac{24\ \text{hr}}{\text{day}} \times \frac{365\ \text{day}}{\text{yr}}$	6,594,715 tons per year
SO_x[a,c]	$\frac{38 \times 2.13\ \text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times (1 - 95/100) \times \frac{6{,}594{,}715\ \text{tons}}{\text{yr}}$	13,344 tons SO_x per year
NO_x[b,c]	$\frac{9.7\ \text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times (1 - 60/100) \times \frac{6{,}594{,}715\ \text{tons}}{\text{yr}}$	12,794 tons NO_x per year
CO[c]	$\frac{0.5\ \text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times \frac{6{,}594{,}715\ \text{tons}}{\text{yr}}$	1,649 tons CO per year
TSP[d]	$\frac{10 \times 11.9\ \text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times (1 - 99.9/100) \times \frac{6{,}594{,}715\ \text{tons}}{\text{yr}}$	392 tons TSP per year
PM_{10}[d]	$\frac{2.3 \times 11.9,\text{lb}}{\text{ton}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times (1 - 99.9/100) \times \frac{6{,}594{,}7151\ \text{tons}}{\text{yr}}$	90 tons PM_{10} per year

a. Ref. 7.2-9, Table 1.1-1.
b. Ref. 7.2-9, Table 1.1-2.
c. Ref. 7.2-9, Table 1.1-3.
d. Ref. 7.2-9, Table 1.1-4.

CO = carbon monoxide
NO_x = oxides of nitrogen
PM_{10} = particulates having diameter less than 10 microns
SO_x = sulfur oxides
TSP = total suspended particulates

TABLE 7-4
AIR EMISSIONS FROM GAS-FIRED ALTERNATIVE

Parameter	Calculation	Result
Annual gas consumption	$4\ \text{units} \times \frac{528\ \text{MW}}{\text{unit}} \times \frac{6{,}928\ \text{Btu}}{\text{kW} \times \text{hr}} \times \frac{1{,}000\ \text{kW}}{\text{MW}} \times 0.85 \times \frac{\text{ft}^3}{1{,}035\ \text{Btu}} \times \frac{24\ \text{hr}}{\text{day}} \times \frac{365\ \text{day}}{\text{yr}}$	105,328,913,423 ft^3 per year
Annual Btu input	$\frac{105{,}328{,}913{,}423\ \text{ft}^3}{\text{yr}} \times \frac{1{,}035\ \text{Btu}}{\text{ft}^3} \times \frac{\text{MM Btu}}{10^6\ \text{Btu}}$	109,015,425 MMBtu per year
SO_x[a]	$\frac{0.0034\ \text{lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times \frac{109{,}015{,}425\ \text{MMBtu}}{\text{yr}}$	185 tons SO_x per year
NO_x[b]	$\frac{0.0128\ \text{lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times \frac{109{,}015{,}425\ \text{MMBtu}}{\text{yr}}$	594 tons NO_x per year
CO[b]	$\frac{0.0168\ \text{lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times \frac{109{,}015{,}425\ \text{MMBtu}}{\text{yr}}$	123 tons CO per year
TSP[a]	$\frac{0.0019\ \text{lb}}{\text{MMBtu}} \times \frac{\text{ton}}{2{,}000\ \text{lb}} \times \frac{109{,}015{,}425\ \text{MMBtu}}{\text{yr}}$	104 tons filterable TSP per year
PM_{10}[a]	$\frac{825\ \text{tons TSP}}{\text{yr}}$	104 tons filterable PM_{10} per year

a. Ref. 7.2-13, Table 3.1-1.
b. Ref. 7.2-13, Table 3.1-2.
CO = carbon monoxide
NO_x = oxides of nitrogen
PM_{10} = particulates having diameter less than 10 microns
SO_x = sulfur oxides
TSP = total suspended particulates