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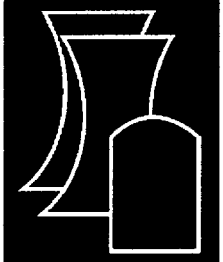

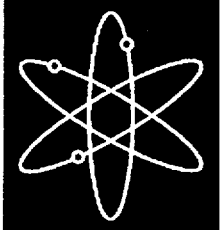

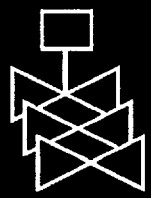

Generic Environmental Impact Statement for License Renewal of Nuclear Plants

Supplement 10

Regarding
Peach Bottom Atomic Power Station, Units 2 and 3

Draft Report for Comment

U.S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Washington, DC 20555-0001

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NUREG-1437
Supplement 10

Generic Environmental Impact Statement for License Renewal of Nuclear Plants

Supplement 10

Regarding
Peach Bottom Atomic Power Station, Units 2 and 3

Draft Report for Comment

Manuscript Completed: June 2002
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Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

COMMENTS ON DRAFT REPORT

Any interested party may submit comments on this report for consideration by the NRC staff. Comments may be accompanied by additional relevant information or supporting data. Please specify the report number NUREG-1437, Supplement 10, draft, in your comments, and send them by September 18, 2002 to the following address:

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Electronic comments may be submitted by the Internet at Peach_Bottom_EIS@nrc.gov.

For any questions about the material in this report, please contact:

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Abstract

The U.S. Nuclear Regulatory Commission (NRC) considered the environmental impacts of renewing nuclear power plant operating licenses (OLs) for a 20-year period in its Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS), NUREG-1437, Volumes 1 and 2, and codified the results in 10 CFR Part 51. The GEIS (and its Addendum 1) identifies 92 environmental issues and reaches generic conclusions related to environmental impacts for 69 of these issues that apply to all plants or to plants with specific design or site characteristics. Additional plant-specific review is required for the remaining 23 issues. These plant-specific reviews are to be included in a supplement to the GEIS.

This draft Supplemental Environmental Impact Statement (SEIS) has been prepared in response to an application submitted to the NRC by the Exelon Generation Company, LLC (Exelon) to renew the OLs for Peach Bottom Units 2 and 3 for an additional 20 years under 10 CFR Part 54. This draft SEIS includes the NRC staff's analysis that considers and weighs the environmental impacts of the proposed action, the environmental impacts of alternatives to the proposed action, and mitigation measures available for reducing or avoiding adverse impacts. It also includes the staff's preliminary recommendation regarding the proposed action.

Regarding the 69 issues for which the GEIS reached generic conclusions, neither Exelon nor the staff has identified information that is both new and significant for any of these issues that apply to Peach Bottom Units 2 and 3. In addition, the staff determined that information provided during the scoping process did not call into question the conclusions in the GEIS. Therefore, the staff concludes that the impacts of renewing the Peach Bottom Units 2 and 3 OLs will not be greater than impacts identified for these issues in the GEIS. For each of these issues, the GEIS conclusion is that the impact is of SMALL[(a)] significance (except for collective offsite radiological impacts from the fuel cycle and high-level waste and spent fuel, which were not assigned a single significance level).

Regarding the remaining 23 issues, those that apply to Peach Bottom Units 2 and 3 are addressed in this draft SEIS. For each applicable issue, the staff concludes that the significance of the potential environmental impacts of renewal of the OLs is SMALL. The staff

(a) Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.

also concludes that additional mitigation measures are not likely to be sufficiently beneficial as to be warranted. The staff determined that information provided during the scoping process did not identify any new issue that has a significant environmental impact.

The NRC staff's preliminary recommendation is that the Commission determine that the adverse environmental impacts of license renewal for Peach Bottom Units 2 and 3 are not so great that preserving the option of license renewal for energy-planning decisionmakers would be unreasonable. This recommendation is based on (1) the analysis and findings in the GEIS; (2) the Environmental Report submitted by Exelon; (3) consultation with Federal, State, and local agencies; (4) the staff's own independent review, and (5) the staff's consideration of public comments received during the scoping process.

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Executive Summary

By letter dated July 2, 2001, the Exelon Generation Company, LLC (Exelon) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) to renew the operating licenses (OLs) for Peach Bottom Units 2 and 3 for an additional 20-year period. If the OLs are renewed, State regulatory agencies and Exelon will ultimately decide whether the plant will continue to operate based on factors such as the need for power or other matters within the State's jurisdiction or the purview of the owners. If the OLs are not renewed, then the plant must be shut down at or before the expiration dates of the current OLs, which are August 8, 2013, for Unit 2, and July 2, 2014, for Unit 3.

Section 102 of the National Environmental Policy Act (NEPA) (42 USC 4332), directs that an environmental impact statement (EIS) is required for major Federal actions that significantly affect the quality of the human environment. The NRC has implemented Section 102 of NEPA in 10 CFR Part 51, Subpart A. In 10 CFR 51.20(b)(2), the Commission requires preparation of an EIS or a supplement to an EIS for renewal of a reactor OL; 10 CFR 51.95(c) states that the EIS prepared at the OL renewal stage will be a supplement to the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2.[(a)]

Upon acceptance of the Exelon application, the NRC began the environmental review process described in 10 CFR Part 51 by publishing a notice of intent to prepare an EIS and conduct scoping. The staff visited the Peach Bottom site in November 2001 and held public scoping meetings on November 7, 2001, in Delta, Pennsylvania. In preparing this draft Supplemental Environmental Impact Statement (SEIS) for Peach Bottom Units 2 and 3, the staff reviewed the Exelon Environmental Report (ER) and compared it to the GEIS; consulted with other agencies; conducted an independent review of the issues following the guidance set forth in NUREG-1555, Supplement 1, the *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal*; and considered the public comments received during the scoping process. The public comments received during the scoping process that were considered to be within the scope of the environmental review are provided in Appendix A, Part 1, of this SEIS.

The staff will hold two public meetings in Delta, Pennsylvania, in July 2002, to describe the preliminary results of the NRC environmental review, answer questions, and provide members of the public with information to assist them in formulating comments on this draft SEIS. When the comment period ends, the staff will consider and disposition all of the comments received. These comments will be addressed in Appendix A, Part 2, of the final SEIS. Additional details

(a) The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the "GEIS" include the GEIS and its Addendum 1.

concerning the meetings will be provided in a future meeting notice and in the Notice of Availability concerning this SEIS in the *Federal Register.*

This draft SEIS includes the NRC staff's preliminary analysis that considers and weighs the environmental effects of the proposed action, the environmental impacts of alternatives to the proposed action, and mitigation measures for reducing or avoiding adverse effects. It also includes the staff's preliminary recommendation regarding the proposed action.

The Commission has adopted the following statement of purpose and need for license renewal from the GEIS:

> 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) decisionmakers.

The goal of the staff's environmental review, as defined in 10 CFR 51.95(c)(4) and the GEIS, is to determine

> ... whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy planning decisionmakers would be unreasonable.

Both the statement of purpose and need and the evaluation criterion implicitly acknowledge that there are factors, in addition to license renewal, that will ultimately determine whether an existing nuclear power plant continues to operate beyond the period of the current OL.

NRC regulations [10 CFR 51.95(c)(2)] contain the following statement regarding the content of SEISs prepared at the license renewal stage:

> The supplemental environmental impact statement for license renewal is not required to include discussion of need for power or the economic costs and economic benefits of the proposed action or of alternatives to the proposed action except insofar as such benefits and costs are either essential for a determination regarding the inclusion of an alternative in the range of alternatives considered or relevant to mitigation. In addition, the supplemental environmental impact statement prepared at the license renewal stage need not discuss other issues not related to the environmental effects of the proposed action and the alternatives, or any aspect of the storage of spent fuel for the facility within the scope of the generic determination in § 51.23(a) ["Temporary storage of spent fuel after cessation of reactor operation–generic determination of no significant environmental impact"] and in accordance with § 51.23(b).

The GEIS contains the results of a systematic evaluation of the consequences of renewing an OL and operating a nuclear power plant for an additional 20 years. It evaluates 92 environmental issues using the NRC's three-level standard of significance—SMALL, MODERATE, or LARGE—developed using the Council on Environmental Quality guidelines. The following definitions of the three significance levels are set forth in a footnote to Table B-1 of 10 CFR Part 51, Subpart A, Appendix B:

SMALL - Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.

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

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

For 69 of the 92 issues considered in the GEIS, the analysis in the GEIS led to the following conclusions:

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

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

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

These 69 issues were identified in the GEIS as Category 1 issues. In the absence of new and significant information, the staff relied on conclusions as amplified by supporting information in the GEIS for issues designated as Category 1 in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B.

Of the 23 issues that do not meet the criteria set forth above, 21 are classified as Category 2 issues requiring analysis in a plant-specific supplement to the GEIS. The remaining two issues, environmental justice and chronic effects of electromagnetic fields, were not categorized. Environmental justice was not evaluated on a generic basis and must be addressed in a plant-specific supplement to the GEIS. Information on the chronic effects of electromagnetic fields was not conclusive at the time the GEIS was prepared.

This draft SEIS documents the staff's evaluation of all 92 environmental issues considered in the GEIS. The staff considered the environmental impacts associated with alternatives to license renewal and compared the environmental impacts of license renewal and the alternatives. The alternatives to license renewal that were considered include the no-action alternative (not renewing the OLs for Peach Bottom Units 2 and 3) and alternative methods of power generation. Based on projections made by the U.S. Department of Energy's (DOE's) Energy Information Administration (EIA), gas- and coal-fired generation appear to be the most likely power-generation alternatives if the power from Units 2 and 3 is replaced. These alternatives are evaluated assuming that the replacement power generation plant is located at either the Peach Bottom site or some other unspecified alternate location in Pennsylvania.

Exelon and the staff have established independent processes for identifying and evaluating the significance of any new information on the environmental impacts of license renewal. Neither Exelon nor the staff has identified information that is both new and significant related to Category 1 issues that would call into question the conclusions in the GEIS. Similarly, neither the scoping process nor the staff has identified any new issue applicable to Peach Bottom Units 2 and 3 that has a significant environmental impact. Therefore, the staff relies upon the conclusions of the GEIS for all of the Category 1 issues that are applicable to Peach Bottom Units 2 and 3.

Exelon's license renewal application presents an analysis of the Category 2 issues that are applicable to Peach Bottom Units 2 and 3 plus environmental justice and chronic effects from electromagnetic fields. The staff has reviewed the Exelon analysis for each issue and has conducted an independent review of each issue. Three Category 2 issues are not applicable, because they are related to plant design features or site characteristics not found at Peach Bottom. Four Category 2 issues are not discussed in this draft SEIS, because they are specifically related to refurbishment. Exelon has stated that its evaluation of structures and components, as required by 10 CFR 54.21, did not identify any major plant refurbishment activities or modifications as necessary to support the continued operation of Peach Bottom Units 2 and 3 for the license renewal period. In addition, any replacement of components or additional inspection activities are within the bounds of normal plant component replacement, and therefore, are not expected to affect the environment outside of the bounds of the plant operations evaluated in the U.S. Atomic Energy Commission's 1972 Final Environmental Statement Related to Operation of Peach Bottom Plant.

Fourteen Category 2 issues related to operational impacts and postulated accidents during the renewal term, as well as environmental justice and chronic effects of electromagnetic fields, are discussed in detail in this draft SEIS. Five of the Category 2 issues and environmental justice apply to both refurbishment and to operation during the renewal term and are only discussed in this draft SEIS in relation to operation during the renewal term. For all 14 Category 2 issues and environmental justice, the staff concludes that the potential environmental effects are of SMALL significance in the context of the standards set forth in the GEIS. In addition, the staff

determined that appropriate Federal health agencies have not reached a consensus on the existence of chronic adverse effects from electromagnetic fields. Therefore, no further evaluation of this issue is required. For severe accident mitigation alternatives (SAMAs), the staff concludes that a reasonable, comprehensive effort was made to identify and evaluate SAMAs. Based on its review of the SAMAs for Peach Bottom Units 2 and 3, and the plant improvements already made, the staff concludes that none of the candidate SAMAs are cost-beneficial.

Mitigation measures were considered for each Category 2 issue. Current measures to mitigate the environmental impacts of plant operation were found to be adequate, and no additional mitigation measures were deemed sufficiently beneficial to be warranted.

If the Peach Bottom OLs are not renewed and the units cease operation on or before the expiration of their current OLs, then the adverse impacts of likely alternatives will not be smaller than those associated with continued operation of Peach Bottom Units 2 and 3. The impacts may, in fact, be greater in some areas.

The preliminary recommendation of the NRC staff is that the Commission determine that the adverse environmental impacts of license renewal for Peach Bottom Units 2 and 3 are not so great that preserving the option of license renewal for energy planning decisionmakers would be unreasonable. This recommendation is based on (1) the analysis and findings in the GEIS; (2) the ER submitted by Exelon; (3) consultation with other Federal, State, and local agencies; (4) the staff's own independent review; and (5) the staff's consideration of public comments received during the scoping process.

Abbreviations/Acronyms

°	degree
μCi	microcurie(s)
μCi/mL	microcurie(s) per milliliter
μGy	microgray(s)
μm	micrometer(s)
μSv	microsieverts
ABWR	advanced boiling water reactor
ACC	averted cleanup and decontamination cost
ACS	American Cancer Society
AEA	Atomic Energy Act of 1954
AEC	U.S. Atomic Energy Commission
AOC	averted offsite property damage costs
AOE	averted occupational exposure
AOSC	averted onsite costs
APB	accident progression bin
APE	averted public exposure
AQCR	air quality control region
ATWS	anticipated transient without scram
Bq	becquerel(s)
Bq/mL	becqueral(s) per milliliter
Btu	British thermal unit(s)
BWR	boiling water reactor
BWROG	boiling water reactor owners group
C	Celsius
CAA	Clean Air Act
CC/MS	cooler condenser/moisture separator
CDF	core damage frequency
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
Ci	curie(s)
cm	centimeter(s)
CS	containment spray
CWA	Clean Water Act
DAW	dry active waste
DBA	design-basis accident

dc	direct current
DOE	U.S. Department of Energy
DPR	demonstration project reactor
DSHPO	Delaware State Historic Preservation Officer
DSM	demand-side management
EIA	Energy Information Administration (of DOE)
EIS	environmental impact statement
ELF-EMF	extremely low frequency-electromagnetic field
EOP	Emergency Operating Procedures
EPA	U.S. Environmental Protection Agency
EPG	Emergency Procedure Guidelines
EPRI	Electric Power Research Institute
EP/SAG	Emergency Procedure and Severe Accident Guidelines
ER	Environmental Report
ESA	Endangered Species Act
ESRP	Environmental Standard Review Plan, NUREG-1555, Supplement 1, Operating License Renewal
F	Fahrenheit
FES	Final Environmental Statement
FPS	Fire Protection System
FR	Federal Register
FSAR	Final Safety Analysis Report
ft	foot/feet
ft/s	feet per second
FWPCA	Federal Water Pollution Control Act (also known as the Clean Water Act of 1977)
FWS	U.S. Fish and Wildlife Service
gal	gallon(s)
GEIS	Generic Environmental Impact Statement for License Renewal of Nuclear Plants, NUREG-1437
gpd	gallon(s) per day
gpm	gallon(s) per minute
GWH	gigawatt-hour(s)
Gy	gray
ha	hectare(s)
HEPA	high-efficiency particulate air (filter)
HIC	High integrity container
HLW	high-level waste

HPCI	high pressure coolant injection
HPSW	High Pressure Service Water
hr	hour(s)
Hz	Hertz
ICRP	International Commission on Radiological Protection
in.	inch(es)
INEEL	Idaho National Engineering and Environmental Laboratory
IPEEE	individual plant examination of external events
ISFSI	independent spent fuel storage installation
ISLOCA	interfacing system loss-of-coolant accident
J	joule
kg	kilogram(s)
km	kilometer(s)
kV	kilovolt(s)
kV/m	kilovolt(s) per meter
kWh	kilowatt hour(s)
L	liter(s)
lb	pound(s)
LNT	linear, nonthreshold
LOCA	loss-of-coolant accident
LOOP	loss of offsite power
LQ	linear-quadratic
m	meter(s)
m/s	meter(s) per second
m^3/d	cubic meters per day
m^3/s	cubic meter(s) per second
mA	milliampere(s)
MACCS	MELCOR Accident Consequence Code System
MDD	maximum daily demand
MDE	Maryland Department of the Environment
mGy	milligray(s)
MHT	Maryland Historical Trust
mi	mile(s)
min	minute(s)
mL	milliliter(s)
mph	mile(s) per hour
mrad	millirad(s)

mrem	millirem(s)
mSv	millisievert(s)
MT	metric ton(s) (or tonne[s])
MTHM	metric ton(s) (or tonne[s]) of heavy metal
MTU	metric ton(s) (or tonne[s])-uranium
MW	megawatt(s)
MWd/MTU	megawatt-day(s) per metric ton (or tonne) of uranium
MW(e)	megawatt(s) electric
MW(t)	megawatt(s) thermal
MWh	megawatt hour(s)
NA	not applicable
NAS	National Academy of Sciences
NCI	National Cancer Institute
NCRP	National Council on Radiation Protection and Measurments
NEPA	National Environmental Policy Act of 1969
NESC	National Electric Safety Code
NHPA	National Historic Preservation Act
NIEHS	National Institute of Environmental Health Sciences
NMFS	National Marine Fisheries Service
NO_x	nitrogen oxide(s)
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NSW	Normal Service Water
ODCM	Offsite Dose Calculation Manual
OL	operating license
PARs	Publically Available Record
PBq	petabecquerel(s)
PDEP	Pennsylvania Department of Environmental Protection
PDS	plant damage state
PECO	Philadelphia Energy Company (predecessor to Exelon)
PHMC	Pennsylvania Historic and Museum Commission
PSHPO	Pennsylvania State Historic Preservation Officer
PM_{10}	particulate matter, 10 microns or less in diameter
PSA	probabilistic safety analysis; prostate-specific antigen
PSD	prevention of significant deterioration
psig	pounds per square inch above atmoshperic pressure
PURTA	Pennsylvania Utility Realty Tax Act
PWR	pressurized water reactor

RAI	request for additional information
RCIC	reactor core isolation cooling
RCP	reactor coolant pump
rem	special unit of dose equivalent, equal to 0.01 Sv
REMP	radiological environmental monitoring program
RHR	residual heat removal
rms	root mean square
RPHP	Radiation and Public Health Project
RWCU	Reactor Water Cleanup
s	second(s)
SAFSTOR	safe storage (a plant status option during decommisisoning)
SAMA	severe accident mitigation alternative
SAR	Safety Analysis Report
SBO	station blackout
SEIS	supplemental environmental impact statement
SER	Safety Evaluation Report
SHPO	State Historic Preservation Office
SIP	state implementation plan
SO_2	sulfur dioxide
SO_x	sulfur oxide(s)
SRBC	Susquehanna River Basin Commission
Sv	Sievert, special unit of dose equivalent
TBq	terabecquerel(s)
UDB	urban development boundary
UFSAR	Updated Final Safety Analysis Report
UNSEAR	United Nations Scientific Committee on the Effects of Atomic Radiation
UPS	Uninterruptible Power Supply
U.S.	United States
USBC	U.S. Bureau of the Census
USC	United States Code
USDA	U.S. Department of Agriculture
w	watt, 1 J/s
yr	year(s)

1.0 Introduction

Under the Nuclear Regulatory Commission's (NRC's) environmental protection regulations in Title 10 of the Code of Federal Regulations (CFR) Part 51, which implement the National Environmental Policy Act (NEPA), renewal of a nuclear power plant operating license (OL) requires the preparation of an environmental impact statement (EIS). In preparing the EIS, the NRC staff is required first to issue the statement in draft form for public comment, and then issue a final statement after considering public comments on the draft. To support the preparation of the EIS, the staff has prepared a *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996; 1999)[(a)]. The GEIS is intended to (1) provide an understanding of the types and severity of environmental impacts that may occur as a result of license renewal of nuclear power plants under 10 CFR Part 54, (2) identify and assess the impacts that are expected to be generic to license renewal, and (3) support 10 CFR Part 51 to define the number and scope of issues that need to be addressed by the applicants in plant-by-plant renewal proceedings. Use of the GEIS guides the preparation of complete plant-specific information in support of the OL renewal process.

The Exelon Generation Company, LLC (Exelon, formerly Philadelphia Electric Company or PECO) operates Peach Bottom nuclear reactor Units 2 and 3 in Pennsylvania under OLs DPR-44 and DPR-56, which were issued by the NRC. These OLs will expire in August 2013 for Unit 2 and July 2014 for Unit 3. On July 2, 2001, Exelon submitted an application to the NRC to renew the Peach Bottom Units 2 and 3 OLs for an additional 20 years under 10 CFR Part 54. Exelon is a *licensee* for the purposes of its current OLs and an *applicant* for the renewal of the OLs. Pursuant to 10 CFR 54.23 and 51.53(c), Exelon submitted an Environmental Report (ER; Exelon 2001a) in which Exelon analyzed the environmental impacts associated with the proposed license renewal action, considered alternatives to the proposed action, and evaluated mitigation measures for reducing adverse environmental effects.

This report is the draft plant-specific supplement to the GEIS (the supplemental EIS [SEIS]) for the Exelon license renewal application. This SEIS is a supplement to the GEIS because it relies, in part, on the findings of the GEIS. The staff will also prepare a separate safety evaluation report in accordance with 10 CFR Part 54.

(a) The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the "GEIS" include the GEIS and its Addendum 1.

1.1 Report Contents

The following sections of this introduction (1) describe the background for the preparation of this SEIS, including the development of the GEIS and the process used by the staff to assess the environmental impacts associated with license renewal, (2) describe the proposed Federal action to renew the Peach Bottom Units 2 and 3 OLs, (3) discuss the purpose and need for the proposed action, and (4) present the status of Exelon's compliance with environmental quality standards and requirements that have been imposed by Federal, State, regional, and local agencies that are responsible for environmental protection.

The ensuing chapters of this SEIS closely parallel the contents and organization of the GEIS. Chapter 2 describes the site, power plant, and interactions of the plant with the environment. Chapters 3 and 4, respectively, discuss the potential environmental impacts of plant refurbishment and plant operation during the renewal term. Chapter 5 contains an evaluation of potential environmental impacts of plant accidents and includes consideration of severe accident mitigation alternatives. Chapter 6 discusses the uranium fuel cycle and solid waste management. Chapter 7 discusses decommissioning, and Chapter 8 discusses alternatives to license renewal. Finally, Chapter 9 summarizes the findings of the preceding chapters and draws conclusions about the adverse impacts that cannot be avoided (the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and the irreversible or irretrievable commitment of resources). The final chapter also presents the staff's preliminary recommendation with respect to the proposed license renewal action.

Additional information is included in appendixes. Appendix A contains public comments received on the environmental review for license renewal and staff responses. Appendices B through F, respectively, list the following:

- the contributors to the supplement
- the chronology of NRC staff environmental review correspondence related to this SEIS
- the organizations contacted during the development of this SEIS
- Exelon's compliance status in Table E-1
- GEIS environmental issues that are not applicable to Peach Bottom Units 2 and 3.

1.2 Background

Use of the GEIS, which examines the possible environmental impacts that could occur as a result of renewing individual nuclear power plant OLs under 10 CFR Part 54, and the established license renewal evaluation process supports the thorough evaluation of the impacts of renewal of OLs.

1.2.1 Generic Environmental Impact Statement

The NRC initiated a generic assessment of the environmental impacts associated with the license renewal term to improve the efficiency of the license renewal process by documenting the assessment results and codifying the results in the Commission's regulations. This assessment is provided in the GEIS, which serves as the principal reference for all nuclear power plant license renewal EISs.

The GEIS documents the results of the systematic approach that was taken to evaluate the environmental consequences of renewing the licenses of individual nuclear power plants and operating them for an additional 20 years. For each potential environmental issue, the GEIS (1) describes the activity that affects the environment, (2) identifies the population or resource that is affected, (3) assesses the nature and magnitude of the impact on the affected population or resource, (4) characterizes the significance of the effect for both beneficial and adverse effects, (5) determines whether the results of the analysis apply to all plants, and (6) considers whether additional mitigation measures would be warranted for impacts that would have the same significance level for all plants.

The NRC's standard of significance was established using the Council on Environmental Quality (CEQ) terminology for "significantly" (40 CFR 1508.27, which requires consideration of both "context" and "intensity"). Using the CEQ terminology, the NRC established three significance levels–SMALL, MODERATE, or LARGE. The definitions of the three significance levels are set forth in the footnotes to Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, 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.

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

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

The GEIS assigns a significance level to each environmental issue, assuming that ongoing mitigation measures would continue.

The GEIS includes a determination of whether the analysis of the environmental issue could be applied to all plants and whether additional mitigation measures would be warranted. Issues are then assigned a Category 1 or a Category 2 designation. As set forth in the GEIS, Category 1 issues are those that meet all of the following criteria:

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

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high-level waste and spent fuel disposal).

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

For issues that meet the three Category 1 criteria, no additional plant-specific analysis is required in this SEIS unless new and significant information is identified.

Category 2 issues are those that do not meet one or more of the criteria of Category 1, and therefore, additional plant-specific review for these issues is required.

In the GEIS, the staff assessed 92 environmental issues and determined that 69 qualified as Category 1 issues, 21 qualified as Category 2 issues, and 2 issues were not categorized. The latter 2 issues, environmental justice and chronic effects of electromagnetic fields, are to be addressed in a plant-specific analysis. Of the 92 issues, 11 are related only to refurbishment, 6 are related only to decommissioning, 67 apply only to operation during the renewal term, and 8 apply to both refurbishment and operation during the renewal term. A summary of the findings for all 92 issues in the GEIS is codified in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B.

1.2.2 License Renewal Evaluation Process

An applicant seeking to renew its OLs is required to submit an ER as part of its application. The license renewal evaluation process involves careful review of the applicant's ER and assurance that all new and potentially significant information not already addressed in or

available during the GEIS evaluation is identified, reviewed, and assessed to verify the environmental impacts of the proposed license renewal.

In accordance with 10 CFR 51.53(c)(2) and (3), the ER submitted by the applicant must

- provide an analysis of the Category 2 issues in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B in accordance with 10 CFR 51.53(c)(3)(ii)

- discuss actions to mitigate any adverse impacts associated with the proposed action and environmental impacts of alternatives to the proposed action.

In accordance with 10 CFR 51.53(c)(2), the ER does not need to

- consider the economic benefits and costs of the proposed action and alternatives to the proposed action except insofar as such benefits and costs are either (1) essential for making a determination regarding the inclusion of an alternative in the range of alternatives considered, or (2) relevant to mitigation

- consider the need for power and other issues not related to the environmental effects of the proposed action and the alternatives

- discuss any aspect of the storage of spent fuel within the scope of the generic determination in 10 CFR 51.23(a) in accordance with 10 CFR 51.23(b)

- contain an analysis of any Category 1 issue unless there is significant new information on a specific issue—this is pursuant to 10 CFR 51.23(c)(3)(iii) and (iv).

New and significant information is (1) information that identifies a significant environmental issue not covered in the GEIS and codified in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, or (2) information that was not considered in the analyses summarized in the GEIS and that leads to an impact finding that is different from the finding presented in the GEIS and codified in 10 CFR Part 51.

In preparing to submit its application to renew the Peach Bottom Units 2 and 3 OLs, Exelon developed a process to ensure that information not addressed in or available during the GEIS evaluation regarding the environmental impacts of license renewal for Peach Bottom Units 2 and 3 would be properly reviewed before submitting the ER, and to ensure that such new and potentially significant information related to renewal of the licenses for Units 2 and 3 would be identified, reviewed, and assessed during the period of NRC review. Exelon reviewed the Category 1 issues that appear in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, to verify that the conclusions of the GEIS remained valid with respect to Peach Bottom Units 2 and 3.

This review was performed by personnel from Exelon and its support organization who were familiar with NEPA issues and the scientific disciplines involved in the preparation of a license renewal ER.

The NRC staff also has a process for identifying new and significant information. That process is described in detail in *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal* (ESRP), NUREG-1555, Supplement 1 (NRC 2000). The search for new information includes (1) review of an applicant's ER and the process for discovering and evaluating the significance of new information; (2) review of records of public comments; (3) review of environmental quality standards and regulations; (4) coordination with Federal, State, and local environmental protection and resource agencies; and (5) review of the technical literature. New information discovered by the staff is evaluated for significance using the criteria set forth in the GEIS. For Category 1 issues where new and significant information is identified, reconsideration of the conclusions for those issues is limited in scope to the assessment of the relevant new and significant information; the scope of the assessment does not include other facets of the issue that are not affected by the new information.

Chapters 3 through 7 discuss the environmental issues considered in the GEIS that are applicable to Peach Bottom Units 2 and 3. At the beginning of the discussion of each set of issues, there is a table that identifies the issues to be addressed and lists the sections in the GEIS where the issue is discussed. Category 1 and Category 2 issues are listed in separate tables. For Category 1 issues for which there is no new and significant information, the table is followed by a set of short paragraphs that state the GEIS conclusion codified in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, followed by the staff's analysis and conclusion. For Category 2 issues, in addition to the list of GEIS sections where the issue is discussed, the tables list the subparagraph of 10 CFR 51.53(c)(3)(ii) that describes the analysis required and the draft SEIS sections where the analysis is presented. The draft SEIS sections that discuss the Category 2 issues are presented immediately following the table.

The NRC prepares an independent analysis of the environmental impacts of license renewal and compares these impacts with the environmental impacts of alternatives. The evaluation of the Exelon license renewal application began with publication of a notice of acceptance for docketing and opportunity for a hearing in the Federal Register (FR; 66 FR 46036 [NRC 2001a]) on August 31, 2001. The staff published a notice of intent to prepare an EIS and conduct scoping (66 FR 48892 [NRC 2001b]) on September 24, 2001. Two public scoping meetings were held on November 7, 2001, in Delta, Pennsylvania. Comments received during the scoping period were summarized in the Peach Bottom License Renewal Environmental Scoping Summary Report, dated April 19, 2002. Comments that are applicable to this environmental review are presented in Part 1 of Appendix A.

The staff followed the review guidance contained in NUREG-1555, Supplement 1, in the *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal* (NRC 2000). The staff and its contractors visited the Peach Bottom site on November 7 and 8, 2001, to gather information and to become familiar with the site and its environs. The staff also reviewed the comments received during scoping, and consulted with Federal, State, regional, and local agencies. A list of the organizations consulted is provided in Appendix D. Other documents related to Peach Bottom Units 2 and 3 were reviewed and are referenced.

This draft SEIS presents the staff's analysis that considers and weighs the environmental effects of the proposed renewal of the OLs for Peach Bottom Units 2 and 3, the environmental impacts of alternatives to license renewal, and mitigation measures available for avoiding adverse environmental effects. Chapter 9, "Summary and Conclusions," provides the NRC staff's preliminary recommendation to the Commission on whether or not the adverse environmental impacts of license renewal are so great that preserving the option of license renewal for energy-planning decisionmakers would be unreasonable.

A 75-day comment period will begin on the date of publication of the U.S. Environmental Protection Agency Notice of Filing of the draft SEIS to allow members of the public to comment on the preliminary results of the NRC staff's review. During this comment period, two public meetings will be held in Delta, Pennsylvania, in July 2002. During these meetings, the staff will describe the preliminary results of the NRC environmental review and answer questions related to it to provide members of the public with information to assist them in formulating their comments.

1.3 The Proposed Federal Action

The proposed Federal action is renewal of the OLs for Peach Bottom Units 2 and 3 (Peach Bottom Unit 1 has been shut down since 1974. The decommissioning of Unit 1 is outside the scope of this SEIS). The Peach Bottom site is located in southern Pennsylvania, on the banks of the Susquehanna River, approximately 31 km (19 mi) south of Lancaster, Pennsylvania, 48 km (30 mi) southeast of York, Pennsylvania, and 61 km (38 mi) north of Baltimore, Maryland. The plant has two General Electric-designed light-water reactors, each with a design rating for a net power output of 1093 megawatts electric (MW[e]). Plant cooling is provided by a once-through heat dissipation system that dissipates heat to the environment. Units 2 and 3 produce electricity to supply the needs of approximately 35% of Exelon's 1.5 million business and residential customers in its mid-atlantic service area. The current OL for Unit 2 expires on August 8, 2013, and for Unit 3 on July 2, 2014. By letter dated July 2, 2001, Exelon submitted an application to the NRC (Exelon 2001b) to renew these OLs for an additional 20 years of operation (i.e., until August 8, 2033, for Unit 2 and July 2, 2034, for Unit 3).

1.4 The Purpose and Need for the Proposed Action

Although a licensee must have a renewed license to operate a reactor beyond the term of the existing OL, the possession of that license is just one of a number of conditions that must be met for the licensee to continue plant operation during the term of the renewed license. Once an OL is renewed, State regulatory agencies and the owners of the plant will ultimately decide whether the plant will continue to operate based on factors such as the need for power or other matters within the State's jurisdiction or the purview of the owners.

Thus, for license renewal reviews, the NRC has adopted the following definition of purpose and need (GEIS Section 1.3):

> 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) decisionmakers.

This definition of purpose and need reflects the Commission's recognition that, unless there are findings in the safety review required by the Atomic Energy Act or findings in the NEPA environmental analysis that would lead the NRC to reject a license renewal application, the NRC does not have a role in the energy-planning decisions of State regulators and power plant licensees as to whether a particular nuclear power plant should continue to operate. From the perspective of the licensee and the State regulatory authority, the purpose of renewing an OL is to maintain the availability of the nuclear plant to meet system energy requirements beyond the current term of the plant's license.

1.5 Compliance and Consultations

Exelon is required to hold certain Federal, State, and local environmental permits, as well as meet relevant Federal and State statutory requirements. In its ER, Exelon provided a list of the authorizations from Federal, State, and local authorities for current operations as well as environmental approvals and consultations associated with Peach Bottom Units 2 and 3 license renewal. Authorizations and consultations most relevant to the proposed OL renewal action are summarized in Table 1-1. The full list of authorizations and consultations provided by Exelon is included in Appendix E. The staff has reviewed the list and consulted with the appropriate Federal, State, and local agencies to identify any compliance or permit issues or significant environmental issues of concern to the reviewing agencies. These agencies did not identify any new and significant environmental issues. The ER states that Exelon is in compliance with

applicable environmental standards and requirements for Peach Bottom Units 2 and 3. The staff has also not identified any environmental issues that are both new and significant.

Table 1-1. Federal, State, and Local Authorizations and Consultations

Agency	Authority	Requirement	Number	Permit Expiration or Consultation Date	Activity Covered
NRC	Atomic Energy Act, 10 CFR Part 50	Operating license	DPR-44 (Unit 2) DRP-56 (Unit 3)	August 8, 2013 (Unit 2) July 2, 2014 (Unit 3)	Operation of Peach Bottom Units 2 and 3
FWS and NMFS	Endangered Species Act, Section 7	Consultation	NA	Initiated October 11, 2000	Operation during the renewal term
SRBC	Susquehanna Basin Compact (18 CFR 803)	Approval	Docket 19830506	Issued on May 12, 1985, no expiration date	Consumptive use of Conowingo Pond water
PDEP	Storage Tank and Spill Prevention Act 32	Registration	187882	Issued annually	Storage tanks (gasoline, used oil, hazardous substances, unlisted materials)
PDEP	Pennsylvania Statutes. Section 691.1 et seq.	NPDES permit and FWPCA Section 401 certification	PA0009733	December 1, 2005	Permit for discharge of waste waters from cooling water, waste water settling basin, auxillary boiler blowdown, sewage treatment plant, dredging rehandling basin, raw intake screen backwash water, and storm water outfall.
PDEP	Pennsylvania Dam Safety and Encroachment Act (32 P.S. Section 693.1 et seq.), Clean Stream Law (35 P.S. Section 691.1 et seq.), Flood Plan Management Act (32 P.S. Section 679.101 et seq.)	Permit	E36-693	December 31,2010	Maintenance dredging of intake area
PDEP	Pennsylvania Safe Drinking Water Act	Permit	6791502	Issued March 21, 1994, no expiration date	Public Water Supply permit
PDEP	Air Pollution Control Act (25 Pa. Code Chapter 127)	Air emissions permit	67-05020	February 29, 2003	Emissions from diesel emergency generators, miscellaneous diesel engines, and other miscellaneous units

Agency	Authority	Requirement	Number	Permit Expiration or Consultation Date	Activity Covered
MDE	Coastal Zone Management Act, Section 307	Consistency determination	Draft	Letter from MDE dated January 29, 2001	Consistency of license renewal with the Maryland Coastal Management Program is under review
DSHPO	National Historic Preservation Act, Section 106	Consultation	NA	Letter from DSHPO to NRC dated October 29, 2001	Impact on sites listed or eligible for listing in the National Register of Historic Places
MHT	National Historic Preservation Act, Section 106	Consultation	NA	Letter from MHT to PECO dated September 22, 2000	Impact on sites listed or eligible for listing in the National Register of Historic Places
PSHPO	National Historic Preservation Act, Section 106	Consultation	NA	Letter from PHMC to PECO dated December 14, 2001	Impact on sites listed or eligible for listing in the National Register of Historic Places

DSHPO - Delaware State Historic Preservation Officer.
FWPCA - Federal Water Pollution Control Act (also known as the Clean Water Act).
FWS - U.S. Fish and Wildlife Service.
MDE - Maryland Department of the Environment.
MHT - Maryland Historical Trust.
NA - Not applicable
NMFS - National Marine Fisheries Service.
NPDES - National Pollutant Discharge Elimination System.
PDEP - Pennsylvania Department of Environmental Protection.
PECO - PECO Energy (predecessor to Exelon).
PHMC - Pennsylvania Historic and Museum Commission.
PSHPO - Pennsylvania State Historic Preservation Officer.
SRBC - Susqehanna River Basin Commission.

1.6 References

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

10 CFR 54. Code of Federal Regulations, Title 10, *Energy,* Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

40 CFR 1508. Code of Federal Regulations, Title 40, *Protection of Environment,* Part 1508, "Terminology and Index."

Atomic Energy Act of 1954 (AEA). 42 USC 2011, et seq.

Endangered Species Act (ESA). 16 USC 1531, et seq.

Federal Water Pollution Control Act. 33 USC 1251, et seq. (Also known as the Clean Water Act [CWA]).

Exelon Generation Company, LLC (Excelon). 2001a. *Applicant's Environmental Report - Operating License Renewal Stage Peach Bottom Units 2 and 3.* Kennett Square, Pennsylvania.

Exelon Generation Company, LLC (Excelon). 2001b. *Application for Renewed Operating Licenses, Peach Bottom Units 2 and 3.* Kennett Square, Pennsylvania.

National Environmental Policy Act of 1969 (NEPA). 42 USC 4321, et seq.

National Historic Preservation Act of 1966 (NHPA). 16 USC 470, et seq.

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

U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants Main Report*, "Section 6.3 – Transportation, Table 9.1, Summary of findings on NEPA issues for license renewal of nuclear power plants, Final Report." NUREG-1437, Volume 1, Addendum 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2000. *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal.* NUREG-1555, Supplement 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2001a. "Notice of Acceptance for Docketing of the Application and Notice of Opportunity for a Hearing Regarding Renewal of License Nos. DPR-44 and DPR-56 for an Additional Twenty-Year Period." *Federal Register.* Vol. 66, No. 170, pp. 46036-46038. August 31, 2001.

U.S. Nuclear Regulatory Commission (NRC). 2001b. "Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process." *Federal Register.* Vol. 66, No. 185, pp. 48892-48893. September 24, 2001.

U.S. Nuclear Regulatory Commission (NRC). 2002. Peach Bottom License Renewal Environmental Scoping Summary Report, April 19, 2002.

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

The Exelon Generation Company's (Exelon's) Peach Bottom Atomic Power Station is located on the shores of the Susquehanna River in York County, Pennsylvania. The plant consists of three units. Units 2 and 3 are operating nuclear reactors and the subject of this action. Unit 1 is a permanently shut down and defueled plant maintained in an operating SAFSTOR decommissioning condition (i.e., safe storage; continued surveillance, security, and maintenance) and is not subject to this action. Additional information regarding SAFSTOR and additional decommissioning methods are described in Section 7.2.2 of NUREG-1437 (NRC 1996). Units 2 and 3 are boiling water reactors (BWRs) which produce steam that turns turbines to generate electricity. In addition to the nuclear units, the site features intake and discharge canals, auxiliary buildings, switchyards, an independent spent fuel storage installation (ISFSI), a training center, and a public boat ramp and picnic area. The plant and its environment are described in Section 2.1, and the plant's interaction with the environment is presented in Section 2.2.

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

Peach Bottom Units 2 and 3 are located on approximately 248 ha (620 ac) of Exelon-owned land in York County, Pennsylvania (Exelon 2001a). The plant is located approximately 61 km (38 mi) north of Baltimore, Maryland. Figures 2-1 and 2-2 show the site location and features within 80 km (50 mi) and 10 km (6 mi), respectively. The area immediately behind the site is a rock cliff that rises to an elevation of about 90 m (300 ft). The site has an exclusion area boundary extending approximately 0.82 km (0.51 mi) around the plant (Exelon 2001a, NRC 1996).

The region surrounding the Peach Bottom site was identified in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996; 1999)[(a)] as having a low population density. Peach Bottom Units 2 and 3 employ a work force of about 725 permanent employees and about 275 contractor employees. Each unit is refueled on a 24-month cycle, which means one refueling at the site every year. During refueling outages, site employment increases by as many as 800 workers for temporary duty (typically, 30 to 40 days). The nearest city limits are Lancaster, Pennsylvania, approximately 31 km (19 mi) to the north, and York, Pennsylvania, approximately 48 km (30 mi) to the northwest of the site.

(a) The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the "GEIS" include the GEIS and its Addendum 1.

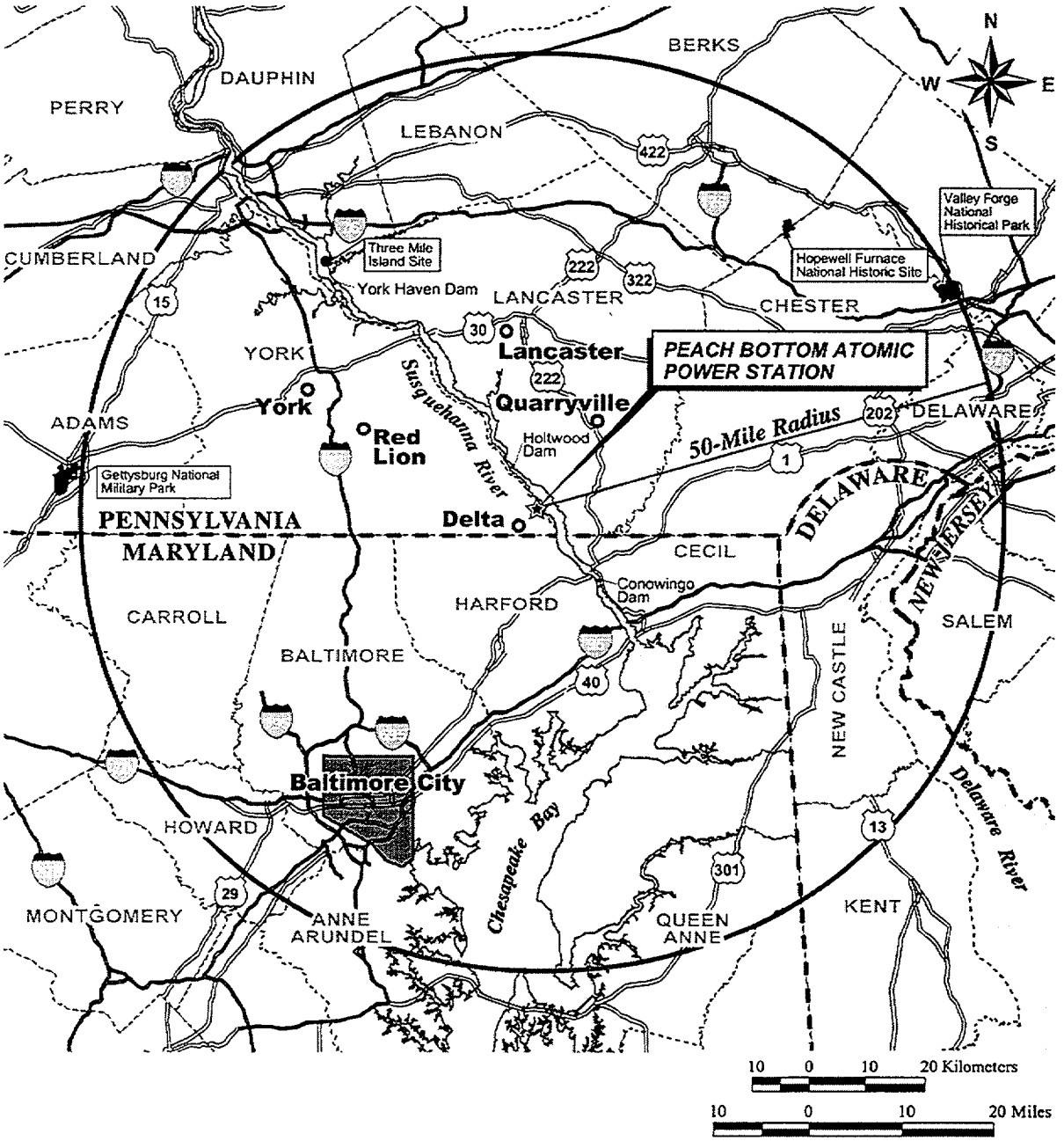

Figure 2-1. Location of Peach Bottom site, 80-km (50-mi) Region

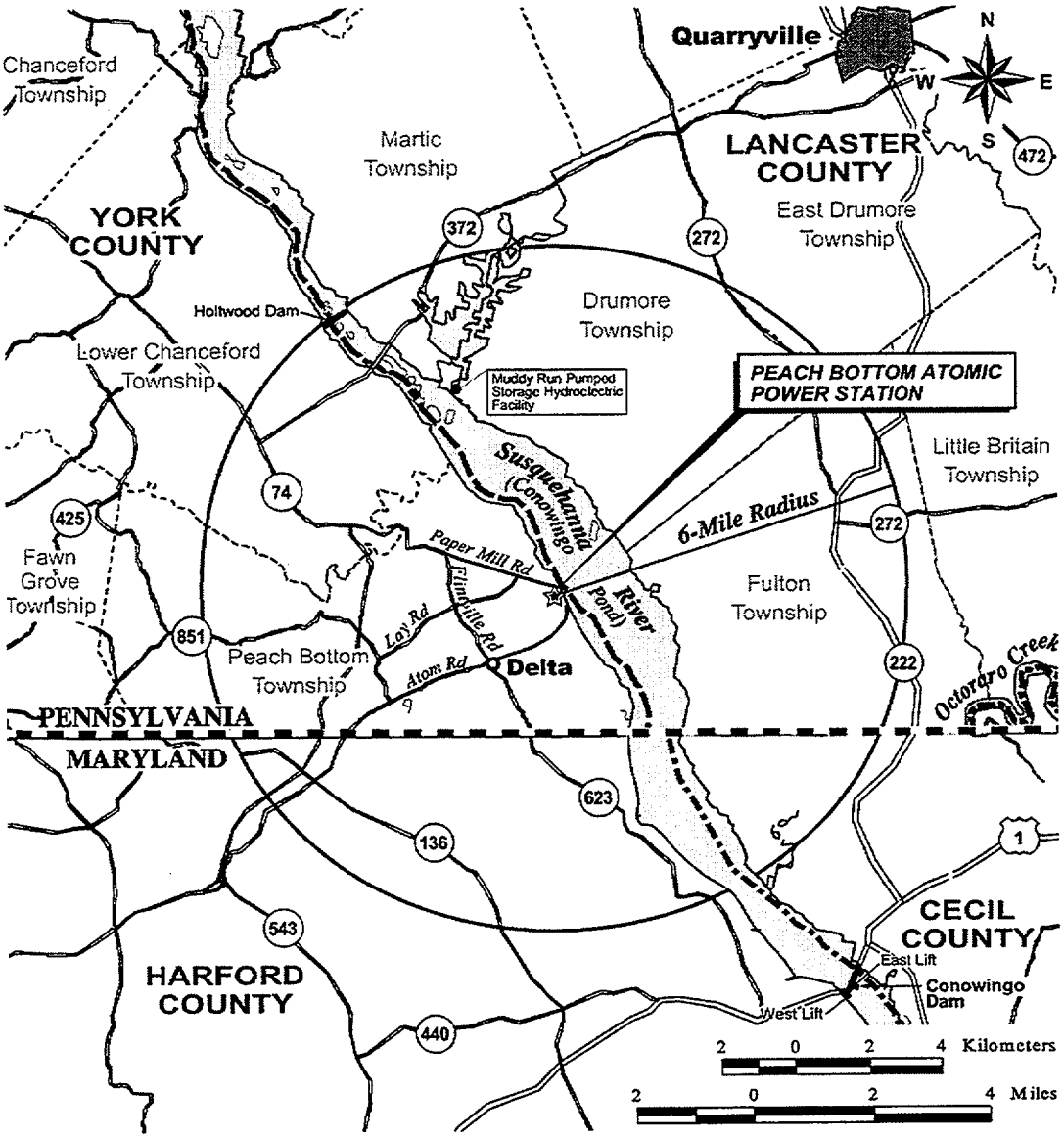

Figure 2-2. Location of Peach Bottom site, 10-km (6-mi) Region

The Peach Bottom site is located on the west side of Conowingo Pond, which was formed when Conowingo Dam was constructed across the Susquehanna River in 1928 (Figure 2-2). The Peach Bottom site is approximately 29 km (18 mi) upstream from the point where the river enters the Chesapeake Bay (Figure 2-1) and 13 km (8 mi) upstream from Conowingo Dam.

In addition to the two operating nuclear reactors and their turbine buildings, intake and discharge canals, and auxiliary buildings, the site includes switchyards, an ISFSI, a training center, the retired Peach Bottom Unit 1 (a prototype high-temperature, gas-cooled reactor now in SAFSTOR decommissioning), and a public boat ramp and picnic area (Exelon 2001a).

2.1.1 External Appearance and Setting

The terrain on either side of Conowingo Pond is steeply hilly. Immediately behind the Peach Bottom site is a rock cliff that was created when part of a hill was cut away for site construction. It rises to an elevation of about 90 m (300 ft) above the river. With the exception of the stack, the plant is not visible from the farming communities located near the site. The plant is visible only from the river and residences on the shores of Conowingo Pond.

The geological location of the site is in the Piedmont Upland Province. It is bounded on the southeast by the Coastal Plain, from which it is separated by the Fall Line, and on the northwest by the Triassic Lowland Section of the Piedmont Province. The Piedmont Upland is a dissected plateau surface with a gently rolling topography. It is underlain by the rocks of the Glenarm series, which are believed to be of late Precambrian or early Paleozoic age. The site itself is underlain by the Peters Creek Schist, probably a member of the widespread Wissahickon Schist. Just to the south is the long, narrow Peach Bottom syncline in which are exposed the somewhat younger Cardiff conglomerate and the Peach Bottom Slate. This small syncline is one of the few structures in the area that can be identified although one or more faults are believed to trend northeast-southwest parallel to the regional structure. The fault nearest to the site is 1.6 km (1 mi) to the southeast. However, these faults, as well as more recent but still ancient faults to the northwest in the Triassic Lowland section, have been inactive for at least 140 million years and are not probable sources for an earthquake (AEC 1973).

The Peters Creek Schist is weathered to a depth of 4.6 to 18 m (15 to 60 ft). This weathered material has been removed for the foundations of the heavier structures. The underlying fresh rock is firm and strong and provides a good foundation for the plant (AEC 1973).

2.1.2 Reactor Systems

Peach Bottom has two active nuclear reactor units (Units 2 and 3) as shown in Figure 2-3. 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 Corporation. Each unit was licensed for an output of 3293 megawatts-thermal (MW(t)), with a design net electric rating of 1,065 megawatts-electric (MW(e)). Units 2 and 3 achieved commercial operation in July 1974 and December 1974, respectively. The facility's net

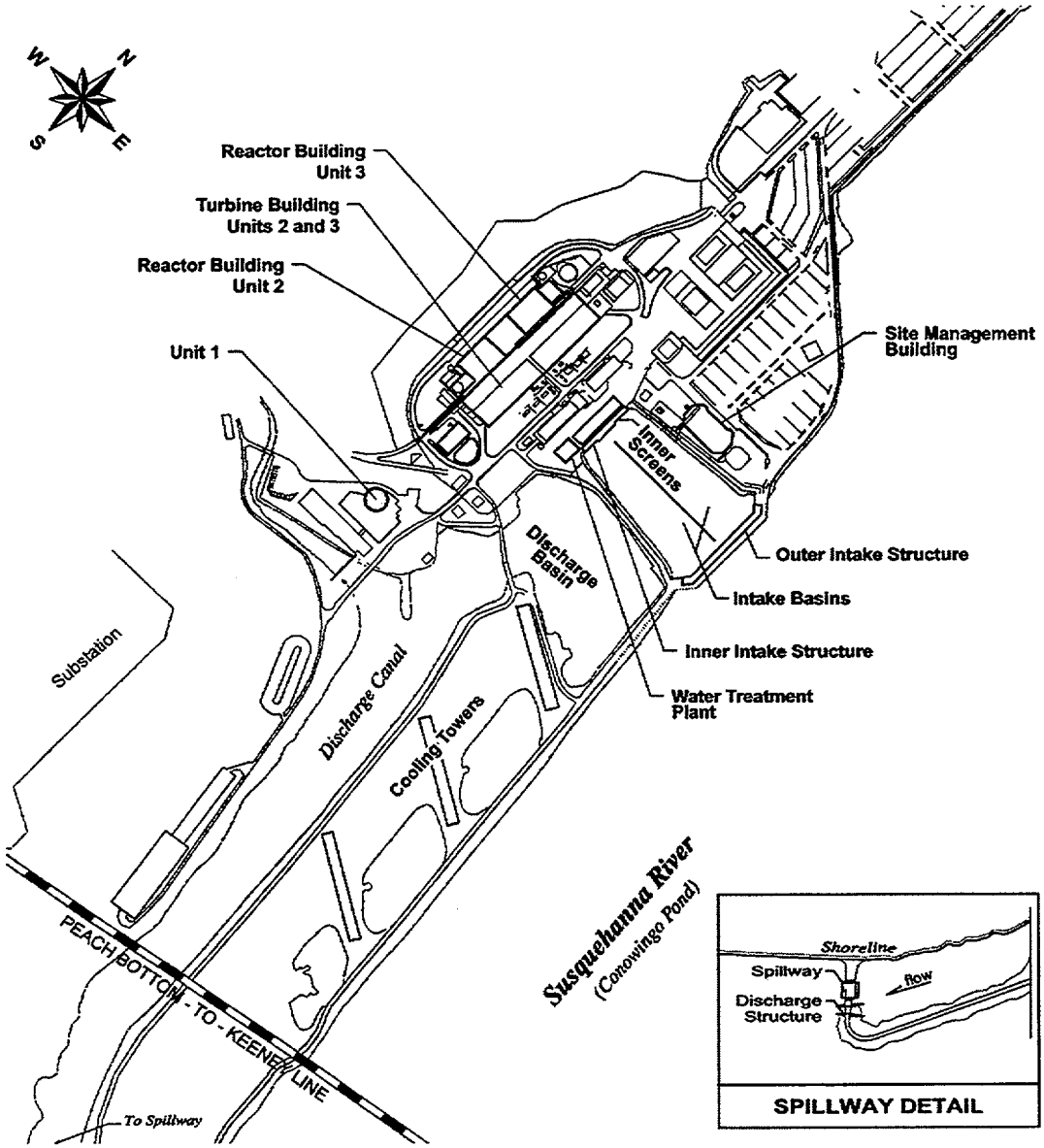

Figure 2-3. Peach Bottom Station Layout

generating capacity was subsequently increased by 60 MW(e). An NRC-prepared environmental assessment and finding of no significant impact concluded that there were no measurable environmental impacts associated with the power uprate. Both units have been uprated to a core power output of 3458 MW(t). Exelon (at that time known as Philadelphia Electric Company, or PECO) received its uprate amendment for Unit 2 in 1994 and for Unit 3 in 1995. Each unit's gross output is 1160 MW(e). The net capacity of each unit is 1093 MW(e)

(Exelon 2001a).

Each reactor's primary containment is a pressure-suppression system consisting of a dry well, pressure-suppression chamber, vent system, isolation valves, containment cooling system, and other service equipment. Each containment system is designed to withstand an internal pressure of 62 pounds per square inch above atmospheric pressure (psig). Together with its engineered safety features, each containment system is designed to provide adequate radiation protection for both normal operation and postulated design-basis accidents, such as earthquakes or loss of coolant. Peach Bottom Units 2 and 3 fuel is low enriched uranium dioxide with enrichments below 5 percent by weight uranium-235 and fuel burn-up levels less than 60,000 megawatt-days per metric ton uranium (Exelon 2001a).

Peach Bottom Unit 1 is located adjacent to Units 2 and 3. It was a prototype, high-temperature, gas-cooled reactor that had a net electrical output of 40 MW(e) (115 MW(t)) and operated from 1966 to 1974. Since then it has been maintained in SAFSTOR. Unit 1 will be decommissioned in the future and is not part of this license renewal application.

2.1.3 Cooling and Auxiliary Water Systems

Peach Bottom Units 2 and 3 use a once-through heat dissipation system that withdraws water from and discharges to Conowingo Pond, a 3600 ha (9000 acre) reservoir on the lower Susquehanna River (Figure 2-3). Water withdrawn from Conowingo Pond passes through a series of intake structures before it is circulated through two main condensers (one for each unit). From the condensers, the water passes through a series of discharge structures and the Conowongo Pond where the heat is dissipated to the environment. The temperature of the cooling water can increase as much as 11.5 °C (20.8 °F) as it passes through the condensers. Exelon also maintains three mechanical-draft "helper" cooling towers with the capacity to divert approximately 60 percent the circulating water flow through the cooling towers. During normal operations, circulating water moves through the plant from the intake structure to the discharge structure in approximately 88 minutes; when three cooling towers are in operation, the transit time is approximately 109 minutes.

The Peach Bottom site is not connected to a municipal water system and acquires all makeup water for the once-through heat dissipation system and potable water from the Susquehanna River. When both units are operating, six circulating water pumps (each rated at 950 m^3/min [250,000 gpm]) draw water from Conowingo Pond at a total rate of 5700 m^3/min (1.5 million gpm). A small fraction of the water is treated at a package plant onsite for use as potable water. Sanitary waste water is treated onsite and discharged to the discharge canal.

The principal components of the circulating water system are the outer intake structure, two intake basins, inner circulating water pump intake structures, condensers, cooling towers, discharge canal, and discharge structure as shown in Figure 2-3.

Water from Conowingo Pond flows into the outer intake structure. The outer intake (or "screenwell") structure is 148 m (487 ft) long along the west bank of Conowingo Pond, parallel to the long axis of the reservoir. Trash racks protect 32 outer intake openings and prevent large floating debris and ice floes from reaching 24 travelling screens. The travelling screens are designed to prevent fish and small debris from entering the system. The screens are made of 1-cm (3/8-in) square mesh and are placed approximately 12 m (40 ft) behind the outer trash racks in the outer intake structure. The rotating screens are washed every 24 hours or when there is a pressure differential between the sides of the screen; the trash and debris are removed to a trash collection area and eventually disposed of at an offsite landfill.

From the outer intake structure, water enters two intake basins. Cooling water for the condensers is withdrawn from the two intake basins. Each basin is 210 m (700 ft) long and 60 m (200 ft) wide. Sediment deposited in these basins is dredged and deposited to one of three onsite landfills. The operation is infrequent (about once in 20 years of operation) but may occur during the license renewal period.

At the end of the two intake basins opposite the outer intake structure is the inner circulating water pump intake structure with six circulating water pump intakes, three in the south basin for Unit 2 and three in the north basin for Unit 3. The inner pump intakes are also protected by travelling screens made of 1-cm (3/8-in) mesh. As with the other screens, the travelling screens for the inner pump intakes are washed every 24 hours or when there is a pressure differential between the sides of the screen; the wash water is returned to the intake basin and the screenings are disposed of at an offsite landfill.

The two condensers are equipped with a system that circulates polyethylene rocket tube cleaners (flexible, cylindrical plugs) through the condenser tubes to prevent the accumulation of deposits and biofouling organisms. The system is also intended to reduce the station's use of oxidizing biocides, such as sodium hypochlorite. The polyethylene rocket tube cleaners are periodically circulated into the circulating water pump discharge line, passed through the condenser and retrieved at the discharge canal for reuse. If the rocket tube cleaner system is out of service for an extended period, sodium hypochlorite may be injected into the system, normally one section of a condenser at a time to minimize the amount of chlorine discharged.

From the condensers, cooling water discharges into a discharge basin approximately 210 m (700 ft) long and 120 m (400 ft) wide. From the discharge basin, the heated cooling water normally flows directly into a 1430 m (4700 ft) long discharge canal. As necessary, 60 percent of the circulating water can also be diverted to the three mechanical-draft helper cooling towers for additional cooling before discharge to the canal. At the end of the discharge canal is the

discharge structure, which contains one permanent opening (spillway) and three adjustable gates that control the flow to Conowingo Pond. The three adjustable gates maintain the velocity of the discharge to between 1.5 and 2.4 m/s (5 and 8 ft/s). A recent study (Normandeau 2000) indicates that water temperatures at the point of discharge were mostly about 11 °C (20 °F) above the intake temperature.

2.1.4 Radioactive Waste Management Systems and Effluent Control Systems

Peach Bottom Units 2 and 3 use liquid, gaseous, and solid radioactive waste management systems to collect and process the liquid, gaseous, and solid wastes that are the by-products of the reactor unit operation. These systems reduce radioactive liquid, gaseous, and solid effluents before they are released to the environment. The waste disposal system meets the design objectives of 10 CFR Part 50, Appendix I (Numerical Guide for Design Objectives and Limiting Conditions for Operation to meet the criterion "As Low As is Reasonably Achievable" for Radiological Material in Light-Water-Cooled Nuclear Power Reactor Effluents), and controls the processing, disposal, and release of radioactive liquid, gaseous, and solid wastes (PECO 2001b).

The liquid and solid wastes from both Units 2 and 3 are routed to a common radioactive waste (radwaste) building for collection, treatment, sampling, and disposal. Packaged solid wastes and reusable radioactive material may be temporarily stored in the radwaste on-site storage facility, or in approved outside storage locations. Gaseous wastes are processed and routed to a common high stack for release to the atmosphere. The liquid and gaseous radwaste systems are designed to reduce the activity in the liquid and gaseous wastes such that the concentrations in routine discharges are less than the applicable regulatory limits. The liquid and gaseous effluents are continuously monitored and the discharge is stopped if the effluent concentrations exceed predetermined limits.

Radioactive fission products build up within the fuel as a consequence of the fission process. These fission products are contained in the sealed fuel rods, but small quantities escape from the fuel rods and contaminate the reactor coolant. Neutron activation of the primary coolant system is also responsible for coolant contamination. Non-fuel solid wastes result from treating and separating radionuclides from gases and liquids and from removing contaminated material from various reactor areas. Solid wastes also consist of reactor components, equipment, and tools removed from service, as well as contaminated protective clothing, paper, rags, and other trash generated from plant operations and design modifications and routine maintenance activities. Solid wastes may be shipped to a waste processor for volume reduction before disposal or they may be sent directly to the licensed burial site. Spent resins and filters are stored or packaged for shipment to an offsite processing or disposal facility.

Fuel rods that have exhausted a certain percentage of their fuel and are removed from the reactor core for disposal are called spent fuel. Peach Bottom Units 2 and 3 currently operate on a 24-month refueling cycle per unit, with one refueling at the site every year. Spent fuel is stored onsite in the spent fuel pool or at the ISFSI.

The *Offsite Dose Calculation Manual* (ODCM) for Peach Bottom Units 2 and 3 describes the methods used for calculating radioactivity concentrations in the environment and the estimated potential offsite doses associated with liquid and gaseous effluents from Peach Bottom (PECO 2001a). The ODCM also specifies controls for release of liquid and gaseous effluents to ensure compliance with the following:

- The concentration of radioactive liquid effluents released from the site to areas at or beyond the site boundary will not exceed 10 times the concentration specified in 10 CFR Part 20, Appendix B, Table 2, Column 2, for radionuclides other than noble gases. For dissolved or entrained noble gases, the concentration shall not exceed 7.4 Bq/mL (2×10^{-4} µCi/mL).

- The dose or dose commitment to a member of the public from any radioactive materials in liquid effluents released from the two reactors at the site to the areas at or beyond the site boundary shall be limited to: (1) less than or equal to 30 µSv (3.0 mrem) to the total body and less than or equal to 100 µSv (10 mrem) to any organ during any calendar quarter; and (2) less than or equal to 60 µSv (6 mrem) to the total body and less than or equal to 200 µSv (20 mrem) to any organ during any calendar year.

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

- The air dose at and beyond the site boundary due to noble gases in gaseous effluents released from the two reactors at the site shall be limited to: (1) less than or equal to 100 μGy (10 mrad) for gamma radiation and less than or equal to 200 μGy (20 mrad) for beta radiation during any calendar quarter; and (2) less than or equal to 200 μGy (20 mrad) for gamma radiation and less than or equal to 400 μGy (40 mrad) for beta radiation during any calendar year.

- The dose to any individual member of the public from the nuclear facility operations will not exceed the maximum limits of 40 CFR Part 190 (<0.25 mSv [25 mrem]) and 10 CFR Part 20 (5 mSv [500 mrem] in a year and 20 μSv [2 mrem] in any hour).

2.1.4.1 Liquid Waste Processing Systems and Effluent Controls

Potentially radioactive liquid wastes are generated from equipment drains, floor drains, containment sumps, the chemistry laboratory, the laundry drain, and miscellaneous sources. The liquid radwaste system collects, processes, stores, monitors, and disposes of all normal and potentially radioactive aqueous liquid wastes from both Units 2 and 3. Wastes are collected in sumps and drain tanks, and then transferred to the tanks in the Radwaste Building for treatment, storage, monitoring, and disposal. The liquid radwaste system is designed to collect various types of liquid wastes separately so that each type of waste can be processed by those methods most appropriate to that type. Liquid wastes are processed on a batch basis, and each batch is sampled to determine that all discharge requirements are met prior to release from the waste system (PECO 2001b). Tanks, equipment, and piping that contain liquid radioactive wastes are enclosed within radwaste areas in buildings or tunnels and are shielded where required to permit operation, inspection and maintenance with acceptable personnel exposures. These areas are drained to sumps that return the liquid to the radwaste system. Liquid requiring cleanup before being discharged to the environment is filtered, demineralized, and sampled. Other drains, sumps, etc., in the plant that do not handle potentially radioactive liquid are not part of this system. This other equipment is used in the collection and disposal of non-radioactive wastes from equipment or areas that are not radioactive or subject to radiological control.

Processed aqueous liquid wastes may be returned to the Condensate System for plant re-use or discharged to the environment after analysis and dilution with condenser circulating water. Liquid wastes may also be packaged for off-site disposal.

Liquid effluents with moderate to high conductivity and generally low radioactive concentrations (low purity water) are pumped to a floor drain collector tank on a batch basis. These effluents are processed through a pressure-precoat type filter and/or mixed bed demineralizer and pumped to the floor drain sample tank. After sampling and analysis, they can be discharged to the environment through the circulating water discharge canal at a controlled rate or pumped to the condensate storage tank if the water quality meets the condensate storage tank water standards. Liquid effluents having conductivity higher than suitable for plant re-use and with radioactivity concentration higher than can be safely released to the environment are processed for proper disposal.

Liquid effluents with chemical wastes such as laboratory drains and chemical decontamination solutions are processed through the chemical waste tank in the Radwaste Building to the radwaste floor drain sump or batch processed to the floor drain collector tank for filtration and dilution along with floor drain waste.

Liquid waste containing detergents or similar cleaning agents or chemicals from the laundry drains, cask wash down, and personnel decontamination station drains is collected and processing may be through the laundry drain filter or through temporary processing equipment specifically configured for treatment of the liquid waste stream, the Chemical/Oily Waste Cleanup Subsystem.

Wastewater containing oils, cleaning agents or chemicals may also be collected in designated drums located in areas around the plant where such wastes are generated. These drums of liquid are transported to the Radwaste Building for processing as required. Processed liquids or wastewater which are acceptable for release without processing are transferred to one of the two laundry drain tanks and isolated. Each isolated batch for discharge is sampled during recirculation. If acceptable for release, it is then discharged to the environment through the laundry drain filter.

Four tanks, which contain potentially radioactive water, are located outside the plant building structures. They are the refueling water storage tank, two condensate storage tanks, and the water storage tank. These tanks are enclosed within watertight dike structures with adequate capacity to contain the contents of the largest single tank. In the event of leaks, spills, or overflows from these tanks, control of the liquid radioactive waste is ensured. Sumps collect liquid from each of the watertight dike structures. From the sumps, the water is either drained by gravity to the liquid radwaste system for processing or is released to the storm sewer (if rain water, etc.). Prior to any release to the storm sewer, any liquid in these sumps is sampled and analyzed for radioactivity to ensure no significant radioactivity is released to the environment from this source.

All systems are protected against overflow and similar undesirable conditions by appropriate alarms and shutdown devices. The ODCM prescribes the alarm/trip set points for the liquid effluent radiation monitors, which are derived from 10 times the effluent concentration limits provided in 10 CFR Part 20, Appendix B, Table 2, Column 2. The alarm/trip set point for each liquid effluent monitor is based on the measurements of radioactivity in a batch of liquid to be released or in the continuous liquid discharge (PECO 2001a).

During 2000, the total volume of liquid effluents from Peach Bottom Units 2 and 3 was 3630 m^3 (958,000 gal), including 69 batch releases. The actual liquid waste generated is reported in the *Peach Bottom Atomic Power Station, Unit Numbers 2 and 3, Radioactive Effluent Release Report, No. 43* (Exelon 2001e). These are typical quantities released to the environment, and Exelon does not anticipate any increase in liquid released during the renewal period. See Section 2.2.7 for a discussion of the theoretical doses to the maximally exposed individual as a result of these releases.

2.1.4.2 Gaseous Waste Processing Systems and Effluent Controls

Radioactive gaseous effluents include low concentrations of fission-product noble gases (such as krypton and xenon), halogens (mostly iodines), tritium contained in water vapor, and particulate material including both fission products and activated corrosion products. Each reactor unit is provided with a gaseous radwaste/off-gas system, which includes condenser air removal subsystems, and gland seal steam exhauster subsystems that discharge to a common main stack. The condenser air removal subsystem is utilized to establish a vacuum in the three main condenser sections and to maintain this vacuum during normal plant operation by removing non-condensable gases. The subsystem removes the condenser gases, which include radiolytic oxygen and hydrogen, air in-leakage, and radioactive fission and activation gases (PECO 2001b).

Subsystem exhaust is cooled in the recombiner condenser where essentially all water vapor (from process steam and recombination) is condensed and drained to the main condenser via the condensate drain tank. The remaining non-condensables pass through charcoal adsorber beds and high efficiency particulate air (HEPA) filters before atmospheric release through a common main stack, which stands approximately 200 m (650 ft) above the plant grade.

Continuous main stack radiation monitoring at sample points in the stack base provides an indication of radioactive releases from the off-gas system. The off-gas effluent radiation monitor and control system is used to monitor the condition of reactor fuel and alert operators if off-gas activity levels are increasing.

The ODCM prescribes alarm/trip set points for the monitor and control instrumentation to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20 for gaseous effluents (PECO 2001a). The actual gaseous effluents for year 2000 are reported in the *Peach Bottom Atomic Power Station, Unit Numbers 2 and 3, Radioactive Effluent Release Report, No. 43* (Exelon 2001e). These are typical quantities released to the environment, and Exelon does not anticipate any increase in gaseous releases during the renewal period. See Section 2.2.7 for a discussion of the theoretical doses to the maximally exposed individual as a result of these releases.

2.1.4.3 Solid Waste Processing

Solid wastes from Peach Bottom Units 2 and 3 consist of spent (dewatered) resin, solidified resin, filters, sludge, evaporator bottoms, dry compressible waste, irradiated components (control rods, etc.), and other non-compressible waste. The solid radwaste system consists of those systems and components that are used to condition and package wet and dry solid wastes so that the waste is suitable for transport and disposal. The system is not used for spent fuel storage and shipment. Temporary storage capacity for packaged solid wastes is

provided by the onsite storage facility or in approved outside storage locations. Different methods are used for processing and packaging solid radioactive wastes, depending primarily upon the waste characteristics. The solid radwaste system includes the phase separators, which serve as an interface with the liquid radwaste processing system and the dewatering system. The dewatering system is the system used to dewater filter and demineralizer material to meet burial site and 10 CFR 61.56 requirements. High integrity containers (HICs) are the disposal package used when the waste classification requires that the waste meet stability requirements. Only HICs certified acceptable for use at the disposal facility to which the waste is destined are used (PECO 2001b).

Dry active wastes (DAWs), generated as a result of operation and maintenance activities, are collected throughout the radiological controlled areas of the facility. Typical wastes of this type are air filters, cleaning rags, protective tape, paper and plastic coverings, discarded contaminated clothing, tools, equipment parts, and solid laboratory wastes. Most DAWs have relatively low radioactive content and may be handled manually. DAWs are collected from throughout the plant in packages, and most are loaded into containers for shipment to an offsite processor for decontamination or further volume reduction prior to disposal. DAWs that do not meet the criteria for processing by the offsite processor may be packaged for direct shipment to a disposal facility. Selected items may be decontaminated onsite as practical for reuse or release as clean. DAWs are monitored as packaged to ensure applicable controls are maintained. Most DAW packages are loaded into containers until a sufficient volume has been collected to fill the container for transport. Packaged dry wastes may also be stored in the onsite storage facility or in approved outside storage locations.

Wet solid radwastes result from the processing of spent demineralizer resins (both bead and powdered) and spent filter material from the equipment drain and floor drain subsystems, and from the three (reactor, condensate, and fuel pool) water cleanup systems. The wastes are spent demineralizer resins and filter material water slurries, which are collected in the four backwash receiving tanks or in the waste sludge tank. The slurries collected in the Condensate and Reactor Water Cleanup backwash receiving tanks are pumped on a batch basis to one of the corresponding phase separators for collection and decay. The slurry is stagnant in the phase separator, allowing solids to settle so that clarified liquid may be decanted off the top. The process continues until a sufficient quantity of solids is collected for processing.

The radwaste filter demineralizers, radwaste deep bed demineralizers, and fuel pool filter demineralizers are backwashed to the Waste Sludge Tank. When a sufficient volume has been collected in the tank, its contents are pumped to a condensate phase separator for further processing. When sufficient volume has been collected in a phase separator, that phase separator is isolated and its contents mixed to obtain a homogeneous slurry in the required solids concentration range. The slurry is then pumped to the dewatering system.

Filled HICs may be stored inside shielded cells located within the onsite storage facility. This facility is designed to allow for remote handling. Cell covers are installed subsequent to a storage or retrieval operation when shielding is required. Floor drains from each cell are routed to a collection tank for sampling and analysis prior to transfer to the non-radioactive sump for discharge, or if radioactive, for processing via a portable demineralizer or transfer to a mobile processing system. Normal discharge is made from the non-radioactive sump to the storm drain system after sample analysis and sump contents monitoring show acceptably clean water. The discharge valve is interlocked to a radiation monitor to prevent inadvertent discharge of contaminated liquids.

Disposal and transportation of solid radioactive wastes are performed in accordance with the applicable requirements of 10 CFR Part 61 and Part 71, respectively. There are no releases to the environment from solid radioactive wastes created at Peach Bottom Units 2 and 3. In 2000, Peach Bottom Units 2 and 3 made 115 shipments of solid radioactive waste with a volume of 186 m^3 (6557 ft^3) and a total activity of 5.4 TBq (146 Ci) (Exelon 2001e). These shipments are representative of the shipments made in the past 5 years and are not expected to change appreciably during the license renewal period.

2.1.5 Nonradioactive Waste Systems

The principal nonradioactive effluents from the Peach Bottom Units 2 and 3 consist of hazardous (chemical) wastes, lubrication oil wastes, and sanitary wastes. The Peach Bottom site is a small quantity hazardous material generator, with generation amounts less than 1000 kg/yr (2200 lbs/yr). The lubrication oils are normally injected into the auxiliary boiler fuel feed. Some lubrication oil may be disposed of as waste, typically 7600 L/yr (2000 gal/yr) for offsite disposal. Spent batteries and discarded fluorescent lights are recycled. Sanitary waste is sent to the onsite sewage treatment plant, which treats a volume of approximately 6800 L/day (1800 gal/day), and can handle up to 57,000 L/day (15,000 gal/day). The sanitary treatment facility is an extended aeration type with sludge settling and chlorination facilities. The liquid effluents from the sewage treatment plant are discharged to the circulating water discharge canal, from which they are discharged into Conowingo Pond (AEC 1973).

2.1.6 Plant Operation and Maintenance

Routine maintenance performed on plant systems and components is necessary for safe and reliable operation of a nuclear power plant. Maintenance activities conducted at Peach Bottom Units 2 and 3 include inspection, testing, and surveillance to maintain the current licensing basis of the plant and to ensure compliance with environmental and safety requirements. Certain activities can be performed while the reactor is operating. Others require that the plant be shut down. Long-term outages are scheduled for refueling and for certain types of repairs or maintenance, such as replacement of a major component. Each of the two nuclear units is refueled on a 24-month schedule, resulting in an average of one refueling every year for the

site. During refueling outages, site employment increases by as many as 800 workers for temporary duty (typically, 30 to 40 days). PECO provided an appendix (Appendix A) in the *Updated Final Safety Analysis Report* (PECO 2001b) regarding the aging management review to manage the effects of aging on systems, structures, and components in accordance with 10 CFR Part 54. The Peach Bottom Units 2 and 3 license renewal application describes the programs and activities that will manage the effects of aging during the license renewal period. Exelon expects to conduct the activities related to the management of aging effects during plant operation or normal refueling and other outages, but plans no outages specifically for the purpose of refurbishment. Exelon has no plans to significantly add additional full-time staff (non-outage workers) at the plant during the period of the renewed licenses.

2.1.7 Power Transmission System

Philadelphia Electric Company (PECO, now Exelon) built only one transmission line, the Peach Bottom-to-Keeney line, for the specific purpose of connecting Peach Bottom Units 2 and 3 to the transmission system (Exelon 2001a). Beginning at the Peach Bottom south substation (Figure 2-4), this 500-kilovolt-transmission line (designated as the 5014 line) runs approximately 55 km (34 mi) eastward to the Keeney substation in northwestern Delaware. The transmission line right-of-way is 90 m (300 ft) (or more) wide. In Pennsylvania and Maryland the right-of-way is maintained by Exelon. In Delaware the right-of-way is maintained by Conectiv Power Delivery. "Right-of-way" is a general term used to identify the land over which a transmission line travels. The right-of-way 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 (Exelon 2001a). The transmission right-of-way also contains other transmission lines, most notably the 230-kV line from the Colora to the Cecil substations, which shares the right-of-way for approximately 19 km (12 mi).

Exelon designed the 5014 Line in accordance with the 1967 edition of the National Electrical Safety Code® (NFPA 1967) 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. The right-of-way is maintained on a five-year cycle by mowing and trimming and on a three-year cycle by the use of herbicides. The maintenance of the transmission right-of-way in Delaware is pursuant to the Memorandum of Understanding between Conectiv and the U.S. Fish and Wildlife Service (NRC 2002). Because the 5014 Line is integral to the larger transmission system, it would remain a permanent part of the transmission system even if Peach Bottom Units 2 and 3 are no longer operated.

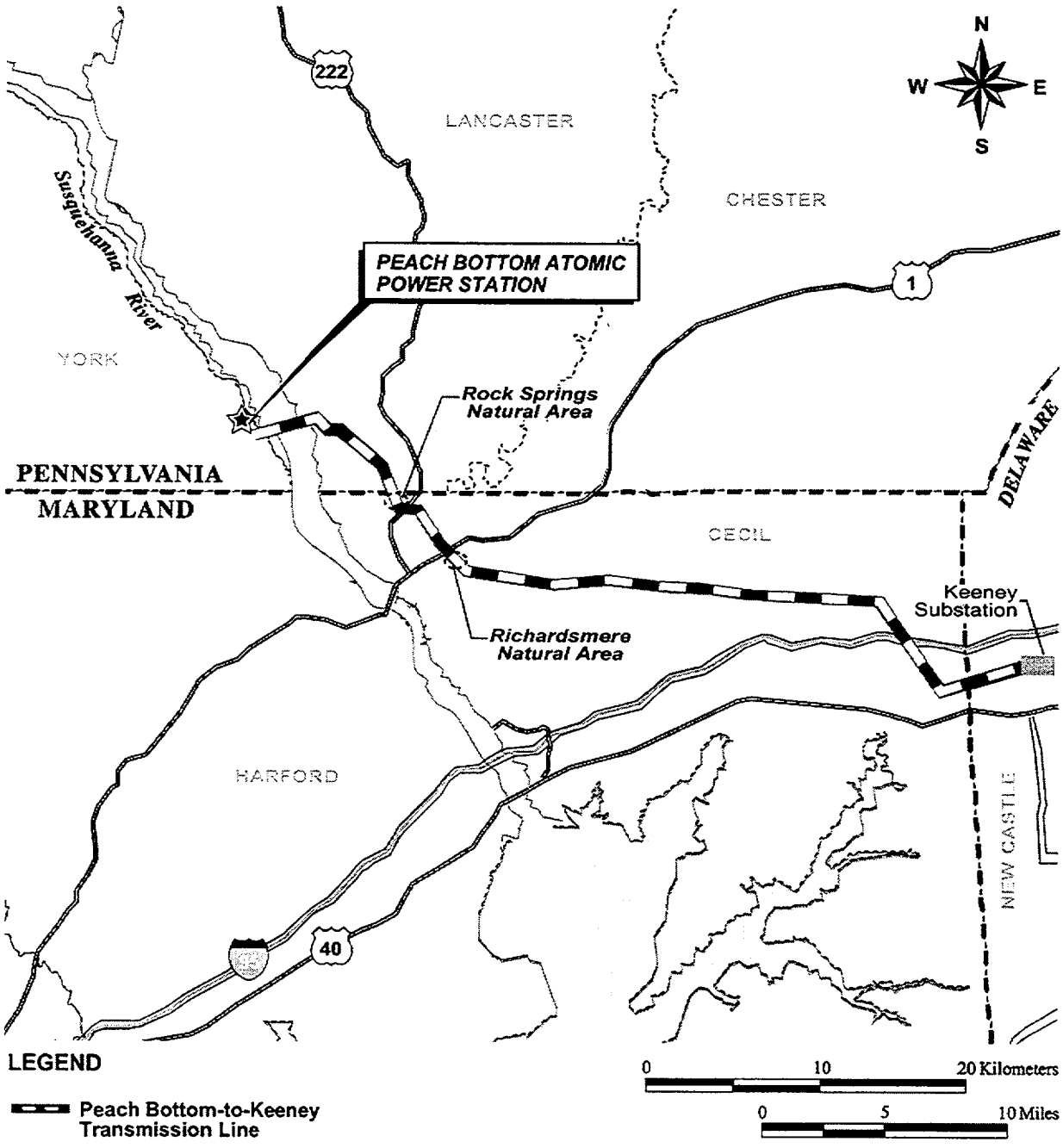

Figure 2-4. Peach Bottom Transmission Line Map

2.2 Plant Interaction with the Environment

Sections 2.2.1 through 2.2.8 provide general descriptions of the environment near Peach Bottom Units 2 and 3 as background information. They also provide detailed descriptions where needed to support the analysis of potential environmental impacts of refurbishment and operation during the renewal term, as discussed in Chapters 3 and 4. Section 2.2.9 describes the historic and archaeological resources in the area, and Section 2.2.10 describes possible impacts on other Federal project activities.

2.2.1 Land Use

The Peach Bottom site is located in Peach Bottom Township, York County, Pennsylvania, on the west side of Conowingo Pond. The plant site is approximately 31 km (19 mi) southwest of Lancaster, Pennsylvania; 48 km (30 mi) southeast of York, Pennsylvania; and 61 km (38 mi) north of Baltimore, Maryland. York is the county seat of York County. The Peach Bottom site consists of 248 ha (620 ac) of land. All industrial facilities associated with the site are located in York County. The area around the site is predominantly rural, characterized by farmland and woods (Exelon 2001a).

Section 307 (c)(3)(A) of the Coastal Management Act [16 USC 1456(c)(3)(A)] requires that applicants for federal licenses that conduct an activity in a coastal zone provide a certification that the proposed activity complies with the enforceable policies of the State's coastal zone program. The Peach Bottom site, located in York County, is not within the Pennsylvania coastal zone, and due to its distance (approximately 80 km [50 mi]) from the coastal zone, does not affect the Pennsylvania coastal zone. However, the Maryland coastal zone extends to Conowingo Pond from which Peach Bottom Units 2 and 3 withdraw and discharge water. The Maryland Department of the Environment issued the Certification of Compliance with the Maryland Coastal Zone Management Program on April 23, 2002.

2.2.2 Water Use

The Peach Bottom site acquires all its cooling water and potable water from Conowingo Pond. Conowingo Pond has a surface area of 3600 ha (9000 ac) and varies from 0.8 to 2.4 km (0.5 to 1.5 mi) in width. Exelon withdraws approximately 5700 m^3/min (1.5 million gpm) of process and potable water from Conowingo Pond.

From 1952 to 1999, the mean monthly average flow at the Susquehanna River at Holtwood Dam (approximately 10 km (6 miles) upstream from Conowingo Pond) was 1070 m^3/s (38,370 cfs), with minimum and maximum monthly average flows of 42 m^3/s (1500 cfs) and 26,700 m^3/s (941,900 cfs) respectively. Normal pond elevation is approximately 33 m (109 feet)

above mean sea level; during maximum Conowingo Dam operational drawdown, the elevation is about 30 m (99 feet) above mean sea level.

The Susquehanna River Basin Commission (SRBC) is the governing body that regulates withdrawals and diversions from the Susquehanna River. The Peach Bottom site is authorized to withdraw from Conowingo Pond per SRBC Resolution Numbers 93-04, 91-2, and 83-4.

Exelon also operates the Muddy Run Pumped Storage Facility approximately 8 km (5 miles) north of the Peach Bottom site. The pumped storage facility withdraws water from the Conowingo Pond at night and releases water to it during daytime periods of peak electric demand. With the operation of the pumped storage facility, the volume of Conowingo Pond varies from about 300 million m^3 (240,000 acre-ft) to 400 million m^3 (322,000 acre-ft) daily.

Cooling process water discharges into a discharge basin and discharge canal before final discharge to the Conowingo Pond. Sanitary waste water is processed in an onsite treatment plant and is also discharged to the discharge canal. Exelon does not withdraw groundwater for cooling or potable water. The Peach Bottom site does have several closed groundwater wells and four wells that provide non-potable water to remote facilities. One well in the Hazardous Materials Yard is 60 m (200 ft) deep and provides 0.02 m^3/min (6 gpm) for washing hands or rinsing equipment. A second well at the South Substation is 90 m (300 ft) deep and provides 0.004 m^3/min (1 gpm) to a toilet at the substation. Water from a third well at the Salt Storage Facility is used for washing trucks and the well at the North Substation provides water to a toilet. These two wells have withdrawal rates similar to the wells at the Hazardous Materials Yard and the South Substation.

Groundwater seeps intermittently from springs in the cliffs behind the Peach Bottom site. Each reactor building and the low-level radioactive waste storage building have sumps that collect the seepage which eventually evaporates. Groundwater that seeps from behind the low-level waste building also discharges to the storm drains.

2.2.3 Water Quality

In accordance with the Federal Water Pollution Control Act (also known as the Clean Water Act), the quality of plant effluent discharges is regulated through the National Pollutant Discharge Elimination System (NPDES). The Pennsylvania Department of Environmental Protection (PDEP) is authorized by the U.S. Environmental Protection Agency (EPA) to issue discharge permits in Pennsylvania. The Peach Bottom site's NPDES permit (PA0009733) regulates all discharges to the Susquehanna River including process and cooling water, sanitary waste water, and storm water.

The NPDES permit (PA0009733) issued by PDEP in 2000 requires continuous monitoring of discharge temperature, but does not stipulate a maximum instantaneous discharge limit. In the event of a joint occurrence of low river flows (less than 85 m^3/s [3000 cfs]) and high ambient river water temperatures (greater than 29 °C [85 °F]), the NPDES permit requires the Peach Bottom site to take appropriate measures to ascertain the potential effects on the local fish community and notify PDEP. If cooling towers are required, tower startup will be initiated following station operating procedures.

Sodium hypochlorite can be injected into the condenser system to control biofouling when the mechanical system is out of service for an extended period. The NPDES permit (PA0009733) limits the instantaneous maximum total residual chlorine concentration at the outfall to 0.20 mg/L (2×10^{-6} lb/gal). Exelon also uses an ammonium chloride-based molluscide to control the Asiatic clam (*Corbicula fluminea*); Exelon is required to monitor and report to PDEP use of the molluscide. Any new regulations promulgated by the EPA or PDEP would be reflected in future permits.

2.2.4 Air Quality

The Peach Bottom site has a humid continental climate characterized by dominance from tropical air masses in summer and polar air masses in winter. Precipitation occurs throughout year with a typical increase in summer rainfall. Meteorological records for southeastern Pennsylvania (i.e., Harrisburg-Middletown area) are generally representative of the Peach Bottom site. The data from this area indicates that lowest precipitation amounts for the year generally last for about a month or two, typically in February and/or March. Mean or normal daily maximum temperatures for southeastern Pennsylvania range from 0 to 4.5 °C (32 to 40 °F) in January to 26.7 to 32.2 °C (80 to 90 °F) in July and August (NOAA 2001a). Normal minimum temperatures range from about -9.4 to -3.9 °C (15 to 25 °F) in January to about 15.6 to 21.1 °C (60 to 70 °F) in August. The mean annual precipitation ranges from 102 to 127 cm (30 to 40 in.). Normal monthly precipitation ranges from 5 to 8 cm (2 to 3 in.) in the dry season (i.e., February) to 8 to 13 cm (3 to 5 in.) in the wet season (NOAA 2001b).

Thunderstorms occur on average between 20 to 30 days per year (NOAA 2001a). During the period June through August, the daily occurrence of thunderstorms is about 5 to 7 days per month. Based on statistics for the 30 years from 1954 through 1983 (Ramsdell and Andrews 1986), the probability of a tornado striking the site is expected to be about 1×10^{-4} per year.

The wind resources are expressed in terms of wind power classes, ranging from class 1 to class 7 (Elliott et al. 1986). Each class represents a range of mean wind power density or approximate mean wind speed at specified heights above the ground. The wind energy resource in southeastern Pennsylvania is limited. The annual average wind power for this part

of the State is rated 1 or 2. Areas designated class 3 or greater are suitable for most wind energy applications, whereas class 2 areas are marginal and class 1 areas are generally not wind power suitable.

Air quality in a given area is a function of the air pollutant emissions (type of pollutant; rate, frequency, duration, exit conditions, and location of release), atmospheric conditions (climate and meteorology), the area itself (size of airshed and topography of the area), and the pollutants transported from outside the area. Air quality within a 50 km radius of the site is generally considered good, with the exception of being within an ozone nonattainment area. Localized sources of emissions include man-made sources of industrial-, residential-, and transportation-related emissions. Natural sources of wind-blown dust contribute to temporary increases in air pollution.

The Peach Bottom site is located in York County, Pennsylvania, which is part of the South Central Pennsylvania Intrastate Air Quality Control Region (AQCR) (40 CFR 81.105). York County, and Lancaster County, immediately across the Susquehanna River from the site, are designated as a nonattainment areas 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(40 CFR 81.15). These counties are designated as nonattainment for ozone (40 CFR 81.15, 81.105, and 81.339).

The Metropolitan Baltimore Intrastate AQCR is also near the site, and encompasses the following areas in Maryland: Anne Arundel County, Baltimore City, Baltimore County, Carroll County, Harford County, and Howard County. All counties in the Metropolitan Baltimore Intrastate AQCR are designated nonattainment for ozone and several zones within Baltimore City and Baltimore County do not meet primary standards for total suspended particulates (40 CFR 81.28 and 81.321). No Prevention of Significant Deterioration Class I areas exist within 100 km (62 mi) of the Peach Bottom site (Clean Air Act).

There are four diesel generators with rated capacities of 2600 kW (3490 hp) and two 52 MMBTU/hr boilers at the Peach Bottom plant (PECO 2001b). The diesels are used for emergency backup power and the boilers are used for space heating and to aid unit start-up. The diesel generators are tested with a 2-hour burn every two weeks. An endurance test involving a 24-hr burn is conducted once every two years. The four units are on a staggered endurance test schedule, with 1 of the 4 units tested every six months. Emissions from these sources are regulated under Pennsylvania's Permit Operating Program under the Title V State permit number 67-05020 issued by the Commonwealth of Pennsylvania, Department of Environmental Protection, Air Quality Program. The current air emissions permit expires on February 29, 2004.

2.2.5 Aquatic Resources

For Peach Bottom Units 2 and 3, the staff has reviewed the 1966-1974 pre- and post-operational fish studies and the 1997-1999 studies that assessed the impact of zero-cooling-tower operation. These studies indicate that the species composition of the Conowingo Pond fish community has not changed significantly, with one exception. This exception is the installation of fish passage facilities at Conowingo Dam and other dams upstream of Peach Bottom Units 2 and 3 which have resulted in anadromous fish populations that migrate past the Peach Bottom site.

The resident fish of Conowingo Pond are, for the most part, common warm-water species (e.g., gizzard shad [*Dorosoma cepedianum*], spotfin shiner [*Cyprinella spiloptera*], channel catfish [*Ictalurus punctatus*], tessellated darter [*Etheostoma olmstedi*], and bluegill [*Lepomis macrochirus*]) that have a wide distribution from the southeastern U.S. to Canada (Normandeau Associates, Inc. 1998, 1999, 2000). Conowingo Pond is well known for its largemouth (*Micropterus salmoides*) and smallmouth bass (*M. dolomieui*) fishing, and also provides opportunities for striped bass (*Morone saxatilis*) and walleye (*Stizostedion vitreum*) fishing. Local and regional fishing clubs and organizations use Conowingo Pond for bass fishing tournaments during the spring, summer, and fall. The heated discharge from Peach Bottom Units 2 and 3, which attracts baitfish and game fish during most months of the year, is an especially popular fishing spot in winter.

The relative abundance of the gizzard shad changed during the 1970s and 1980s. They were introduced into Conowingo Pond during 1972 (PECO 1975). 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 alewife (*Alosa pseudoharengus*) and American shad (*A. sapidissima*), and are likely to remain an important part of the ecosystem near the Peach Bottom site. During 1999, more than 950,000 gizzard shad were trapped below the Conowingo Dam and were lifted to Conowingo Pond (Susquehanna River Anadromous Fish Restoration Cooperative 2000).

Aside from the increase in the gizzard shad population, the only other significant change in the fish community of Conowingo Pond over the last 25 years has been the increase in numbers of anadromous fish (e.g., American shad, blueback herring [*A. aestivalis*], alewife, and striped bass) moving through Conowingo Pond during the spring and fall. No anadromous fish were collected during 9 years (1966-1974) of monitoring Conowingo Pond's fish populations to assess potential impacts of the Muddy Run Pumped Storage Facility and Peach Bottom Units 2 and 3 (PECO 1975). During 1972, a consortium of Federal, regional, and State agencies began trapping and transporting anadromous fish from downstream of Conowingo Dam to upriver locations. Fish lifts and fish ladders have been installed at Conowingo Dam and the

other mainstem dams and transporting has been discontinued. Completion of the fishway at York Haven Dam, during 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 during the spring, to upstream spawning locations (Susquehanna River Anadromous Fish Restoration Cooperative 2000). Juvenile shad and herring move downstream through the Pond during 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 during the 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 during 1980 to 15,964 during 1990 (Susquehanna River Anadromous Fish Restoration Cooperative 2000.), and to more than 150,000 during 2000 (Pennsylvania Fish & Boat Commission 2000). Additionally, large numbers of river herring (more than 130,000 during 1999) and substantial numbers of striped bass (1231 during 1999) also passed upstream at the Conowingo fish lift (Susquehanna River Anadromous Fish Restoration Cooperative 2000).

Only three freshwater mollusc taxa were collected in more than 8 years (1967-1974) of pre- and post-operational benthic monitoring conducted in support of Peach Bottom Units 2 and 3's CWA Section 316(a) Demonstration (Philadelphia Electric Company 1975). 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 during the last several decades has been the appearance and rapid colonization since the mid-1980s of the exotic Asiatic clam, *Corbicula* sp.

2.2.6 Terrestrial Resources

The Peach Bottom site is located within the northern piedmont ecoregion (Omernik 1987). Prior to European settlement the region was dominated by oak-chestnut forests which have subsequently been lost or altered because of timber cutting, farming, and the introduction of chestnut blight in the early 1900s. Second growth forests in the plant vicinity are now characterized as oak-hickory or oak-tulip tree assemblages with a variety of subcommunity types depending on the local terrain (USAEC 1973). Most of the land in the vicinity of the Peach Bottom site and the Peach Bottom-to-Keeney transmission line is rolling hills covered with a mixture of farmland (including row crops, pasture, and old fields) and woodlots.

Landuse, vegetative communities, and wildlife habitats in both areas have not changed significantly over the past 25 years.

In the vicinity of the Peach Bottom site and transmission line, there are three terrestrial species listed as threatened or endangered by the U.S. Fish and Wildlife Service (FWS) and one species that has been delisted by the FWS (Table 2-1). An additional 53 species listed as threatened, endangered, or of concern by the States of Pennsylvania and/or Maryland are known to occur near the Peach Bottom site or the associated transmission right-of-way (Table 2-1).

Table 2-1. Federal and State Endangered, Threatened, and Candidate Plant and Terrestrial Animal Species Currently or Historically Occurring in the Vicinity of the Peach Bottom Site or the Peach Bottom-to-Keeney Transmission Line.

Scientific Name	Common Name	Federal Status[a]	PA Status[a,b]	MD Status[a,c]
Cryptotis parva	least shrew	—	E	—
Myotis leibii	eastern small-footed myotis	—	T	—
Neotoma magister	eastern woodrat	—	T	E
Sorex fumeus	smoky shrew	—	—	T
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

Table 2-1. (contd)

Scientific Name	Common Name	Federal Status[a]	PA Status[a,b]	MD Status[a,c]
Nyctanssia violacea	yellow-crowned night heron	—	E	—
Oporornius philadelphia	mourning warbler	—	—	E
Pandion haliaetus	osprey	—	T	—
Rallus eleganus	king rail	—	E	—
Ambystoma tigrinum	tiger salamander	—	—	E
Pseudotriton montanus	mud salamander	—	E	—
Clemmys muhlenbergii	bog turtle	T	E	T
Opheodrys aestivus	rough green snake	—	T	—
Pseudemys rubriventris	red-bellied turtle	—	T	—
Speyeria idalia	regal fritillary	—	E	E
Agrimonia microcarpa	small-fruited agrimony	—	—	E
Agrimonia striata	woodland agrimony	—	—	E
Arethusa bulbosa	dragon's mouth	—	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

Table 2-1. (contd)

Scientific Name	Common Name	Federal Status[a]	PA Status[a,b]	MD Status[a,c]
Helonias bullata	swamp pink	T	—	E
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; DM = Delisted, monitored for first 5 years
(b) Pennsylvania status as of 11/13/01, (PDCNR 2001)
(c) Maryland status as of 11/13/01, (MDNR 2001)
— = Not listed or protected (or does not occur in the state)

Bald eagles are listed as threatened by the FWS and as endangered by the Pennsylvania Game Commission. There are at least 4 active bald eagle nests within the Pennsylvania portion of Conowingo Pond, with the closest nest to the Peach Bottom site being on Little Bear Island, approximately 5 km (3 mi) upstream (Brauning and Peebles 2001). There are also approximately 6 nests between Conowingo Dam and the Maryland/Pennsylvania border (David Brinker, Md. DNR, Personal communication). The lower Susquehanna River is an important bald eagle area in Pennsylvania, and is one of the few areas in the state where eagles can be observed year round. Recent surveys indicate that as many as 10 to 15 eagles are in the vicinity of the Peach Bottom site during the summer breeding season and up to 20 birds over-winter in the vicinity of the Peach Bottom site (Brauning and Peebles 2001). In especially cold weather, as many as 15 to 20 birds at a time have been observed perched near the Peach Bottom Units 2 and 3 discharge canal, which may be the only nonfrozen part of the river.

The bog turtle is known to occur in York and Lancaster counties, Pennsylvania; Cecil County, Maryland; and New Castle County, Delaware. Exelon commissioned a survey for bog turtle habitat at the Peach Bottom site and along the Peach Bottom-to-Keeney transmission line (Tetra Tech 2000a). This survey conformed to accepted protocol for a Phase 1 survey as described in *Guidelines for Bog Turtle Surveys* (FWS 2000). No areas of suitable bog turtle habitat were identified during these surveys. Although the transmission line traverses a number of streams, most of these are incised channels through upland habitats, without adjacent bogs, swamps, or marshy meadows that constitute the required habitat for bog turtles.

The peregrine falcon was formerly listed as threatened by the FWS, but was removed from the list of endangered and threatened species in 1999 (FWS 1999). Status monitoring of this species will continue through at least 2004. Peregrines are very rare in the vicinity of the Peach Bottom site and only one individual has been observed over-wintering on Conowingo Dam. A historic nest site is located several miles upstream from Peach Bottom site, but has not been occupied in over 100 years.[(a)]

One additional Federally listed species, the swamp pink (*Helonias bullata*) (Federal Threatened, Maryland Endangered, Delaware Conservation Concern) is known to occur in Cecil County, Maryland and New Castle County, Delaware. However, the known populations of swamp pink in these counties are all located along the fall line between the Piedmont and coastal plain ecoregions, which primarily lies south of Interstate 95 in Cecil County and these populations are not located near the Peach Bottom-to-Keeney transmission line.[(b)] The swamp pink was not observed during field surveys of the Peach Bottom-to-Keeney transmission line conducted by the Maryland Department of Natural Resources during the late 1980s or during subsequent evaluations (e.g., MDNR 1998).

The Peach Bottom-to-Keeney transmission line does not cross any Federal or State parks, wildlife refuges, or wildlife management areas. PECO cooperated with the Maryland Nature Conservancy to establish and protect two natural areas crossed by the Peach Bottom-to-Keeney transmission right-of-way. The 42 ha (103-acre) Rock Springs Powerline Natural Area is located near Rock Springs, Maryland, and the 22 ha (55 acre) Richardsmere Powerline Natural Area is located near Richardsmere, Maryland. Both of these natural areas are managed to protect rare plant species (Wiegland 1988a,b; MDNR 1998). The Peach Bottom-to-Keeney Transmission line occupies approximately 30% and 4.5% of the Rock Springs and Richardsmere Natural Areas, respectively.

(a) Personal communication with Dan Brauning, Pennsylvania Game Commission, November 15, 2001.
(b) Personal communication with David Brinker, Maryland Department of Natural Resources, November 30, 2001.

The transmission line right-of-way is maintained by a combination of trimming, mowing, and application of approved herbicides (PECO 2000). Trees are trimmed on a 5-year cycle, with mowing conducted as needed. Herbicides are applied on a 3-year cycle and consist of both broadcast foliar and basal stem treatments. Certified applicators perform this work, and they primarily use non-restricted use herbicides. Hand cutting, instead of herbicide treatments, is generally used in wetlands. Sensitive areas (such as the Rock Springs and Richardsmere Powerline Natural Areas) are marked on maps carried by the maintenance field crews. The applicant supports an ongoing study to determine the effects of various right-of-way maintenance techniques on wildlife (Yahner et al. 2001).

2.2.7 Radiological Impacts

Exelon has conducted a radiological environmental monitoring program (REMP) around the Peach Bottom site since 1974. Through this program, radiological impacts to workers, the public, and the environment are monitored, documented, and compared to the appropriate standards. The objective of the REMP is the following:

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

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

Radiological releases are summarized in the annual reports titled *Annual Radiological Environmental Operating Report Peach Bottom Atomic Power Station Units 2 and 3* (Exelon 2001b) and *Radioactive Effluent Release Report* (Exelon 2001e). The limits for all radiological releases are specified in the Peach Bottom *Offsite Dose Calculation Manual*, and these limits are designed to meet Federal standards and requirements (PECO 2001a). The REMP includes monitoring of the aquatic environment (fish, invertebrates, and shoreline sediment), atmospheric environment (airborne radioiodine, gross beta, and gamma), terrestrial environment (vegetation), and direct radiation.

Review of historical data on releases and the resultant dose calculations revealed that the doses to maximally exposed individuals in the vicinity of Peach Bottom site were a small fraction of the limits specified in the EPA's environmental radiation standards 40 CFR Part 190 as required by 10 CFR 20.1301(d). For 2000, dose estimates were calculated based on actual liquid and gaseous effluent release data (Exelon 2001c). Calculations were performed using the plant effluent release data, onsite meteorological data, and appropriate pathways identified in the ODCM.

During 2000, Peach Bottom Units 2 and 3 did not release any strontium-90 or strontium-89 in the gaseous effluents. Liquid effluents containing radioactive materials, including strontium-90 and strontium-89 were released into the discharge canal. The only time that strontium was released in the liquid effluents was during the third and fourth quarters of 2000. In the third quarter a total of 5.4×10^{-1} MBq (1.46×10^{-5} Ci) of strontium-89 were released. In the fourth quarter the effluents were: 4.3×10^{-3} MBq (1.16×10^{-7} Ci) of strontium-89 and 4.48×10^{-4} MBq (1.21×10^{-8} Ci) of strontium-90. The releases and average diluted concentrations were well below the NRC regulatory limits. The quantities of materials released in all effluents during 2000 are comparable to the quantities released in the past 5 years and is expected to remain similar during the license renewal period.

Exelon performs an assessment of radiation dose to the general public from radioactive effluents, assuming a person was located 400 m (1300 ft) east of the vents (on or near Conowingo Pond) for 10 hours a day, 5 days each week, for 50 weeks of the year, inhaling gaseous effluents from both Peach Bottom Units 2 and 3 (Exelon 2001c). For 2000, the total body dose to this hypothetical person from inhalation was estimated to be 1.08×10^{-3} mSv (1.08×10^{-1} mrem) or 0.02 percent of the annual limit of 5 mSv (500 mrem). For dose due to liquid effluents, Exelon assumes a person is located 460 m (1500 ft) below the discharge canal and stands on the bank of the Conowingo Pond for 67 days per year and is exposed to direct radiation from the cooling canal sediments, which have deposits of radioactive materials from the effluent releases from both Peach Bottom Units 2 and 3.

For 2000, the estimate of dose to a hypothetical person from this shoreline deposition was 3.41×10^{-5} mSv (3.41×10^{-3} mrem) or 0.06 percent of the annual limit of 6.0×10^{-2} mSv (6 mrem). Evaluation of doses from gaseous effluent releases from the two units for the same year resulted in an annual dose due to noble gases of 1.1×10^{-3} mGy (1.1×10^{-1} mrad) for gamma radiation and 6.32×10^{-4} mGy (6.32×10^{-2} mrad) from beta air dose. These are 0.50 percent and 0.16 percent, respectively, of the annual limits (see Section 2.1.4) (Exelon 2001c). These doses, which are representative of the doses from the past 5 years, demonstrate that the impact to the environment from radioactive releases from Peach Bottom Units 2 and 3 is SMALL.[(a)]

The applicant does not anticipate any significant changes to the radioactive effluent releases or exposures from Peach Bottom Units 2 and 3 operations during the renewal period; therefore, the impacts to the environment are not expected to change.

(a) The doses are very small fractions of the 40 CFR Part 190 limits, i.e., annual dose equivalent not to exceed 0.25 mSv (25 mrem) to the whole body, 0.75 mSv (75 mrem) to the thyroid, and 0.25 mSv (25 mrem) to any other organ of any member of the public.

2.2.8 Socioeconomic Factors

The staff reviewed the applicant's environmental report (ER) (Exelon 2001a) and information obtained from several county, city, and economic development staff during a site visit to York County from November 6 through 8, 2001. The following information describes the economy, population, and communities near the Peach Bottom site.

2.2.8.1 Housing

Approximately 1000 employees work at Peach Bottom Units 2 and 3 (about 275 contract employees and approximately 735 permanent employees). Approximately 35 percent of Exelon's employees live in York County, 30 percent live in Lancaster County, 13 percent live in Chester County (mostly on the western edge of the county), 10 percent live in Harford County, Maryland, and the rest live in other locations (see Table 2-3). Table 2-4 presents further breakdown of the residency, by city and county, of 735 permanent employees at Peach Bottom Units 2 and 3. Tables 2-2 and 2-3 do not contain the residences of the contract employees. Location information is not available for contractor employees, but the geographic distribution of their residences is assumed to be similar to that of the permanent employees. Given the predominance of Exelon employees living in York and Lancaster counties and the absence of the liklihood of significant socioeconomic effects in other locations, the focus of the analyses undertaken in this SEIS is on these two counties.

Table 2-2. Peach Bottom Units 2 and 3—Employee and Contract Employee Residence Information by County

County	Number of Personnel	Percent of Total Personnel
York County PA	260	35
Lancaster County PA	223	30
Chester County PA	99	13
Harford County MD	71	10
Subtotal	653	89
Total Permanent Employees	735	100
Contractor Employees	275	—
Total Plant Personnel	1010	—

Source: Exelon 2001d

Table 2-3. Peach Bottom Units 2 and 3—Permanent Employee Residence Information by County and City

County and City[a]	Number of Exelon Personnel	Percent of Exelon Personnel
YORK COUNTY, PA		
South Part of County		
Delta	46	6.3
Airville-Brogue area	38	5.2
Fawn Grove-New Park area	17	2.3
Felton	14	1.9
Stewartstown	10	1.4
Subtotal	125	17.0
North Part of County		
Red Lion	57	7.8
York, Dover, East York, West York	44	6.0
Dallas Town	20	2.7
Subtotal	121	16.5
Total Named Places	246	33.5
Total York County	260	35.4
LANCASTER COUNTY, PA		
South Part of County		
Quarryville	42	5.7
Pequea	14	1.9
Holtwood	11	1.5
Kirkwood	10	1.4
Subtotal	77	10.5
North Part of County		
Lancaster, Roherstown, Landisville, Salunga	48	6.5
Willow Street	33	4.5
Millersville	17	2.3
Subtotal	98	13.3
Named Places	175	23.8
Total Lancaster County	223	30.3

Table 2-3. (contd)

County and City[a]	Number of Exelon Personnel	Percent of Exelon Personnel
CHESTER COUNTY, PA		
Lincoln University	18	2.4
West Chester	12	1.6
Nottingham	11	1.5
Oxford	11	1.5
Total Named Places	52	7.1
Total Chester County	99	13.5
HARFORD COUNTY, MD		
Bel Air	25	3.4
Total Harford County	71	9.7
Other counties	82	11.2
Grand Total	735	100.0

(a) Addresses are for both townships (rural areas) and incorporated cities and towns. Only cities and towns with at least 10 employees are shown.

Source: Exelon 2001d

Exelon refuels each nuclear unit on a 24-month cycle, or about one refueling outage per year for the site. During these refueling outages, site employment increases by as many as 800 temporary workers for 30 to 40 days. Most of these temporary workers are assumed to be located in same geographic areas as the permanent Exelon staff.

Table 2-4 provides the number of housing units and housing unit vacancies for York and Lancaster counties for 1990 and 2000, the latest years for which information is available. Both York County and Lancaster County have urban development boundaries (UDBs) within which development is to take place, but otherwise do not have growth-management controls.

Table 2-4. Housing Units and Housing Units Vacant (Available) by County During 1990 and 2000

	1990	2000	Approximate Percentage Change 1990–2000
YORK COUNTY, PA			
Housing Units	134,761	156,720	16.3
Occupied Units %	95.5	94.6	-1.0
Vacant Units %	4.5	5.4	20.0
LANCASTER COUNTY, PA			
Housing Units	156,462	179,990	15.0
Occupied Units %	96.5	95.9	-0.6
Vacant Units %	3.5	4.1	17.1

(a) USBC 2001b, 2001c

2.2.8.2 Public Services

- **Water Supply**

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 (York County Planning Commission 1998). York County has projected water use through 2010 at roughly 182,500 m^3/day (48 million gpd). In 1996, the average daily use was approximately 121,000 m^3/day (32 million gpd).

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 9 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 (York County Planning Commission 1998). 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 (York County Planning Commission 1998).

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 321,800 m^3/day (85 million gpd). In 1993, average daily consumption was 251,400 m^3/day (66 million gpd). 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 (Lancaster County 1997).

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.

- **Education**

In October 2000, there were 16 school districts in York County with total enrollment of 67,000 students attending York County mainstream public schools. This represents an increase of approximately 1900 students since 1997 (Pennsylvania Department of Education 2001).

Although the region's school districts themselves do not keep track of Peach Bottom employee children, Table 2-5 shows the total average daily attendance for those school districts that likely serve most of these children.

There are 75 elementary schools (including primary learning centers) in York County. In October 2000, these schools (and some middle and intermediate schools with 5th and 6th graders) had an enrollment population of 36,260 in grades 1-6 (Pennsylvania Department of Education 2001).

Table 2-5. School Districts with Significant Numbers of Peach Bottom Site-Related Students

District	City	Current Average Daily Attendance
South Eastern	Delta	3163
Red Lion	Red Lion	5425
York City	York	7589
York Suburban	York	2654
West York Area	York	2999
Central York	York	4145
Lancaster City	Lancaster	11,203
Manheim Township	Lancaster	5011
Conestoga Valley	Lancaster	3590
Solanco	Quarryville	4361

Source: Pennsylvania Department of Education 2001; Action Realty 2001

There are 20 junior high schools, intermediate schools, and middle schools in York County. In October 2000, they had an enrollment of 10,825 7th and 8th graders (Pennsylvania Department of Education 2001).

There are 19 senior high and technical high schools in York County. In October, 2000, the enrollment in the schools numbered 19,941 students in grades 9-12 (Pennsylvania Department of Education 2001)

- **Transportation**

York County is served by Interstate 83 (I-83), which enters the county from the north and ends in downtown Baltimore. The largest capacity highway in the immediate vicinity of the Peach Bottom site is Pennsylvania Highway 74, which is a north-south road. U.S. Highway 30 (U.S. 30) is the major east-west highway that traverses the middle of the county, about 20 miles to the northwest of the Peach Bottom site.

Road access to the Peach Bottom site 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 the Peach Bottom site, 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. 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.

Both York County and Lancaster County are well-served by Class I railroads, but there is no rail service to the Peach Bottom site.

2.2.8.3 Offsite Land Use

Within the Commonwealth of Pennsylvania, counties are the first subdivision of government 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. The area within 10 km (6 mi) of the Peach Bottom site includes parts of York and Lancaster counties in Pennsylvania, and sections of Harford and Cecil counties in Maryland. This section will focus on the Pennsylvania counties of York and Lancaster, because approximately 66 percent of the permanent Peach Bottom site workforce lives in these communities. In York County, there are 72 municipalities (including Peach Bottom Township where the Peach Bottom site is located), and in Lancaster County, there are 60. Both York and Lancaster counties have experienced significant growth in the last decade. 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 as priorities in both plans. In York County, proposed growth areas are identified and development is promoted within the areas. New development beyond growth areas is directed to areas around existing boroughs and villages.

The York County Growth Management Map designates established and interim growth areas, as well as established rural areas. In Lancaster County, the designation 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 and agricultural areas. Delta Borough, with a population of 741 (Pennsylvania State Data Center 2000b) is the municipality nearest to the Peach Bottom site and is located southwest of the site. No major metropolitan areas occur within 10 km (6 mi) of the Peach Bottom site. However, one urban area (Baltimore Metropolitan Statistical Area) with a population of 100,000 or more is approximately 60 km (40 mi) southwest of the site (Exelon 2000a).

York County has a total land area of 236,049 ha (583,040 ac) with the predominant land use being agriculture (63.6 percent), followed by residential (20.5 percent) (York County 2000). Lancaster County covers approximately 245,785 ha (607,360 ac), and, like York County, the predominant land use is agricultural (64.5 percent) with approximately 158,634 ha (392,000 ac) in agricultural land (Rural Pennsylvania 2001)

There are three hydroelectric facilities within 13 km (8 mi) of the Peach Bottom site. The Muddy Run Pumped Storage Hydroelectric Facility is approximately 8 km (5 mi) upstream on the east side of the Susquehanna River; the Holtwood Dam and Hydroelectric Facility is approximately 10 km (6 mi) upstream; and the Conowingo Dam and Hydroelectric Facility is approximately 13 km (8 mi) downstream in Maryland (Exelon 2001a).

No national parks or other Federally reserved areas have been identified within 10 km (6 mi) of the Peach Bottom site; however, two protection areas for management of rare plant species were established by PECO in cooperation with the Maryland Nature Conservancy. The Rock Spring Powerline Natural Area is a 42-ha (103-acre) parcel approximately 11 km (7 mi) southeast of the site near Rock Springs, Maryland, and the Richardsmere Powerline Natural Area near Richardsmere, Maryland is a 22-ha (55-acre) parcel approximately 16 km (10 mi) southeast of the Peach Bottom site (Exelon 2001a).

2.2.8.4 Visual Aesthetics and Noise

The Peach Bottom units, including Units 2 and 3 and supporting structures, can be seen and heard from the Conowingo Pond itself, from the public access boat ramp and picnic areas

immediately upstream of the plant, and from private residences along the shores of Conowingo Pond. The most visible features of the Peach Bottom site structures are the emission stacks from Units 2 and 3, the containment structures, cooling towers, and intake screens. Cliffs rising on the west side of Conowingo Pond, trees, and vegetation shield the main plant structures from view from the west, although the stack and meteorological tower are tall enough to be seen from public roads and rural residences. The Peach Bottom Plant is also visible from the Conowingo Pond at night because of outside lighting used at the Peach Bottom site and lighting used on the Units 2 and 3 emission stacks and the meteorological tower. There is no visible plume from Units 2 and 3 operations because the cooling towers are not normally used.

Noise from the Peach Bottom Units 2 and 3 is noticeable by users of the Conowingo Pond and facilities upstream of the plant. Noise transmission across Conowingo Pond is facilitated by the lack of barriers on the pond. Cliffs, vegetation, and trees largely screen residents living to the west from noise generated by the plant.

2.2.8.5 Demography

Population was estimated from the Peach Bottom site out to a distance of 80 km (50 mi).

Exelon used 1990 census data from the U.S. Census Bureau website (USBC 1999) and geographic information system software (ArcView®) to determine demographic characteristics in the vicinity of the Peach Bottom site. NRC guidance calls for the use of the most recent USBC decennial census data, which in the case of the Peach Bottom site, was the 2000 census (USBC 2001a). The Census Bureau provides updated annual projections, in addition to decennial data, for selected portions of its demographic information. Section 2.11 (Minority and Low-Income Populations) of the environmental report used 1990 minority and low-income population demographic information, because updated projections were not available by census tract. Exelon chose to also use 1990 data in discussing total population, so that the data sets would be consistent throughout its site environmental report. The NRC staff used 2000 census data in this section and in discussing minority populations.

As derived from Census Bureau 2000 information, at least 452,400 people live within 32 km (20 mi) of the Peach Bottom site. Applying the GEIS sparseness measures, Peach Bottom site has a population density of 139 persons/km^2 (360 persons/mi^2) within 32 km (20 mi) and falls into the least sparse category, Category 4 (having greater than or equal to 46 persons/km^2 [120 persons/mi^2] within 32 km [20 mi]). As estimated from Census Bureau 2000 information, at least 5,270,600 people live within 80 km (50 mi) of the Peach Bottom site. This equates to a population density of 258 persons/km^2 (671 persons/mi^2) within 80 km (50 mi). Applying the GEIS proximity measures, the Peach Bottom site is classified as being "in close proximity," Category 4 (having greater than or equal to 73 persons/km^2 [190 persons/mi^2] within 80 km [50 mi]). According to the GEIS sparseness and proximity matrix, Peach Bottom site ranks of

sparseness Category 4 and proximity Category 4 result in the conclusion that the Peach Bottom site is located in a high population area. All or parts of 24 counties are located within 80 km (50 mi) of the Peach Bottom site (Figure 2-1). Of the counties, 10 are in Pennsylvania, 10 are in Maryland, 2 are in Delaware, and 2 are in New Jersey. The Baltimore Metropolitan Statistical area is the largest metropolitan area within 80 km (50 mi) of the Peach Bottom site. Other sizable cities and towns (within 80 km [50 mi]) include Reading, Harrisburg, Chester, Lancaster, and York, Pennsylvania, and Wilmington, Delaware (Environmental Systems Research Institute Undated). Approximately 66 percent of Peach Bottom site 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 those of the Commonwealth of Pennsylvania as a whole. Between 1980 and 1990, the Commonwealth's 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 (Campbell 1997). Projections for the period from 2000 through 2020 show Lancaster and York counties surpassing the Commonwealth's growth rate with population increases of 23 and 9 percent, respectively.

The larger towns nearby the Peach Bottom site include York, 48 km (30 mi) to the northwest; Red Lion, 32 km (20 mi) to the northwest; Quarryville, 16 km (10 mi) to the northeast; and Lancaster, 31 km (19 mi) due north. Between 1990 and 2000, York County experienced a population growth from 339,600 (in 1990) to 381,800 (in 2000), a 12.4 percent increase over the decade (USBC 2001a), while Lancaster County grew from 422,800 to 470,700, an increase of 11.3 percent. The greatest relative population growth within the 80-km (50-mi) radius around the Peach Bottom site between 1990 and 2000 occurred in Carroll County, Maryland, northwest of Baltimore (22.3 percent).

Table 2-6 shows estimated populations and annual growth rates for the two counties with the greatest potential to be affected by license renewal activities.

Table 2-6. 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)USBC 1995
(b) Pennsylvania State Data Center 2000a
(c) Tetra Tech NUS 2000b

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

Table 2-7 presents the population distribution within 80 km (50 mi) of the Peach Bottom site for the year 2000.

Table 2-7. Population Distribution within 80 km (50 mi) of the Peach Bottom Site

0 to 16 km (0 to 10 mi)	16 to 32 km (10 to 20 mi)	32 to 48 km (20 to 30 mi)	48 to 64 km (30 to 40 mi)	64 to 80 km (40 to 50 mi)	Total
43,879	408,481	873,103	2,028,471	1,916,694	5,270,628

Source: USBC 2001

The population centers within the 16-km (10-mi) area are the town of Delta, Peach Bottom Township, Drumore Township (Drumore), and Fulton Township (Wakefield). The populations of these settlements in the year 2000 were 741, 4412, 2114, and 2688, respectively. Most of the new residential development within the 16-km (10-mi) radius has

been in Peach Bottom Township, west of the Peach Bottom site, and south of the Pennsylvania/Maryland border in Harford County.

The county planning departments for York and Lancaster counties project relatively low population growth for Peach Bottom Township in York County, Drumore and Fulton Townships and nearby areas. This area has relatively less growth than other parts of the two counties. There are several residential developments that have started in the vicinity of York, Shewsbury Township, Hanover/Penn, and Fairview /Newberry areas (York County Planning Commission 1995, 1997).

- **Transient Population**

The transient population in the vicinity of the Peach Bottom site can be identified as daily or seasonal. Daily transients are associated with places where a large number of people gather regularly, such as local businesses, industrial facilities, and schools. Table 2-8 presents information on the major employers and number of employees for facilities located within 16 km (10 mi) of the Peach Bottom site.

Table 2-8. Major Employment Facilites Within 16 km (10 mi) of the Peach Bottom Site

Firm	Number of Employees
Cecil County	
Fawn Grove Manufacturing Company	100
H.E. Shallcross and Sons	35
Harford County	
Blue Ridge Flooring Company	65
C.D. Miller	NA
Maryland Green Marble Corporation	16
Maryland Lava Company	70
Miller Chemical and Fertilizer Corporation	21
McMorquodale Color Card Company	22
Maryland Ceramic and Steatite Company	45
Whitefore Packing Company	150
Petti Frocks, Inc., Assoc.	84
R. Roberts and Son	20

Table 2-8. (contd)

Firm	Number of Employees
B.G.S. Jourdan & Sons	55
The Susquehanna Electric Company	65
York County	
Star Printing Company	NA
Weldon Packing Company	NA
Snyder Pacaking Company	100
PECO Energy	64
South Eastern School District (Fawn Grove)	281
Lancaster County	
Pennsylvania Power & Light Company	150

Source: Table 2.2.12 in Peach Bottom Atomic Power Station, Final Safety Analysis Report, Rev. 12 (January 1994)
NA = not available

Seasonal transients result from part-time residents who may reside in southern Pennsylvania during the summer tourist season or pursue recreational activities there throughout the year. Lancaster County, for example, claims 5 million tourists per year. (York County does not have a comparable estimate of the number of visitors. The 1999 Pennsylvania Economic Impact Report [D. K. Shifflet and Associates 2000] estimates visitor spending in York County at $774 million, compared with $1357 million in Lancaster County, indicating about 57 percent as much activity in York County). Conowingo Pond is regularly used for bass fishing tournaments in the spring, summer, and fall. The heated discharge at the Peach Bottom site, which attracts baitfish and game fish in most months of the year, is an especially popular fishing spot in winter. Susquehannock State Park, across the Susquehanna River and upstream from the Peach Bottom site, has drawn nearly 97,000 visitors per year during the years 1999 and 2000.[a]

- **Agricultural Labor**

There are 2200 farms in York County and 5910 in Lancaster County (Pennsylvania Agricultural Statistics Service 2001). The main agricultural crops grown within the 80-km (50-mi) radius of the Peach Bottom site are livestock and dairy, corn, and hay. As a result,

(a) Telephone contact with staff at Gifford Pinchot State Park in Lewisberry, Pennsylvania, January 31, 2002. (Gifford Pinchot staff manage information on Susquehannock State Park.)

around 5900 farm workers are present at some time during the year in Lancaster County (about 3800 for less than 150 days per year) and 2200 in York County (1700 for less than 150 days per year) (USDA 1997a, 1997b). Both counties are entirely within the 80-km (50-mi) circle. Almost all of the laborers on farms in the area are believed to be resident in the area. Migrant labor plays little or no role.

2.2.8.6 Economy

Both Lancaster County and York County have experienced steady growth in population and economic activity during the last decade. Both counties are designated as metropolitan statistical areas, ranking 89th and 108th of the 276 metropolitan statistical areas in the country in 2000 (USBC 2001d), with populations of approximately 423,800 and 339,600, 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 (EDC 2000, Lancaster Chamber of Commerce and Industry 2000, YCEDC 2000).

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) (Lancaster Chamber of Commerce and Industry 2000), with health services as the leading employment group, closely followed by the eating and drinking establishments group (EDC 2000a). The manufacturing sector employs 25.3 percent of the labor force (Lancaster Chamber of Commerce and Industry 2000), with the "production of food and related products" as the major employment group within this category (EDC 2000a). 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 (EDC 2000a). In York County, the manufacturing sector leads employment with 29 percent, followed by services at 23.4 percent (York County Chamber of Commerce and Visitors Bureau, Pennsylvania 2000). There are more than 1000 manufacturing companies that employ nearly 53,000 people (YCEDC 2000), with the industrial machinery and equipment industry group in the lead. The health services industry employs the greatest number of the services' sector groups (Pennsylvania Labor Market Information Database System 2000a).

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 (Pennsylvania Labor Market Information Database System 2000b).

The Peach Bottom Atomic Power Station thus is an important employer, but by no means the most important economic entity in York and Lancaster counties. It ranks 21st on the list of York County's top 100 employers, and employs 1.3% of the 60,000-plus employees working for those 100 employers.

County planning officials expect the future area of growth for York County to be in the north end of the county. The southeast part of the county is expected to remain largely rural because it is largely undeveloped, has relatively little infrastructure and few major highways, and has strong desires for agricultural preservation.

Population in Lancaster County (moderate growth forecast) is projected to increase from approximately 423,000 (1990) to around 684,000 (2035), or approximately 62 percent over the 45-year period. York County population is projected to increase from approximately 340,000 (1990) to around 452,000 (2035), or approximately 33 percent.

Exelon is a significant property taxpayer in York County. Until recently, however, all tax payments went to the Commonwealth of Pennsylvania and then were distributed back to local government units by formula. The year 2000 is the first year when taxes were paid directly to local governments

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 (Noll 2000a). 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 (Baldwin 2000).

Table 2-9 lists annual budget figures for York County, Peach Bottom Township, and the South Eastern School District (in York County) for the years 1996 through 2000. Exelon determined that past tax information would not provide the best assessment of the Peach Bottom site's impact for two reasons. First, there has been 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

were 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. Power generating companies 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 the Peach Bottom site to York County, Peach Bottom Township, and the Southeastern School District had not yet been determined. Until a determination is made, Exelon 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. These figures would constitute a small portion of the operating budgets of the three local government units affected.

Table 2-9. Local Government Budgets and Projected Taxes for Peach Bottom Units 2 and 3

Year	Annual Budget for York County[a]	Annual Budget for Peach Bottom Township[b]	Annual Budget for South Eastern 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
Estimated Year 2000 Peach Bottom property taxes (% of 2000 Budgets)	$151,000 (0.07%)	$30,000 (1.8%)	$840,000 (3.6%) plus $420,000 subject to possible refund (1.8%)

(a) Baldwin 2000
(b) Noll 2000b

2.2.9 Historic and Archaeological Resources

This section discusses the cultural background and the known historic and archaeological resources at the Peach Bottom site and in the surrounding area.

2.2.9.1 Cultural Background

The region around the Peach Bottom site is rich in prehistoric and historic Native American and EuroAmerican cultural resources including over 350 National Register of Historic Places property listings in three counties surrounding the Peach Bottom site (Exelon 2001a). Known examples of older prehistoric sites are rare but Native American archaeological sites that date after 4000 BC are fairly common in the area. The majority of recorded prehistoric archaeological sites were found within the first terraces above the Susquehanna River. In the vicinity of the Peach Bottom site, these terraces are under waters of the Conowingo Pond (which was formed when Conowingo Dam was constructed across the Susquehanna River in 1928) or not present at all within the steeply sloped and modified terrain.

The lower reaches of the Susquehanna River encompass one of the areas in North America longest settled by Europeans. Their occupation began in the Seventeenth Century. Just downstream from Conowingo Pond, the remains of the Susquehanna and Tidewater Canal (1840) are still visible and there are the archaeological remains of Lapidum, a settlement destroyed by the British in the War of 1812.

Early contact with European colonists and events associated with that contact make it difficult to associate present-day tribal groups with the territory in the vicinity of the Peach Bottom site. The contacts led to tribal movements, alliances with either the French or English, armed conflicts, epidemics, shifting inter-tribal confederacies, and eventual removal, or extinction in some cases, as the European expansion took place. The contacts took place so early that the record provides a poor basis for inferences concerning the owners of the land at the time the colonists arrived.

For the Peach Bottom site, the original occupants of the Susquehanna River valley were the Susquehannocks, a confederacy of at least five tribes with more than 20 villages. Adjacent to the Susquehannocks were the Shawnee to the west in Pennsylvania; the Delaware (also known as Lenni-Lenape, as well as the closely related Nanticoke) in southeastern Pennsylvania, New Jersey and Delaware; and the Piscataway (also Canoy) to the south in Maryland. The Susquehannocks suffered the most as a culture and were nearly gone by the early 1700s; by 1763 they were essentially extinct although many remaining individuals had moved to other tribes. Along with the decline of the Susquehannock, other tribes moved into the Susquehanna River valley, including the Shawnee and the Piscataway who spread northward along the river,

establishing a town at the mouth of Canoy Creek in 1718 (near present day Bainbridge upriver from Peach Bottom).

A series of treaties beginning in the 1750s and continuing for the next two or three decades effectively removed tribal entities from the region. The Delaware and Shawnee primarily moved first to the Ohio River Valley and then to Oklahoma and Kansas, respectively, where they exist today.

Today, there are no Federally recognized Indian tribes in Pennsylvania, New Jersey, Delaware, or Maryland. There are three State-recognized remnant groups of the Lenni-Lenape and Nanticoke, and there are two remnant groups of Piscataway who have petitioned the State of Maryland for recognition. Among the reasons the Piscataway desire at least State recognition involves repatriation of nearly 500 Piscataway burials currently held by the Maryland Historical Trust and Smithsonian Institution. One of the Piscataway groups is known as the "Piscataway-Conoy Confederation," a name that at least connotes a historical relationship to the Susquehanna River valley in southern Pennsylvania. Today, the Piscataway (numbering nearly 25,000 individuals) live primarily in southern Maryland.

2.2.9.2 Historic and Archaeological Resources at Peach Bottom Site

In 1972, I. F. Smith, an archaeologist from the William Penn Museum, conducted an evaluation of the Peach Bottom property. Although the extent and methodology of his efforts were limited, the archaeologist concluded that there were no archaeological sites in the areas of Units 2 and 3, and that likely areas for discovery of archaeological resources were no longer intact at the time of his visit (Smith 1972a). Smith stated:

> ...it is the flood plain and terrace that are the most likely areas to find Indian settlements and these are obviously no longer susceptible to investigation at Peach Bottom because they have either been built upon in the past or flooded by the backwaters of Conowingo Dam. (Smith 1972b: USAEC 1973)

No historic architectural, historic landscape, traditional cultural property, or archaeological sites have been recorded on the Peach Bottom site (Exelon 2001a). The applicant's environmental report indicates that no artifacts ever have been found within the Peach Bottom site boundary (Exelon 2001a). The staff did not conduct further historic and archaeological site file searches at record repositories in Pennsylvania, Maryland, and Delaware.

The utility right-of-way that includes the Peach Bottom-to-Keeney, Delaware transmission line crosses part of a feeder canal for the Chesapeake and Delaware Canal system (Griffith 2001). This feeder canal was dug in the early 1800s but never used for its intended purpose to transport agricultural goods (Guider 1974). Completion of a rail line in 1826 eliminated the

need for the canal. The Delaware State Historic Preservation Office recognizes the feeder canal as historically important: it is a rare remnant of the mostly altered canal system and it reflects canal construction techniques of the early Nineteenth Century (Griffith 2001).

The utility right-of-way at the intersection with the feeder canal is approximately 122 m (400 ft) wide. The right-of-way was in place before the Peach Bottom line was added and it presently includes three other overhead transmission lines and at least one underground utility easement. The right-of-way is clear of trees but grass and brush covered. A gravel surfaced utility road meanders through the right-of-way and crosses the remnant trench for the feeder canal underneath the Peach Bottom line.

The old feeder canal alignment remains a visible and well-defined feature along much of its original route through present-day woodlands. It displays less definition and more in-filling as it passes under the transmission right-of-way. The changes under the transmission right-of-way are cumulative effects from a range of human and natural activities that extend back in time to a period well before the addition of the Peach Bottom-to-Keeney, Delaware transmission line to the utility right-of-way.

The New Castle County Natural Resources Conservation Service has aerial photographs of the area of concern in its files. These photographs date to 1937, 1946, 1954, 1961, 1968, 1977, 1982, 1988/89, and 1998. Staff review of these aerial photographs indicates that the feeder canal remained relatively intact until after 1968. At that time, and before 1977, small noticeable changes began to occur: first, a utility road crossed the feeder canal at a new place in the transmission right-of-way and below the present-day Peach Bottom-to-Keeney, Delaware transmission line. Second, a series of accumulative changes began, which continue to the present, resulting in gradual loss of vegetation along the alignment of the canal and a progressive loss of sharpness in the features of the canal as viewed from the air. The loss of distinct edges of the feeder canal may also occur in the wooded areas.

2.2.10 Related Federal Project Activities and Consultations

The staff reviewed the possibility that activities of other Federal agencies might impact the renewal of the OL for Peach Bottom Units 2 and 3. Any such activities could result in cumulative environmental impacts and the possible need for the Federal agency to become a cooperating agency for preparation of the SEIS.

NRC is required under Section 102 of the NEPA to consult with and obtain the comments of any Federal agency that has jurisdiction by law or special expertise with respect to any environmental impact involved. NRC is consulting with the FWS. Consultation correspondence is included in Appendix E.

2.3 References

10 CFR 20. Code of Federal Regulations, Title 10, *Energy*, Part 20, "Standards for Protection Against Radiation."

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

10 CFR 54. Code of Federal Regulations, Title 10, *Energy,* Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

10 CFR 61. Code of Federal Regulations, Title 10, *Energy,* Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste."

10 CFR 71. Code of Federal Regulations, Title 10, *Energy,* Part 71, "Packaging and Transportation of Radioactive Material."

40 CFR 81. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 81, "Designation of Areas for Air Quality Planning Purposes." Available at: http://frwebgate.access.gpo.gov/cgi-bin/multidb.cgi . Accessed December 14, 2001.

40 CFR 190. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations."

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3.0 Environmental Impacts of Refurbishment

Environmental issues associated with refurbishment activities are discussed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996; 1999).[a] The GEIS includes a determination of whether the analysis of the environmental issues could be applied to all plants and whether additional mitigation measures would be warranted. Issues are then assigned a Category 1 or a Category 2 designation. As set forth in the GEIS, Category 1 issues are those that meet all of the following criteria:

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

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

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

For issues that meet the three Category 1 criteria, no additional plant-specific analysis is required unless new and significant information is identified.

Category 2 issues are those that do not meet one or more of the criteria for Category 1 and, therefore, additional plant-specific review of these issues is required.

License renewal actions may require refurbishment activities for the extended plant life. These actions may have an impact on the environment that requires evaluation, depending on the type of action and the plant-specific design. Environmental issues associated with refurbishment that were determined to be Category 1 issues are listed in Table 3-1.

Environmental issues related to refurbishment considered in the GEIS for which these conclusions could not be reached for all plants, or for specific classes of plants, are Category 2 issues. These are listed in Table 3-2.

(a) The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the "GEIS" include the GEIS and its Addendum 1.

Table 3-1. Category 1 Issues for Refurbishment Evaluation

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section
SURFACE-WATER QUALITY, HYDROLOGY, AND USE (FOR ALL PLANTS)	
Impacts of refurbishment on surface-water quality	3.4.1
Impacts of refurbishment on surface-water use	3.4.1
AQUATIC ECOLOGY (FOR ALL PLANTS)	
Refurbishment	3.5
GROUNDWATER USE AND QUALITY	
Impacts of refurbishment on groundwater use and quality	3.4.2
LAND USE	
Onsite land use	3.2
HUMAN HEALTH	
Radiation exposures to the public during refurbishment	3.8.1
Occupational radiation exposures during refurbishment	3.8.2
SOCIOECONOMICS	
Public services: public safety, social services, and tourism and recreation	3.7.4; 3.7.4.3; 3.7.4.4; 3.7.4.6
Aesthetic impacts (refurbishment)	3.7.8

Category 1 and Category 2 issues related to refurbishment that are not applicable to Peach Bottom because they are related to plant design features or site characteristics not found at Peach Bottom are listed in Appendix F.

The potential environmental effects of refurbishment actions would be identified, and the analysis would be summarized within this section, if such actions were planned. Exelon Generation Company, LLC (Exelon) indicated that it has performed an evaluation of structures and components pursuant to 10 CFR 54.21 to identify activities that are necessary to continue operation of Peach Bottom Units 2 and 3 during the requested 20-year period of extended operation. These activities include replacement of certain components as well as new inspection activities and are described in the Environmental Report (ER; Exelon 2001).

Table 3-2. Category 2 Issues for Refurbishment Evaluation

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section	10 CFR 51.53 (c)(3)(ii) Subparagraph
TERRESTRIAL RESOURCES		
Refurbishment impacts	3.6	E
THREATENED OR ENDANGERED SPECIES (FOR ALL PLANTS)		
Threatened or endangered species	3.9	E
AIR QUALITY		
Air quality during refurbishment (nonattainment and maintenance areas)	3.3	F
SOCIOECONOMICS		
Housing impacts	3.7.2	I
Public services: public utilities	3.7.4.5	I
Public services: education (refurbishment)	3.7.4.1	I
Offsite land use (refurbishment)	3.7.5	I
Public services, transportation	3.7.4.2	J
Historic and archaeological resources	3.7.7	K
ENVIRONMENTAL JUSTICE		
Environmental justice	Not addressed[a]	Not addressed[a]

(a) Guidance related to environmental justice was not in place at the time the GEIS and the associated revision to 10 CFR Part 51 were prepared. If a licensee plans to undertake refurbishment activities for license renewal, environmental justice must be addressed in the licensee's environmental report and the staff's environmental impact statement.

However, Exelon stated that the replacement of these components and the additional inspection activities are within the bounds of normal plant component replacement and inspections; therefore, they are not expected to affect the environment outside the bounds of plant operations as evaluated in the final environmental statement (AEC 1973). In addition, Exelon's evaluation of structures and components as required by 10 CFR 54.21 did not identify any major plant refurbishment activities or modifications necessary to support the continued operation of Peach Bottom Units 2 and 3 beyond the end of the existing operating licenses.

Therefore, refurbishment is not considered in this draft Supplemental Environmental Impact Statement.

3.1 References

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

10 CFR 54. Code of Federal Regulations, Title 10, *Energy,* Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

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4.0 Environmental Impacts of Operation

Environmental issues associated with operation of a nuclear power plant during the renewal term are discussed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996; 1999).[a] The GEIS includes a determination of whether the analysis of the environmental issues could be applied to all plants and whether additional mitigation measures would be warranted. Issues are then assigned a Category 1 or a Category 2 designation. As set forth in the GEIS, Category 1 issues are those that meet all of the following criteria:

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

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

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

For issues that meet the three Category 1 criteria, no additional plant-specific analysis is required unless new and significant information is identified.

Category 2 issues are those that do not meet one or more of the criteria for Category 1, and therefore, additional plant-specific review of these issues is required.

This chapter addresses the issues related to operation during the renewal term that are listed in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, and are applicable to the Peach Bottom Units 2 and 3. Section 4.1 addresses issues applicable to the cooling system. Section 4.2 addresses issues related to transmission lines and on-site land use. Section 4.3 addresses the radiological impacts of normal operation. Section 4.4 addresses issues related to the socioeconomic impacts of normal operation during the renewal term. Section 4.5 addresses issues related to groundwater use and quality. Section 4.6 discusses the impacts of renewal-term operations on threatened and endangered species. Section 4.7 addresses new information that was raised during the scoping period. The results of the evaluation of environmental issues related to operation during the renewal term are summarized in

(a) The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the "GEIS" include the GEIS and its Addendum 1.

Section 4.8. Finally, Section 4.9 lists the references for Chapter 4. Category 1 and Category 2 issues that are not applicable to Peach Bottom Units 2 and 3 because they are related to plant design features or site characteristics not found at the Peach Bottom site are listed in Appendix F.

4.1 Cooling System

Category 1 issues in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, that are applicable to Peach Bottom Units 2 and 3 cooling system operation during the renewal term are listed in Table 4-1. Exelon stated in its Environmental Report (ER; Exelon 2001) that it is not aware of any new and significant information associated with the renewal of the Peach Bottom Units 2 and 3 operating licenses (OLs). The staff has not identified any significant new information during its independent review of the Exelon ER (Exelon 2001), the staff's site visit, scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of the issues, the GEIS concluded that the impacts are SMALL, and additional plant-specific mitigation measures beyond those already in place at Peach Bottom Units 2 and 3 are not likely to be sufficiently beneficial to be warranted.

Table 4-1. Category 1 Issues Applicable to the Operation of the Peach Bottom Units 2 and 3 Cooling System During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section
SURFACE WATER QUALITY, HYDROLOGY, AND USE (FOR ALL PLANTS)	
Altered current patterns at intake and discharge structures	4.2.1.2.1
Altered thermal stratification of lakes	4.2.1.2.3; 4.3.2.2
Temperature effects on sediment transport capacity	4.2.4.2.3; 4.3.2.2
Scouring caused by discharged cooling water	4.2.1.2.3
Eutrophication	4.2.1.2.3
Discharge of chlorine or other biocides	4.2.1.2.4; 4.3.2.2
Discharge of sanitary wastes and minor chemical spills	4.2.1.2.4; 4.3.2.2
Discharge of other metals in wastewater	4.2.1.2.4; 4.3.2.2
Water use conflicts (plants with once-through cooling systems)	4.2.1.3; 4.3.2.1

Table 4-1. (contd)

AQUATIC ECOLOGY (FOR ALL PLANTS)	
Accumulation of contaminants in sediments or biota	4.2.1.2.4; 4.3.3; 4.4.3; 4.4.2.2
Entrainment of phytoplankton and zooplankton	4.2.2.1.1; 4.3.3; 4.4.3
Cold shock	4.2.2.1.5; 4.3.3; 4.4.3
Thermal plume barrier to migrating fish	4.2.2.1.6; 4.4.3
Distribution of aquatic organisms	4.2.2.1.6; 4.4.3
Premature emergence of aquatic insects	4.2.2.1.7; 4.4.3
Gas supersaturation (gas bubble disease)	4.2.2.1.8; 4.4.3
Low dissolved oxygen in the discharge	4.2.2.1.9; 4.3.3; 4.4.3
Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	4.2.2.1.10; 4.4.3
Stimulation of nuisance organisms	4.2.2.1.11; 4.4.3
TERRESTRIAL RESOURCES	
Cooling tower impacts on crops and ornamental vegetation	4.3.4
Cooling tower impacts on native plants	4.3.5.1
Bird collisions with cooling towers	4.3.5.2
HUMAN HEALTH	
Microbiological organisms (occupational health)	4.3.6
Noise	4.3.7

A brief description of the staff's review and the GEIS conclusions, as codified in Table B-1, for each of these issues follows:

- Altered current patterns at intake and discharge structures. Based on information in the GEIS, the Commission found that

  > 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.

The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of altered current patterns at intake and discharge structures during the renewal term beyond those discussed in the GEIS.

- Altered thermal stratification of lakes. Based on information in the GEIS, the Commission found that

  > 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.

  The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of altered thermal stratification of lakes during the renewal term beyond those discussed in the GEIS.

- Temperature effects on sediment transport capacity. Based on information in the GEIS, the Commission found that

  > 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.

  The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of temperature effects on sediment transport capacity during the renewal term beyond those discussed in the GEIS.

- Scouring caused by discharged cooling water. Based on information in the GEIS, the Commission found that

  > 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.

The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of scouring caused by discharged cooling water during the renewal term beyond those discussed in the GEIS.

- Eutrophication. Based on information in the GEIS, the Commission found that

> 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.

The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information including plant monitoring data and technical reports. Therefore, the staff concludes that there are no impacts of eutrophication during the renewal term beyond those discussed in the GEIS.

- Discharge of chlorine or other biocides. Based on information in the GEIS, the Commission found that

> Effects are not a concern among regulatory and resource agencies, and are not expected to be a problem during the license renewal term.

The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information including the National Pollutant Discharge Elimination System (NPDES) permit for the Peach Bottom site, plant monitoring data and technical reports. Therefore, the staff concludes that there are no impacts of discharge of chlorine or other biocides during the renewal term beyond those discussed in the GEIS.

- Discharge of sanitary wastes and minor chemical spills. Based on information in the GEIS, the Commission found that

> 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.

The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available

information including the NPDES permit for the Peach Bottom site, plant monitoring data and technical reports. Therefore, the staff concludes that there are no impacts of discharges of sanitary wastes and minor chemical spills during the renewal term beyond those discussed in the GEIS.

- Discharge of other metals in wastewater. Based on information in the GEIS, the Commission found that

> 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.

The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information including the NPDES permit for the Peach Bottom site, plant monitoring data and technical reports. Therefore, the staff concludes that there are no impacts of discharges of other metals in wastewater during the renewal term beyond those discussed in the GEIS.

- Water-use conflicts (plants with once-through cooling systems). Based on information in the GEIS, the Commission found that

> These conflicts have not been found to be a problem at operating nuclear power plants with once-through heat dissipation systems.

The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of water use conflicts associated with the once-through cooling system during the renewal term beyond those discussed in the GEIS.

- Accumulation of contaminants in sediments or biota. Based on information in the GEIS, the Commission found that

> 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.

The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of available information. Therefore, the staff concludes that there are no impacts of accumulation of contaminants in sediments or biota during the renewal term beyond those discussed in the GEIS.

- Entrainment of phytoplankton and zooplankton. Based on information in the GEIS, the Commission found that

  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.

  The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of entrainment of phytoplankton and zooplankton during the renewal term beyond those discussed in the GEIS.

- Cold shock. Based on information in the GEIS, the Commission found that

  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.

  The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of cold shock during the renewal term beyond those discussed in the GEIS.

- Thermal plume barrier to migrating fish. Based on information in the GEIS, the Commission found that

  > 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.

  The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of thermal plume barriers to migrating fish during the renewal term beyond those discussed in the GEIS.

- Distribution of aquatic organisms. Based on information in the GEIS, the Commission found that

  > Thermal discharge may have localized effects but is not expected to effect the larger geographical distribution of aquatic organisms.

  The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts on the distribution of aquatic organisms during the renewal term beyond those discussed in the GEIS.

- Premature emergence of aquatic insects. Based on information in the GEIS, the Commission found that

  > 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.

  The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of premature emergence of aquatic insects during the renewal term beyond those discussed in the GEIS.

- Gas supersaturation (gas bubble disease). Based on information in the GEIS, the Commission found that

> 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.

The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of gas supersaturation during the renewal term beyond those discussed in the GEIS.

- Low dissolved oxygen in the discharge. Based on information in the GEIS, the Commission found that

> 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.

The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of low dissolved oxygen during the renewal term beyond those discussed in the GEIS.

- Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses. Based on information in the GEIS, the Commission found that

> 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.

The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of losses from

predation, parasitism, and disease among organisms exposed to sublethal stresses during the renewal term beyond those discussed in the GEIS.

- Stimulation of nuisance organisms. Based on information in the GEIS, the Commission found that

> 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.

The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of stimulation of nuisance organisms during the renewal term beyond those discussed in the GEIS.

- Cooling tower impacts on crops and ornamental vegetation. Based on information in the GEIS, the Commission found that

> 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 renewal term.

The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no cooling tower impacts on crops and ornamental vegetation during the renewal term beyond those discussed in the GEIS.

- Cooling tower impacts on native plants. Based on information in the GEIS, the Commission found that

> 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.

The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no cooling tower impacts on native plants during the renewal term beyond those discussed in the GEIS.

- Bird collisions with cooling towers. Based on information in the GEIS, the Commission found that

> These collisions have not been found to be a problem at operating nuclear power plants and are not expected to be a problem during the license renewal term.

The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of bird collisions with cooling towers during the renewal term beyond those discussed in the GEIS.

- Microbiological organisms (occupational health). Based on information in the GEIS, the Commission found that

> Occupational health impacts are expected to be controlled by continued application of accepted industrial hygiene practices to minimize worker exposures.

The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of microbiological organisms on occupational health during the renewal term beyond those discussed in the GEIS.

- Noise. Based on information in the GEIS, the Commission found that

> 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.

The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of noise during the renewal term beyond those discussed in the GEIS.

The Category 2 issues related to cooling system operation during the renewal term that are applicable to Peach Bottom Units 2 and 3 are discussed in the section that follows, and are listed in Table 4-2.

4.1.1 Water Use Conflicts (Plants With Cooling Ponds or Cooling Towers Using Make-Up Water From a Small River With Low Flow)

Water use conflicts for plants with cooling ponds or cooling towers using make-up water from a small river with low flow is a Category 2 issue, requiring a site-specific assessment before license renewal.

The staff independently reviewed the Peach Bottom Atomic Power Station ER (Exelon 2001), visited the site, and reviewed the applicant's NPDES Permit issued by the Commonwealth of Pennsylvania (PA0009733, that expires on December 1, 2005).

Table 4-2. Category 2 Issues Applicable to the Operation of the Peach Bottom Units 2 and 3 Cooling System During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
SURFACE WATER QUALITY, HYDROLOGY, AND USE (FOR ALL PLANTS)			
Water use conflicts (plants with cooling ponds or cooling towers using make-up water from a small river with low flow)	4.3.2.1	A	4.1.1
AQUATIC ECOLOGY (FOR PLANTS WITH ONCE-THROUGH AND COOLING POND HEAT-DISSIPATION SYSTEMS)			
Entrainment of fish and shellfish in early life stages	4.2.2.1.2; 4.3.3	B	4.1.2
Impingement of fish and shellfish	4.2.2.1.3; 4.3.3	B	4.1.3
Heat shock	4.2.2.1.4; 4.3.3	B	4.1.4
HUMAN HEALTH			
Microbiological organisms (public health)(plants using lakes or canals, or cooling towers or cooling ponds that discharge into a small river)	4.3.6	G	4.1.5

Surface water withdrawals may impact riparian and in-stream habitat. Section 2.2.2 describes Peach Bottom site surface water withdrawals from Conowingo Pond.

The impact of consumptive loss on the downstream riparian communities is associated with the difference it could potentially cause in river surface elevation. As described in Section 2.1.3, Peach Bottom Units 2 and 3 normally operate as once-through plants. As necessary, 60 percent of the circulating water can also be diverted to three mechanical-draft helper cooling towers for additional cooling before discharging to the discharge canal. If the three helper cooling towers were operated, approximately 0.16 to 0.62 m^3/s (5.5 to 22 cfs) would be lost to evaporation (Section 316(a) Demonstration Report, July 1975). During a 50-year period, the minimum monthly average flow was 42.5 m^3/s (1500 cfs). The consumptive loss incurred by plant operation of the helper cooling towers has the greatest effect on surface elevation during low-flow periods. At the minimum monthly average flow, evaporative loss due to operation of the helper cooling towers would represent less than 2 percent of the river's flow.

The staff reviewed the Clean Water Act 316(a) demonstration for Peach Bottom Units 2 and 3 and the ER relative to potential water-use conflicts due to consumptive loss of stream flow from the helper cooling towers usage. Based on this review, the staff has concluded that the potential impacts are SMALL, and further mitigation is not warranted.

4.1.2 Entrainment of Fish and Shellfish in Early Life Stages

For plants with once-through cooling systems, entrainment of fish and shellfish in early life stages into cooling water systems associated with nuclear power plants is considered a Category 2 issue, requiring a site-specific assessment before license renewal.

The staff independently reviewed the Peach Bottom Atomic Power Station ER (Exelon 2001), visited the site, and reviewed the applicant's NPDES Permit.

Section 316(b) of the Clean Water Act (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 NPDES Permit PA00097733, issued December 31, 1976, and revised April 11,

1977 (PECO 1977). 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 Peach Bottom Units 2 and 3 operation. The 316(b) Demonstration concluded that: "the intake structure at Peach Bottom reflects the best technology available for minimizing adverse environmental effects" (PECO 1977). Subsequent NPDES permits have required no further entrainment studies. In compliance with the provisions of the Clean Water Act and Pennsylvania's Clean Streams Law, Pennsylvania issued the current NPDES permit.

Section 2.2.5 discusses the efforts of State and Federal agencies to restore anadromous fish populations in the Susquehanna River. Exelon and other operators of hydroelectric facilities on the lower Susquehanna fund this activity. 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 are upstream of the Holtwood, Safe Harbor, and York Haven hydroelectric dams and the Peach Bottom site (Figure 2-1). Larval shad grow quickly and develop into 10- to 15-cm (4- to 6-in.) 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 en route to the Chesapeake Bay. These juvenile shad and herring are too large to be entrained in the condenser cooling water at Peach Bottom Units 2 and 3 (Susquehanna River Anadromous Fish Restoration Cooperative 1997, 1998, 1999, 2000).

The staff has reviewed the available information and based on the results of entrainment studies and the operating history of the Peach Bottom Units 2 and 3 intake structure, concludes that the potential impacts of entrainment of fish and shellfish in the early life stages in the cooling water intake system are SMALL. During the course of the SEIS preparation, the staff considered mitigation measures for the continued operation of Peach Bottom Units 2 and 3. When continued operation for an additional 20 years is considered as a whole, all of the specific effects on the environment (whether or not "significant") were considered. Based on the assessment to date, the staff expects that the measures in place at Peach Bottom Units 2 and 3 (e.g., intake screens) provide mitigation for all impacts related to entrainment and no further mitigation measures are warranted.

4.1.3 Impingement of Fish and Shellfish

For plants with once-through cooling systems, impingement of fish and shellfish on debris screens of cooling water systems associated with nuclear power plants is considered a Category 2 issue, requiring a site-specific assessment before license renewal.

The staff independently reviewed the Peach Bottom Units 2 and 3 ER (Exelon 2001), visited the site, and reviewed the applicant's NPDES Permit.

Section 316(b) of the Clean Water Act (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). The designed operation criteria are maintained in part by removal of sediments that are deposited in the canal. Maintenance of the designed depth for the intake canal helps ensure that approach velocities at the screens meet criteria. Impingement on debris screens of the cooling system of fish and shellfish is a potential adverse environmental impact that can be minimized by the best available technology. Exelon (as PECO) submitted a 316(b) Demonstration to the EPA in June 1977 in accordance with the "Special Conditions: Environmental Studies" provision of NPDES Permit PA00097733, issued December 31, 1976, and revised April 11, 1977 (PECO 1977). 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 Peach Bottom Units 2 and 3 operation. The 316(b) Demonstration concluded that: "the intake structure at Peach Bottom reflects the best technology available for minimizing adverse environmental effects" (Philadelphia Electric Company 1977). Subsequent NPDES permits have required no further impingement studies. In compliance with the provisions of the Clean Water Act and Pennsylvania's Clean Streams Law, Pennsylvania issued the current NPDES permit.

Since 1985, Exelon has conducted studies at the Peach Bottom site 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 upstream of 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 (Pennsylvania Fish & Boat Commission 2000). During 1999, approximately 95 percent of the juveniles examined at the Peach Bottom site were produced in hatcheries (Susquehanna River Anadromous Fish Restoration Cooperative 2000). During 1999, intake screens at Peach Bottom Units 2 and 3 were examined three times weekly from October 18 through December 20 (23 sample dates). More than 5000 fish were impinged, including 285 juvenile

(young-of-the-year) American shad, 112 juvenile blueback herring, and 2 adult blueback herring (Susquehanna River Anadromous Fish Restoration Cooperative 2000).

Numbers of American shad impinged during 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 (14.4 million fry were stocked during 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 during 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 (Susquehanna River Anadromous Fish Restoration Cooperative 2000). 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 Peach Bottom Units 2 and 3 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 Peach Bottom Units 2 and 3 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.

The staff has reviewed the available information and based on the results of impingement studies and the operating history of the Peach Bottom Units 2 and 3 intake structure, concludes that the potential impacts of impingement of fish and shellfish the on debris screens of the cooling water intake system are SMALL. During the course of the SEIS preparation, the staff considered mitigation measures for the continued operation of Peach Bottom Units 2 and 3. When continued operation for an additional 20 years is considered as a whole, all of the specific effects on the environment (whether or not "significant") were considered. Based on the assessment to date, the staff expects that the measures in place at Peach Bottom Units 2 and 3 (e.g., intake screens and the waste heat treatment facility) provide mitigation for all impacts related to impingement and no further mitigation measures are warranted.

4.1.4 Heat Shock

For plants with once-through cooling systems, the effects of heat shock are listed as a Category 2 issue and require plant-specific evaluation before license renewal. 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 (NRC 1996).

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.

The staff independently reviewed the Peach Bottom Peach Bottom Units 2 and 3 ER (Exelon 2001), visited the site, and reviewed the applicant's NPDES Permit.

Peach Bottom Units 2 and 3 use a once-through heat dissipation system. Exelon also has Section 316(a) alternative thermal effluent limits. Five mechanical draft ("helper") cooling towers were built on berms adjacent to the discharge canal to supply additional cooling capacity in summer months, but in recent years these cooling towers have not been necessary. 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). Exelon (as PECO) submitted a CWA Section 316(a) demonstration for Peach Bottom Units 2 and 3 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 Peach Bottom Units 2 and 3 have a 316(a) alternative thermal effluent limit, no further assessment is required.

The staff has reviewed the available information and, on the basis of the conditions of the NPDES permit and the operating history of the Peach Bottom Units 2 and 3 discharge, concludes that the potential impacts of discharging heated water from the cooling water intake system are SMALL. During the course of the SEIS preparation, the staff considered mitigation measures for the continued operation of Peach Bottom Units 2 and 3. When continued operation for an additional 20 years is considered as a whole, all of the specific effects on the environment (whether or not "significant") were considered. Based on the assessment to date, the staff expects that the measures in place at Peach Bottom Units 2 and 3 (e.g., intake screens) provide mitigation for all impacts related to heat shock and no further mitigation measures are warranted.

4.1.5 Microbiological Organisms (Public Health)

For plants discharging cooling water to cooling ponds, lakes, canals, or small rivers, the effects of microbiological organisms on human health are listed as a Category 2 issue and require plant-specific evaluation before license renewal. The Category 2 designation is based on the magnitude of the potential public health impacts associated with thermal enhancement of *Naegleria fowleri* (a pathogenic amoeba) that could not be determined generically. NRC noted that impacts of nuclear plant cooling towers and thermal discharges are considered to be of

small significance if they do not enhance the presence of microorganisms that are detrimental to water quality and public health (NRC 1999). The assessment criteria relate to thermal discharge temperature, thermal characteristics, thermal conditions for the enhancement of *N. fowleri*, and impact to public health.

The staff independently reviewed the Peach Bottom Units 2 and 3 ER (Exelon 2001), visited the site, and reviewed the applicant's NPDES Permit.

Peach Bottom Units 2 and 3 use a once-through cooling water system that withdraws from and discharges to Conowingo Pond. Five mechanical draft ("helper") cooling towers were built on berms adjacent to the discharge canal to supply additional cooling capacity in summer months, but in recent years these cooling towers have not been necessary. Discharge limits and monitoring requirements for Peach Bottom Units 2 and 3 are set forth in the applicant's NPDES Permit. The NPDES permit states that "the permittee shall provide for effective disinfection of this discharge to control disease-producing organisms during the swimming season (May 1 through September 30) to achieve a fecal coliform concentration not greater than 200/100 ml geometric average, and not greater than 1000/100 ml in more than 10% of the samples tested" [Part C(I)(E)].

The discharge temperatures from Peach Bottom Units 2 and 3, which do not exceed 43.3 °C (110 °F) in late summer, are below those known to be conducive to growth and survival of thermophilic pathogens. Further, disinfection of the sewage effluent from the Peach Bottom site reduces the likelihood that a seed source or inoculants would be introduced to the station's heated discharge or Conowingo Pond.

The staff has reviewed the thermal characteristics of the Conowingo Pond and the Peach Bottom Units 2 and 3 discharge. The staff does not expect power plant operations to stimulate growth and reproduction of pathogenic microbiological organisms in Conowingo Pond downstream of the plant. Under certain circumstances, the organisms might be present in the immediate area of the discharge outfall but would not be expected in sufficient concentrations to pose a threat to downstream water users. Many of these pathogenic microbiological organisms are ubiquitous in nature, occurring in the digestive tracts of wild mammals and birds, but are usually only a problem when the host is immunologically compromised. The thermal characteristics of the Peach Bottom Units 2 and 3 discharge would not promote the growth of microbiological organisms that are detrimental to water and public health. The staff does not expect operations of Peach Bottom Units 2 and 3 or cooling systems to change significantly over the license renewal term, and there is no reason to believe that discharge temperatures will increase or that disinfection would cease. Thus, the staff concludes that potential effects of microbiological organisms on human health resulting for the operation of the plant's cooling

water discharge to the aquatic environment on or in the vicinity of the site are SMALL. The staff also concludes that the mitigation in place at the Peach Bottom site, that is management of the discharge temperatures into Conowingo Pond and sewage treatment, will control any potential growth of thermophilic microbological organisms and further mitigation is not warranted.

4.2 Transmission Lines

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 that are applicable to the transmission line from Peach Bottom Units 2 and 3 are listed in Table 4-3. Exelon stated in its ER that it is not aware of any new and significant information associated with the renewal of the Peach Bottom Units 2 and 3 OLs. The staff has not identified any significant new information during its independent review of the Exelon ER (Exelon 2001), the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of those issues, the staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

Table 4-3. Category 1 Issues Applicable to Transmission Lines During the Renewal Term

ISSUE -- 10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section
TERRESTRIAL RESOURCES	
Power line right-of-way management (cutting and herbicide application)	4.5.6.1
Bird collisions with power lines	4.5.6.2
Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)	4.5.6.3
Floodplains and wetland on power line right-of-way	4.5.7
AIR QUALITY	
Air quality effects of transmission lines	4.5.2
LAND USE	
Onsite land use	4.5.3
Power line right-of-way	4.5.3

A brief description of the staff's review and GEIS conclusions, as codified in Table B-1 of the GEIS, for each of these issues follows:

- Power line right-of-way management (cutting and herbicide application). Based on information in the GEIS, the Commission found that

> The impacts of right-of-way maintenance on wildlife are expected to be of small significance at all sites.

The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, and consultation with the U.S. Fish and Wildlife Service (FWS), or its evaluation of other information. Therefore, the staff concludes that there are no impacts of power line right-of-way management during the renewal term beyond those discussed in the GEIS.

- Bird collisions with power lines. Based on information in the GEIS, the Commission found that

> Impacts are expected to be of small significance at all sites.

The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, consultation with FWS, or its evaluation of other information. Therefore, the staff concludes that there are no impacts of bird collisions with power lines during the renewal term beyond those discussed in the GEIS.

- Impacts of electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock). Based on information in the GEIS, the Commission found that

> 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.

The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other information. Therefore, the staff concludes that there are no impacts of electromagnetic fields on flora and fauna during the renewal term beyond those discussed in the GEIS.

- Flood plains and wetlands on power line right-of-way. Based on information in the GEIS, the Commission found that

> 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.

The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, consultation with FWS, or its evaluation of other information. Therefore, the staff concludes that there are no impacts of power line rights-of-way on floodplains and wetlands during the renewal term beyond those discussed in the GEIS.

- Air-quality effects of transmission lines. Based on the information in the GEIS, the Commission found that

> Production of ozone and oxides of nitrogen is insignificant and does not contribute measurably to ambient levels of these gases.

The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other information. Therefore, the staff concludes that there are no air quality impacts of transmission lines during the renewal term beyond those discussed in the GEIS.

- Onsite land use. Based on the information in the GEIS, the Commission found that

> Projected onsite land use changes required during the renewal period would be a small fraction of any nuclear power plant site and would involve land that is controlled by the applicant.

The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other information. Therefore, the staff concludes that there are no onsite land use impacts during the renewal term beyond those discussed in the GEIS.

- Power line right-of-way (land use). Based on information in the GEIS, the Commission found that

> Ongoing use of power line right of ways would continue with no change in restrictions. The effects of these restrictions are of small significance.

The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other information. Therefore, the staff concludes that there are no impacts of power line rights-of-way on land use during the renewal term beyond those discussed in the GEIS.

There is one Category 2 issue and one uncategorized issue related to transmission lines. These issues are listed in Table 4-4 and are discussed in Sections 4.2.1 and 4.2.2.

Table 4-4. Category 2 and Uncategorized Issues Applicable to Transmission Lines During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
HUMAN HEALTH			
Electromagnetic fields, acute effects (electric shock)	4.5.4.1	H	4.2.1
Electromagnetic fields, chronic effects	4.5.4.2	NA	4.2.2

4.2.1 Electromagnetic Fields—Acute Effects

In the GEIS (NRC 1996), the staff found that without a review of the conformance of each nuclear plant transmission line with National Electrical Safety Code (NESC 1997) criteria, it was not possible to determine the significance of the electric shock potential. Evaluation of individual plant transmission lines is necessary because the issue of electric shock safety was not addressed in the licensing process for some plants. For other plants, land use in the vicinity of transmission lines may have changed, or power distribution companies may have chosen to upgrade line voltage. To comply with 10 CFR 51.53(c)(3)(ii)(H), the applicant must provide an assessment of the potential shock hazard if the transmission lines that were constructed for the specific purpose of connecting the plant to the transmission system do not meet the recommendations of the NESC for preventing electric shock from induced currents. In the case

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

There is one 500-kV transmission line that connects the Peach Bottom switchyard to the Keeney substation. This line was constructed before the current (1997) NESC standard was adopted. Another line, a 230-kV line, shares the corridor for approximately 19 km (12 miles), from Colora to the Cecil substations. Exelon performed an analysis to confirm that the transmission lines conform to the current NESC clearance requirements for limiting electric shock hazard. The NESC requires that transmission lines be designed to limit the steady-state current due to electrostatic effects to 5 mA root mean square (rms).

Calculations were performed to estimate the electrostatic effects (induced effects) based on the strength of the electrostatic field , which, in turn, depends on the voltage of the transmission line. The calculations were based on scaling factors from other induced current calculations, which were applied to the electric field strengths to obtain the current (Tetra Tech NUS 2000). It was assumed that a large tractor-trailer (55-ft long by 8-ft wide and 11.8 ft average height) is located directly under the transmission line. Scaling factors for tractor-trailers in the other induced current calculations ranged from 0.65 to 0.92 (mA-m/kV). An average scaling factor of 0.80 mA-m/kV was used. For comparison the scaling factor in the EPRI Handbook, Table 8.8.3, for a truck (52-ft-long by 8-ft-wide by 12-ft-tall) is 0.64. Hence the analysis is conservative. The maximum line voltage for the 500-kV line is 525 kV, and for the 230-kV line is 241.5 kV. Based on these maximum field strengths the tractor-trailer would experience a field-strength of 6.22 kV/m, resulting in an induced current of 4.98 mA.

The maximum steady state short-circuit currents determined by Exelon both onsite and offsite are within the NESC limit of 5 mA. Therefore, the staff concludes that the impact of the potential for electric shock is SMALL, and further mitigation is not warranted.

4.2.2 Electromagnetic Fields—Chronic Effects

In the GEIS, the chronic effects of 60-Hz electromagnetic fields from power lines were not designated as Category 1 or 2, and will not be until a scientific consensus is reached on the health implications of these fields.

The potential for chronic effects from these fields continues to be studied and is not known at this time. The National Institute of Environmental Health Sciences (NIEHS) directs related research through the U.S. Department of Energy (DOE). A recent report (NIEHS 1999) contains the following conclusion:

> The NIEHS concludes that ELF-EMF [extremely low frequency-electromagnetic field] exposure cannot be recognized as entirely safe because of weak scientific evidence that exposure may pose a leukemia hazard. In our opinion, this finding is insufficient to warrant aggressive regulatory concern. However, because virtually everyone in the United States uses electricity and therefore is routinely exposed to ELF-EMF, passive regulatory action is warranted such as a continued emphasis on educating both the public and the regulated community on means aimed at reducing exposures. The NIEHS does not believe that other cancers or non-cancer health outcomes provide sufficient evidence of a risk to currently warrant concern.

This statement is not sufficient to cause the staff to change its position with respect to the chronic effects of electromagnetic fields. The staff considers the GEIS finding of "not applicable" still appropriate and will continue to follow developments on this issue.

4.3 Radiological Impacts of Normal Operations

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 that are applicable to Peach Bottom Units 2 and 3 in regard to radiological impacts are listed in Table 4-5. Exelon stated in its ER (Exelon 2001) that it is not aware of any new and significant information associated with the renewal of the Peach Bottom Units 2 and 3 OLs.

Table 4-5. Category 1 Issues Applicable to Radiological Impacts of Normal Operations During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section
HUMAN HEALTH	
Radiation exposures to public (license renewal term)	4.6.2
Occupational radiation exposures (license renewal term)	4.6.3

The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other information. Therefore, the staff concludes that there are no impacts related to these issues beyond those

discussed in the GEIS. For all of those issues, the the staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

A brief description of the staffs review and the GEIS conclusions, as codified in Table B-1, for each of these issues follows:

- Radiation exposures to public (license renewal term). Based on information in the GEIS, the Commission found that

  > Radiation doses to the public will continue at current levels associated with normal operations.

  The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of radiation exposures to the public during the renewal term beyond those discussed in the GEIS.

- Occupational radiation exposures (license renewal term). Based on information in the GEIS, the Commission found that

  > 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.

  The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of occupational radiation exposures during the renewal term beyond those discussed in the GEIS.

There are no Category 2 issues related to radiological impacts of routine operations.

4.4 Socioeconomic Impacts of Plant Operations During the License Renewal Period

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 that are applicable to socioeconomic impacts during the renewal term are listed in Table 4-6. Exelon (formerly PECO) stated in its ER (Exelon 2001) that it is not aware of any new and significant information associated with the renewal of Peach Bottom Units 2 and 3 OLs. The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other information. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS (NRC 1996). For these issues, the staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

Table 4-6. Category 1 Issues Applicable to Socioeconomics During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section
SOCIOECONOMICS	
Public services: public safety, social services, and tourism and recreation	4.7.3; 4.7.3.3; 4.7.3.4; 4.7.3.6
Public services: education (license renewal term)	4.7.3.1
Aesthetic impacts (license renewal term)	4.7.6
Aesthetic impacts of transmission lines (license renewal term)	4.5.8

A brief description of the staff's review and the GEIS conclusions, as codified in Table B-1, for each of these issues follows:

- Public services: public safety, social services, and tourism and recreation. Based on information in the GEIS, the Commission found that

  > Impacts to public safety, social services, and tourism and recreation are expected to be of small significance at all sites.

  The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts on public safety,

social services, and tourism and recreation during the renewal term beyond those discussed in the GEIS.

- Public services: education (license renewal term). Based on information in the GEIS, the Commission found that

  Only impacts of small significance are expected.

  The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts on education during the renewal term beyond those discussed in the GEIS.

- Aesthetic impacts (license renewal term). Based on information in the GEIS, the Commission found that

  No significant impacts are expected during the license renewal term.

  The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no aesthetic impacts during the renewal term beyond those discussed in the GEIS.

- Aesthetic impacts of transmission lines (license renewal term). Based on information in the GEIS, the Commission found that

  No significant impacts are expected during the license renewal term.

  The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no aesthetic impacts of transmission lines during the renewal term beyond those discussed in the GEIS.

Table 4-7 lists the Category 2 socioeconomic issues, which require plant-specific analysis and environmental justice, which was not addressed in the GEIS.

Table 4-7. Environmental Justice and GEIS Category 2 Issues Applicable to Socioeconomics During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
SOCIOECONOMICS			
Housing impacts	4.7.1	I	4.4.1
Public services: public utilities	4.7.3.5	I	4.4.2
Offsite land use (license renewal term)	4.7.4	I	4.4.3
Public Services, transportation	4.7.3.2	J	4.4.4
Historic and archaeological resources	4.7.7	K	4.4.5
Environmental Justice	Not addressed[(a)]	Not addressed[(a)]	4.4.6

(a) Guidance related to environmental justice was not in place at the time the GEIS and the associated revision to 10 CFR Part 51 were prepared. Therefore, environmental justice must be addressed in the licensee's environmental report and the staff's environmental impact statement.

4.4.1 Housing Impacts During Operations

In determining housing impacts, the applicant chose to follow Appendix C of the GEIS (NRC 1996), which presents a population characterization method that is based on two factors, "sparseness" and "proximity" (GEIS Section C.1.4 [NRC 1996; 1999]). Sparseness measures population density within 32 km (20 mi) of the site, and proximity measures population density and city size within 80 km (50 mi). Each factor has categories of density and size (GEIS Table C.1), and a matrix is used to rank the population category as low, medium, or high (GEIS Figure C.1).

In 1990, the population living within 32 km (20 mi) of Peach Bottom Units 2 and 3 was estimated to be approximately 481,900 (Exelon 2001, Table G.2-2). This translates to around 150 persons/km^2 (383persons/mi^2) living on the land area present within a 32-km (20-mi) radius of the Peach Bottom site. This concentration falls into the GEIS sparseness Category 4 (i.e., having greater than or equal to 46 persons/km^2 [120 persons/mi^2]). These calculations were redone using the 2000 Census of Population, finer geographic detail, and a more conservative rule, which counted only those Census block groups contained entirely within the 32-km (20-mi) circle. This produced an estimate of at least 452,400, or 139 persons/km^2 (360 persons/mi^2), still GEIS sparseness category 4.

The proximity score also was recalculated by the NRC staff using the 2000 Census. The conservative estimate using the 2000 Census was about 5.3 million, or 260 persons/km^2 (670 persons/mi^2), well within proximity Category 4. Applying the GEIS proximity measures (NRC 1996; 1999), Peach Bottom Units 2 and 3 are classified as Category 4 (i.e., having greater than or equal to 73 persons/km^2 [190 persons/mi^2]) within 80 km (50 mi) of the site. According to the GEIS, these sparseness and proximity scores identify the nuclear units as being located in a high-population area.

In 10 CFR Part 51, Subpart A, Appendix B, Table B-1, NRC concluded that impacts on housing availability are expected to be of small significance at plants located in a high-population area where growth-control measures are not in effect. The Peach Bottom site is located in a high-population area, and although both York County and Lancaster County and their municipal and township governmental units attempt to direct growth to maintain the rural character of the southern parts of the counties (Lancaster County Planning Commission 1997, Lancaster County [PA] Planning Commission 1999, York County Planning Commission 1997, York County Department of Planning and Zoning 2000), these growth-control measures would not limit the relatively small amount of additional housing that might be required. Based on the NRC criteria, Exelon expects housing impacts to be SMALL during continued operations (Exelon 2001).

SMALL 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 is required to meet new demand (NRC 1996). The GEIS assumes that no more than a total additional staff of 60 permanent workers might be needed at both units together during the license renewal period to perform routine maintenance and other activities. Although Exelon expects to perform these routine activities during scheduled outages, they assumed they would not add more than 60 total employees to their permanent staff during license renewal (Exelon 2001). This addition of 60 permanent workers, plus 81 indirect jobs (Exelon 2001), would result in an increased demand for a total of 141 housing units around the Peach Bottom site (or 93 housing units for York and Lancaster Counties).[(a)] The demand for the existing housing units could be met with the construction of new housing or use of existing, unoccupied housing. In York and Lancaster Counties, nonagricultural employment was approximately 398,000 in 2000 (Commonwealth of Pennsylvania Department of Labor and Industry Center for Workforce Information and Analysis 2001) and the population at around 870,000 in 2000 (Exelon 2001). Even if the increase in projected housing units were concentrated in the rural southern parts of York and Lancaster counties, it would not create a discernible change in housing availability, change in rental rates or housing values, or spur

(a) This assumes 66 percent of the new hires reside in the two counties (see Section 2.2.8.1).

much new construction or conversion. As a result, Exelon concludes that the impacts would be SMALL and mitigation measures would not be necessary (Exelon 2001).[a]

The staff reviewed the available information relative to housing impacts and Exelon's conclusions. Based on this review, the staff concludes that the impact on housing during the license renewal period would be SMALL, and further mitigation is not warranted.

4.4.2 Public Services: Public Utility Impacts During Operations

Impacts on public utility services are considered SMALL if there is little or no change in the ability of the system to respond to the level of demand, and thus there is no need to add capital facilities. Impacts are considered MODERATE if overtaxing of service capabilities occurs during periods of peak demand. Impacts are considered LARGE if existing levels of service (e.g., water or sewer services) are substantially degraded and additional capacity is needed to meet ongoing demands for services. The GEIS indicates that, in the absence of new and significant information to the contrary, the only impacts on public utilities that could be significant are impacts on public water supplies (NRC 1996).

Analysis of impacts on the public water supply system considered both plant demand and plant-related population growth. Section 2.2.2 describes the Peach Bottom Units 2 and 3 permitted withdrawal rate and actual use of water. Exelon plans no refurbishment in conjunction with this license renewal, so plant demand would not change beyond current demands (Exelon 2001).

Exelon assumed an increase of 60 license renewal employees during license renewal, the generation of 141 new jobs, and a net overall population increase of approximately 375 persons and 93 households as a result of those jobs,[b] all of which would create SMALL impacts. The plant-related population increase would require an additional 115 m^3/day (30,000 gal/day) of potable water (Exelon 2001).[c] This amount is within the residual capacity of the existing water systems that service York and Lancaster counties. The current approximate average daily demand for both counties combined is 371,000 m^3/day (98 million gpd), and the projected expected demand in 2010 is 503,500 m^3/day (133 million gpd). The additional 115 m^3/day is 0.03 percent of the current demand and 0.02 percent of the projected demand. The staff finds

(a) The Exelon estimate of 93 housing units is likely to be an extreme "upper bound" estimate. Most of the potentially new jobs would most likely be filled by existing area residents, thus creating no, or little, net demand for housing.
(b) Calculated by assuming that the average number of households 1 per new job and household size is 2.66 persons per household (Exelon 2001).
(c) Calculated assuming that the average American uses between 50 and 80 gallons of water for personal use per day; 500 people x 80 gallons per person/day = 40,000 gallons/day (151 m^3/day).

that the impact of increased water use on area water systems is SMALL and that further mitigation is not warranted.

4.4.3 Offsite Land Use During Operations

Offsite land use during the license renewal term is a Category 2 issue (10 CFR 51, Subpart A, Appendix B, Table B-1). Table B-1 of 10 CFR 51 Subpart A, Appendix B notes that "significant changes in land use may be associated with population and tax revenue changes resulting from license renewal."

Section 4.7.4 of the GEIS defines the magnitude of land-use changes as small if very little new development and minimal changes to an area's land-use pattern result. Moderate change results if considerable new development and some changes to the land-use pattern occur. The magnitude of change is large if large-scale new development and major changes in the land-use pattern occur.

Exelon has identified a maximum of 60 additional employees during the license renewal term plus an additional 81 indirect jobs (total 141) in the surrounding community (Exelon 2001). Section 3.7.5 of the GEIS (NRC 1996) states that if plant-related population growth is less than 5 percent of the study area's total population, offsite 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 23 persons/km^2 (60 persons/mi^2), and at least one urban area with a population of 100,000 or more within 80 km (50 mi). In this case, population growth will be less than 5 percent of the area's total population, the area has established patterns of residential and commercial development, a population density of well over 23 persons/km^2 (60 persons/mi^2), and at least one metropolitan area (Baltimore Metropolitan Statistical Area) with a population of 100,000 or more within 80 km (50 mi). Consequently, the staff concludes that population changes resulting from license renewal are likely to result in small offsite land-use impacts.

Tax revenue can affect land use because it enables local jurisdictions to be able to provide the public services (e.g., transportation and utilities) necessary to support development. Section 4.7.4.1 of the GEIS states that the assessment of tax-driven land-use impacts during the license renewal term should consider (1) the size of the plant's payments relative to the community's total revenues, (2) the nature of the community's existing land-use pattern, and (3) the extent to which the community already has public services in place to support and guide development. If the plant's tax payments are projected to be small relative to the community's total revenue, tax-driven land-use changes during the plant's license renewal term would be small, especially where the community has pre-established patterns of development and has

provided adequate public services to support and guide development. Section 4.7.2.1 of the GEIS states that if tax payments by the plant owner are less than 10 percent of the taxing jurisdiction's revenue, the significance level would be small. If the plant's tax payments are projected to be medium to large relative to the community's total revenue, new tax-driven land-use changes would be moderate.

As discussed in Section 2.2.8.6, the amounts of property taxes to be paid by Exelon for Peach Bottom Units 2 and 3 to York County, Peach Bottom Township, and the South Eastern School District had not yet been determined. Until a determination is made, Exelon has agreed to pay non-refundable payments to the following beginning in 2000: York County, $151,000 per year; Peach Bottom Township, $30,000 per year; and the South Eastern School District, $840,000 per year. The size of the plant's payments relative to the community's total revenues is York County, 0.07 percent; Peach Bottom Township, 1.8 percent; and South Eastern School District, 3.6 percent.

Exelon has determined that major refurbishment activities are not necessary at Peach Bottom Units 2 and 3 in conjunction with license renewal. Thus, there will be no increase in employment at the Peach Bottom site as a result of license renewal activities. Exelon has also stated that the permanent workforce at Peach Bottom Units 2 and 3 will remain stable during the license renewal period of 20 years (Exelon 2001). The plant's tax payments are projected to be less than 10 percent of the community's total revenue. Additional mitigation for land-use impacts during the license renewal period does not appear to be warranted. For these reasons, the staff concludes that the net impact of plant-related population increases is likely to be small. The staff also concludes that tax-related land-use impacts are likely to be small.

4.4.4 Public Services: Transportation Impacts During Operations

On October 4, 1999, 10 CFR 51.53(c)(3)(ii)(J) and 10 CFR Part 51, Subpart A, Appendix B, Table B-1 were revised to clearly state that "Public Services: Transportation Impacts During Operations" is a Category 2 issue (see NRC 1999 for more discussion of this clarification). The issue is treated as such in this supplemental environmental impact statement (SEIS).

However, expected growth is not due directly to increases in employment at the Peach Bottom site. The permanent employment associated with Peach Bottoms Units 2 and 3 is currently about 1000 employees (Exelon and contractors [Exelon 2001]). During refueling outages, which occur about once a year, as many as 800 additional workers are hired on a temporary basis. The Pennsylvania Department of Transportation does not maintain level-of-service designations for roadways in the Commonwealth; however, the local residents do not regard the associated annual traffic increase as a problem (Section 2.1.1.2). The "upper bound" potential increase in permanent staff during the license renewal term is 60 additional workers,

or approximately 6 percent of the current permanent and contract work force of approximately 1000. Access to the Peach Bottom site is on State routes. Based on these facts, Exelon concluded that the impacts on transportation during the license renewal term would be SMALL, and further mitigation measures would not be warranted.

The staff reviewed Exelon's assumptions and resulting conclusions. The staff concludes that any impact of Exelon on transportation service degradation is likely to be SMALL and not require further mitigation.

4.4.5 Historic and Archaeological Resources

There are no known historic or archaeological resources at the Peach Bottom site. One feature, which the State of Delaware considers an historic property, a feeder canal for the Chesapeake and Delaware Canal system, crosses the Peach Bottom-to-Kenney, Delaware transmission line. The Peach Bottom Units 2 and 3 license renewal application for continued operations does not include proposals for future land-disturbing activities or structural modifications beyond routine maintenance at the plant.

Exelon (as PECO) initiated communication with the Pennsylvania, Delaware and Maryland State Historic Preservation Offices by letters dated July and August of 2000 (Hutton 2000a, 2000b, 2000c). The letters express a desire to assess the effects of the license renewal on historic properties, as required by the Nuclear Regulatory Commission of applicants for operating license renewal. The letters specifically include the power station and a single related transmission line (Peach Bottom-to-Keeney, Delaware) within the purview of the undertaking. Exelon indicated that there were no known historic properties in the area of potential effect of the undertaking. Exelon requested State concurrence with a determination that the license renewal process would have "...no effect on any historic or archaeological properties."

Both the Pennsylvania and Maryland State Historic Preservation Offices responded to Exelon's letters: they concurred that the operation and management of the Peach Bottom facility would not affect historic properties. The Delaware State Historic Preservation Office made no written response to the applicant but informed NRC staff of the presence of a property in Delaware in the vicinity of the transmission line that it considers historic.

The Pennsylvania State Historic Preservation Office wrote on December 14, 2000, that it had reviewed the undertaking in accordance with Section 106 of the National Historic Preservation Act. As long as the renewed license to operate the Peach Bottom facility involved only operational and maintenance activities, they agreed that the undertaking would not affect historic and archaeological resources (Carr 2000).

The Maryland State Historic Preservation Office responded similarly on September 22, 2000. The Administrator of Project Review and Compliance wrote it is "...the opinion of the Maryland Historical Trust that the license renewal application will have no effect on historic properties eligible for or listed in National Register of Historic Places, including standing structures and archeological sites." (Cole 2000). She said that no additional archaeological investigations are warranted because of prior disturbance in the project area, and that no additional architectural investigations are necessary (Cole 2000).

Although the Delaware State Historic Preservation Office did not respond in writing to the letter from the applicant, they have expressed concerns to the NRC (Griffith 2001). Its written communication was triggered by the NRC's Federal Register notice of intent to develop an EIS for the proposed action to consider the renewal of the applicant's Peach Bottom Units 2 and 3 operating license for an additional 20 years.

A representative of the Delaware State Historic Preservation Office had made earlier informal contact with NRC staff and participated in an onsite examination in the State of Delaware where the transmission line crosses remnants of a feeder canal for the old Chesapeake and Delaware Canal. The letter from the Delaware State Historic Preservation Office followed-up on the October visit and confirmed statements made by the representative during the trip and in subsequent conversation (Griffith 2001):

(1) The Delaware State Historic Preservation Office considers the re-licensing a Federal undertaking with the potential to affect historic properties.

(2) The official finds in a preliminary evaluation that a feeder canal crossed by the Peach Bottom-to-Keeney, Delaware transmission line is a historic resource that meets standards for its listing on the National Register of Historic Places.

(3) The Delaware State Historic Preservation Office believes that operation of Peach Bottom under the previous license has caused adverse effects on the feeder canal at the transmission line crossing.

(4) Finally, the Delaware State Hisroric Preservation Office official anticipates that grant of a license renewal by Nuclear Regulatory Commission for operation of Peach Bottom would allow continuation of adverse effects on the feeder canal's key historical features (the canal, its towpath, and an associated back borrow area).

The NRC staff has considered the position expressed by the Delaware State Historic Preservation Office and provides the following discussion to put the issue into context. The

original operating licenses were granted after full compliance with the provisions of the National Historic Preservation Act. Exelon, its predecessors, and associated agents for operation of the Peach Bottom-to-Keeney, Delaware transmission line, performed work without knowledge of the existence and historic value of the Chesapeake and Delaware feeder canal that traverses the transmission line corridor.

In 1966, seven years or more before the Federal government granted the initial operating licenses for Peach Bottom Units 2 and 3, Congress passed the National Historic Preservation Act. Section 106 (16 USC § 470j(a)), the provision of that Act most relevant to the current consideration, set out the requirements for Federal agencies to consider the impact of their Federally funded or Federally assisted undertakings on historic preservation. Under the Section, Federal agencies had to

> ...prior to the issuance of any license, ...take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. The head of any such Federal agency shall afford the Advisory Council on Historic Preservation ... a reasonable opportunity to comment with regard to such undertaking. (16 USC § 470j(a))

The original regulations to implement Section 106 of the Act (36 CFR 800) took effect in 1979, five years after the Federal government granted the initial operating licenses for Peach Bottom Units 2 and 3. Until 1979, the Advisory Council on Historic Preservation had no established regulatory process for Federal agencies to use to fulfill National Historic Preservation Act Section 106 responsibilities.

In 1972, with a request for comment, the U.S. Atomic Energy Commission sent information on the proposed license action for Peach Bottom Units 2 and 3, including information on historic and archaeological resources and determinations, to the Advisory Council on Historic Preservation (Giambusso 1972). Although the Advisory Council on Historic Preservation made no reply (AEC 1973), the U.S. Atomic Energy Commission met the then current standard for National Historic Preservation Act compliance.

The feeder canal identified as a historic property by the State of Delaware was first documented in September 1974 (Guider). That is, it was identified after the Federal government granted the license and two years after the U.S. Atomic Energy Commission sent its Draft Environmental Statement on the original license decision to the Advisory Council on Historic Preservation with a request for comment (AEC 1973, Giambusso 1972).

In his letter of October 29, 2001, the Delaware State Historic Preservation Office official made a request that the Nuclear Regulatory Commission should consider three specific tasks to take into account effects of the proposed action to grant the license renewal (Griffith 2001):

(1) "the restoration of the depth and width of the Feeder Canal across the transmission line;

(2) the construction of a simple bridge to permit vehicular access across the Feeder Canal for routine transmission line right-of-way maintenance; and,

(3) monitoring of the transmission line right-of-way to prevent uncontrolled crossing of the Feeder Canal by dirt bikes and ATVs and the repair of damage resulting from such uncontrolled crossings, if they do occur."

These requests fall into two categories. First, an action to correct a perceived negative result of past operations (Number 1, above). Second, specific actions to prevent future deterioration of the feeder canal (Numbers 2 and 3, above). The NRC staff provided the recommendations provided them to the applicant, however, the staff has determined that these actions do not relate to the current Federal undertaking, a decision under consideration by the Nuclear Regulatory Commission to extend operating licenses.

The applicant stated that, for the license renewal period, (1) "No major structural modifications have been identified..." (2) "Any maintenance activities necessary to support license renewal would be limited to previously disturbed areas;" and, (3) "No additional land disturbance is anticipated in support of license renewal." (Hutton 2000a, 2000b, and 2000c). The applicant should reflect the aforementioned in its licensing basis commitments and, under such conditions, staff believes continued operation of Peach Bottom would not have an effect effect on any known or on potential unknown or undiscovered historic or archaeological resources located in areas of potential effect.

The historically important Chesapeake and Delaware Feeder Canal occurs within the Delaware portion of its Peach Bottom-to-Keeney, Delaware transmission line. However, since the applicant does not own and does not perform operational or maintenance work on the part of the transmission line that contains the feeder canal (Gallagher 2002), it has no opportunity to take the value of this resource into account during operation and maintenance work. Given the commitments of the applicant to avoid future disturbance and to control access to lands it manages, the staff concludes that the impact of operation and maintenance of the Peach Bottom site during the license renewal period are SMALL. It requires no further mitigation.

4.4.6 Environmental Justice

Environmental justice refers to a Federal policy in which Federal actions should not result in disproportionately high and adverse impacts on minority[a] or low-income populations. Executive Order 12898 (59 FR 7629) directs Federal executive agencies to consider environmental justice under the National Environmental Policy Act of 1969 (NEPA). The Council on Environmental Quality (CEQ) has provided guidance for addressing environmental justice (CEQ 1997). Although it is not subject to the Executive Order, the Commission has voluntarily committed to undertake environmental justice reviews. Specific guidance is provided in NRC Office of Nuclear Reactor Regulation Office Instruction LIC-203, *Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues* (NRC 2001).

For the purpose of the staff's review, a minority population is defined to exist if the percentage of minorities within the Census block groups[b] in each state within the 80 km (50-mile) potentially affected by the license renewal of Peach Bottom Units 2 and 3 exceeds the corresponding percentage of minorities in the state of which it is a part by 20 percent, or if the corresponding percentage of minorities within the Census block group is at least 50 percent. A low-income population is defined to exist if the percentage of low-income population within a census block group exceeds the corresponding percentage of low-income population in the state of which it is a part by 20 percent, or if the corresponding percentage of low-income population within a census block group is at least 50 percent. For census block groups within York and Lancaster counties, for example, the percentage of minority and low-income populations is compared to the percentage of minority and low-income populations in Pennsylvania. Exelon conducted its analysis using 1990 census tracts rather than the smaller block groups. Staff used the 2000 Census block groups for identifying minority populations, but used the 1990 Census block groups to identify low-income populations because the 2000 Census data on incomes were not yet available for small geographic areas.

The scope of the review as defined in NRC Guidance (NRC 2001) should include an analysis of impacts on minority and low-income populations, the location and significance of any environmental impacts during operations on populations that are particularly sensitive, and any additional information pertaining to mitigation. The descriptions to be provided by this review

(a) The NRC guidance for performing environmental justice reviews defines "minority" as American Indian or Alaskan Native; Asian; Native Hawaiian or other Pacific Islander; or Black races; or Hispanic ethnicity. "Other" races and multi-racial individualsmay be considered as separate minorities (NRC 2001).

(b) A census block group is a combination of census blocks, which are statistical subdivisions of a census tract. A census block is the smallest geographic entity for which the Census Bureau collects and tabulates decennial census information. A census tract is a small, relatively permanent statistical subdivision of counties delineated by local committees of census data users in accordance with Census Bureau guidelines for the purpose of collecting and presenting decennial census data. Census block groups are subsets of census tracts (USBC 2001b).

should state whether these impacts are likely to be disproportionately high and adverse, and to evaluate the significance of such impacts.

The staff examined the geographic distribution of minority and low-income populations recorded during the 2000 Census (USBC 2001) within 80 km (50 mi) of Peach Bottom Units 2 and 3, encompassing all of York, Lancaster, and Chester counties in Pennsylvania; Baltimore City and County, Harford and Cecil counties in Maryland; Kent County in Delaware; parts of Adams, Cumberland, Dauphin, Lebanon, Montgomery, Delaware, and Berks counties in Pennsylvania; Queen Anne, Anne Arundel, Howard, Caroline, Frederick, and Carroll counties in Maryland; New Castle County, Delaware; and Salem and Gloucester counties in New Jersey. The analysis was also supplemented by field inquiries to the planning department and social service agencies in York and Lancaster counties.[(a)]

Exelon conducted its analysis for minority and low income populations using the convention of including the census tracts if at least 50 percent of their area lay within 80-km (50-mi) of Peach Bottom Units 2 and 3 (Exelon 2001). Using this convention, the 80-km radius included 1201 census tracts. The NRC staff used the more detailed Census block groups, which resulted in a universe of 3962 block groups, and followed the latest guidance in NRC 2001 for designating minority categories, including "other" races and multiple-race individuals. Exelon used the "more than 20 percent" criterion to determine whether a census tract should be counted as containing a minority or low-income population (Exelon 2001). Staff found that the "50%" criterion was also applicable at the block group level. Following these criteria, Table 4-8 indicates how many census block groups within the 80-km area exceed the threshold for determining minority and low-income populations. Figures 4-1 and 4-2 show the distribution of census block groups for the minority and low-income populations, respectively (shaded areas).

Based on the "more than 20 percent greater" criterion, Exelon determined that Black minority populations exist in 209 census tracts: 21 in Delaware, 136 in Maryland, 4 in New Jersey, and 48 in Pennsylvania. Hispanic minorities 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. Staff analysis using the 2000 Census confirmed the relative numbers and locations of minority populations in the Exelon analysis, although the number of block groups in the staff's analysis is larger than the number of tracts used by Exelon. Figure 4-1 shows the locations of minority populations.

(a) York and Lancaster counties were the focus of this inquiry because all of both counties lie within the 80-km (50-mi) radius and are nearest the Peach Bottom site. The staff concluded that any findings of environmental justice issues in these counties would warrant further field inquiries in more distant counties. For reasons stated later in this section, further investigation was not warranted.

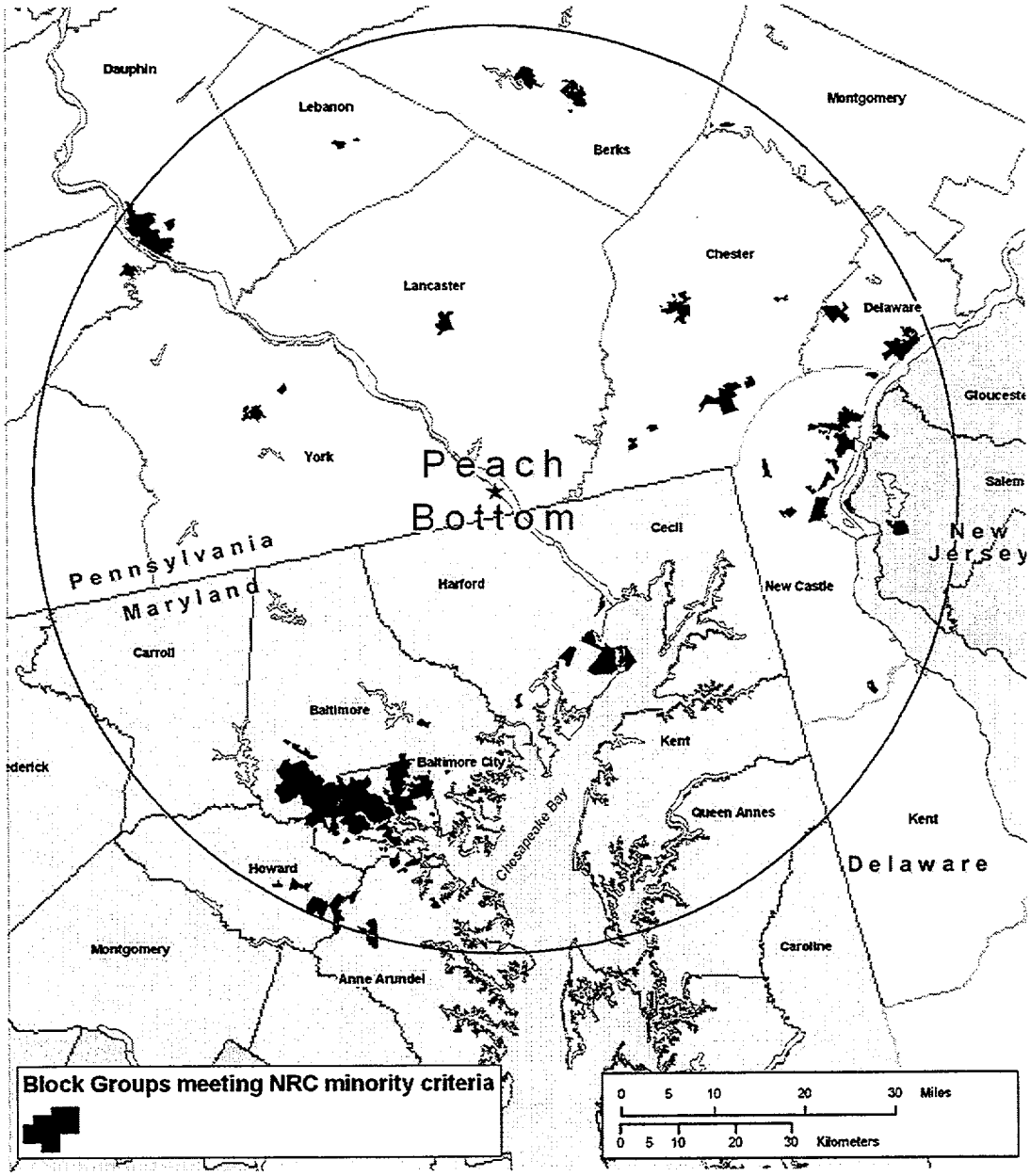

Figure 4-1. Geographic Distribution of Minority Populations (shown in shaded areas) Within 80-km (50-mi) of Peach Bottom Site Based on 2000 Census Block Group Data [(a)]

(a) Note: Some of the census block groups extend into open water.

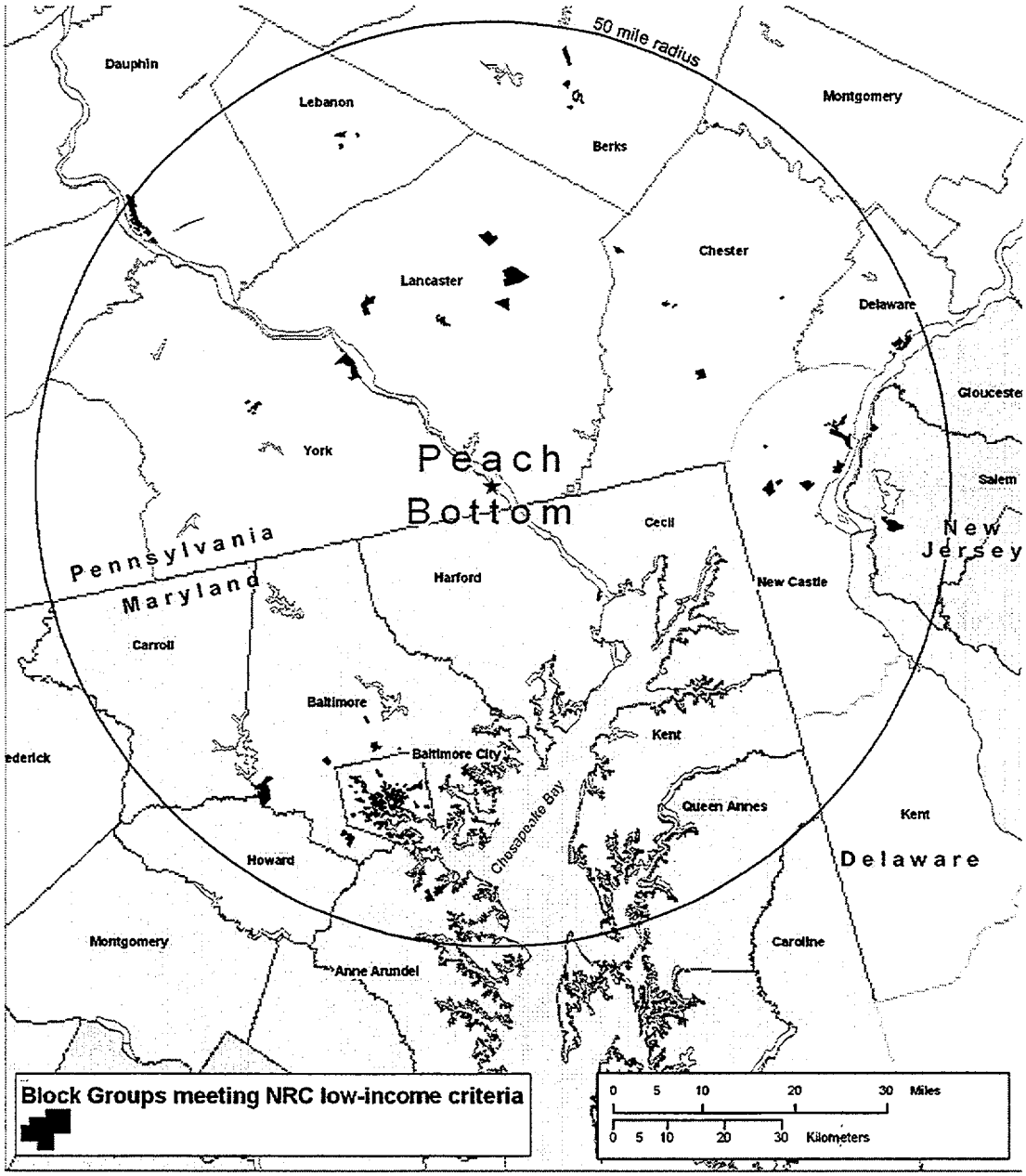

Figure 4-2. Geographic Distribution of Low-Income Populations (shown in shaded areas) Within 80-km (50-mi) of the Peach Bottom Site Based on 1990 Census Block Group Data[a]

(a) Note: Some of the census block groups extend into open water.

Black minority populations tend to be concentrated in urban areas, especially in metropolitan Baltimore and Philadelphia. Hispanic minority populations, with the exception of a few block groups, are concentrated in the Cities of Lancaster and Reading.

By the NRC criteria (50% of population, or at least 20 percent greater than state), 420 of the total 4271 1990 census block groups within 80 km (50 mi) of the site contain low-income populations. The majority of census block groups containing low-income populations are located in the Baltimore metropolitan area. The remaining census block groups also tend to be located in urban areas. In Pennsylvania, low income block groups are concentrated in the Philadelphia metropolitan area, Harrisburg, Reading, Lancaster, York. In New Jersey, most are in Salem. In Delaware, they are concentrated in Newark and Wilmington. Figure 4-2 shows the locations of the low-income populations.

With the locations of minority and low-income populations identified, the staff proceeded to evaluate whether any of the environmental impacts of the proposed action could affect these populations in a disproportionate manner. Based on staff guidance (NRC 2001), air, land, and water resources within about 80 km (50 mi) of the Peach Bottom site were examined. Within that area, a few potential environmental impacts could affect human populations; all of these were considered SMALL for the general population. These include:

- groundwater-use conflicts (discussed in Section 4.5)
- electric shock (discussed in Section 4.2.1)
- microbiological organisms (discussed in Section 4.1.5)
- postulated accidents (discussed in Chapter 5 of this SEIS and Chapter 5 of the GEIS)

The pathways through which the environmental impacts associated with Peach Bottom Units 2 and 3 license renewal can affect human populations are discussed in each associated section. The staff then evaluated whether minority and low-income populations could be disproportionately affected by these impacts. The staff found no unusual resource dependencies or practices, such as subsistence agriculture, hunting, or fishing through which the populations could be disproportionately affected. In addition, the staff did not identify any location-dependent disproportionate impacts affecting these minority and low-income populations. The staff concludes that offsite impacts from Peach Bottom Units 2 and 3 to minority and low-income populations would be SMALL, and no additional mitigation actions are warranted.

4.5 Groundwater Use and Quality

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 applicable to Peach Bottom Units 2 and 3 groundwater use and quality is identified in Table 4-8. Exelon stated in its ER (Exelon 2001) that it is not aware of any new and significant information associated with the renewal of the Peach Bottom Units 2 and 3 operating licenses (OLs). The staff has not identified any significant new information during its independent review of the ER (Exelon 2001), the staff's site visit, scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts related to this issue beyond those discussed in the GEIS. For this issue, the staff concluded that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

Table 4-8. Category 1 Issue Applicable to Groundwater Use and Quality During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section
GROUNDWATER USE AND QUALITY	
Ground-water-use conflicts (potable and service water; plants that use <100 gpm).	4.8.1.1

A brief description of the staff's review and the GEIS conclusions, as codified in Table B-1, follows:

- Ground-water-use conflicts (potable and service water; plants that use <100 gpm). Based on information in the GEIS, the Commission found that

  > Plants using less than 100 gpm are not expected to cause any groundwater use conflicts.

  As discussed in Section 2.2.2, Peach Bottom site groundwater use is less than 0.07 m^3/s (100 gpm). The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no groundwater-use conflicts during the renewal term beyond those discussed in the GEIS.

There is one Category 2 issue related to groundwater use and quality that is applicable to Peach Bottom Units 2 and 3. This issue is listed in Table 4-9 and discussed in Section 4.5.1.

Table 4-9. Category 2 Issue Applicable to Groundwater Use and Quality During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
GROUNDWATER USE AND QUALITY			
Ground-water-use conflicts (plants using cooling towers withdrawing makeup water from a small river)	4.8.1.3 4.4.2.1	A	4.5.1

4.5.1 Ground-water-Use Conflicts (Plants Using Cooling Towers Withdrawing Makeup Water From a Small River)

Groundwater use conflicts for plants that have cooling towers withdrawing makeup water from a small river is a Category 2 issue, requiring a site-specific assessment before license renewal.

Surface water withdrawals from small water bodies during low-flow conditions may result in groundwater use conflicts with nearby groundwater users.

The impact of consumptive loss on nearby groundwater users is associated with the difference it could potentially cause in aquifer recharge, especially if other new groundwater or upstream surface water users begin withdrawals. Section 2.2.2 describes Peach Bottom site surface water withdrawals from Conowingo Pond. As described in Section 2.1.3, Peach Bottom Units 2 and 3 normally operate with a once-through cooling system. However, since groundwater flows towards Conowingo Pond, groundwater withdrawals would not be impacted by changes in river flow.

The staff reviewed the CWA Section 316(a) Demonstration for Peach Bottom Unis 2 and 3 and the ER relative to potential groundwater-use conflicts due to consumptive loss of aquifer recharge. Based on this review, the staff has concluded that the potential impacts are SMALL, and additional mitigation is not warranted.

4.6 Threatened or Endangered Species

Threatened or endangered species are listed as a Category 2 issue in 10 CFR Part 51, Subpart A, Appendix B, Table B-1. This issue is listed in Table 4-10.

Table 4-10. Category 2 Issue Applicable to Threatened or Endangered Species During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
THREATENED OR ENDANGERED SPECIES (FOR ALL PLANTS)			
Threatened or endangered species	4.1	E	4.6

This issue requires consultation with appropriate agencies to determine whether threatened or endangered species are present and whether they would be adversely affected. Exelon initiated consultation under Section 7 of the Endangered Species Act during June 2000 with a request for information to the National Marine Fisheries Service (NMFS) concerning species potentially occurring near the Peach Bottom site. The presence of threatened or endangered species in the vicinity of the Peach Bottom site is discussed in Sections 2.2.5 and 2.2.6.

Exelon has no plans to conduct refurbishment or construction at the Peach Bottom site 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.

4.6.1 Aquatic Species

During more than 30 years of monitoring the fish populations of Conowingo Pond, no Federally listed fish species have been collected. The Atlantic sturgeon (*Acipenser oxyrhynchus*), a candidate for federal listing has been captured by anglers in the lower Susquehanna River below the Conowingo Dam in Maryland (Normandeau Associates, Inc. 1998), 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 (AEC 1973; PECO 1975), Exelon (as PECO)-funded research and monitoring studies (Normandeau 1998, 1999,

2000), standard fisheries references, journal articles, and government web sites (Normandeau 1999), 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 (Normandeau 1998). Occasionally, small numbers of hickory shad (32 in 1999) are collected at the Conowingo West Lift (Susquehanna River Anadromous Fish Restoration Cooperative 2000). Another State-listed species, the cisco *(Coregonus artedi)* has been introduced to the upper Susquehanna River (Harvey's Lake in Luzeme County, Pennsylvania) (Normandeau 2000) and the lower Susquehanna River (downstream of the Conowingo Dam in Maryland) (Normandeau 1998) and has been reported from Conowingo "Reservoir" (Normandeau 1999). However, the cisco has not been collected from Conowingo Pond and is not believed to be present. State- or Federal-listed molluscs have not been found in Conowingo Pond.

4.6.2 Terrestrial Species

Exelon initiated consultation with the U.S. Fish and Wildlife Service (FWS) in October 2000 with a letter requesting information and describing recently completed bog turtle surveys. The FWS responded with an indication that there were likely to only be transient species in the vicinity of the plant and that adverse effects were unlikely (Exelon 2001a). The staff chose to further evaluate the potential impacts of continued operation of Peach Bottom Units 2 and 3 on the bald eagle and other Federally listed species that may occur near the plant or the transmission line (see Section 2.2.6). The staff evaluated the available information concerning these species and determined that continued operation of Peach Bottom Units 2 and 3 during the license renewal term was not likely to adversely affect the bald eagle and likely to have no effect on any other Federally listed endangered or threatened species. This conclusion was forwarded to the FWS on January 17, 2002 (resubmitted on March 13, 2002). The FWS concurred with these conclusions in a letter dated April 17, 2002. Copies of these correspondence are provided in Appendix E.

Based on its review of the applicant's report and its independent analysis, and pending the outcome of consultation with the FWS, it is the staff's conclusion that continued operation of the plant under license renewal is not likely to adversely affect bald eagles, and will have no effect on other listed or proposed endangered or threatened species within the immediate vicinity of the Peach Bottom site or the associated transmission line. Therefore, it is the staff's preliminary determination that the impact on threatened or endangered species of an additional 20 years operation of the Peach Bottom Units 2 and 3 plant and of continued maintenance activities of the transmission corridor would be SMALL, and further mitigation is not warranted.

4.7 Evaluation of Potential New and Significant Information on Impacts of Operations During the Renewal Term

4.7.1 Evaluation of Potential New and Significant Radiological Impacts on Human Health

During the public scoping period for the Peach Bottom Units 2 and 3 SEIS, there were comments about the studies related to strontium-90 radiation levels in deciduous (baby) teeth and use of these studies as "in-body" measurements of radioactive materials. The commenters suggested that the source of this material was the Peach Bottom plant and that this is new and significant information and, therefore, should be considered in the environmental impact evaluation for Peach Bottom Units 2 and 3, specifically with respect to public health. This section (1) summarizes the comments related to strontium-90 in deciduous teeth obtained during the public scoping period and (2) discusses why the staff determined that "in-body" measurements of strontium-90 in deciduous teeth as a means to evaluate public health impacts from releases from nuclear power plants is not new and significant information.

The staff has evaluated whether any of the comments related to strontium-90 in the environment could be new and significant with respect to the conclusions in the GEIS. In 2000, a report titled *Strontium-90 in Deciduous Teeth as a Factor in Early Childhood Cancer* was published (Gould et al. 2000) that alleges there was an increase in cancer incidence due to strontium-90 released from nuclear power facilities. The evidence claimed in the report was elevated levels of strontium-90 in deciduous teeth. The staff has determined that the report does not represent new information with regard to the Category 1 issues as evaluated in the GEIS, nor does it identify a significant departure from what was specifically documented in the GEIS with regard to public dose. This section addresses the claims by the Radiation and Public Health Project (RPHP) staff, which were the authors of the Gould report. The staff has determined that the strontium-90 found in deciduous teeth in the vicinity of Peach Bottom Units 2 and 3 is not due to releases from the plant and that the operation of Peach Bottom Units 2 and 3 would not be responsible if there were to be an increased incidence of cancer in the area.

4.7.1.1 Summary of Comments

During the scoping process, there were comments both written and verbal at the public meeting related to the work by Gould et al. and the RPHP (Mangano et al. 2001). The comments focused on several issues identified by the Gould study. The first issue was use of "in-body" measurement of radionuclides to determine public health effects. The second issue was use of

strontium-90 to perform "in-body" measurement to evaluate the potential health risks from release of radioactive materials from Peach Bottom Units 2 and 3. The third major issue described was an apparent increase in cancer incidence in the communities near Peach Bottom Units 2 and 3. Finally, commentors suggested that a cause-and-effect relationship exists between reactor operation, catastrophic events, and perceived increase in cancer rates.

The discussion that follows explains the basis for the staff's conclusion that the public scoping comments do not provide new and significant information related to the Category 1 radiological human health issues. The discussion (1) explains the source and amount of strontium-90 in the environment, (2) describes the concensus standards of national and international organizations that form the basis of NRC's regulations related to protecting public health, (3) addresses the radiological monitoring programs at nuclear power reactors and specifically the program at Peach Bottom Units 2 and 3, (4) explains why "in-body" measurement of radioactive materials is not used to determine public health impacts, (5) addresses the statements regarding cancer incidence discussed in the Gould report and public comment, and (6) addresses the implication that radioactive effluents from nuclear reactors are the cause of perceived increases in cancer incidence near Peach Bottom Units 2 and 3. Finally, the rationale for assigning radiological issues as Category 1 in the GEIS and the staff's evaluation of these issues for Peach Bottom Units 2 and 3 are briefly discussed.

4.7.1.2 Strontium-90 in the Environment

There are three sources of strontium-90 in the environment: fallout from nuclear weapons testing, releases from the Chernobyl accident in the Ukraine, and potential releases from nuclear power reactors. By far the largest source of strontium-90 in the environment is from weapons testing fallout.

Both strontium-89 and strontium-90 were released to the atmosphere by aboveground explosions of nuclear weapons (UNSCEAR 2001). Although the United States performed its last atmospheric test of a nuclear weapon in 1963, other countries continued to perform atmospheric testing of nuclear weapons until 1980 (UNSCEAR 2001). Strontium-89 has a half-life of 50.5 days, while the half-life of strontium-90 is 28.8 years. Consequently, virtually no strontium-89 currently remains in the soil from nuclear weapons testing (Eisenbud 1987). In contrast, strontium-90 remains in soils of the Northern Hemisphere at more than 50% of its peak levels in the 1960s (UNSCEAR 2000). Approximately 622 PBq (16.8 million Ci) of strontium-90 were produced and globally dispersed in atmospheric nuclear weapons testing.

Numerous measurements of the global disposition on strontium-90 and the occurrence of these and other fallout radionuclides in foodstuffs and the human body were made at the time the

atmospheric tests were taking place. The worldwide average effective dose from ingesting strontium-90 (1945 to date) is 97 μSv (9.7 mrem). The worldwide average effective dose from inhaling strontium-90 (1945 to 1985) is 9.2 μSv (0.92 mrem). No statistically significant excess of biological effects due to strontium-90 exposures at levels characteristic of worldwide fallout has been demonstrated (NCRP 1991).

The other two sources of strontium-90 in the environment are the Chernobyl accident in April 1986 when approximately 8 PBq (216,000 Ci) of strontium-90 were released into the atmosphere, and releases from nuclear power reactor operations. The total annual release of strontium-90 into the atmosphere from all U.S. nuclear power plants is typically 37 MBq (0.001 Ci). The amount of strontium-90 released into the environment from a nuclear facility is so low that the only chance of detecting strontium-90 is sampling the nuclear power plant effluents themselves. In addition to strontium-90, power reactors also release very small quantities of strontium-89.

Because of the extremely small amount of strontium-90 released from nuclear power plant effluents, it is unlikely that strontium-90 found in deciduous teeth would be from nuclear power plants. Without determining that there is strontium-89 in the teeth, it is impossible to tell where the strontium-90 is from. If there is no strontium-89 in the teeth, then it is unlikely that the strontium-90 is from a recent release from a nuclear reactor. The fact that the RPHP has failed to measure the strontium-89 to strontium-90 ratio in any deciduous teeth collected limits conclusions regarding the source of the internal contamination.

4.7.1.3 Regulatory Basis and Discussion of Risk

The evaluation of health effects from exposure to radiation, both natural and man-made, is an ongoing activity involving public, private, and international institutions. International and national organizations such as the International Commission on Radiological Protection (ICRP) and National Council on Radiation Protection and Measurements (NCRP) provide consensus standards developed from recent and ongoing research. NRC's regulatory limits for effluent releases and subsequent dose to the public are based on the radiation protection recommendations of these organizations. NRC provides oversight of all licensed commercial nuclear reactors to ensure that regulatory limits for radiological effluent releases and the resulting dose to the public from these releases are within the established limits. The regulations related to radiological effluents and dose to the public can be found in 10 CFR Part 20 and 10 CFR Part 50, Appendix I.

The National Academy of Sciences' Committee on the BEIR published its fifth report (BEIR V) just over a decade ago (National Research Council 1990). That report contains mathematical

models that predict risk of radiation-induced cancers in human populations over and above the incidence of cancer that occurs in the absence of radiation exposure. The BEIR V committee chose a linear, nonthreshold (LNT) dose-response model for solid cancers and a linear-quadratic (LQ) model for leukemia.

The BEIR V report does not address what is safe or not safe; it merely evaluates excess cancer risk in terms of probabilities. ICRP Publication 60 (1991), however, does define safe in the sense of "acceptable risk," and this and similar definitions have been reaffirmed by the NCRP (NCRP 1993) and the U.S. Environmental Protection Agency (EPA 1987). These implicit definitions of "safe" are embodied in all U.S. radiation protection regulations, including those of the NRC.

There is no human activity without some risk, however slight, so "safe" does not mean "with no risk," but rather "safe" means "with an acceptably tiny risk." What risk is acceptable from society's standpoint is determined by the political process in the United States as spelled out recently, for example, by the U.S. Presidential/Congressional Commission on Risk Assessment and Risk Management[a] (Omenn et al. 1997).

4.7.1.4 Effluent Monitoring at Peach Bottom

Regulatory Guide 1.21 recommends that "a quarterly analysis for strontium-89 and strontium-90 should be made on a composite of all filters from each sampling location collected during the quarter." The sensitivity is such that the analysis for radioactive material in particulate form should be sufficient to permit measurement of a small fraction of the activity, which would result in annual exposures of 200 μSv (20 mrem) to any organ of an individual, or 60 μSv (6 mrem) to the whole body, in an unrestricted area (see Section 2.1.4). Nuclear power plants, including Peach Bottom Units 2 and 3, routinely release small amounts of radioactive material in their effluents. To demonstrate that the plant is within the regulatory limits, the plants monitor the radiological materials released to the environment and take frequent radiological samples around the plant site as well as analyze their effluent discharge. Both strontium-89 and strontium-90 can be found in power plant effluents in very small quantities. Each nuclear power plant in the United States is required to submit an annual report on effluent releases to NRC. The report contains information about the types and quantities of radionuclides that are released to the environment, as well as the dose impact on the environment.

(a) Internet http://www.riskworld.com.

Gaseous and liquid effluent releases are monitored at Peach Bottom Units 2 and 3 to demonstrate that they are within regulatory limits. The licensee also has a Radioactive Effluents Control Program, including the Offsite Dose Calculation Manual that provides the procedures for monitoring releases to the environment. The results of this monitoring are provided to NRC in annual reports titled *Annual Radioactive Effluent Release Report* (Exelon 2001a) and *Annual Radiological Environmental Operating Report* (Exelon 2001b). The effluent control program was reviewed for the preparation of this SEIS. The releases of radionuclides to the environment, including strontium-90, are monitored as prescribed by Peach Bottom Units 2 and 3 *Offsite Dose Calculation Manual* (PECO 2001) and have been maintained well below regulatory limits. During 2000, Peach Bottom Units 2 and 3 did not release detectable levels of strontium-90 or strontium-89 in the gaseous effluents. Liquid effluents containing radioactive materials, including strontium-90 and strontium-89, were released into the discharge canal. The only time radioactive strontium was released in detectable levels in the liquid effluents was during the third and fourth quarters of 2000. In the third quarter a total of 0.54 MBq (1.46×10^{-5} Ci) of strontium-89 was released. In the fourth quarter the effluents were 4.3×10^{-3} MBq (1.16×10^{-7} Ci) of strontium-89 and 4.48×10^{-4} MBq (1.21×10^{-8} Ci) of strontium-90 (Exelon 2001c). These total amounts of radioactive effluents released from Peach Bottom Units 2 and 3 were only a small fraction of the NRC regulatory limits. The quantities of materials released to the atmosphere and liquid for 2000 are comparable to the quantities released in the past 5 years and the expected quantities released in years to come, including the license renewal period.

4.7.1.5 Use of "In-Body" Radionuclide Measurements to Assess Public Risk from Radiological Effluents from Peach Bottom Units 2 and 3

Scoping comments have stated or implied that the NRC should measure radioactive substances in persons living near nuclear power plants. Such measurements would be misleading and unwarranted for a variety of reasons:

- Radioactive substances may come from a variety of sources. In the case of strontium-90, the primary source has always been fallout from atmospheric weapons tests (UNSCEAR 2001). The scoping comments that imply that strontium-90 measured in people near nuclear plants must have come from nuclear plants has no basis.

- Interpreting measurements of radioactive materials in people is difficult unless one knows what each individual was exposed to, when the exposures occurred, and by what routes they occurred (ingestion, inhalation, etc.). In particular for strontium-90, dietary contributions from foodstuffs produced out of the region must be considered. Finally,

human migration must be considered, because people may have lived and acquired radionuclides elsewhere than near a nuclear power plant.

- Substances in the human body are dynamic, not static. This includes radioactive and nonradioactive substances. The dynamic processes include intake of material; uptake to systemic circulation from the gastrointestinal tract, respiratory tract, or skin; translocation throughout the body system; retention over time; and elimination via excretion and radioactive decay. Thus, even in deciduous teeth, the time course of exposure leading to intake and all other dynamic processes must be considered to interpret measurements.

4.7.1.6 Ability for Strontium-90 to Cause Cancer

Scoping comments emphasized the adverse health effects of strontium-90. This isptope is produced in roughly 5.8% of nuclear fissions in a reactor's fuel elements and undergoes radioactive decay with a half-life of almost 29 years. Strontium-90, and its radioactive decay product yttrium-90, are not harmful unless they are near or inside the body. They are easily shielded if outside the body, resulting in no radiation exposure.

If ingested, strontium-90 tends to mimic calcium when it is in the body and therefore becomes concentrated in calcified tissues such as bones and teeth. If ingested in quantities that produce very large radiological dose rates (about one thousand times higher than dose rates we all receive from natural background [Raabe 1994]), strontium-90 is known to increase the risk of bone cancer and leukemia in animals, and is presumed to do so in people. Below these dose rates, there is no evidence of any excess cancer.

Compared to other radionuclides, both natural and human-made, strontium-90 is not the most toxic. For example, naturally occurring thorium 230 is 700 times more radiotoxic when inhaled.

4.7.1.7 Cause-and-Effect Relationship Between Radiological Releases from Peach Bottom Units 2 and 3 and Increased Incidence in Cancers in the Area

Scoping comments on the Peach Bottom SEIS have stated or implied that claimed statistical associations between cancer rates and reactor operations are cause-and-effect relationships. Considerable of technical literature has addressed causal association, that is, when two things that appear to be associated over time can lead one to deduce that one causes the other.

A simple counterexample helps illustrate this point. A college professor gives the following example of a causal inference: "In the winter I wear galoshes. In the winter I get colds. Therefore, galoshes cause colds." There's no argument that a strong statistical association exists between wearing galoshes and the health effect of colds. However, there is an argument about whether galoshes *cause* colds. So, how does one go about addressing whether this association is really causation?

Here are some of the major factors to consider before inferring that a statistical association is a causal one (Hill 1965):

(1) Strength: Is a large effect observed, e.g., 32-fold lung cancer increase in heavy smokers?

(2) Consistency: Is the effect consistently observed across studies?

(3) Specificity: Does the effect occur in specific persons, for particular sites and types of disease.

(4) Temporality: Does exposure precede disease? Is there a suitable latent period between exposure and clinical symptoms?

(5) Biological Gradient: Is there a dose-response curve in which increasing dose leads to increasing response?

(6) Biological Plausibility: Is there a plausible biological mechanism for the observed association?

(7) Coherence: Does the cause-and-effect inference seriously conflict with generally known facts of the natural history and biology of the disease?

(8) Experiment: Does intervention reduce or prevent the association?

(9) Analogy: Do other, similar agents produce the effects?

Statistical association alone does not prove causation. The RPHP work fails to meet many of these criteria, even if the strontium-90 measurements were the result of the nuclear power plant operations. In particular, they fail to meet criteria 1, 2, 3, 4, and 6.

Epidemiology is the study of patterns of health and disease in human populations. In 1995, an international group of experts assembled to help determine how to use epidemiology studies for risk assessments. Their work has been published (Federal Focus Inc. 1996) and a non-copyrighted summary is on the internet at http://www.pnl.gov/berc/epub/risk/index.html.

A disease cluster is a group of cases of a disease that appear around the same time in a limited geographic or occupational area. A non-technical analysis of "the cancer-cluster myth" has been published in a popular magazine (Gawande 1999). Gawande explains why infectious disease clusters can and should spur immediate investigations and perhaps intervention by public health officials, and yet why non-infectious disease clusters rarely, if ever, are verified (see, for example, Neutra 1990 and Reynolds et al. 1996). For cancer, which has a significant latency between exposure and appearance of clinical symptoms, apparent clusters are very misleading because of migration and confounding sources of exposure.

4.7.1.8 Additional Discussion on Cancer

Information regarding the relationships between environmental exposure to radiation and cancer as stated in the Gould report were not substantiated. One form of cancer the Gould report linked to strontium-90 exposure is "the extremely rare form of childhood cancer known as rhabdomyosarcoma" (Gould et al. 2000). Rhabdomyosarcoma is not rare; indeed it is the most common soft tissue sarcoma in children (ACS 2001a), and is the fifth most common form of pediatric cancer (St. Jude Children's Research Hospital 2001). Furthermore, no association has been documented between the incidence of rhabdomyosarcoma and any environmental condition, including toxic substances, air or water pollution, or radiation exposure (ACS 2001a).

While the Gould report is correct with regard to the general increase in cancer incidence in the United States (Gould et al. 2000), this increase does not appear to be due to environmental causes other than cigarette smoking. The National Cancer Institute (NCI 2001) states that

> It is true that a person's chance of developing cancer within his or her lifetime is almost twice as great today as it was half a century ago, which means that doctors are seeing more cases of cancer than they did in the past. However, this increase is caused largely by the facts that people are living longer and cancer is more prevalent in older

> people. When corrected for the increasing average age of the population, cancer rates in the United States have actually been stable or even falling slightly in the past several years. Much of the rise prior to that was due to cigarette smoking, a well established and avoidable cause of cancer.

The American Cancer Society (ACS) (ACS 2001b) acknowledges that a dramatic increase in prostate cancer was noted between 1989 and 1992, but notes that this increase was apparent rather than real. They suggest that it was due to earlier diagnosis in men without any symptoms by increased use of prostate-specific antigen (PSA) blood test screening. They note that prostate cancer incidence rates have declined significantly since 1992 (ACS 2001b).

With regard to cancer clusters, especially breast cancer deaths, that are identified by the Gould report (Gould et al. 2000), detailed studies of this phenomenon have yet to substantiate relationships with environmental exposures, especially from nuclear power plants. Scientists from the NCI conducted and are conducting studies of breast cancer death clusters in the northeastern United States, the Washington D.C. area, and San Francisco. Primary factors driving the observed differences appear to be regional differences in the ages of mothers at first birth and mammography screening (Sturgeon et al. 1995).

At the request of Congress, the NCI conducted a study of cancer mortality rates around 52 nuclear power plants, 9 DOE facilities, and 1 former commercial fuel reprocessing facility. The study covered the period from 1950 to 1984 and evaluated the change in mortality rates before and during facility operations. The study (Jablon, Hrubec, and Boice 1991) concluded the following:

> From the evidence available, this study has found no suggestion that nuclear facilities may be linked causally with excess deaths from leukemia or from other cancers in populations living nearby.

Additionally, the ACS (ACS 2001c) has concluded that although reports about cancer case clusters in such communities have raised public concern, studies show that clusters do not occur more often near nuclear plants than they do by chance elsewhere in the population. Likewise, there is no new evidence that links strontium-90 with increases in breast cancer, prostate cancer, or childhood cancer rates. The ACS recognizes that public concern about environmental cancer risks often focuses on risks for which no carcinogenicity has been proven or on situations where known carcinogen exposures are at such low levels that risks are negligible. "Ionizing radiation emissions from nuclear facilities are closely controlled and involve negligible levels of exposure for communities near such plants." (ACS 2001c).

4.7.1.9 Conclusion

In the GEIS, radiation exposure to the public during the license renewal term was considered a Category 1 issue (see Chapter 1 and Section 4.3 for discussions of Category 1 issues and radiological impacts from normal operations). The GEIS determined that the risk to the public from continued operation of a nuclear plant would not increase during the license renewal term. Doses to members of the public from Peach Bottom Units 2 and 3 emissions were specifically evaluated in Section 4.3 of the GEIS, using data from monitored emissions and ambient monitoring, and were found to be well within regulatory limits.

The staff extensively reviewed the Gould report, the comments received during the public scoping period, and the written comments provided by the RPHP. The staff has concluded that the claims of elevated levels of childhood cancer in the vicinity of the plant caused by the release of strontium-90 during routine operations is unfounded and without scientific merit. In-plant monitoring of effluent streams has established that there are no significant releases of strontium-90 from the plant. No causal relationship has been established between the levels of strontium-90 being reported by the RPHP in deciduous teeth and childhood cancer. Furthermore, there is near unanimous consensus among the scientific community on the adequacy of current radiation protection standards.

The staff concludes that the information provided from the Gould report and subsequent scoping comments do not provide any information that can be considered new and significant with respect to the findings of the GEIS on the health effects to the public from radiological effluent releases due to the Peach Bottom Units 2 and 3.

4.8 Summary of Impacts of Operations During the Renewal Term

Neither Exelon nor the staff is aware of information that is both new and significant related to any of the applicable Category 1 issues associated with Peach Bottom Units 2 and 3 operation during the renewal term. Consequently, the staff concludes that the environmental impacts associated with these issues are bounded by the impacts described in the GEIS. For each of these issues, the GEIS concluded that the impacts would be SMALL and that additional plant-specific mitigation measures are not likely to be sufficiently beneficial to warrant implementation.

Plant-specific environmental evaluations were conducted for 14 Category 2 issues applicable to Peach Bottom operation during the renewal term and for environmental justice and chronic

effects of electromagnetic fields. For 14 issues and environmental justice, the staff concluded that the potential environmental impact of renewal term operations of Peach Bottom Units 2 and 3 would be of SMALL significance in the context of the standards set forth in the GEIS and that further mitigation would not be warranted. In addition, the staff determined that a consensus has not been reached by appropriate Federal health agencies regarding chronic adverse effects from electromagnetic fields. Therefore, no evaluation of this issue is required.

4.9 References

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

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36 CFR 800. Code of Federal Regulations, Title 36, *Parks, Forests, and Public Property,* Part 800, "Protection of Historic Properties."

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5.0 Environmental Impacts of Postulated Accidents

Environmental issues associated with postulated accidents are discussed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996; 1999a).[(a)] The GEIS includes a determination of whether the analysis of the environmental issue could be applied to all plants and whether additional mitigation measures would be warranted. Issues are then assigned a Category 1 or a Category 2 designation. As set forth in the GEIS, Category 1 issues are those that meet all of the following criteria:

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

(2) Single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective off site radiological impacts from the fuel cycle and from high level waste and spent fuel disposal).

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

For issues that meet the three Category 1 criteria, no additional plant-specific analysis is required unless new and significant information is identified.

Category 2 issues are those that do not meet one or more of the criteria for Category 1, and therefore, additional plant-specific review of these issues is required.

This chapter describes the environmental impacts from postulated accidents that might occur during the license renewal term.

5.1 Postulated Plant Accidents

Two classes of accidents are evaluated in the GEIS. These are design-basis accidents (DBAs) and severe accidents, as discussed below.

(a) The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the "GEIS" include the GEIS and Addendum 1.

5.1.1 Design-Basis Accidents

In order to receive NRC approval to operate a nuclear power facility, an applicant must submit a safety analysis report (SAR) as part of its application. The SAR presents the design criteria and design information for the proposed reactor and comprehensive data on the proposed site. The SAR also discusses various hypothetical accident situations and the safety features that are provided to prevent and mitigate accidents. The NRC staff reviews the application to determine whether the plant design meets the Commission's regulations and requirements and includes, in part, the nuclear plant design and its anticipated response to an accident.

DBAs are those accidents that both the licensee and the NRC staff evaluate to ensure that the plant can withstand normal and abnormal transients, and a broad spectrum of postulated accidents without undue hazard to the health and safety of the public. A number of these postulated accidents are not expected to occur during the life of the plant, but are evaluated to establish the design basis for the preventive and mitigative safety systems of the facility. The acceptance criteria for DBAs are described in 10 CFR Part 50 and 10 CFR Part 100.

The environmental impacts of DBAs are evaluated during the initial licensing process, and the ability of the plant to withstand these accidents is demonstrated to be acceptable before issuance of the operating license (OL). The results of these evaluations are found in license documentation such as the staff's Safety Evaluation Report (SER), the Final Environmental Statement (FES), the licensee's Updated Final Safety Analysis Report (UFSAR), and Section 5.1 of this supplemental environmental impact statement (SEIS). The licensee is required to maintain the acceptable design and performance criteria throughout the life of the plant including any extended-life operation. The consequences for these events are evaluated for the hypothetical maximum exposed individual; as such, changes in the plant environment will not affect these evaluations. Because of the requirements that continuous acceptability of the consequences and aging management programs be in effect for license renewal, the environmental impacts as calculated for DBAs should not differ significantly from initial licensing assessments over the life of the plant, including the license renewal period. Accordingly, the design of the plant relative to DBAs during the extended period is considered to remain acceptable and the environmental impacts of those accidents were not examined further in the GEIS.

The Commission has determined that the environmental impacts of DBAs are of SMALL significance for all plants because the plants were designed to successfully withstand these accidents. Therefore, for the purposes of license renewal, design-basis events are designated as a Category 1 issue in 10 CFR Part 51, Subpart A, Appendix B, Table B-1. The early resolution of the DBAs make them a part of the current licensing basis of the plant; the current licensing basis of the plant is to be maintained by the licensee under its current license and,

therefore, under the provisions of 10 CFR 54.30, is not subject to review under license renewal. This issue, applicable to Peach Bottom Units 2 and 3, is listed in Table 5-1.

Table 5-1. Category 1 Issue Applicable to Postulated Accidents During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section
POSTULATED ACCIDENTS	
Design-basis accidents	5.3.2; 5.5.1

Based on information in the GEIS, the Commission found that

> The NRC staff has concluded that the environmental impacts of design basis accidents are of small significance for all plants.

Exelon Generation Company, LLC (Exelon) stated in its Environmental Report (ER; Exelon 2001) that it is not aware of any new and significant information associated with the renewal of the Peach Bottom Units 2 and 3 OLs. The staff has not identified any significant new information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts related to this issue beyond those discussed in the GEIS.

5.1.2 Severe Accidents

Severe nuclear accidents are more severe than DBAs because they could result in substantial damage to the reactor core, whether or not there are serious offsite consequences. The GEIS assessed the impacts of severe accidents during the license renewal period, using the results of existing analyses and site-specific information to conservatively predict the environmental impacts of severe accidents for each plant during the renewal period.

Based on information in the GEIS, the Commission found that

> 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.

Therefore, the Commission has designated mitigation of severe accidents as a Category 2 issue in 10 CFR Part 51, Subpart A, Appendix B, Table B-1. This issue, applicable to Peach Bottom Units 2 and 3, is listed in Table 5-2.

Table 5-2. Category 2 Issue Applicable to Postulated Accidents During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections	10 CFR 51.53(c)(3)(ii) Subparagraph	SEIS Section
	POSTULATED ACCIDENTS		
Severe Accidents	5.3.3; 5.3.3.2; 5.3.3.3; 5.3.3.4; 5.3.3.5; 5.4; 5.5.2	L	5.2

The staff has not identified any significant new information with regard to the consequences from severe accidents during its independent review of the Exelon ER (Exelon 2001), the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of severe accidents beyond those discussed in the GEIS. However, in accordance with 10 CFR 51.53(c)(3)(ii)(L), the staff has reviewed severe accident mitigation alternatives (SAMAs) for Peach Bottom Units 2 and 3. The results of its review are discussed in Section 5.2.

5.2 Severe Accident Mitigation Alternatives

10 CFR 51.53(c)(3)(ii)(L) requires that license renewal applicants consider alternatives to mitigate severe accidents if the staff has not previously evaluated severe accident mitigation alternatives (SAMAs) for the applicant's plant in an environmental impact statement (EIS) or related supplement or in an environmental assessment. The purpose of this consideration is to ensure that plant changes (i.e., hardware, procedures, and training) with the potential for improving severe accident safety performance are identified and evaluated. SAMAs have not been previously considered for Peach Bottom Units 2 and 3; therefore, the following addresses those alternatives.

5.2.1 Introduction

Exelon submitted an assessment of SAMAs for Peach Bottom Units 2 and 3 as part of the ER (Exelon 2001). This assessment was based on the current Peach Bottom Probabilistic Safety Analysis (PSA), a plant-specific adaptation of the offsite consequence analysis performed as part of the NRC-sponsored probabilistic safety assessment for Peach Bottom Units 2 and 3 and documented in NUREG/CR-4551 (NRC 1990b), and insights from the Peach Bottom Individual Plant Examination of External Events (IPEEE) (PECO 1996). In identifying and evaluating potential SAMAs, Exelon considered several SAMA analyses for other plants (Limerick, Watts Bar, Comanche Peak, and Hatch) and other documents that discuss potential plant improvements, such as NUREG-1560 (NRC 1997a) and NUREG-1462 (NRC 1994a). Exelon

identified and evaluated 204 potential SAMA candidates. This list was reduced to 30 unique SAMA candidates by eliminating SAMAs that were either not applicable to Peach Bottom Units 2 and 3, were related to phenomena that are not risk-significant in BWRs, or were similar to other SAMAs being considered. Other SAMAs were excluded because they had already been implemented at Peach Bottom Units 2 and 3. This list was further screened and the remaining SAMAs were evaluated in detail. The study concluded that none of the SAMAs identified would be cost-beneficial.

Based on a review of the SAMA assessment, the NRC issued a request for additional information (RAI) to Exelon by letter dated December 20, 2001 (NRC 2001). Key questions concerned differences between the updated PSA used for the SAMA analysis and earlier risk assessments for Peach Bottom Units 2 and 3, the potential impact of uncertainties and external event risk contributors on the study results, the role of the plant-specific risk study in the SAMA identification process, and the effects of the power uprate on the risk profile. Exelon submitted additional information on January 30, 2002 (Exelon 2002) in response to the RAIs. In these responses, Exelon included supplemental tables showing the impacts of uncertainties, additional sensitivity analyses, and an assessment of the impact of the power uprate on accident progression. Exelon submitted further information on April 8, 2002 (Enclosure 3 to NRC 2002) clarifying remaining issues. In these responses, Exelon provided additional information on the jockey pump SAMA and on the averted risk values determined for SAMA candidates. Exelon's responses addressed the staff's concerns and reaffirmed that none of the SAMAs would be cost-beneficial.

An assessment of SAMAs for Peach Bottom Units 2 and 3 is presented below.

5.2.2 Estimate of Risk for Peach Bottom Units 2 and 3

Exelon's estimates of offsite risk at Peach Bottom Units 2 and 3 are summarized in Section 5.2.2.1. The summary is followed by a review of Exelon's risk estimates in Section 5.2.2.2.

5.2.2.1 Exelon's Risk Estimates

The SAMA analysis is based on two distinct analyses: (1) the Level 1 and 2 probabilistic safety assessment performed by Exelon and documented as Peach Bottom PSA, Revision 1, and (2) the extension of the Level 2 PSA to a Level 3 assessment based on application of the NUREG-1150 (NRC 1990a) consequence analysis results for Peach Bottom Units 2 and 3, as reported in NUREG/CR-4551 (NRC 1990b). The Peach Bottom PSA is an update to the Peach Bottom IPE submittal (PECO 1992) and reflects plant changes since the issuance of NUREG-1150 (NRC 1990a) and NUREG/CR-4551 (NRC 1990b). The scope of the Peach Bottom PSA does not include seismic or fire PSA models. As such, the Peach Bottom PSA does not permit either the numerical assessment of the baseline risk or identification of the quantitative change in risk

that could be attributed to any proposed SAMA due to seismic or fire accident initiators. As described in Section 5.2.2.2, Exelon chose to evaluate the potential effects associated with these initiators through a sensitivity study.

The total core damage frequency (CDF) for internal events is 4.5×10^{-6} per reactor-year. The breakdown of CDF is provided in Table 5-3 . As shown in this table, the current analyses show that loss of offsite power (LOOP) and transient events, including station blackout (SBO) and anticipated transient without scram (ATWS), are the dominant contributors to CDF. The contribution of loss-of-coolant accidents (LOCAs) and other internal event initiators to CDF is less than 8 percent.

Table 5-3. Peach Bottom Units 2 and 3 Core Damage Frequency (Revision 1 of PSA)

Initiating Event	Frequency (per reactor-year)	% Contribution to CDF
Loss of Offsite Power (LOOP)	2.1×10^{-6}	46
Transients	1.2×10^{-6}	28
Station Blackout (SBO)	4.7×10^{-7}	10
Anticipated Transient Without Scram (ATWS)	4.3×10^{-7}	10
Loss-of-Coolant Accident (LOCA)	1.9×10^{-7}	4
Internal floods	6.0×10^{-8}	1
Others	4.8×10^{-8}	1
Total CDF (from internal events)	4.5×10^{-6}	100

The total Peach Bottom Unit 2 Level 1 CDF used in the SAMA submittal is 4.5×10^{-6} per reactor-year. The frequency associated with the plant damage states (PDSs) with significant offsite releases is 2.4×10^{-6} per reactor-year. The difference between the Level 1 CDF and the Level 2 endstate frequency represents those core damage sequences that lead to negligible or no release from the primary containment.

The total CDF for Peach Bottom Unit 3 is 4.2×10^{-6} per reactor-year, which is about 8 percent lower than that of Unit 2. This difference is attributed mostly to LOOP sequences involving the loss of 2 or 3 shared diesel generators. Asymmetry in emergency electric power distribution between the units and the diesel loading capability (one RHR pump per diesel generator) concurrent with the common LOOP initiator result in different diesel failure combinations having different CDF impacts at each unit.

The Peach Bottom PSA is limited to Level 1 and 2 and does not include an assessment of off-site consequences. Exelon extended the Level 2 PSA to a Level 3 assessment based on use of the NUREG/CR-4551 consequence analyses, and then scaled these results to account for increased population in the vicinity of Peach Bottom Units 2 and 3 at end of the license renewal period, as described below.

Each sequence in the Peach Bottom Level 2 PSA was reviewed and binned into one of 10 collapsed accident progression bins (APBs) used in NUREG/CR-4551. NUREG/CR-4551 provides the fractional contribution of the ten collapsed APBs and sufficient information to determine the frequency associated with each of the ten collapsed APBs. Exelon determined the population dose by multiplying the ratio of the CDF in the Peach Bottom PSA to the CDF in the NUREG/CR-4551 study by the product of the fractional contribution of the collapsed APBs and the total risk estimate from NUREG/CR-4551. Specifically, for a given collapsed APB the submittal defines the population dose risk as:

$$PDR_{PBAPS-PSA} = \frac{Frequency_{PBAPS-PSA}}{Frequency_{NUREG/CR-4551}} \bullet f_{APB} \bullet PDR_{NUREG/CR-4551}$$

where

$PDR_{PBAPS-PSA}$ = population dose risk at 50 miles for Peach Bottom (person-rem per reactor-year)

$Frequency_{PBAPS-PSA}$ = frequency of each collapsed APB in Peach Bottom PSA (per reactor-year)

$Frequency_{NUREG/CR-4551}$ = frequency of each collapsed APB in NUREG/CR-4551 (per reactor-year)

f_{APB} = fractional contribution of the collapsed APB to the population dose risk in NUREG/CR-4551

$PDR_{NUREG/CR-4551}$ = population dose risk at 50 miles for NUREG/CR-4551 (person-rem per reactor-year).

The resulting population dose estimates were summed over all bins to arrive at a total population dose.

The NUREG/CR-4551 consequence analyses were based on Version 1.5 of the MACCS computer code and site-specific data available at the time of the study (e.g., meteorology, demographics, and offsite property values). For purposes of the SAMA analysis, the population dose estimates were adjusted to account for the increase in population at the end of the

proposed license extension. The population distribution used as input to the NUREG/CR-4551 MACCS analyses is based on the 1980 sector population data for the Peach Bottom site. Using 1990 and 1980 Census data, a growth ratio was developed and used to extrapolate the population out to 2034 to approximate the population at the end of the license renewal period. The ratio of the population density was calculated as:

$$P_{2034/1980} = \frac{\left(\frac{PD_{50(1990)} - PD_{50(1980)}}{1990 - 1980} \bullet 44 \text{ years} + PD_{50(1990)}\right)}{PD_{50(1990)}} \approx 4$$

where

$P_{2034/1980}$ = 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

$PD_{50(1980)}$ = 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 this analysis, Exelon estimates the dose to the population within 80 km (50 mi) of the Peach Bottom site to be 0.147 person-Sv (14.7 person-rem) per reactor-year. The contribution to total population dose from the various containment release modes is shown in Table 5-4. Early containment failure dominates the population dose risk at Peach Bottom Units 2 and 3.

Table 5-4. Breakdown of Population Dose by Containment Release Mode

Containment Release Mode	Population Dose [person-Sv (person-rem) per reactor-year]	
Late containment failure	0.006	0.6
Early containment failure	0.133	13.3
Vessel breach, no containment failure	0.002	0.2
No vessel breach, no containment failure	0.006	0.6
Total	0.147	14.7

5.2.2.2 Review of Exelon's Risk Estimates

Exelon's estimate of offsite risk at the Peach Bottom site is based on Revision1 of the Peach Bottom PSA and the application of the NUREG-1150 Level 3 PSA results as reported in

NUREG/CR-4551 (NRC 1990b) to the results of plant-specific Peach Bottom Level 2 PSA. This review considered the following major elements of the analysis:

- the Level 1 and 2 risk models that form the bases for the 1992 IPE and 1996 IPEEE submittals (PECO 1992, 1996)

- the major modifications to the IPE model that have been incorporated in the Peach Bottom PSA

- the extension of the Level 2 PSA to a Level 3 assessment based on use of the NUREG/CR-4551 consequence analyses and subsequent scaling of these results to account for increased population in the vicinity of the Peach Bottom site at the end of the period of extended operation

- the contribution to risk due to internal and external initiating events, as reflected in the NRC-sponsored PSA for Peach Bottom Units 2 and 3 conducted as part of the NUREG-1150 studies.

Each of these analyses was reviewed to determine the acceptability of Exelon's risk estimates for the SAMA analysis, as summarized below.

The staff's review of the Peach Bottom IPE is described in an NRC safety evaluation dated October 25, 1995 (NRC 1995). The review was based on a comparison between the results reported in the IPE submittal and the results of the staff study documented in NUREG-1150 and NUREG/CR-4551. Based on this review, the staff concluded that Exelon's analysis met the intent of Generic Letter 88-20 (NRC 1988); that is, the IPE was of adequate quality to be used to look for design or operational vulnerabilities. Overall, the staff believed that the Peach Bottom IPE was of adequate quality to be used as a tool in searching for areas with high potential for risk reduction and to assess such risk reductions.

A comparison of risk profiles between the original IPE (which was reviewed by the NRC staff) and the current PSA used in the SAMA analysis indicates a 20 percent reduction in the total Peach Bottom Unit 2 CDF. The PSA was updated twice (in 1997 and again in 1999) since the original IPE was submitted to the NRC to reflect model enhancements and plant changes, such as a 5 percent power uprate approved in 1994. The specific changes since the Peach Bottom IPE include (Exelon 2002):

- improved plant operating experience was reflected in the overall frequency of initiating events

- initiating events that were previously subsumed within other initiators (e.g., loss of instrument air and service water) were modeled as separate initiating events

- more detailed modeling of operator actions directed by procedures during LOOP events was incorporated, including credit for the Conowingo tie-line

- common cause failure terms for high pressure coolant injection (HPCI)/reactor core isolation cooling (RCIC), direct current (dc) battery pairs, and other miscellaneous systems were added

- treatment of common cause failures was reevaluated using the new Idaho National Engineering and Environmental Laboratory (INEEL) database (INEEL 1998)

- implementation of improved technical specifications was reflected in the model.

The incorporation of lower initiating event frequencies, additional LOOP recovery capabilities such as the Conowingo tie-line, and the INEEL common cause database have resulted in a reduction in total internal events CDF from that reported in the IPE. On the other hand, modeling of additional initiating events, detailed operator actions for LOOP, and common cause terms for HPCI/RCIC and dc batteries have resulted in increasing the total internal events CDF. Collectively, the incorporation of all the changes have resulted in a 20 percent reduction in the total CDF, as compared with the original IPE CDF estimate of about 5.5E-06 per reactor-year. This is a relatively small change. The revised CDF estimate for Peach Bottom Units 2 and 3 is still comparable to values estimated for other BWR/3 and BWR/4 model plants, which Figure 11.2 of NUREG-1560 (NRC 1997a) shows to range from 9E-08 to 8E-05 per reactor-year, with a point estimate value of 2E-05 per reactor-year.

The staff noted that the Peach Bottom PSA has been subjected to peer review at various stages, by internal and external reviewers, including a 1998 review of Revision 1 using the BWR Owners Group (BWROG) PSA Peer Review Certification Implementation Guidelines (Exelon 2002).

Exelon submitted an IPEEE by letter dated May 29, 1996 (PECO 1996), in response to Supplement 4 of Generic Letter 88-20 (NRC 1991). Exelon did not identify fundamental weaknesses or vulnerabilities to severe accident risk in regard to the external events related to seismic, fire, or other external events. However, a number of areas were identified for improvement in both the seismic and fire areas. In a letter dated November 22, 1999, the staff concluded that the submittal met the intent of Supplement 4 to Generic Letter 88-20 (NRC 1999b).

In a response to an RAI, Exelon acknowledged (Exelon 2002) that the risk assessment methods used for the Peach Bottom IPEEE do not provide the means to determine the numerical estimates of the CDF contributions from seismic and fire initiators. However, the licensee states that the current risk associated with external events at Peach Bottom Units 2 and 3 is much lower than that which existed at the time of the publication of NUREG/CR-4551 because of many plant

improvements that have been made since that time, mostly as a result of the insights gained from the Peach Bottom IPEEE. These improvements include:

- Increased fire brigade awareness of important fire areas
- Incorporated automatic sprinklers in 4 kV switchgear areas
- Incorporated sprinklers in the 13 kV area and added sprinkler heads on the 116 ft elevation between the 13 kV area and the remainder of the turbine building (i.e., creating a water curtain at the openings)
- Replaced or upgraded Thermo-lag fire barriers in several fire areas
- Replaced or upgraded miscellaneous equipment for resolution of Generic Safety Issue A-46, "Seismic Qualification of Equipment in Operating Plants."

In addition, Exelon notes that the quantitative contributions from external events, as estimated in NUREG/CR-4551 for Peach Bottom Units 2 and 3, would be bounded by the 95th percentile CDF estimate for internal events (see Table 5-6). An associated sensitivity study by Exelon shows that use of the 95th percentile CDF in the cost-benefit evaluation in lieu of the point estimate value impacts the screening for only two SAMAs. However, a further evaluation of these two SAMAs indicates that they would not be cost-beneficial (Exelon 2002). This is discussed further in Section 5.2.6.2.

The failure to consider the quantitative impact of external events by the licensee is acceptable given: (1) the IPEEE process has led to the identification and disposition of potential external events vulnerabilities; and (2) the insights from the consideration of the 95th percentile of the risk of core damage, which bound the potential impact if the quantitative risk of external events were included.

The process used by Exelon to extend the Peach Bottom PSA to an assessment of offsite consequences was reviewed. That process involved binning the sequences in the Peach Bottom Level 2 PSA into one of 10 collapsed APBs used in NUREG/CR-4551 and determining the population dose based on the APB frequency and the consequences of the APBs reported in NUREG/CR-4551. The relative distribution of the site-specific economic data utilized in NUREG/CR-4551 was assumed to remain constant. However, the overall growth in economy and agriculture were assumed to be reflected by the growth in the population. This increase was accounted for by scaling the population dose estimates by a factor of 4. Evacuation modeling remained unchanged from what was utilized in NUREG/CR-4551. The staff concludes that the process used by Exelon to extend the Level 2 PSA results to a Level 3 assessment, and to scale the results to account for subsequent population growth is technically sound and properly implemented, and therefore is acceptable. Furthermore, the staff concludes that the evacuation

assumptions and analysis are reasonable and acceptable for the purposes of the SAMA evaluation.

The Exelon assessment has focused on the risk based on the uprate power of 3458 MW(t). In response to an RAI, Exelon qualitatively assessed the influence of the 5 percent power uprate on the containment response and radiological releases to be negligible (Exelon 2002). The staff concludes that the basis for the licensee's qualitative assessment of the 5 percent power uprate is reasonable, and that the methodology used by Exelon to estimate the CDF and offsite consequences for Peach Bottom Units 2 and 3 provides an acceptable basis from which to proceed with an assessment of risk reduction potential for candidate SAMAs. Accordingly, the staff based its assessment of risk on the CDF and population doses reported by Exelon.

5.2.3 Potential Design Improvements

The process for identifying potential plant improvements, an evaluation of that process, and the improvements evaluated in detail by Exelon are discussed in this section.

5.2.3.1 Process for Identifying Potential Design Improvements

Exelon's process for identifying potential plant improvements (SAMAs) consisted of the following elements:

- review of SAMA analyses submitted in support of original licensing and license renewal activities for other operating nuclear power plants and advanced light-water reactor plants
- review of other NRC and industry documentation
- review of plant-specific risk management insights developed as part of the accident management implementation process at Peach Bottom Units 2 and 3

Those accident management strategies that were identified in the IPE as beneficial in reducing risk in a measurable manner and applicable to Peach Bottom Units 2 and 3 have already been implemented by Exelon. These include an enhanced version of the procedure for loss of offsite power events (SE-11), and the Torus Hard Piped Vent. The review of the updated PSA in 1997 and 1999 did not reveal any significant changes in the risk profile originally assessed as part of the IPE process (Exelon 2002).

Based on this process, an initial list of 204 candidate improvements was identified, as reported in Table G.4-16 of Appendix G to the ER. Exelon performed a qualitative, Phase I screening of the initial list of SAMAs using the following criteria:

- The SAMA is not applicable to Peach Bottom Units 2 and 3 due to design differences (e.g., not applicable to the BWR/4 Mark I design).

- The SAMA is related to an interfacing system loss-of-coolant accident (ISLOCA). These types of events are not considered to be significant risk contributors for BWRs, as described in NRC Information Notice 92-36 (NRC 1992) and its supplement (NRC 1994b).

- The SAMA is related to the mitigation of recirculation pump seal failures. NUREG-1560 indicates that although reactor coolant pump (RCP) seal leakage is important to pressurized water reactors (PWRs), it does not significantly contribute to CDF in BWRs [NRC 1997a].

- The SAMA has already been implemented at Peach Bottom Units 2 and 3.

- The SAMA is related to design changes that would be implemented prior to construction (primarily those taken from the severe accident mitigation design alternative analysis for the Advanced Boiling Water Reactor).

- The SAMA was known to have an implementation cost that far exceeds any possible risk benefit.

Any SAMA candidates that were sufficiently similar to other SAMA candidates were either combined or screened from further consideration. Based on the Phase I screening, 174 SAMAs were eliminated, leaving 30 SAMAs which were considered applicable to Peach Bottom Units 2 and 3 and of potential value in reducing the risk of severe accidents.

These 30 candidate SAMAs were further evaluated and screened as part of a Phase II evaluation. Exelon quantitatively evaluated the risk-reduction potential and the implementation costs for each of the 30 SAMA candidates, as described in Sections 5.2.4 and 5.2.5, respectively. If the implementation costs were greater than the maximum benefit, then the SAMA was screened from further consideration. Using this approach, all but 12 SAMAs were eliminated because the cost was expected to exceed the maximum benefit. Of the 12 remaining candidates, seven were screened from further analysis based on plant-specific risk insights regarding the systems that would be affected by the proposed SAMA (i.e., a more realistic evaluation of the benefit that would be obtained). These include:

- SAMA 2 - Improved ability to cool the residual heat removal (RHR) heat exchangers. This was screened out on the basis that a procedure is already in-place to cross-tie to the opposite unit High Pressure Service Water (HPSW) pumps, a cross-tie to the Fire Protection System (FPS) would not provide sufficient flow for cooling, and the cost of new hardware addition would be more than $2 million.

- SAMA 6 - Use the fire protection system as a backup source for the containment spray system. This was originally screened out on the basis that adding a backup source would not contribute to risk reduction because the Emergency Operating Procedures (EOPs), based on EPG Revision 4 guidance, would preclude using the sprays. In a response to an RAI (Exelon 2002), Exelon did clarify that new in-place procedures, based on Revision 1 of the Emergency Procedure and Severe Accident Guidelines (EP/SAG), would allow for the drywell sprays to be used to cool debris and thereby reduce probability for shell melt-through. Thus a backup source could possibly contribute to risk reduction. However, Exelon points our that the maximum benefit resulting from using the fire protection system is $284,000. This is contrasted with the cost of $0.5M/unit or $1.0M/site, which would include hardware changes to enhance the flow rate and to supply supplemental power to the RHR injection values.

- SAMA 15 - Proceduralize intermittent operation of HPCI. This was screened out based on Exelon's judgement that intermittent operation of HPCI during SBO events would be detrimental to battery life and would not be desirable.

- SAMA 17 - Enhance procedure to instruct operators to trip unneeded RHR/containment spray (CS) pumps on loss of room ventilation. This was screened out on the basis that the risk reduction worth associated with CS, LPCI, and Normal Service Water (NSW) is minimal and therefore only a small change in the CDF would be expected due to improvements in room cooling dependency.

- SAMA 19 - Modify Reactor Water Cleanup (RWCU) for use as decay heat removal system and proceduralize use. This was screened out on the basis that the Peach Bottom RWCU system is incapable of serving as the sole decay heat removal system until many days after reactor shutdown.

- SAMA 27 - Improve Uninterruptible Power Supplies (UPS). This was screened out on the basis that the UPSs are not considered by Exelon to be risk significant, although they would increase the reliability of power supplies supporting front-line safety equipment. Because they are considered risk insignificant, the UPSs are not even modeled in the Peach Bottom PRA. Thus, no quantitative measure of averted risk, however small, could be made by Exelon.

- SAMA 30 - DC Cross-ties. This was screened out on the basis that a procedure (SE-11) has already been developed to optimize cross-tie capabilities of the 4 kV buses and various power supplies afforded by the emergency diesel generators and the dedicated power source from Conowingo Dam. Because the benefit is already obtained from the SE-11 procedure, the addition of the DC cross-ties would not be cost effective.

The five remaining SAMA candidates are listed in Table 5-5. For each of the five remaining SAMA candidates, a more detailed conceptual design was prepared along with a more detailed estimated cost, as described in Section 5.2.5.

5.2.3.2 Staff Evaluation

Exelon's efforts to identify potential SAMAs focused primarily on areas associated with internal initiating events. The initial list of SAMAs generally addressed the accident categories that are dominant CDF contributors or issues that tend to have a large impact on a number of accident sequences at Peach Bottom Units 2 and 3. The preliminary review of Exelon's SAMA identification process raised some concerns that plant-specific risk contributors were not fully considered. The staff requested additional plant-specific risk information (e.g. importance measures) to determine if any significant SAMAs might have been overlooked. Exelon's response to the RAI indicated that all important plant-specific candidate SAMAs had been considered (Exelon 2002). However, importance measures were only used on a selected basis. Exelon did not provide information indicating that they had performed a systematic and comprehensive evaluation of importance measures and their relation to potential SAMAs. Exelon indicated that, because there are only small differences between the IPE PRA and the current (Revision 1) PSA, the original and subsequent evaluations of plant-specific accident mitigation strategies is sufficient for SAMA candidate determination. While the staff's position is that a comprehensive assessment of importance measures and/or cut sets is important to determining SAMA candidates, it does recognize that Exelon used the plant-specific risk study to identify candidate SAMAs and therefore concludes that the list of SAMA candidates appears to address the major contributors to risk for both the IPE and the PSA.

The list of 204 candidate SAMAs focuses on hardware changes that tend to be expensive to implement. However, about one-third of the 204 candidate SAMAs involve something other than hardware changes. These options could provide marginally smaller risk reductions with much smaller implementation costs.

Of the 204 SAMA candidates, Exelon eliminated 26 because they were associated with reactor coolant pump seal failures or ISLOCA (both considered to be too insignificant with respect to BWR risk to pursue), 31 were eliminated because they were determined to not be applicable to Peach Bottom Units 2 and 3 (for various reasons), 39 were combined with other similar candidate SAMAs, 61 were already implemented at Peach Bottom Units 2 and 3, 10 were determined to not be cost beneficial (cost of implementation would exceed risk benefit), and 7 were judged to provide no safety benefit. This left 30 SAMA candidates for further consideration. Of the 30 remaining SAMAs that were applicable to Peach Bottom Units 2 and 3 and were of potential value in averting the risk of severe accidents, 7 were not hardware changes.

As described in Section 5.2.3.1, Exelon eliminated 18 of the remaining 30 SAMA candidates as part of the Phase II screening by comparing the estimated costs of the candidates to the

maximum benefit ($2.04M/site, see Section 5.2.6 for further discussion) attained by eliminating all risk, and finding that costs for each of the eighteen were much greater than the maximum benefit. Because the actual benefit for any of the eighteen would be considerably less than this maximum, the staff concludes that these eighteen were properly eliminated.

The next step in the process was to reduce the remaining 12 SAMA candidates further. Seven were eliminated by Exelon by considering cost, enhancements and qualitative arguments for disposition. The staff considered each and concluded that the Exelon position was acceptable except for the matter of the fire protection system as a containment spray source backup (SAMA 6). In response to RAIs, Exelon addressed this matter further and also addressed a SAMA candidate not considered in its original SAMA list. These two potential SAMAs are discussed below.

The staff questioned Exelon's basis for screening out SAMA 6 (use the fire protection system [FPS] as a backup source for the containment spray system) given that the plant-specific emergency operating procedures had been modified since the original screening, potentially impacting the value of this SAMA. In response to an RAI, Exelon indicated that the SAMAs were dispositioned when procedures based on Revision 4 of the Emergency Procedure Guidelines (EPG) were in place at Peach Bottom Units 2 and 3. These guidelines severely restricted the ability to use drywell sprays, making this hardware modification ineffective. Since that time, the procedures have been revised based on Revision 1 of the Emergency Procedure and Severe Accident Guidelines (EP/SAG), which provide less restrictive guidance concerning the use of drywell sprays for accident mitigation. Revision 2 of the EP/SAG, which was issued by the Boiling Water Reactor Owners Group in 2001 but is not yet implemented at Peach Bottom Units 2 and 3, provides additional flexibility in the use of sprays.

In response to the staff's request, Exelon provided additional information regarding the benefits and costs of this SAMA. Exelon noted that the diesel fire pump could be used to supply the drywell sprays in those accident sequences for which AC power or DC power may not be available to operate RHR or HPSW. The Fussell-Vesely importance for these sequences leading to core damage is approximately 0.1. Thus, only about 10 percent of the core damage scenarios leading to possible radionuclide releases could be influenced by the use of FPS for drywell sprays. Exelon noted that FPS as a backup source for the containment spray system would require a modification to enhance the system flow rate and add supplemental power to the RHR injection values, and estimated the cost of these modifications at $0.5m/unit. The maximum benefit was estimated to be $284K based on a conservative assumption that all SBO events would be successfully mitigated using the fire protection system. On the basis of this information, Exelon concluded that this SAMA will not provide sufficient risk reduction to warrant its expense. The staff considers Exelon's dispositioning of this SAMA based on the above costs and benefits to be reasonable.

The staff's risk study of Peach Bottom Units 2 and 3 (NRC 1990b) concluded that a potentially beneficial procedural modification might be one to reduce the probability of a common-mode DC power failure. Exelon addressed this possible additional candidate in their responses to RAIs (Exelon 2002). They state that the DC system and associated common cause events have a low impact on the baseline CDF and risk (e.g., the Fussell-Vesely importance is 4.3×10^{-5}) and that therefore, justification for a modification is not supported as being cost beneficial. The staff concludes that the Exelon evaluation is reasonable.

The remaining 5 SAMA candidates are addressed quantitatively in Sections 5.2.4 and 5.2.5.

The NRC notes that the set of SAMAs submitted is not all inclusive, because additional, possibly even less expensive, design alternatives can always be postulated. However, the staff concludes that the benefits of any additional modifications are unlikely to exceed the benefits of the modifications evaluated and that the alternative improvements would not likely cost less than the least expensive alternatives evaluated, when the subsidiary costs associated with maintenance, procedures, and training are considered. On this basis, the NRC concludes that the set of potential SAMA alternatives identified by Exelon is acceptable.

5.2.4 Risk Reduction Potential of Design Improvements

Exelon developed a quantitative estimate of the risk reduction for each of the 5 SAMAs remaining after the Phase II screening. The specific impacts on the CDF and the population dose were identified, the appropriate model elements were changed to reflect the plant or procedure enhancement, and the models were requantified. Table 5-5 lists the assumptions used to estimate the risk reduction, the estimated risk reduction in terms of percent reduction in CDF and population dose, and the estimated total benefit (present value) of the averted risk for each of the 5 SAMAs.

In response to an RAI, Exelon estimated the uncertainties associated with the calculated CDF, and reassessed the Phase II screening based on use of the 95th percentile value of the CDF in the cost-benefit analysis instead of the point estimate value. Exelon found that two of the SAMAs would no longer be screened out; however, a more detailed examination by Exelon concluded that these two SAMAs would not be justified on a cost-benefit basis (Exelon 2002). In addition, Exelon states that even if the impact of external events on the CDF, as estimated in NUREG/CR-4551 in the late 1980s, were to be included in the evaluation, the increase would be less than that provided by the 95th percentile CDF estimate from internal events (Exelon 2002). These assessments are discussed further in Section 5.2.6.2.

Of the five candidates described in Table 5-5, the one that has costs and benefits that are of the same order is SAMA 21, suppression pool jockey pump. This pump would provide an independent means of providing long term injection into the reactor pressure vessel following

venting or containment failure. In the PSA, the jockey pump was initially simulated by changing the failure probability for the fire pump from 0.8 to 0.01 (the PSA includes a simple representation of the fire pump to perform a similar function). This is considered optimistic by Exelon. The resulting risk reduction translated into a benefit value of $351,000. Because this risk-reduction value was large, the staff asked Exelon for additional information regarding the costs and the risk-reduction potential of this SAMA. Exelon claimed that a more realistic benefit value for SAMA 21 is about $152,000 (Enclosure 3 to NRC 2002). The PSA evaluation for the more realistic case assumed that the jockey pump is supplied by the E2 480V bus, i.e., the bus with the lowest risk achievement worth in the model, with a total system reliability of 0.05 (including human error) instead of the optimistic value of 0.01. The staff concurs that the reliability value of 0.05 is a reasonable best-estimate, and that the more realistic risk reduction estimates provided by Exelon are appropriate values to use in the SAMA assessment.

The NRC staff has reviewed Exelon's bases for calculating the risk reduction for the various plant improvements and concludes that the methodology is sound and that the values calculated are reasonable for SAMA purposes.

5.2.5 Cost Impacts of Candidate Design Improvements

As part of the Phase II screening, Exelon developed a preliminary cost estimate for each of the 30 unique SAMA candidates remaining after the qualitative (Phase I) screening. These preliminary cost estimates, reported in Table G.4-2 of the ER, were developed to determine which SAMA candidates would clearly cost more than $2.04M (the maximum benefit associated with completely eliminating all risk, as described in Section 5.2.6.1) and could readily be dismissed. The cost estimates were based on the total costs associated with engineering, procurement, and construction. All costs for all SAMAs were provided on a per site basis. Where applicable, costs were determined on dual-unit basis (rather than doubling a single-unit estimate) to give a more accurate overall cost estimate.

Using the $2.04M screening value, 18 candidate SAMAs were eliminated. Of the 12 remaining candidates, seven were screened from further analysis based on plant-specific risk insights regarding the systems that would be affected by the proposed SAMA, as described in Section 5.2.3.1 and 5.2.3.2. For the five remaining SAMA candidates, a more detailed conceptual design was prepared along with a more detailed cost estimate based on the same set of cost elements considered. Table 5-5 shows the cost estimates for the five remaining SAMAs.

The staff compared the cost estimates in Table G.4-2 of the ER to estimates developed elsewhere for similar improvements, including estimates developed as part of other licensees' analyses of SAMAs for operating reactors and advanced light-water reactors. The Exelon estimates were found to be consistent and reasonable for the SAMAs under consideration.

Table 5-5. SAMA Cost/Benefit Screening Analysis

Phase II SAMA #	SAMA	Assumptions	% Risk Reduction		Total Benefit	Cost (2001 dollars)	Net Value ($)	
			CDF	Population Dose			Base Case	3% Discount Rate
1	Enhance procedural guidance for use of cross-tied component cooling or service water pumps	Eliminate initiating events related to loss of service water, by setting basic events involving failure of service water, turbine building closed cooling water, and reactor building closed cooling water pumps to zero	0.7	0.07	$8400	$50,000	(41,600)	(39,000)
11	Provide additional DC battery capacity	Extend battery life 4 hours to simulate additional battery capability. Impacts the loss of offsite power cases with HPCI and/or RCIC available.	19	13	$265,000	$1,600,000	(1,330,000)	(1,250,000)
13	Develop procedures to repair or replace failed 4-kV breakers	Improved procedures to repair or replace failed 4 kV breakers would reduce 4 kV breaker "fail to close" rates to zero, and reduce 4kV bus failure rates by a factor of 10.	0.1	very small	$400	$50,000	(49,600)	(49,500)
18	Increase the safety relief valve reseat reliability (case A)	Safety relief valve (SRV) "failure to reseat" probabilities reduced by a factor of 10.	4	5	$94,000	$2,000,000	(1,910,000)	(1,890,000)
18	Increase the safety relief valve reseat reliability (case B)	SRV "failure to reseat" probabilities reduced by a factor of 10, and stuck-open safety relief valve initiating event frequency reduced by a factor of 10.	6	10	$174,000	$2,000,000	(1,830,000)	(1,770,000)
21	Install suppression pool jockey pump for alternate injection to the reactor pressure vessel (optimistic)	Installation of a suppression pool jockey pump simulated by reducing the failure probability for the fire pump to 0.01	8	27	$351,000	$480,000	(129,000)	(19,400)
21	Install suppression pool jockey pump for alternate injection to the reactor pressure vessel (realistic)	Installation of a suppression pool jockey pump simulated by reducing the failure probability for the fire pump to 0.05	5	9	$152,000	480,000	(328,000)	(280,000)

For SAMAs 1 and 13, the estimate of $50,000 for a site procedural change is consistent with other cost assessments for similar actions. The range determined from other SAMA studies is $30,000 to $70,000.

For SAMA 18, the cost estimate of $2M is based on $200K/safety relief valve (SRV) times 10 automatic depressurization system SRVs (5 per unit). Because this SAMA assumes replacing the SRVs with new models, the cost is reasonable.

For SAMA 11, the cost estimate of $1.6M is based on $200K/battery times 8 batteries. This cost includes engineering analysis, equipment (new battery capability), and modification implementation. The cost is reasonable for a "hardware" SAMA of this size.

For SAMA 21, Exelon provided an estimated implementation cost of $480K (for both units) based on a previous cost estimate for the Advanced Boiling Water Reactor (ABWR). The ABWR cost estimate was doubled to account for the higher cost of installing the modification in an operating plant, versus during new plant construction. In response to a staff request, Exelon noted that this cost estimate was optimistic and that, in reality, when considering the costs associated with the installation of a totally independent system (new pump, power supply cables, and new piping) capable of injecting saturated water from the suppression pool, the costs would be much higher (Enclosure 3 to NRC 2002). Based on these comments from Exelon and further consideration of the modification, the staff considers the cost estimate of $480,000 not unreasonable but certainly optimistic. The lower-bound nature of this estimate should be taken into account in the cost-benefit comparison.

The staff concludes that the cost estimates are sufficient and appropriate for use in the SAMA evaluations.

5.2.6 Cost-Benefit Comparison

The staff's evaluation of Exelon's cost-benefit analysis is described in the following sections.

5.2.6.1 Exelon Evaluation

The methodology used by Exelon was based primarily on NRC's guidance for performing cost-benefit analysis, i.e., NUREG/BR-0184, *Regulatory Analysis Technical Evaluation Handbook* (NRC 1997b). The guidance involves determining the net value for each SAMA according to the following formula:

$$\text{Net Value} = (\$APE + \$AOC + \$AOE + \$AOSC) - COE$$

where

$APE = present value of averted public exposure ($)

$AOC = present value of averted offsite property damage costs ($)

$AOE = present value of averted occupational exposure costs ($)

$AOSC = present value of averted onsite costs ($)

COE = cost of enhancement ($)

If the net value of a SAMA is negative, the cost of implementing the SAMA is larger than the benefit associated with the SAMA and it is not considered cost-beneficial. Exelon's derivation of each of the associated costs is summarized below.

Averted Public Exposure (APE) Costs

The APE costs were calculated using the following formula:

APE = Annual reduction in public exposure (Δperson-rem/reactor-year)
x monetary equivalent of unit dose ($2000 per person-rem)
x present value conversion factor (10.76 based on a 20-year period with a 7-percent discount rate).

As stated in NUREG/BR-0184 (NRC 1997b), it is important to note that the monetary value of the public health risk after discounting does not represent the expected reduction in public health risk due to a single accident. Rather, it is the present value of a stream of potential losses extending over the remaining lifetime (in this case, the renewal period) of the facility. Thus, it reflects the expected annual loss due to a single accident, the possibility that such an accident could occur at any time over the renewal period, and the effect of discounting these potential future losses to present value. For the purposes of initial screening, Exelon calculated an APE of approximately $317,000.

Averted Offsite Property Damage Costs (AOC)

The AOCs were calculated using the following formula:

AOC = Annual CDF reduction
x offsite economic costs associated with a severe accident (on a per-event basis)
x present value conversion factor.

For the purposes of initial screening (severe accident costs eliminated), Exelon cited an annual offsite economic risk of $51,700 based on the Level 3 risk analysis. This results in a discounted value of approximately $557,000.

Averted Occupational Exposure (AOE) Costs

The AOE costs were calculated using the following formula:

AOE = Annual CDF reduction
x occupational exposure per core damage event
x monetary equivalent of unit dose
x present value conversion factor.

Exelon derived the values for averted occupational exposure from information provided in Section 5.7.3 of the regulatory analysis handbook (NRC 1997b). Best-estimate values provided for immediate occupational dose (3300 person-rem) and long-term occupational dose (20,000 person-rem over a 10-year cleanup period) were used. The present value of these doses was calculated using the equations provided in the handbook in conjunction with a monetary equivalent of unit dose of $2000 per person-rem, a real discount rate of 7 percent, and a time period of 20 years to represent the license renewal period. For the purposes of initial screening (severe accident costs eliminated), Exelon calculated an AOE of approximately $1,700.

Averted Onsite Costs (AOSC)

Averted onsite costs include averted cleanup and decontamination costs and averted power replacement costs. Repair and refurbishment costs are considered for recoverable accidents only and not for severe accidents. Exelon derived the values for AOSC based on information provided in Section 5.7.6 of the regulatory analysis handbook (NRC 1997b).

Exelon divided this cost element into two parts, the Onsite Cleanup and Decontamination Cost, also commonly referred to as averted cleanup and decontamination costs (ACC), and the Replacement Power Cost (RPC).

Averted cleanup and decontamination costs (ACC) are calculated using the following formula:

ACC = Annual CDF reduction
x present value of cleanup costs per core damage event
x present value conversion factor.

The total cost of cleanup and decontamination subsequent to a severe accident is estimated in the regulatory analysis handbook to be $1.1x10^9$ (undiscounted). This value was converted to present costs over a 10-year cleanup period and integrated over the term of the proposed license extension. For the purposes of initial screening (severe accident costs eliminated), Exelon calculated an ACC of approximately $53,600.

Long-term RPC are calculated using the following formula:

RPC = Annual CDF reduction
x present value of replacement power for a single event
x factor to account for remaining service years for which replacement power is required
x reactor power scaling factor

For the purposes of initial screening (severe accident costs eliminated), Exelon calculated an RPC of approximately $91,000.

Exelon evaluated all costs and benefits on a per site rather than per unit basis. Accordingly, they applied a factor of two multiplier to each of the above cost elements to account for the contribution from both units. Using the above equations and applying this multiplier, Exelon estimated the total present dollar value equivalent associated with completely eliminating severe accidents at Peach Bottom Units 2 and 3 to be $2.04M for the site.

Exelon's Results

The cost-benefit results for the individual analysis of the final five SAMA candidates are presented in Table 5-5. All of the SAMAs have negative net values. Exelon concluded that implementation of any of these SAMAs is not justified because the costs of implementation exceed the benefits. Therefore, Exelon has decided not to pursue any of these SAMAs further.

5.2.6.2 Staff Evaluation

The cost-benefit analysis conducted by Exelon was based primarily on the NRC's Regulatory Analysis Technical Evaluation Handbook (NRC 1997b). Averted risks were for the Peach Bottom Units 2 and 3, and thus were twice the values for a single unit. To maintain expenditures on the same scale, Exelon either doubled the single-unit SAMA costs or assessed SAMA costs on a (shared) plant station basis. While this is not a typical practice, it is reasonable.

Exelon originally did not perform sensitivity studies as recommended in the regulatory analysis handbook (NRC 1997b). In response to an RAI, Exelon performed a sensitivity study in which the discount rate was reduced from 7 percent in the baseline analysis to 3 percent. This results in an increase in the maximum benefit (for completely eliminating all risk) from $2.04M to about $2.7M. As a result, five of the SAMAs previously eliminated in the Phase II screening (on the basis that their implementation costs were greater than the maximum benefit) were reassessed because their implementation costs would be less than the revised maximum benefit of $2.7M. These SAMAs were:

- SAMA 3 - Install an independent method of suppression pool cooling
- SAMA 5 - Install a containment vent large enough to remove ATWS decay heat
- SAMA 23 - Install a Safety-Related Condensate Storage Tank
- SAMA 24 - Install improved vacuum breakers (redundant valves in each line)
- SAMA 28 - Dedicated RHR (bunkered) Power Supply

Upon further evaluation, either the risk reduction associated with these additional SAMAs was estimated to be relatively small, or the realistic implementation costs were judged to be greater

than the benefits. On this basis, Exelon determined that these SAMAs would not be cost beneficial.

Similarly, implementing any of the SAMAs in the near term instead of waiting until the start of the license renewal period (thereby extending the period in the value-impact analysis) would not increase the net benefit sufficiently to make any of the SAMA candidates cost-beneficial.

Use of a 3 percent discount rate also increases the benefits associated with the 5 candidate SAMAs that had already survived the Phase II screening. The net benefits of these SAMAs using a 3 percent discount rate is shown in the last column of Table 5-5. The net benefits for each of the SAMAs remain negative, although SAMA 21 - Install suppression pool jockey pump, is only marginally negative (-$19K), based on an averted risk value of $461K and an estimated cost of $480K.

In their responses to the staff's RAIs (Exelon 2002), Exelon addressed the impact of considering the 95th percentile CDF, a value 7 times larger than the point estimate (see Table 5-6). The resultant increase in the averted risks would tend to make the SAMAs more attractive.

Table 5-6. Uncertainty in the Calculated CDF for Peach Bottom Unit 2

Percentile	CDF (per reactor-year)
5th	1.6×10^{-6}
25th	2.6×10^{-6}
50th	4.2×10^{-6}
75th	7.8×10^{-6}
95th	3.0×10^{-5}

Exelon reassessed all 30 of the candidate SAMAs and found that two SAMAs became cost-beneficial under the 95th percentile assumption. These were SAMA 11 - Provide additional DC battery capability, and SAMA 21 - Install suppression pool jockey pump. The benefits for SAMA 11 are still relatively close to the costs (i.e., a net value of $145K) when the 95th percentile CDF is used. Since the 95th percentile is an upper bound, and the net value is still relatively small, the staff agrees with Exelon that SAMA 11 is not a candidate for further consideration.

The benefits of SAMA 21 are substantially greater than the costs (i.e., a net value of $1.85M) when the 95th percentile CDF and optimistic risk reduction assumptions (see Section 5.2.4) are used, suggesting that the SAMA might also be cost-beneficial given more modest increases in the estimated CDF than a factor of seven. Also, as mentioned above, the net value of SAMA 21 is only marginally negative using a 3 percent discount rate (and point estimate CDF values). However, when averted onsite costs (AOSC) are excluded from the cost benefit, the net value becomes more negative. (The Regulatory Analysis Guidelines direct the staff to display the results with this attribute excluded if such exclusion would change the apparent conclusion to

be drawn from the calculated net benefit.) Furthermore, based on a more realistic estimate of the risk reduction for this SAMA provided in Section 5.2.4, the benefits are substantially less and this SAMA would have a negative net value of approximately $300K. The impact of these major assumptions and uncertainties on the cost-benefit results are summarized in Table 5-7.

Table 5-7 Impact of Uncertainties on SAMA #21 Costs and Benefits

	Analysis Case				
Cost-Benefit Element	**Base Case**	**95th Percentile CDF**	**3% Discount Rate**	**AOSC excluded**	**"Realistic" Averted-Risk Benefit**
Benefit	$351K	$2,330K	$461K	$339K	$152K
Cost	$480K	$480K	$480K	$480K	$480K
Net Value	–$129K	+$1,850K	–$19K	–$141K	–$328K

Exelon stated that the estimated cost to implement SAMA 21 is conservative (see discussion in Section 5.2.5). The staff acknowledges that the implementation cost may be conservative, and further notes that when AOSC is excluded, the net value of the SAMA is clearly negative. Although this SAMA may have a positive net value under certain conditions, it does not appear to be justified on a cost-benefit basis, given a broader consideration of the conservatisms, uncertainties, and assumptions inherent in the analysis.

5.2.7 Conclusions

Exelon compiled a list of 204 SAMA candidates using as resources: SAMA analyses submitted in support of licensing activities for other nuclear power plants, NRC and industry documents, and documents related to advanced power reactor designs (ABWR). A qualitative screening removed those SAMA candidates that: (1) did not apply to Peach Bottom Units 2 and 3 due to design differences, (2) were related to the mitigation of recirculation pump seal failures or ISLOCA (not significant risk contributors for BWRs), (3) had already been implemented at Peach Bottom Units 2 and 3, or (4) were related to design changes prior to construction. Using the updated Peach Bottom PSA, a maximum obtainable benefit of about $2.04M was calculated. This value was used in a second screening that eliminated the SAMA candidates whose cost to implement would exceed the maximum obtainable benefit. This process left only 12 SAMA candidates for further analysis. SAMAs related to non-risk significant systems were then screened out because any change in the reliability of these systems was found to have a negligible impact on the PSA evaluation. For the remaining 5 SAMA candidates, a more detailed conceptual design and cost estimate were developed as shown in Table 5-5.

The cost-benefit analyses showed that none of the final five SAMA candidates were cost-beneficial. Exelon concluded that there was no justification to implement any of the SAMA candidates and decided not to pursue any of the SAMA candidates further.

The staff reviewed the Exelon analysis and concluded that the methods used and the implementation of those methods were sound. The treatment of SAMA benefits and costs, the generally large negative net benefits, and the inherently small baseline risks support the general conclusion that the SAMA evaluations performed by Exelon are reasonable and sufficient for the license renewal submittal. The unavailability of a seismic and fire PSA model precluded a quantitative evaluation of SAMAs specifically aimed at reducing risk of these initiators; however, significant improvements have been realized as a result of the IPEEE process at Peach Bottom Units 2 and 3 that would minimize the likelihood of identifying cost-beneficial enhancements in this area.

Based on its review of Exelon's SAMA analyses, the staff concludes that none of the candidate SAMAs are cost-beneficial. This conclusion is consistent with the low residual level of risk indicated in the Peach Bottom PSA and the fact that Peach Bottom Units 2 and 3 has already implemented many plant improvements identified by the IPE and IPEEE.

5.3 References

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

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

10 CFR 54. Code of Federal Regulations, Title 10, *Energy*, Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

10 CFR Part 100. Code of Federal Regulations, Title 10, *Energy*, Part 100, "Reactor Site Criteria."

Exelon Generation Company, LLC (Exelon). 2001. *Applicant's Environmental Report - Operating License Renewal Stage Peach Bottom Units 2 and 3.* Kennett Square, Pennsylvania.

Exelon Generation Company (Exelon). 2002. Letter from Michael P. Gallagher, Exelon to U.S. Nuclear Regulatory Commission. Subject: Response to Request for Additional Information Related to Severe Accident Mitigation Alternatives. January 30, 2002.

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Philadelphia Electric Company (PECO). 1996. Letter from, PECO to NRC. Subject: Individual Plant Examination of External Events (IPEEE) Submittal, Peach Bottom Atomic Power Station Units 2 and 3, dated May 29, 1996.

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U.S. Nuclear Regulatory Commission (NRC). 1990b. NUREG/CR-4551, Volume 4, Parts 1 and 2, *Evaluation of Severe Accident Risks: Peach Bottom, Unit 2.* Washington, D.C.

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U.S. Nuclear Regulatory Commission (NRC). 1992. Information Notice 92-36: *Intersystem LOCA Outside Containment*, May 7, 1992, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1994a. NUREG-1462, *Final Safety Evaluation Report Related to the Certification of the System 80+ Design.* Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1994b. Information Notice 92-36, Supplement 1: *Intersystem LOCA Outside Containment*, February 22, 1994, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1995. Letter from (NRC) to (Philadelphia Electric Company), Subject: Staff Evaluation of the Peach Bottom Atomic Power Station, Units 2 and 3, Individual Plant Examination (TAC Nos. M74448 and M74449), October 25, 1995, Washington, D.C.

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

U.S. Nuclear Regulatory Commission (NRC). 1997a. NUREG-1560, *Individual Plant Examination Program: Perspectives on Reactor Safety and Plant Performance.* Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1997b. NUREG/BR-0184, *Regulatory Analysis Technical Evaluation Handbook.* Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1999a. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants Main Report*, "Section 6.3 – Transportation, Table 9.1, Summary of findings on NEPA issues for license renewal of nuclear power plants, Final Report." NUREG-1437, Volume 1, Addendum 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 1999b. Letter from Bartholomew C. Buckley (NRC) to James A. Hutton (PECO Energy Company), Subject: Review of Peach Bottom Atomic Power Station, Units 2 and 3, Individual Plant Examination of External Events Submittal (TAC Nos. M83657 and M83658), November 22, 1999, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2001. Letter from L. L. Wheeler, U.S. NRC to Michael P. Gallagher, Exelon. Subject: Request for Additional Information Related to the Staff's Review of Severe Accident Mitigation Alternatives for Peach Bottom Atomic Power Station Units 2 and 3 (TAC Nos. MB2011 and MB2012), December 20, 2001, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2002. NRC staff Note to File, from L. L. Wheeler, Subject: Public Availability of Information provided to the NRC Staff in Support of the Environmental Review of the Application Submitted by Exelon Generation Company, LLC, for Renewal of the Operating Licenses for Peach Bottom Atomic Power Station, Units 2 and 3, with enclosures, May 30, 2002.

6.0 Environmental Impacts of the Uranium Fuel Cycle and Solid Waste Management

Environmental issues associated with the uranium fuel cycle and solid waste management are discussed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996; 1999).[a] The GEIS includes a determination of whether the analysis of the environmental issue could be applied to all plants and whether additional mitigation measures would be warranted. Issues are then assigned a Category 1 or a Category 2 designation. As set forth in the GEIS, Category 1 issues are those that meet all of the following criteria:

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

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective off site radiological impacts from the fuel cycle and from high-level waste [HLW] and spent fuel disposal).

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

For issues that meet the three Category 1 criteria, no additional plant-specific analysis is required unless new and significant information is identified.

Category 2 issues are those that do not meet one or more of the criteria for Category 1, and therefore, additional plant-specific review of these issues is required.

This chapter addresses the issues that are related to the uranium fuel cycle and solid waste management during the license renewal term that are listed in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, and are applicable to Peach Bottom Units 2 and 3. The generic potential impacts of the radiological and nonradiological environmental impacts of the uranium fuel cycle and transportation of nuclear fuel and wastes are described in detail in the GEIS based, in part, on the generic impacts provided in 10 CFR 51.51(b), Table S-3, "Table of Uranium Fuel Cycle Environmental Data," and in 10 CFR 51.52(c), Table S-4, "Environmental

(a) The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the "GEIS" include the GEIS and its Addendum 1.

Impact of Transportation of Fuel and Waste to and from One Light-Water-Cooled Nuclear Power Reactor." The staff also addresses the impacts from radon-222 and technetium-99 in the GEIS.

6.1 The Uranium Fuel Cycle

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 that are applicable to Peach Bottom Units 2 and 3 from the uranium fuel cycle and solid waste management are listed in Table 6-1.

Table 6-1. Category 1 Issues Applicable to the Uranium Fuel Cycle and Solid Waste Management During the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section
URANIUM FUEL CYCLE AND WASTE MANAGEMENT	
Offsite radiological impacts (individual effects from other than the disposal of spent fuel and high level waste)	6.1; 6.2.1; 6.2.2.1; 6.2.2.3; 6.2.3; 6.2.4; 6.6
Offsite radiological impacts (collective effects)	6.1; 6.2.2.1; 6.2.3; 6.2.4; 6.6
Offsite radiological impacts (spent fuel and high level waste)	6.1; 6.2.2.1; 6.2.3; 6.2.4; 6.6
Nonradiological impacts of the uranium fuel cycle	6.1; 6.2.2.6; 6.2.2.7; 6.2.2.8; 6.2.2.9; 6.2.3; 6.2.4; 6.6
Low-level waste storage and disposal	6.1; 6.2.2.2;6.4.2; 6.4.3; 6.4.3.1; 6.4.3.2; 6.4.3.3; 6.4.4; 6.4.4.1; 6.4.4.2; 6.4.4.3; 6.4.4.4; 6.4.4.5; 6.4.4.5.1; 6.4.4.5.2; 6.4.4.5.3; 6.4.4.5.4; 6.4.4.6;6.6
Mixed waste storage and disposal	6.4.5.1; 6.4.5.2; 6.4.5.3; 6.4.5.4; 6.4.5.5; 6.4.5.6; 6.4.5.6.1; 6.4.5.6.2; 6.4.5.6.3; 6.4.5.6.4; 6.6
On-site spent fuel	6.1; 6.4.6; 6.4.6.1; 6.4.6.2; 6.4.6.3; 6.4.6.4; 6.4.6.5; 6.4.6.6; 6.4.6.7; 6.6
Nonradiological waste	6.1; 6.5; 6.5.1; 6.5.2; 6.5.3; 6.6
Transportation	6.1; 6.3.1; 6.3.2.3; 6.3.3; 6.3.4; 6.6, Addendum 1

Exelon Generation Company, LLC (Exelon) stated in its Environmental Report (ER; Exelon 2001) that it is not aware of any new and significant information associated with the renewal of the Peach Bottom Units 2 and 3 operating licenses. The staff has not identified any significant new information during its independent review of the Exelon ER (Exelon 2001), the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For these issues, the staff concluded in the GEIS that the impacts are SMALL except for the collective offsite radiological impacts from the fuel cycle and from HLW and spent fuel disposal, as discussed below, and that additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

A brief description of the staff review and the GEIS conclusions, as codified in Table B-1, 10 CFR 51, for each of these issues follows:

- Offsite radiological impacts (individual effects from other than the disposal of spent fuel and high level waste). Based on information in the GEIS, the Commission found that

  > Off-site impacts of the uranium fuel cycle have been considered by the Commission in Table S-3 of this part [10 CFR 51.51(b)]. Based on information in the GEIS, impacts on individuals from radioactive gaseous and liquid releases including radon-222 and technetium-99 are small.

  The staff has not identified any new and significant information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no offsite radiological impacts of the uranium fuel cycle during the renewal term beyond those discussed in the GEIS.

- Offsite radiological impacts (collective effects). Based on information in the GEIS, the Commission found that

  > The 100 year environmental dose commitment to the U.S. population from the fuel cycle, high level waste and spent fuel disposal excepted, is calculated to be about 14,800 person rem [148 person Sv], 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 doses projected 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.
>
> Nevertheless, despite all the uncertainty, some judgement as to the regulatory NEPA [National Environmental Policy Act] implications of these matters should be made and it makes no sense to repeat the same judgement 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.

The staff has not identified any new and significant information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no offsite radiological impacts (collective effects) from the uranium fuel cycle during the renewal term beyond those discussed in the GEIS.

- Offsite radiological impacts (spent fuel and HLW disposal). Based on information in the GEIS, the Commission found that

> 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 [1 mSv] 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 [1 mSv] 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 [1 mSv] per year. The lifetime individual risk from 100 millirem [1 mSv] annual dose limit is about 3×10^{-3}.

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 Department of Energy in the "Final Environmental Impact Statement: Management of Commercially Generated Radioactive Waste," October 1980 [DOE 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 HLW 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 released over 10,000 years. Reporting performance standards that will be required by EPA are expected to result in releases and associated health consequences in the range between 10 and 100 premature cancer deaths with an upper limit of 1,000 premature cancer deaths world-wide for a 100,000 metric tonne (MTHM) repository.

Nevertheless, despite all the uncertainty, some judgement as to the regulatory NEPA implications of these matters should be made and it makes no sense to repeat the same judgement 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 HLW disposal, this issue is considered Category 1.

Since the GEIS was originally issued in 1996, the EPA has published radiation protection standards for Yucca Mountain, Nevada, at 40 CFR Part 197 "Public Health and

Environmental Radiation Protection Standards for Yucca Mountain, Nevada," on June 13, 2001 (66 FR 32132). The Energy Policy Act of 1992 (42 USC 10101 et seq.) directs that the NRC adopt these standards into its regulations for reviewing and licensing the repository. The NRC published its regulations at 10 CFR Part 63, on November 2, 2001 (66 FR 55792). These standards include the following: (1) 0.15 mSv/year (15 mrem/year) dose limit for members of the public during the storage period prior to repository closure, (2) 0.15 mSv/year (15 mrem/year) dose limit for the reasonably maximally exposed individual for 10,000 years following disposal, (3) 0.15 mSv/year (15 mrem/year) dose limit for the reasonably maximally exposed individual as a result of a human intrusion at or before 10,000 years after disposal, and (4) a groundwater protection standard that states for 10,000 years of undisturbed performance after disposal, radioactivity in a representative volume of ground water will not exceed (a) 0.0002 MBq/L (5 pCi/L) (radium-226 and radium-228), (b) 0.0006 Mbq/L (15 pCi/L) (gross alpha activity), and (c) 0.04 mSv/year (4 mrem/year) to the whole body or any organ (from combined beta and photon emitting radionuclides).

On February 15, 2002, subsequent to the receipt of a recommendation by the Secretary, Department of Energy, the President recommended the Yucca Mountain site for the development of a repository for the geologic disposal of spent nuclear fuel and HLW.

This change in regulatory status does not cause the staff to change its position with respect to the impact of spent fuel and HLW disposal. The staff still considers the Category 1 classification in the GEIS appropriate.

The staff has not identified any new and significant information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no offsite radiological impacts related to spent fuel and HLW disposal during the renewal term beyond those discussed in the GEIS.

- Nonradiological impacts of the uranium fuel cycle. Based on information in the GEIS, the Commission found that

  > The nonradiological impacts of the uranium fuel cycle resulting from the renewal of an operating license for any plant are found to be small.

  The staff has not identified any new and significant information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no nonradiological impacts of the uranium fuel cycle during the renewal term beyond those discussed in the GEIS.

- Low-level waste storage and disposal. Based on information in the GEIS, the Commission found that

  > The comprehensive regulatory controls that are in place and the low public doses being achieved at reactors ensure that the radiological impacts to the environment will remain small during the term of a renewed license. The maximum additional on-site land that may be required for low-level waste storage during the term of a renewed license and associated impacts will be small. Nonradiological impacts on air and water will be negligible. The radiological and nonradiological environmental impacts of long-term disposal of low-level waste from any individual plant at licensed sites are small. In addition, the Commission concludes that there is reasonable assurance that sufficient low-level waste disposal capacity will be made available when needed for facilities to be decommissioned consistent with NRC decommissioning requirements.

  The staff has not identified any new and significant information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of low-level waste storage and disposal associated with the renewal term beyond those discussed in the GEIS.

- Mixed waste storage and disposal. Based on information in the GEIS, the Commission found that

  > The comprehensive regulatory controls and the facilities and procedures that are in place ensure proper handling and storage, as well as negligible doses and exposure to toxic materials for the public and the environment at all plants. License renewal will not increase the small, continuing risk to human health and the environment posed by mixed waste at all plants. The radiological and nonradiological environmental impacts of long-term disposal of mixed waste from any individual plant at licensed sites are small. In addition, the Commission concludes that there is reasonable assurance that sufficient mixed waste disposal capacity will be made available when needed for facilities to be decommissioned consistent with NRC decommissioning requirements.

  The staff has not identified any new and significant information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of mixed waste storage and disposal associated with the renewal term beyond those discussed in the GEIS.

- Onsite spent fuel. Based on information in the GEIS, the Commission found that

> 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.

The staff has not identified any new and significant information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of onsite spent fuel associated with license renewal beyond those discussed in the GEIS.

- Nonradiological waste. Based on information in the GEIS, the Commission found that

> 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.

The staff has not identified any new and significant information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no nonradiological waste impacts during the renewal term beyond those discussed in the GEIS.

- Transportation. Based on information in the GEIS, the Commission found that

> 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 HLW 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 Sec. 51.52.

Peach Bottom Units 2 and 3 meet the fuel-enrichment and burnup conditions set forth in Addendum 1 to the GEIS. The staff has not identified any new and significant information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no

impacts of transportation associated with license renewal beyond those discussed in the GEIS.

There are no Category 2 issues for the uranium fuel cycle and solid waste management.

6.2 References

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

10 CFR 54. Code of Federal Regulations, Title 10, *Energy,* Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

10 CFR 63. Code of Federal Regulations, Title 10, *Energy,* Part 63, "Disposal of High-Level Radioactive Wastes in a Geologic Repository at Yucca Mountain, Nevada."

40 CFR 191. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 191, "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Waste."

40 CFR 197. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 197, "Public Health and Environmental Radiation Protection Standards for Management and Disposal for Yucca Mountain, Nevada."

66 FR 32132. "Public Health and Environmental Radiation Protection Standards for Yucca Mountain, NV." *Federal Register.* Vol. 66, No.114. June 13, 2001.

66 FR 55792 "Disposal of High-Level Radioactive Wastes in a Proposed Geologic Repository at Yucca Mountain, Nevada." *Federal Register.* Vol. 66, No. 213. November 2, 2001.

Energy Policy Act of 1992. 42 USC 10101, et seq.

Exelon Generation Company, LLC (Exelon). 2001. *Applicant's Environmental Report – Operating License Renewal Stage Peach Bottom Units 2 and 3.* Kennett Square, Pennsylvania.

National Academy of Sciences (NAS). 1995. *Technical Bases for Yucca Mountain Standards.* Washington, D.C.

U.S. Department of Energy (DOE). 1980. *Final Environmental Impact Statement: Management of Commercially Generated Radioactive Waste.* DOE/EIS-0046F, Washington, D.C.

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

U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Main Report*, "Section 6.3 – Transportation, Table 9.1, Summary of findings on NEPA issues for license renewal of nuclear power plants, Final Report." NUREG-1437, Volume 1, Addendum 1, Washington, D.C.

7.0 Environmental Impacts of Decommissioning

Environmental issues associated with decommissioning, which result from continued plant operation during the renewal term are discussed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996; 1999).[a] The GEIS includes a determination of whether the analysis of the environmental issue could be applied to all plants and whether additional mitigation measures would be warranted. Issues are then assigned a Category 1 or a Category 2 designation. As set forth in the GEIS, Category 1 issues are those that meet all of the following criteria:

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

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite radiological impacts from the fuel cycle and from high level waste and spent fuel disposal).

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

For issues that meet the three Category 1 criteria, no additional plant-specific analysis is required unless new and significant information is identified.

Category 2 issues are those that do not meet one or more of the criteria for Category 1, and therefore, additional plant-specific review of these issues is required. There are no Category 2 issues related to decommissioning.

Category 1 issues in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B that are applicable to Peach Bottom Units 2 and 3 decommissioning following the renewal term are listed in Table 7-1. Exelon Generation Company, LLC (Exelon) stated in its Environmental Report (ER; Exelon 2001) that it is aware of no new and significant information regarding the environmental impacts of Peach Bottom Units 2 and 3 license renewal. The staff has not identified any significant new information during its independent review of the Exelon ER (Exelon 2001), the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts related to these issues beyond those discussed in

(a) The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the "GEIS" include the GEIS and its Addendum 1

the GEIS. For all of these issues, the staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to be warranted.

Table 7-1. Category 1 Issues Applicable to the Decommissioning of Peach Bottom Units 2 and 3 Following the Renewal Term

ISSUE—10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Section
DECOMMISSIONING	
Radiation Doses	7.3.1; 7.4
Waste Management	7.3.2; 7.4
Air Quality	7.3.3; 7.4
Water Quality	7.3.4; 7.4
Ecological Resources	7.3.5; 7.4
Socioeconomic Impacts	7.3.7; 7.4

A brief description of the staff's review and the GEIS conclusions, as codified in Table B-1, for each of the issues follows:

- Radiation doses. Based on information in the GEIS, the Commission found that

> 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 [0.01 person-Sv] caused by buildup of long-lived radionuclides during the license renewal term.

The staff has not identified any new and significant information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no radiation doses associated with decommissioning following license renewal beyond those discussed in the GEIS.

- Waste management. Based on information in the GEIS, the Commission found that

> 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.

The staff has not identified any new and significant information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of solid waste associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

- Air quality. Based on information in the GEIS, the Commission found that

> 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.

The staff has not identified any new and significant information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of license renewal on air quality during decommissioning beyond those discussed in the GEIS.

- Water quality. Based on information in the GEIS, the Commission found that

> 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.

The staff has not identified any new and significant information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of the license renewal term on water quality during decommissioning beyond those discussed in the GEIS.

- Ecological resources. Based on information in the GEIS, the Commission found that

> Decommissioning after either the initial operating period or after a 20-year license renewal period is not expected to have any direct ecological impacts.

The staff has not identified any new and significant information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of the license renewal term on ecological resources during decommissioning beyond those discussed in the GEIS.

- Socioeconomic impacts. Based on information in the GEIS, the Commission found that

  > 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.

The staff has not identified any new and significant information during its independent review of the Exelon ER, the staff's site visit, the scoping process, or its evaluation of other available information. Therefore, the staff concludes that there are no impacts of license renewal on the socioeconomic impacts of decommissioning beyond those discussed in the GEIS.

7.1 References

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

Exelon Generation Company, LLC (Exelon). 2001. *Applicant's Environmental Report – Operating License Renewal Stage Peach Bottom Units 2 and 3.* Kennett Square, Pennsylvania.

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

U.S. Nuclear Regulatory Commission (NRC). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Main Report*, "Section 6.3 – Transportation, Table 9.1, Summary of findings on NEPA issues for license renewal of nuclear power plants, Final Report." NUREG-1437, Volume 1, Addendum 1, Washington, D.C.