U.S.NRC

United States Nuclear Regulatory Commission

Protecting People and the Environment

NUREG-1437
Supplement 35

Generic Environmental Impact Statement for License Renewal of Nuclear Plants

Supplement 35

Regarding Susquehanna Steam Electric Station, Units 1 and 2

Draft Report for Comment

Office of Nuclear Reactor Regulation

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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 35, draft, in your comments, and send them by July 21, 2008 to the following address:

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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 Title 10, Part 51, of the *Code of Federal Regulations* (10 CFR Part 51). In the GEIS (and its Addendum 1), the NRC staff 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 Supplemental Environmental Impact Statement (SEIS) has been prepared in response to an application submitted to the NRC by PPL Susquehanna, LLC (PPL) to issue renewed OLs for Susquehanna Steam Electric Station, Units 1 and 2 (SSES) 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 NRC staff's preliminary recommendation regarding the proposed action.

Regarding the 69 issues for which the GEIS reached generic conclusions, neither PPL nor the NRC staff has identified information that is both new and significant for any issue that applies to SSES. In addition, the NRC staff determined that information provided during the scoping process did not call into question the conclusions in the GEIS. Therefore, the NRC staff concludes that the impacts of issuing renewed OLs for SSES will not be greater than impacts identified for these issues in the GEIS. For each of these issues, the NRC staff's conclusion in the GEIS is that the impact is of SMALL significance[a] (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 SSES are addressed in this draft SEIS. For most applicable issues, the NRC staff concludes that the significance of the potential environmental impacts of renewal of the OLs is SMALL, with the exception of impacts to historic and archaeological resources. Impacts to historic and archaeological resources, in the absence of mitigative measures, could be MODERATE. The NRC staff determined that information

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

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 SSES are not so great that preserving the option of license renewal for energy-planning decision makers would be unreasonable. This recommendation is based on (1) the analysis and findings in the GEIS; (2) the Environmental Report submitted by PPL; (3) consultation with Federal, State, and local agencies; (4) the NRC staff's own independent review; and (5) the NRC staff's consideration of public comments received during the scoping process.

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Executive Summary

By letter dated September 13, 2007, PPL Susquehanna, LLC (PPL) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) to issue renewed operating licenses (OLs) for Susquehanna Steam Electric Station Units, 1 and 2 (SSES) for an additional 20-year period. If the OLs are renewed, State regulatory agencies and PPL 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 units must be shut down at or before the expiration dates of the current OLs, which are July 17, 2022, for Unit 1, and March 23, 2024, for Unit 2.

The NRC has implemented Section 102 of the National Environmental Policy Act (NEPA), Title 42, Section 4321, of the *United States Code* (42 USC 4321), in Title 10, Part 51, of the *Code of Federal Regulations* (10 CFR Part 51). In 10 CFR 51.20(b)(2), the Commission requires preparation of an Environmental Impact Statement (EIS) or a supplement to an EIS for issuing a renewed reactor OL. In addition, 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 PPL 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 NRC staff visited the SSES site in May 2007 and held public scoping meetings on November 15, 2006, in Berwick, Pennsylvania. In the preparation of this draft Supplemental Environmental Impact Statement (SEIS) for SSES, the NRC staff reviewed the PPL 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: *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 draft SEIS.

The NRC staff will hold two public meetings in Berwick, Pennsylvania, in late May 2008, to describe the preliminary results of the NRC environmental review, to answer questions, and to provide members of the public with information to assist them in formulating comments on this draft SEIS. When the comment period ends, the NRC staff will consider and address all of the

(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.

comments received. These comments will be addressed in Part 2 of Appendix A, "Comments Received on the Environmental Review," in the final SEIS.

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 NRC 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 (issuing a renewed 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 evaluation criterion for the NRC 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 issuing a renewed 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 footnotes 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 reached 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 characteristics.

(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 not likely 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 NRC 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 NRC staff's consideration of all 92 environmental issues identified in the GEIS. The NRC 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 issuing the renewed OLs for SSES) and alternative methods of power generation. Based on projections made by the U.S. Department of Energy's Energy Information Administration, gas- and coal-fired generation appear to be the most common power-generation alternatives constructed through 2030 in the United States. The NRC staff evaluated the environmental impacts of these alternatives constructed both at the SSES site or some other unspecified alternate location. The NRC staff also evaluated a new nuclear alternative at both the SSES site and an alternate site, as well as a combination alternative with some generation located at the SSES site.

PPL and the NRC staff have established independent processes for identifying and evaluating the significance of any new information on the environmental impacts of license renewal. Neither PPL nor the NRC 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 NRC staff has identified any new issue applicable to SSES that has a significant environmental impact. Therefore, the NRC staff relies upon the conclusions of the GEIS for all of the Category 1 issues that are applicable to SSES.

PPL's license renewal application presents an analysis of the Category 2 issues as well as environmental justice and chronic effects from electromagnetic fields. The NRC staff has reviewed the PPL analysis for each issue and has conducted an independent review of each issue. Six Category 2 issues are not applicable, because they are related to plant design features – like once-through cooling – or site characteristics – like cooling ponds – not found at SSES. Four Category 2 issues are not discussed in this draft SEIS, because they are specifically related to refurbishment. PPL 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 SSES for the license renewal period. In addition, any replacement of components or additional inspection activities are within the bounds of normal plant operation, and are not expected to affect the environment outside of the bounds of the plant operations evaluated in the U.S. Atomic Energy Commission's 1981 *Final Environmental Statement Related to Operation of Susquehanna Steam Electric Station.*

The NRC staff discusses in detail 11 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, 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 10 of 11 Category 2 issues and environmental justice, the NRC staff concludes that the potential environmental effects are of SMALL significance in the context of the standards set forth in the GEIS. For one Category 2 issue (historic and archaeological resources), the NRC staff determined that the potential impacts could be MODERATE in significance. In addition, the NRC 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 NRC staff concludes that a reasonable, comprehensive effort was made to identify and evaluate SAMAs. Based on its review of the SAMAs for SSES, and the plant improvements already made, the NRC staff concludes that none of the potentially cost-beneficial SAMAs relate to adequately managing the effects of aging during the period of extended operation; therefore, they need not be implemented as part of the license renewal pursuant to 10 CFR Part 54.

For each Category 2 issue, potential mitigative actions, where available, are discussed, regardless of the impact level.

Cumulative impacts of past, present, and reasonably foreseeable future actions were considered, regardless of what agency (Federal or non-Federal) or person undertakes such other actions. For purposes of this analysis, where SSES license renewal impacts are deemed to be SMALL, the NRC staff concluded that these impacts would not result in significant cumulative impacts on potentially affected resources.

If the renewed SSES OLs are not issued and the units cease operation on or before the expiration of their current OLs, then the adverse impacts of likely alternatives would not be smaller than those associated with continued operation of SSES. 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 SSES 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 PPL; (3) consultation with other Federal, State, and local agencies; (4) the NRC staff's own independent review; and (5) the NRC staff's consideration of public comments received during the scoping process.

Abbreviations/Acronyms

µg	microgram(s)
µm	micrometer(s)
AADT	average annual daily traffic
ac	acre(s)
ACC	averted cleanup and decontamination costs
AEA	Atomic Energy Act of 1954
AEC	U.S. Atomic Energy Commission
ALARA	as low as reasonably achievable
AOC	averted offsite property damage costs
AOE	averted occupational exposure
AOSC	averted onsite costs
APE	averted public exposure
AQCR	Air Quality Control Region
ATWS	anticipated transient without scram
BAQ	Bureau of Air Quality (in PDEP)
BOD	biochemical oxygen demand
Bq	Becquerel(s)
Btu	British thermal unit(s)
BWR	boiling water reactor
°C	degrees Celsius
CAA	Clean Air Act
CAI	Commonwealth Associates, Inc.
CBOD	carbonaceous biochemical oxygen demand
CDC	Centers for Disease Control
CDF	core damage frequency or combined disposal facility
CEQ	Council on Environmental Quality
CFR	*Code of Federal Regulations*
Ci	curie(s)
cm	centimeter(s)
CO	carbon monoxide
CO_2	carbon dioxide
COE	cost of enhancement
COL	combined operating license
CWA	Clean Water Act

d	day(s)
dBA	"A-weighted" decibel level
DBA	design-basis accident
dbh	diameter at breast height
DOE	U.S. Department of Energy
DSM	demand-side management
EA	environmental assessment
EFH	essential fish habitat
EIA	Energy Information Administration (in DOE)
EIS	Environmental Impact Statement
ELF-EMF	extremely low frequency-electromagnetic field
EPA	U.S. Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
EPU	extended power update
ER	Environmental Report
ESA	Endangered Species Act
ESP	early site permit
°F	degrees Fahrenheit
FAA	Federal Aviation Administration
FCC	Federal Correctional Complex
FCI	Federal Correctional Institution
FES	Final Environmental Statement
FR	*Federal Register*
FSAR	Final Safety Analysis Report
ft	foot/feet
ft^3	cubic foot/feet
FWPCAA	Federal Water Pollution Control Act Amendments of 1972
FWS	U.S. Fish and Wildlife Service
gal	gallon(s)
GE	General Electric
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)

HAP	hazardous air pollution
HEPA	high-efficiency particulate air
HLW	high-level waste
hr	hour(s)
Hz	Hertz
IEEE	Institute of Electrical and Electronic Engineers
IES	Institute of Educational Science
in.	inch(es)
INEEL	Idaho National Engineering and Environmental Laboratory
ISFSI	independent spent fuel storage installation
kg	kilogram(s)
km	kilometer(s)
kV	kilovolt(s)
kV/m	kilovolt(s) per meter
kW	kilowatt(s)
kWh	kilowatt hour(s)
L	liter(s)
lb	pound(s)
LLMW	low-level mixed wastes
LNG	liquefied natural gas
LOCA	loss-of-coolant accident
LOS	loss of service
LWR	light-water reactor
m	meter(s)
m^3	cubic meter(s)
mA	milliampere(s)
MACCS2	MELCOR Accident Consequence Code System 2
MEI	maximally exposed individual
mgd	million gallons per day
mi	mile(s)
mL	milliliter(s)
mph	mile(s) per hour
mrem	millirem(s)
MSL	mean sea level
MSU	Montana State University
MT	metric ton(s) or tonne(s)

MTHM	metric tonne(s) of heavy metal
MTU	metric ton(s) of uranium
MW	megawatt(s)
MWd/MTU	megawatt day(s) per metric ton of uranium
MW(e)	megawatt(s) electric
MW(t)	megawatt(s) thermal
MWh	megawatt hour(s)
NA	not applicable
NAAQS	National Ambient Air Quality Standards
NAS	National Academy of Sciences
NBII	National Biological Information Infrastructure
NEPA	National Environmental Policy Act of 1969
NESC	National Electric Safety Code
ng	nanogram(s)
NHPA	National Historic Preservation Act
NIEHS	National Institute of Environmental Health Sciences
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NOV	Notice of Violation
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NPF	Nuclear Power Facility
NRC	U.S. Nuclear Regulatory Commission
NRCS	Natural Resources Conservation Service
NREL	National Renewable Energy Laboratory
NRHP	*National Register of Historic Places*
NWS	National Weather Service
ODCM	Offsite Dose Calculation Manual
OFGAC	Ottawa Forests and Greenspace Advisory Committee
OL	operating license
PASPGP-3	Pennsylvania State Programmatic General Permit-3
PCB	polychlorinated biphenyl
PDCNR	Pennsylvania Department of Conservation and Natural Resources
PDEP	Pennsylvania Department of Environmental Protection
PDOT	Pennsylvania Department of Transportation
PFBC	Pennsylvania Fish and Boat Commission
PGA	Pennsylvania General Assembly
PHMC	Pennsylvania Historical and Museum Commission

$PM_{2.5}$	particulate matter 2.5 micrometers or less in diameter
PM_{10}	particulate matter 10 micrometers or less in diameter
PNHP	Pennsylvania Natural Heritage Program
PPL	PPL Susquehanna, LLC and Pennsylvania Power & Light Company
PRA	Probabilistic Risk Assessment
PSA	Probabilistic Safety Assessment
PSD	Prevention of Significant Deterioration
PSW	plant service water
PURTA	Pennsylvania Utility Realty Tax Act
RAB	reactor auxiliary building
RAI	request for additional information
RCRA	Resource Conservation and Recovery Act
REMP	Radiological Environmental Monitoring Program
ROI	region of influence
ROW	right-of-way
Riverlands	Riverlands Recreation Area
s	second(s)
SAMA	severe accident mitigation alternative
SAR	Safety Analysis Report
SBO	station blackout
SCR	selective catalytic reduction
SEIS	Supplemental Environmental Impact Statement
SER	Safety Evaluation Report
SHPO	State Historic Preservation Office
SLC	Safety Light Corporation
SNP	Safety Net Program
SO_2	sulfur dioxide
SO_x	sulfur oxides
sq ft	square foot/feet
SR	State Route
SRAFRC	Susquehanna River Anadromous Fish Restoration Committee
SRBC	Susquehanna River Basin Commission
SSES	Susquehanna Steam Electric Station, Units 1 and 2
Stat.	*Statutes at Large*
TWh	terawatt hour(s)
UFSAR	Updated Final Safety Analysis Report
U.S.	United States

USACE	U.S. Army Corps of Engineers
USC	*United States Code*
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
USP	U.S. Penitentiary
VOC	volatile organic compound
yr	year(s)
WHO	World Health Organization

1.0 Introduction

Under the U.S. Nuclear Regulatory Commission's (NRC's) environmental protection regulations in Title 10, Part 51, of the *Code of Federal Regulations* (10 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 NRC 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.

PPL Susquehanna, LLC (PPL) operates Susquehanna Steam Electric Station, Units 1 and 2 (SSES) in northeastern Pennsylvania under NRC OLs NPF-014 and NPF-022, respectively. Unit 1's OL will expire in July 2022, and Unit 2's OL will expire in March 2024. By letter dated September 13, 2006, PPL submitted an application to the NRC to renew the SSES Units 1 and 2 OLs for an additional 20 years under 10 CFR Part 54 (PPL 2006a). PPL 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), PPL submitted an Environmental Report (ER) (PPL 2006b) in which PPL 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 PPL license renewal application. This draft SEIS is a supplement to the GEIS because it relies, in part, on the findings of the GEIS. As part of the safety review, the NRC 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 draft SEIS, including the development of the GEIS and the process used by the NRC staff to assess the environmental impacts associated with license renewal, (2) describe the proposed Federal action to renew the SSES OLs, (3) discuss the purpose and need for the proposed action, and (4) present the status of PPL'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 draft 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. Chapter 9 also presents the NRC staff's preliminary recommendation with respect to the proposed license renewal action.

Additional information is included in appendixes. Appendix A contains public comments related to the environmental review for license renewal and NRC staff responses to those comments. Appendixes B through G, respectively, list the following:

- The contributors to the supplement,

- A chronology of NRC staff's environmental review correspondence related to this draft SEIS,

- The organizations contacted during the development of this draft SEIS,

- PPL's compliance status in Table E-2 (this appendix also contains copies of consultation correspondence prepared and sent during the evaluation process),

- GEIS environmental issues that are not applicable to SSES, and

- Severe accident mitigation alternatives (SAMAs).

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 support 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 for impacts 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 presented 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 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 characteristics.

(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 draft 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 NRC 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 two uncategorized issues are environmental justice and chronic effects of electromagnetic fields. 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.

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), and

- 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); and

- 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 SSES OLs, PPL developed a process to ensure that information not addressed in or available during the GEIS evaluation regarding the environmental impacts of license renewal for SSES would be properly reviewed before submitting the ER, and to ensure that such new and potentially significant information related to renewal of the OLs for SSES would be identified, reviewed, and assessed during the period of NRC review. PPL 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 SSES. This review was performed by personnel from PPL 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*, 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 NRC 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 SSES. 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 NRC 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 PPL license renewal application began with publication of a notice of receipt and availability of an application for license renewal (NRC 2006a) on October 2, 2006. The NRC staff published a Notice of Intent to prepare an EIS and conduct scoping (NRC 2006b) on November 2, 2006. Two public scoping meetings were held on November 15, 2006, in Berwick, Pennsylvania. Comments received during the scoping period were summarized in the *Environmental Impact Statement Scoping Process: Summary Report – Susquehanna Steam Electric Station Units 1 &*

2 (NRC 2007), dated April 2007. Comments that are applicable to this environmental review are presented in Part 1 of Appendix A.

The NRC staff followed the review guidance contained in NUREG-1555, Supplement 1 (NRC 2000). The NRC staff and contractors retained to assist the NRC staff visited the SSES site on May 14 through 17, 2007, to gather information and to become familiar with the site and its environs. The NRC staff also reviewed the comments received during scoping and consulted with Federal, State, regional, and local agencies. Appendix C contains a chronological listing of correspondences related to the license renewal process. A list of the organizations consulted is provided in Appendix D. Other documents related to SSES were reviewed and are referenced in this draft SEIS.

This draft SEIS presents the NRC staff's analysis that considers and weighs the environmental effects of the proposed renewal of the OLs for SSES, 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 Berwick, Pennsylvania, in May 2008. During these meetings, the NRC 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 SSES Units 1 and 2. The current OL for Unit 1 expires on July 17, 2022, and for Unit 2 on March 23, 2024. By letter dated September 13, 2006, PPL submitted an application to the NRC (PPL 2006a) to renew these OLs for an additional 20 years of operation (i.e., until July 17, 2042, for Unit 1 and March 23, 2044, for Unit 2).

The SSES site is located in northeastern Pennsylvania, with the nearest metropolitan area, Wilkes-Barre, 20 mi (32 km) to the northeast; other nearby metropolitan areas include Allentown, 50 mi (80 km) to the southeast, and Harrisburg, 70 mi (110 km) southwest of the SSES site. The plant has two General Electric-designed boiling-water reactors, each with a current power level of 3439 megawatts thermal (MW(t)) and a net power output of 1135 megawatts electric (MW(e)), though the facility has recently received approval for an extended power uprate (EPU) allowing an increase of each unit's power level to 3952 MW(t), or approximately 1300 MW(e) per unit (NRC 2008). Plant cooling is provided by a closed-cycle heat dissipation system that dissipates heat primarily to the air. Units 1 and 2 produce electricity to supply the needs of roughly 2 million homes..

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 of 1954 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 utility officials 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

PPL is required to hold certain Federal, State, and local environmental permits, as well as meet relevant Federal and State statutory requirements. In its ER, PPL (2006b) provided a list of the authorizations from Federal, State, and local authorities for current operations as well as environmental approvals and consultations associated with SSES license renewal. The ER states that PPL is in compliance with applicable environmental standards and requirements for SSES. Authorizations and consultations relevant to the proposed OL renewal action are included in Appendix E.

The NRC staff has reviewed the list of authorizations and consulted with the appropriate Federal, State, and local agencies to identify any compliance or environmental issues of concern to the reviewing agencies. These agencies did not identify any new and significant environmental issues. The NRC staff has not identified any environmental issues that are both new and significant.

1.6 References

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

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

40 CFR Part 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.

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

PPL Susquehanna, LLC (PPL). 2006a. *Susquehanna Steam Electric Station Application for Renewed Operating Licenses Numbers NPF-14 and NPF-22.* Docket Nos. 50-387 and 50-388. Berwick, Pennsylvania. (September 13, 2006).

PPL Susquehanna, LLC (PPL). 2006b. *Susquehanna Steam Electric Station Units 1 and 2 License Renewal Application, Appendix E: Applicant's Environmental Report – Operating License Renewal Stage*. Allentown, Pennsylvania. (September 2006). ADAMS No. ML062630235.

U.S. Nuclear Regulatory Commission (NRC). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants.* NUREG-1437, Vols. 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, Vol. 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). 2006a. "Notice of Receipt and Availability of Application for Renewal of Susquehanna Steam Electric Station, Units 1 and 2 Facility Operating License Nos. NPF-14 and NPF-22 for an Additional 20 Year Period." *Federal Register*, Vol. 71, No. 190, p. 58014. Washington, D.C. (October 2, 2006).

U.S. Nuclear Regulatory Commission (NRC). 2006b. "Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process." *Federal Register*, Vol. 71, No. 212, pp. 64566–64568. Washington, D.C. (November 2, 2006).

U.S. Nuclear Regulatory Commission (NRC). 2007. *Environmental Impact Statement Scoping Process: Summary Report – Susquehanna Steam Electric Station Units 1 & 2, Berwick, Pennsylvania.* Washington, D.C. (April 2007). ADAMS No. ML070740684.

U.S. Nuclear Regulatory Commission (NRC). 2008. *Susquehanna Steam Electric Station Unit 1 Amendment to Facility Operating License* and *Susquehanna Steam Electric Station Unit 2 Amendment to Facility Operating License.* Washington, D.C. (January 2008). ADAMS No. ML080020195.

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

The Susquehanna Steam Electric Station, Units 1 and 2 (SSES) is owned and operated by PPL Susquehanna, LLC (PPL), a subsidiary of PPL Corporation, LLC. SSES is located on the shore of the Susquehanna River in Salem Township, Luzerne County, Pennsylvania. The plant consists of two boiling water reactors that produce steam, which turns turbines to generate electricity. The site includes a reactor building, a turbine building, a radioactive waste building, two natural draft cooling towers, a diesel emergency generator building, a spray pond, a switchyard, a sewage treatment plant, a learning center, and an environmental lab. The plant and its environs are described in Section 2.1, and the plant's interaction with the environment is presented in Section 2.2.

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

SSES is located just west of the Susquehanna River. The largest community within 10 mi (16 km) of the site is the borough of Berwick, which is approximately 5 mi (8 km) southwest of SSES, in Luzerne County, Pennsylvania. The nearest major metropolitan areas are Wilkes-Barre, Pennsylvania, approximately 20 mi (32 km) to the northeast, and Allentown, Pennsylvania, approximately 50 mi (80 km) to the southeast, as depicted in Figure 2-1. Harrisburg, Pennsylvania, is located approximately 70 mi (110 km) southwest of the SSES site.

2.1.1 External Appearance and Setting

As mentioned in Section 2.0, site structures include a reactor building, a turbine building, a radioactive waste building, two mechanical draft cooling towers, an emergency diesel generator building, and the Susquehanna Substation (AEC 1973). Transmission lines and rights-of-way (ROWs) (shown in Figure 2-2) are also prominent features on and near the Susquehanna site. The site's exclusion zone has been designated as being within the Owner Controlled Area fence. The plant, cooling towers, and switchyard are located in the western portion of the site. The fenced-in station area is 115 ac (47 ha) (PPL 2007f). The turbine building, radioactive waste building, and outer containment building complex extend 830 ft (250 m) at the longest point, 290 ft (90 m) at the widest point, and are 201 ft (61 m) above grade at the highest point. The two cooling towers are each 540 ft (165 m) high and 420 ft (130 m) in diameter at the base. The major visible structures are the reactor building (which houses both reactors), the turbine building, the radioactive waste building, the service and administration building, and the two

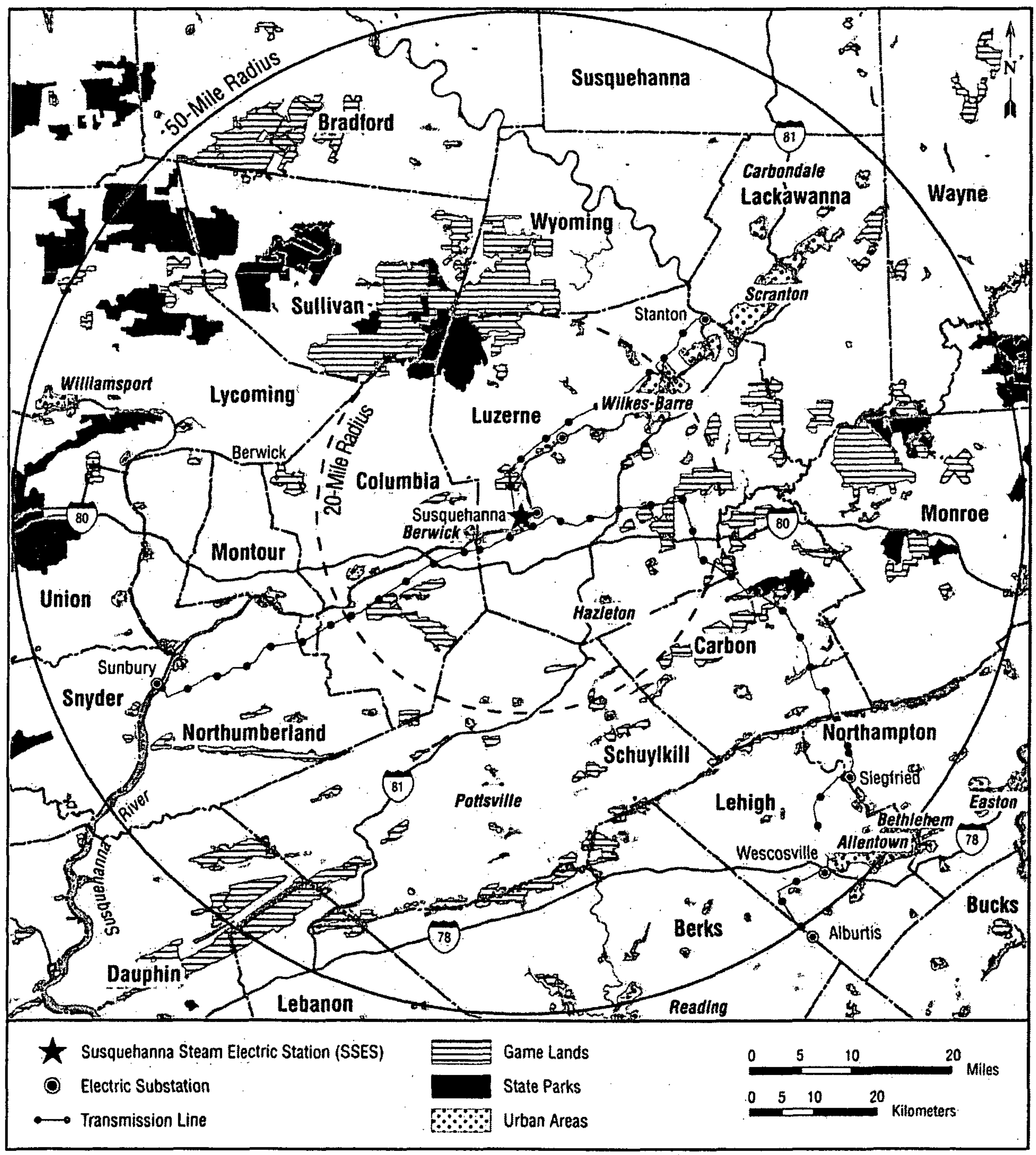

Figure 2-1. Location of Susquehanna Steam Electric Station, 50-mi (80-km) Region (Source: PPL 2006a)

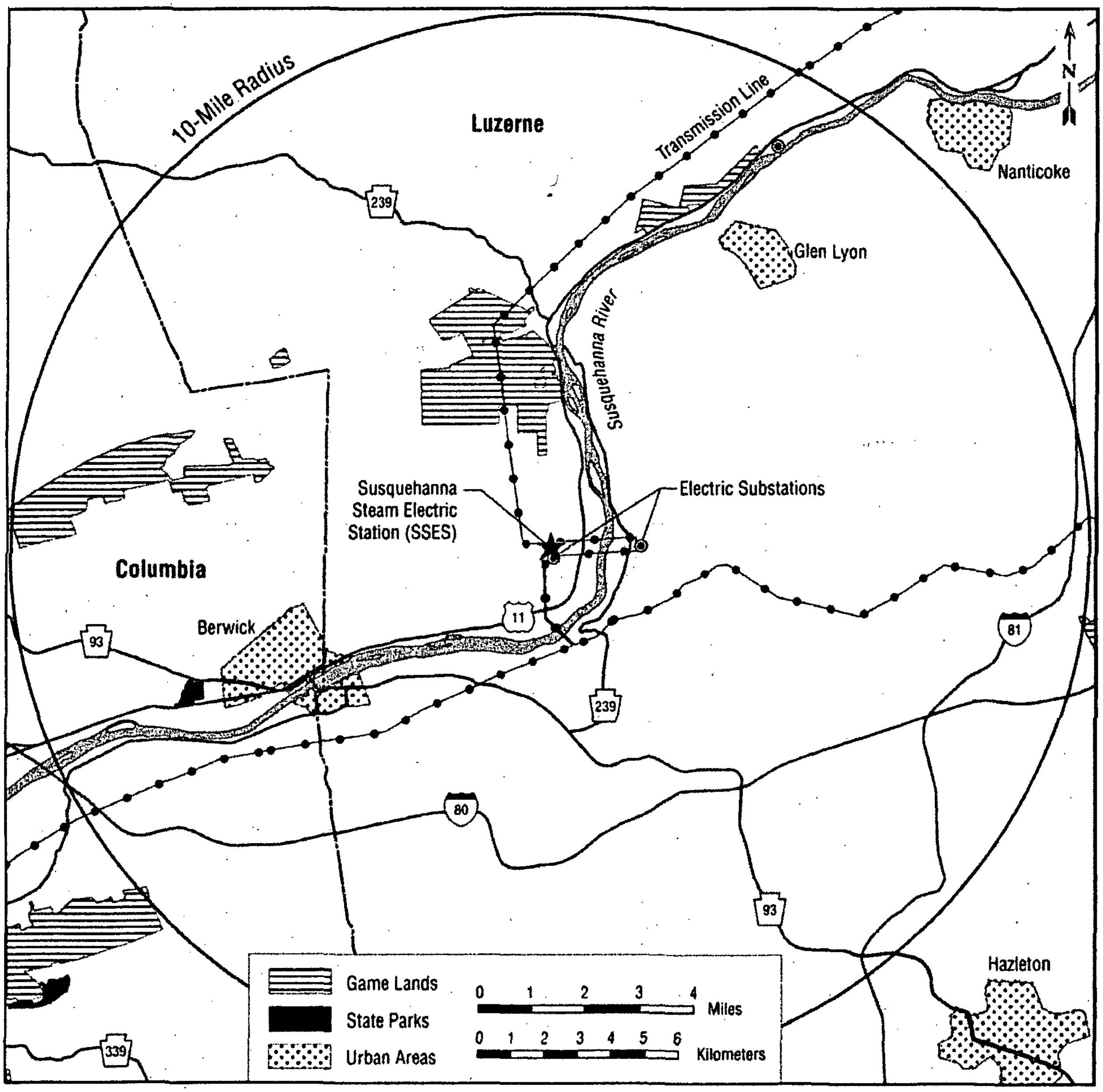

Figure 2-2. Susquehanna Steam Electric Station, 10-mi (16-km) Region (Source: PPL 2006a)

cooling towers. The station buildings are visible only in the immediate vicinity due to the rolling terrain. The tops of the cooling towers are visible at greater distance because they protrude above the hilltops.

The land located between the power generating facilities and the Susquehanna River is referred to as the Riverlands Recreation Area (Riverlands). Riverlands area sanitation system is connected to the SSES plant facilities, and freshwater is obtained from onsite wells. SSES plant personnel monitor and maintain the Riverlands facilities and equipment. Visitation to Riverlands is projected at 120,000 visitors per year (PPL 2007f).

2.1.2 Reactor Systems

SSES is a two-unit plant with General Electric (GE) boiling water reactors (BWRs) and generators. Bechtel Corporation was the architect-engineer and construction contractor. The original steam turbines, supplied by GE, were replaced with Siemens-Westinghouse units in 2003 (Unit 2) and 2004 (Unit 1). SSES uses low-enriched uranium dioxide fuel with enrichments below 5.0 percent by weight uranium-235, with peak fuel rod burnup levels less than 62,000 megawatt days per metric ton uranium (MWd/MTU). The units share a common control room, refueling floor, turbine operating deck, radioactive waste system, and other auxiliary systems (PPL 2006a).

The U.S. Nuclear Regulatory Commission (NRC) approved the Unit 1 operating license on July 17, 1982, and commercial operation began June 8, 1983. The Unit 2 operating license was issued on March 3, 1984, and commercial operation began February 12, 1985. SSES currently operates at power levels up to 3439 megawatts thermal (MW(t)) and has an electrical output of up to 1135 megawatts electric (MW(e)) for each unit. PPL Susquehanna, LLC has recently received NRC approval for a power uprate license amendment, which will allow the units to increase their power output to 3952 MW(t) (NRC 2008). The uprate will allow PPL to increase the potential electrical output of each unit to approximately 1300 MW(e) (PPL 2006b). The NRC staff's analysis of environmental impacts in Chapter 4 of this document incorporates the effects of operating SSES at the new power level.

The SSES facility is depicted in Figure 2-3. SSES uses BWR/4 reactors and Mark II primary containments (PPL 2006a). The reactor containment structures consist of drywells, which enclose the reactor vessel and recirculation pumps; a pressure suppression chamber, which stores a large volume of water; a connecting vent system between the drywells and the suppression chamber; and isolation valves. The reactors and related systems are enclosed in a containment building that is designed to prevent leakage of radioactivity to the environment in the improbable event of a rupture of the reactor coolant piping.

The containment building is reinforced concrete in the form of a truncated cone over a cylindrical section, with the drywells in the upper conical section and the suppression chamber in the lower cylindrical section. These two sections comprise a structurally integrated reinforced concrete pressure vessel, lined with welded steel plate and provided with a steel domed head for closures at the top of the drywell (PPL 2007g). A 0.25-in. (0.6-cm) welded steel liner is attached to the inside face of the concrete shell to ensure a high degree of leak-tightness. In addition, the containment wall is a 6-ft (1.8-m)-thick reinforced concrete wall. The containment wall serves as a radiation shield for both normal and accident conditions.

The containment building is ventilated to maintain pressure and temperature within acceptable limits. The containment ventilation system also can purge the containment prior to entry. Exhaust from the ventilation system is monitored for radioactivity before being released. Airborne effluents are released from the station via five rooftop vents, two on the reactor building, two on the turbine building, and one on the radioactive waste building (PPL 2007a). Continuous sampling for noble gases, particulates, and iodines is performed at each vent. High-efficiency particulate air (HEPA) filters are used to filter the air before releasing it. SSES conducts a sampling and analysis program for airborne effluents in accordance with the plant technical requirements.

As shown in Figure 2-3, the other prominent structures outside of the fenced-in area on the SSES site include the learning center; the sewage treatment building; the SSES environmental laboratory; the intake and discharge structures; the SSES substation (the switchyard); power transmission lines extending from the SSES substation to the southern site boundary; a warehouse building; a meteorological tower; and various storage areas, roads, and parking lots.

2.1.3 Cooling and Auxiliary Water Systems

SSES operates a closed-cycle heat dissipation system to remove waste heat from the circulating water system, which cools the main condensers. The circulating water system is composed of the intake embayment, river intake structure, intake pumps, condensers, two natural draft cooling towers, and an underground discharge pipe ending with a submerged diffuser located in the Susquehanna River. The Susquehanna River is the source of water for the circulating water and service water systems at SSES, and blowdown from the cooling towers is discharged back to the river (PPL 2006a).

The make-up water river intake structure is located on the western bank of the Susquehanna River. The intake structure consists of a steel superstructure above the operating floor and a reinforced concrete substructure that extends into the rock below the river bottom. The superstructure contains the make-up water pumps and associated screens, including switchgear, automatic operating equipment for trash-handling screens, motor control centers,

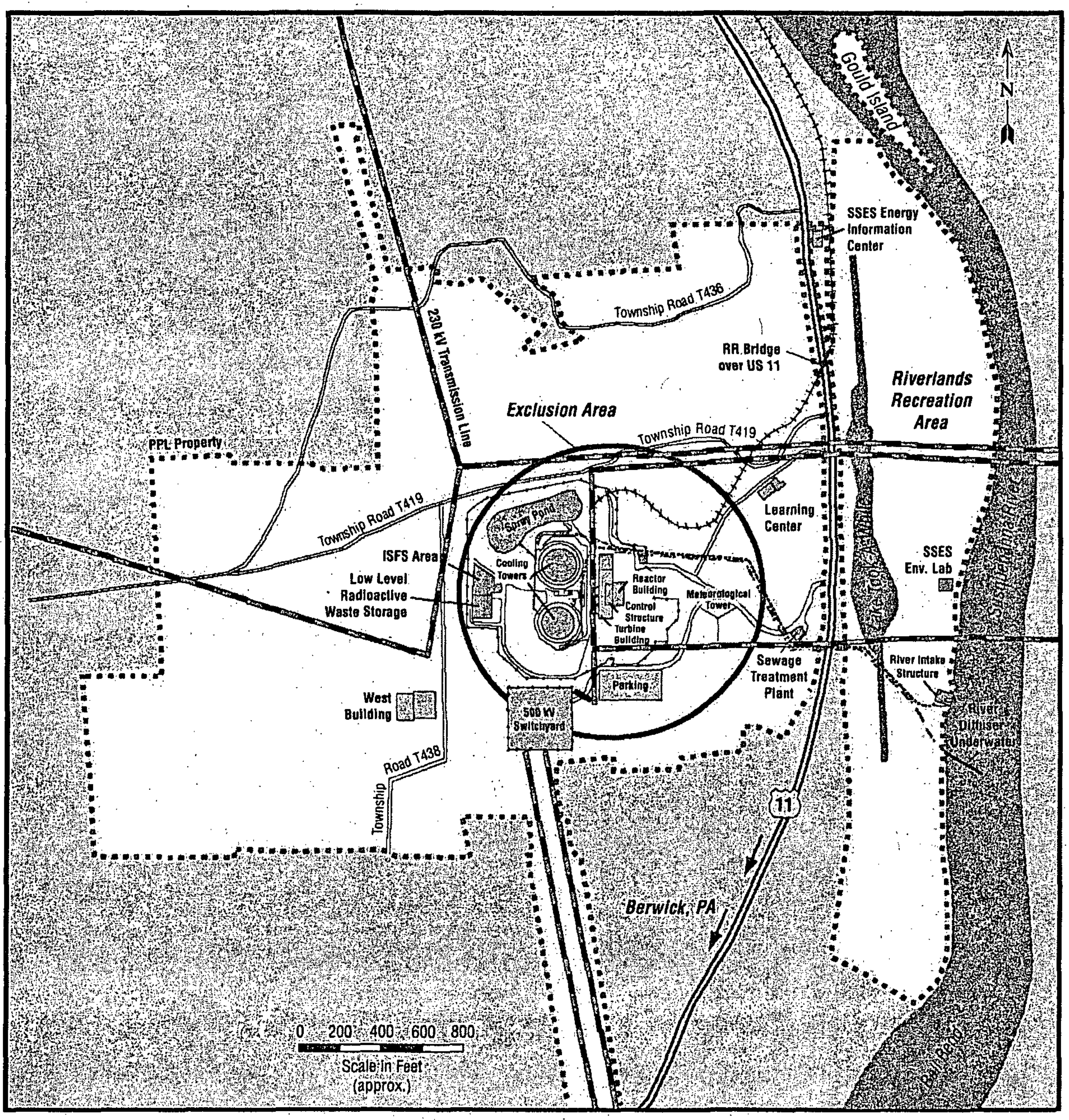

Figure 2-3. Susquehanna Steam Electric Station Site Layout
(Source: PPL 2006a)

screen-wash strainers, and a debris-handling facility. The substructure contains two water entrance bays, and each bay houses traveling screens and two pump chambers (PPL 2006a).

After entering the intake embayment, a skimmer wall, bar screen, trash rack, and traveling screens prevent large floating debris from clogging the intake. A low-pressure screen-wash system periodically operates to release aquatic organisms and debris impinged on the traveling screens to a pit with debris removal equipment that collects material into a dumpster for offsite disposal. Warm circulating water from the cooling towers can be diverted to the river intake structure to prevent icing; this usually occurs from November through March on an as-needed basis. Susquehanna River water is drawn into the dual intake bays, passes beneath the skimmer wall, and then through 1-in. (2.5-cm)-on-center vertical bar screens and 3/8-in. (0.9-cm) mesh traveling screens before entering the basins that house four intake pumps. Each pump has a capacity of 13,500 gallons per minute (gpm) (51,100 L/min). Prior to implementation of the proposed extended power uprate (EPU), typically three of these pumps supply the make-up flow of 40,500 gpm (153,000 L/min) to the circulating water system, and, at certain times of the year, the fourth pump is put into service. Implementing the EPU will increase the amount of the time the fourth pump will be operated (PPL 2006a).

After passing through the traveling screens, water is pumped to the two cooling tower basins via underground pipes. The circulating water system withdraws water from the cooling tower basins, circulates it through the main condensers, and returns the water to the cooling towers at a rate of 968,000 gpm (3,660,000 L/min), or 484,000 gpm (1,830,000 L/min) per tower. The service water system withdraws water from the cooling tower basins at a rate of approximately 54,000 gpm (204,000 L/min), or 27,000 gpm (102,000 L/min) per tower, for cooling various heat exchangers and equipment, and also returns water to the cooling tower basins (PPL 2006a).

The counter-flow natural draft cooling towers are each 540 ft (160 m) tall with a base diameter of 420 ft (130 m). Consumptive use of river water at SSES occurs when cooling water is evaporated into the atmosphere from the cooling towers. At the current power level, approximately 26,800 gpm (101,000 L/min) of water is lost through evaporation; once the EPU is implemented, this evaporation rate will increase to 30,500 gpm (115,000 L/min). The remaining cooling water is discharged back to the Susquehanna River as blowdown at a rate of 10,800 gpm (40,900 L/min) via the underground diffuser system. Implementing the EPU will increase the amount of blowdown to approximately 11,200 gpm (42,400 L/min) (PPL 2006a).

Cooling tower blowdown, spray pond overflow, and other permitted liquid effluents are discharged to the Susquehanna River via a common discharge structure located approximately 600 ft (200 m) downstream of the river intake structure. The discharge consists of a buried pipe that connects to a submerged discharge structure/diffuser. The diffuser pipe is 200 ft (60 m) long, with the last 120 ft (37 m) containing seventy-two 4-in. (10-cm) portals that direct the discharge at a 45-degree angle upwards and downstream. The facility's sewage plant treated effluent also discharges to the river through a concrete outfall structure located between the river intake and discharge structures (PPL 2006a).

Consumptive water use at SSES is regulated by the Susquehanna River Basin Commission (SRBC), an independent agency that manages water use along the entire length of the Susquehanna River. The former permit granted for SSES operation by SRBC was for consumptive water use up to a monthly average of 40 million gallons per day (mgd) (150 million L/day), not to exceed 48 mgd (180 million L/d) (permit #19950301-1 EPUL-0578) (PPL 2006a). To support the increase in consumptive water that would be required after implementing the EPU, in December 2006, PPL submitted an application to SRBC to eliminate the 40 mgd (150 million L/d) average monthly consumptive usage limit, and to approve a maximum daily river water withdrawal of 66 mgd (250 million L/d) (Fields 2007). SRBC has approved this increase and continued to allow a peak daily consumptive use of 48 mgd (182 million L/d) (SRBC 2007a). The SRBC permit is required for plant operation, and PPL must adhere to the prescribed water use limits and any applicable mitigative measures.

SSES's ultimate heat sink for the engineered safeguard service water system is an 8-ac (3-ha) concrete-lined spray pond containing 25 million gallons (95 million L) of water. The spray pond provides auxiliary cooling and supplies cooling water for the diesel generators and the residual heat removal service water system during unit shutdowns. Make-up water for the spray pond is supplied by the river water make-up system (PPL 2006a).

In accordance with Pennsylvania National Pollution Discharge Elimination System (NPDES) permit requirements, the SSES circulating-water and service-water systems are injected with sodium hypochlorite, sodium bromide, nonoxidizing biocides, and scale inhibitors to minimize fouling in the pipes and the condensers (PDEP 2005a; PPL 2006a).

2.1.4 Radioactive Waste Management Systems and Effluent Control Systems

The SSES radioactive waste management systems and effluent control systems control the processing, disposal, and release of radioactive wastes and meet the radiation dose limits as set forth in title 10, Part 20, of the Code of Federal Regulations (10 CFR Part 20) and the dose design objectives of 10 CFR part 50, Appendix I ("Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low As Is Reasonably Achievable' for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents"). Unless otherwise noted, the description of the radioactive waste management systems and effluent control systems presented here (Sections 2.1.4.1, 2.1.4.2, and 2.1.4.3) is based on information provided in the applicant's Environmental Report (ER) (PPL 2006a) or the SSES Final Safety Analysis Report (FSAR), Version 62 (PPL 2007g) and was confirmed during the NRC staff's site visit in May 2007.

Radioactive wastes resulting from plant operations are classified as liquid, gaseous, or solid. Liquid radioactive wastes are primarily generated from liquids received directly from portions of the reactor coolant system or that were contaminated by contact with liquids from the reactor coolant system. Gaseous radioactive wastes are generated from gases or airborne particulates vented from reactor and turbine equipment containing radioactive material. Solid radioactive wastes are solids from the reactor coolant system, solids that came into contact with reactor coolant system liquids or gases, or solids used in the reactor coolant system or steam and power conversion system operation or maintenance (PPL 2007g).

Reactor fuel that has exhausted a certain percentage of its fissile uranium content is referred to as spent fuel. Spent fuel assemblies are removed from the reactor core and replaced with fresh fuel assemblies during routine refueling outages, typically every 24 months. Spent fuel assemblies are then stored in the spent fuel pool in the reactor building. SSES also provides for onsite storage of low-level mixed wastes (LLMW), which contain both radioactive and chemically hazardous materials (PPL 2007g). LLMW are addressed in Section 2.1.5.

SSES's Offsite Dose Calculation Manual (ODCM) describes the methodology and parameters used to calculate offsite doses resulting from radioactive gaseous and liquid effluents from the plant. The ODCM also specifies the controls for release of the gaseous and liquid effluents, such as the monitoring alarm and trip set points, used to verify that the radioactive material being discharged meets regulatory limits (PPL 2007c).

Minimal changes will be made to the waste treatment systems to handle the additional waste expected to be generated by the proposed EPU; for example, the installation of an additional condensate filter and demineralizer. The preliminary data on the changes in liquid, gaseous, and solid radioactive wastes levels are discussed in Sections 2.1.4.1, 2.1.4.2, and 2.1.4.3.

2.1.4.1 Liquid Waste Processing Systems and Effluent Controls

The liquid waste processing system collects, holds, treats, processes, and monitors all liquid radioactive wastes for reuse or disposal. The system is divided into several subsystems so that liquid wastes from various sources can be segregated and processed separately. Cross connections between the subsystems provide additional flexibility for processing the wastes by alternate methods. The wastes are collected, treated, and disposed of according to their conductivity and/or radioactivity (PPL 2007g).

Liquid waste is collected in sumps and drain tanks and transferred to the appropriate subsystem collection tanks for subsequent treatment, disposal, or recycle. Liquid waste is processed by a series of components employing various processes specifically designed to provide maximum decontamination factors. The processing methods used include filtration, reverse osmosis, and/or demineralization. Following treatment, the processed wastes in the waste evaporator condensate tank, waste monitor tanks, or secondary liquid waste monitor tanks are analyzed for chemical and radioactive content prior to being discharged. Any planned releases from the system are evaluated in conjunction with all other radioactive liquid released to ensure that the total release does not exceed the ODCM limits. All liquid effluents are released in batch mode and sampled and analyzed before release. The effluent is discharged into the cooling tower blowdown line for dilution prior to release to the Susquehanna River. Liquid releases to the river are limited to satisfy the dose objectives of Appendix I to 10 CFR Part 50.

The NRC staff reviewed the SSES radioactive effluent release reports for 2002 through 2006 for liquid effluents. The releases in 2006 were representative of the releases in prior years. There were 103 liquid batch releases in 2006. The amount of radioactivity discharged in liquid releases, excluding gases and tritium, totaled 0.0013 curies (Ci) (48,100,000 Becquerels (Bq)) in 2006. A total of 89 Ci ($3.29 \cdot 10^{12}$ Bq) of tritium were released in 2006. A small quantity of dissolved/entrained gases (less than 0.00002 Ci [740,000 Bq]) was also reported by the licensee for the year 2006 (PPL 2003, 2004a, 2005a, 2006c, 2007a).

Based on the liquid waste processing systems and effluent controls and performance from 2002 through 2006, similar small quantities of radioactive liquid effluents are expected from SSES and, except for the EPU as discussed below, are not expected to increase during the renewal period. These releases would result in doses to members of the public that are well below the as low as is reasonably achievable (ALARA) dose objectives of Appendix I to 10 CFR Part 50, as discussed in Section 2.2.7.

The EPU would produce a larger amount of radioactive fission and activation products which will result in larger volume of liquid waste to be processed. As part of the EPU license amendment, the licensee performed an evaluation showing that the liquid radioactive waste treatment system has the capacity to remove all but a small amount of the increased radioactive material. The licensee estimated that quantity of radioactive liquid effluents released to the environment would increase slightly less than 1 percent from current levels (as listed above) due to the EPU (PPL 2006b). Based on experience from EPUs at other plants, the NRC staff concludes that this is an acceptable estimate. Therefore, the findings of the NRC staff, in the SSES EPU environmental assessment (EA), concludes that there would be a small environmental impact from the additional amount of liquid radioactive material generated following implementation of the proposed EPU during the license renewal period (NRC 2007).

2.1.4.2 Gaseous Waste Processing Systems and Effluent Controls

At SSES, the gaseous waste management system includes subsystems that process gases from the offgas system and various ventilation systems. This system reduces radioactive gaseous releases from the plant by filtration or delay, which allows decay of radioactive materials prior to release. The effluents are released to the atmosphere from one of the five rooftop vents located on the reactor and turbine buildings for each unit and the standby gas treatment system in the radwaste building.

The offgas system removes the noncondensable gases from the main condenser for each unit by the mechanical vacuum pump during startup and shutdown, or by the steam air ejectors during normal operation. The offgas consists of activation gases, fission product gases, radiolytic hydrogen, and condenser air leakage. After leaving the condenser, the offgas is passed through a hydrogen dilution and recombination system where hydrogen and oxygen are catalytically recombined into water. After recombination, the offgas is routed to a chiller to remove moisture, and then is sent through the activated carbon adsorber train. The activated carbon selectively adsorbs and delays the noble fission product gases, which have short half-lives, for decay. After exiting the carbon bed, the gases pass through a HEPA filter where any entrained particulates or any activated carbon dust are collected. The offgas stream exiting the HEPA filter is directed to the vent on top of the reactor building for that unit (PPL 2007g).

The vent collection system receives the discharge of vents and other equipment in the radioactive waste, reactor, and turbine buildings. These components contain only a small amount of fission product gases. Prior to release through the ventilation systems, the gases are monitored and passed through a prefilter, high-efficiency particulate filter, charcoal filter, and another high-efficiency particulate filter in series, which reduce any airborne particulate radioactive material to very low levels. The effluents are continuously monitored, and an alarm is activated in the control room if the monitor set points are exceeded. The operators would then take action to reduce or terminate release (PPL 2007g).

The NRC staff reviewed the SSES radioactive effluent release reports for 2002 through 2006 for gaseous effluents. The releases in 2006 were representative of the releases in prior years. In 2006, SSES made no gaseous batch releases. All SSES gaseous effluents, in 2006, are continuous releases that contained a total of 0.74 Ci (2.74×10^{10} Bq) of fission and activation gases, 1.4×10^{-5} Ci (5.18×10^{5} Bq) of iodine-131, 7.9×10^{-4} Ci (2.92×10^{7} Bq) of particulate matter with half-lives greater than 8 days, and a total of 59 Ci (2.18×10^{12} Bq) of tritium (PPL 2007a).

These releases, except for the EPU as discussed below, are not expected to increase 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.

The licensee has estimated that the amount of radioactive material released in gaseous effluents would increase in proportion to the increase in power level (14 percent) following EPU implementation (PPL 2006b). Based on experience from EPUs at other plants, the NRC staff concludes that this is an acceptable estimate. The offsite dose to a member of the public, including the additional radioactive material that would be released from the proposed EPU, is calculated to still be well within the radiation standards of 10 CFR Part 20 and the design objectives of Appendix I to 10 CFR Part 50. Therefore, the preliminary findings of the NRC staff, in the SSES EPU EA, are that there would be a small environmental impact from the additional amount of gaseous radioactive material generated following implementation of the proposed EPU (NRC 2007).

2.1.4.3 Solid Waste Processing

The solid radioactive waste system is designed to collect, process, and package solid radioactive wastes generated as a result of normal plant operation. It is also capable of storing the packaged waste until it is shipped offsite to a waste processor for treatment and/or disposal or to a licensed burial site. The solid radioactive waste equipment is located in the radioactive waste building. The solid waste management system consists of the wet process stream and the dry process stream. The wet process stream is used to collect, process, dewater, and solidify the wet solids such as filter slurries and spent resins. The dry process stream is used to collect and package dry solid wastes. Dry solid wastes include contaminated filter media, clothing, rags, equipment, tools, paper, and plastic sheeting (PPL 2007g).

Transportation and disposal of solid radioactive wastes are performed in accordance with the applicable requirements of 10 CFR Part 71 and 10 CFR Part 61, respectively. No releases to the environment occur from solid radioactive wastes generated at SSES. During the period 2000 through 2005, the amount of annual radioactive materials in the solid wastes generated varied from 2500 (9.25×10^{13} Bq) to almost 190,000 Ci (7.03×10^{15} Bq). The largest amount of radioactive material generated in the solid waste was 189,995 Ci (7.03×10^{15} Bq) in 2000 (PPL 2001, 2002, 2003, 2004a, 2005a, 2006c). In 2006 (the most recent year for which data were available), SSES made a total of 11 shipments of solid waste (PPL 2007a). Approximately 238 m^3 (8400 ft^3) of solid waste containing almost 91,000 Ci (3.37×10^{15} Bq) of radioactivity was shipped offsite. Approximately 89,000 Ci (3.30×10^{15} Bq) of this activity was associated with a waste stream called "irradiated components" that had a volume of only about 8.1 m^3 (286 ft^3). This type of waste is generated only occasionally at SSES. The range of approximately 2500 to 6000 Ci (9.26×10^{13} to 2.22×10^{14} Bq) is more typical. The volumes reported are for noncompacted wastes. Volume reduction by compaction is performed by a contractor at an offsite location. No irradiated fuel shipments were made in 2006 (PPL 2007a). The solid waste volumes and radioactive material activity levels, except for the EPU as discussed below, are not expected to increase during the renewal period.

The proposed EPU would produce a larger amount of radioactive fission and activation products, which would require more frequent replacement or regeneration of radioactive waste treatment system filters and demineralizer resins. The licensee has estimated that the volume of solid radioactive waste would increase by approximately 11 percent due implementation of the EPU (PPL 2006b). Based on experience from EPUs at other plants, the NRC staff concludes that this is an acceptable estimate. The increased volume of the solid waste would still be bounded by the 10,400 ft^3 (295 m^3) annual estimate in the 1981 Final Environmental Statement (FES) for operation (NRC 1981). Therefore, the NRC staff, in the SSES EPU EA, concluded that there would be a small environmental impact from the additional amount of solid radioactive material generated following implementation of the proposed EPU (NRC 2007).

Looking forward, there is a potential issue related to radioactive waste disposal that may impact SSES's ability to dispose of its low-level solid radioactive waste in the future. The State of South Carolina-licensed low-level radioactive waste disposal facility located in Barnwell, South Carolina, may limit access to radioactive waste generators in States that are not part of the Atlantic Low-Level Waste Compact after June 2008. SSES is aware of the potential loss of access to this low-level radioactive waste disposal facility and is developing plans to address the issue.

During the site audit, the PPL staff indicated that, if Barnwell would not be available to them, they would be able to send their Class A low-level waste to the EnergySolutions (formerly Envirocare of Utah) disposal facility in Utah and store Class B and C wastes onsite. They indicated that they would have enough storage capacity to 20 to 30 years. The SSES would still have to meet all applicable dose limits, design objectives, and standards, which apply to all operations and facilities at the site (see Section 2.2.7).

2.1.5 Nonradioactive Waste Systems

PPL generates nonradioactive waste at SSES from facility maintenance, cleaning, and operational processes.

2.1.5.1 Nonradioactive Waste Streams

PPL generates solid waste, as defined by the Resource Conservation and Recovery Act (RCRA), as part of routine plant maintenance, cleaning activities, and plant operations. In Pennsylvania, solid waste is further classified as either municipal waste (25 PA Code Article VII) or residual waste (25 PA Code Article IX). Residual waste is defined as garbage from industrial operations and sludge from industrial wastewater or sewage treatment plants. Some of the residual wastes generated at SSES include used oil (nonhazardous), paper, trash, sludge, oily debris, grease, asbestos-containing waste, and polychlorinated biphenyl (PCB)-containing waste generated as part of routine facility operations. Over the past 5 years, SSES has annually generated approximately 3 million lb (1.4 million kg) of residual waste. PPL submits annual reports to the Pennsylvania Department of Environmental Protection (PDEP) Bureau of Waste Management identifying the waste streams and providing generation rates and methods of disposal (PPL 2007e).

The U.S. Environmental Protection Agency (EPA) classifies certain nonradioactive wastes as hazardous based on characteristics including ignitability, corrosivity, reactivity, or toxicity (further information on hazardous waste is available in 40 CFR Part 261). State-level regulators may add wastes to EPA's list of hazardous wastes. RCRA provides standards for the treatment, storage, and disposal of hazardous waste for hazardous waste generators (regulations are available in 40 CFR Part 262). RCRA regulations are administered in the State by the PDEP (25 PA Code Article VII). The last compliance audit conducted by the PDEP at SSES was in 1993. No violations were noted (PPL 2007e).

SSES generates hazardous wastes such as waste paints, lab packs, solvents, and lead barriers (PPL 2007e). SSES is a large-quantity generator of hazardous waste (EPA ID No. PAD000765883), meaning that it can generate more than 2200 lb (1000 kg) of hazardous waste in a month (PPL 2007e). From 2002 to 2006, SSES generated approximately 5000 to 10,000 lb (2250 to 4500 kg) of hazardous waste per year, except for 2004. In 2004, SSES disposed of approximately 23,000 lb (10,400 kg) of expired or unused paint, which resulted in approximately 30,000 lb (13,600 kg) of hazardous waste being disposed (PPL 2007f). It is expected that SSES would continue to generate hazardous waste during the proposed renewal term although waste minimization efforts are expected to reduce the amount generated.

The U.S. Environmental Protection Agency (EPA) classifies several hazardous wastes as universal wastes; these include batteries, pesticides, mercury-containing items, and fluorescent lamps. Pennsylvania has incorporated, by reference, the EPA's regulations (available at 40 CFR Part 273) regarding universal wastes (in 25 PA Code 266b). SSES is a large-quantity generator of universal waste (meaning that it can accumulate 5000 kg [11,023 lb] or more of universal waste at any time), generating waste batteries, waste fluorescent lamps, and waste thermostats (PPL 2007e). The universal wastes are accumulated in satellite areas and then stored at the waste accumulation area before being removed for offsite disposal.

The waste accumulation area at SSES is a locked, fenced area for the storage of hazardous waste and recyclable materials awaiting offsite recycling. Within the fenced area, there is a hazardous materials storage building, which provides individual covered bays for the various types of hazardous materials used at the facility (PPL 2007e).

PPL once operated a solid waste landfill at SSES. The disposal site was closed in 1993, following PDEP-approved closure plans. PPL received final closure certification from PDEP for the landfill in December 2003 (PPL 2007e).

The Emergency Planning and Community Right-to-Know Act (EPCRA) requires applicable facilities to provide information on hazardous and toxic chemicals to local emergency planning authorities (Title 42, Section 11001, of the *United States Code* (42 USC 11001)). PPL is subject to Federal EPCRA reporting requirements, and thus submits annual Section 312 Tier II reports to local emergency planning agencies for substances such as resins, lubricants, compressed gases, diesel fuel, gasoline, and refrigerants (PPL 2007e).

Low-level mixed wastes (LLMW) are wastes that contain both low level radioactive waste and RCRA hazardous waste (10 CFR 266.210). EPA (or an authorized State agency) regulates the hazardous component of the mixed waste through RCRA, and the NRC regulates radioactive waste subject to the Atomic Energy Act. Pennsylvania has incorporated by reference Federal regulations exempting LLMW from RCRA storage and treatment regulations provided the waste meets specific conditions (25 PA Code § 266a.20).

SSES accumulates LLMW such as lab packs, solvents, paints, cutting fluids, and lead penetration barriers during routine facility operation and maintenance. LLMW are stored within the controlled area prior to shipment offsite for initial treatment and energy recovery before ultimately being disposed of at Envirocare in Utah. In 2002, 2003, and 2005, SSES generated approximately 1000 lb (450 kg) of mixed waste. In 2004, there was a peak of almost 3000 lb (1360 kg), due to removal of numerous lead penetration barriers. No LLMW were disposed in 2006 (PPL 2007f).

SSES has an onsite sewage treatment plant to treat sanitary waste. Sludge from the treatment plant is removed by a contract service and sent to the Berwick City Sanitary System. The wastewater is released to the Susquehanna River through NPDES permitted Outfall 079 (PA-0047325). Section 2.2.3 contains more detailed information about the NPDES permitted outfalls.

SSES has a State-only operating permit (No. 40-00027) from the PDEP for the air emissions released from the use of emergency diesel generators (PDEP 2003). However, the permit does not require collection of particulate emissions, and therefore the operation of the generators does not result in the creation of solid waste. SSES is recognized as a synthetic minor facility by PDEP due to the small quantity of emissions and hours of operation. Section 2.2.4 provides more information about air permit requirements at SSES.

2.1.5.2 Pollution Prevention and Waste Minimization

PPL recycles numerous waste streams generated at SSES to Luzerne County and other vendors. Lead, mixed metals, cardboard, plastic, paper, mixed glass, wood waste, used oil, food waste, batteries, and consumer electronics are recycled or beneficially reused, diverting tons of waste from the local landfills (PPL 2007e).

The EPA's Office of Pollution Prevention and Toxics has established a clearinghouse that provides information regarding waste management and technical and operational approaches to pollution prevention. The EPA's clearinghouse can be used as a source for additional opportunities for waste minimization and pollution prevention at SSES, as appropriate.

2.1.6 Facility Operation and Maintenance

Maintenance activities conducted at SSES include inspection, testing, and surveillance to maintain the current licensing basis of the facility and to ensure compliance with environmental and safety requirements. Various programs and activities currently exist at SSES to maintain, inspect, test, and monitor the performance of facility equipment. These maintenance activities include inspection requirements for reactor vessel materials, boiler and pressure vessel in-service inspection and testing, a maintenance structures monitoring program, and maintenance of water chemistry.

Additional programs include those implemented to meet technical specification surveillance requirements, those implemented in response to the NRC generic communications, and various periodic maintenance, testing, and inspection procedures. Certain program activities are performed during the operation of the unit, while others are performed during scheduled refueling outages. PPL refuels SSES on a nominal 24-month interval.

2.1.7 Power Transmission System

Transmission lines that are considered within the scope of license renewal are constructed specifically to connect the facility to the regional electric transmission grid (10 CFR 51.53(c)(3)(ii)(H)). The Final Environmental Statements for SSES (AEC 1973; NRC 1981) described three short 230-kV ties, one 230-kV transmission line (Stanton-Susquehanna #2 line), and two 500-kV transmission lines (Susquehanna-Wescosville-Alburtis and Sunbury-Susquehanna #2 line) that originally were used to connect SSES with the grid. All of these in-scope transmission lines are owned and operated by PPL. There are four other transmission lines that were in existence and connected to the 230-kV Susquehanna switchyard prior to the construction of SSES and were not constructed to connect SSES to the grid. They are the Stanton #1, Jenkins, Harwood, and Sunbury #1 lines. There are no PPL-owned or -operated switchyards or substations present within any of the transmission line segments described above.

The three short transmission ties were constructed to supply startup power to SSES from preexisting 230-kV lines in the immediate vicinity of the plant (Montour and Mountain lines). These transmission ties also transmit the output of Unit 1 to the Susquehanna switchyard located across the Susquehanna River. The ties consist of a 2.3-mi (3.7-km)-long line to connect the Mountain and Montour lines to the 230-kV Unit 1 main transformer, a 1.8-mi (2.9-km)-long line to connect the Stanton line to the Unit 1 main transformer, and a 2.2-mi (3.5-km)-long line to connect the Unit 1 main transformer to the 230-kV switchyard across the

Susquehanna River. The lines cross the Susquehanna River on tubular, single-pole towers in foundations of reinforced concrete.

From the Susquehanna switchyard, the 230-kV Stanton-Susquehanna #2 line runs northeast from SSES for 30 mi (48 km) to the Lackawanna substation, which is located about 5 mi (8 km) northeast of Scranton, Pennsylvania. This transmission line was originally built to 500-kV standards, but still operates at 230 kV. The power lines are carried on tubular, single-pole towers in the immediate vicinity of the site, with the remaining length of the lines using single-circuit lattice steel towers. The ROW for this line varies from 100 to 400 ft (30 to 122 m) wide and occupies approximately 1400 ac (570 ha).

The first of the 500-kV lines, the Susquehanna-Wescosville-Alburtis line, extends southeast from the onsite Unit 2 500-kV switchyard, for approximately 76 mi (122 km) to the Alburtis substation located approximately 3 mi (5 km) southwest of Allentown, Pennsylvania. The power lines are carried on tubular, single-pole towers in the immediate vicinity of SSES, with the remaining length of the lines using single-circuit lattice steel towers. The ROW varies from 100 to 350 ft (30 to 110 m) wide and occupies approximately 3200 ac (1295 ha).

The second of the 500-kV lines, the Sunbury-Susquehanna #2 line, extends west-southwest from the Unit 2 500-kV switchyard for approximately 44 mi (71 km) and connects with a substation located in Sunbury, Pennsylvania. The power lines are carried on tubular, single-pole towers in the immediate vicinity of SSES, with the remaining length of the lines using single-circuit lattice steel towers. This transmission line shares a ROW with the Sunbury #1 line, which is not associated with SSES. The ROW is approximately 325 ft (99 m) wide and occupies approximately 1700 ac (690 ha).

The transmission lines principally cross hardwood forests, including Pennsylvania State Game Lands, and agricultural land. Routine vegetation maintenance within the transmission line ROWs is performed by PPL and its contractors and includes the use of mechanical clearing and hand-applied herbicides (PPL Electric Utilities Corporation 2007). PPL does not use herbicides within 50 ft (15 m) of a wetland or stream crossing. Within the ROWs, smaller trees, such as flowering dogwood (*Cornus florida*), elderberry (*Sambucus canadensis*), Eastern red cedar (*Juniperus virginiana*), and dwarf willow (*Salix herbacea*), are encouraged and preserved to the extent possible (to avoid ground fault conditions and remain consistent with applicable regulations and standards), with larger trees being preserved when topography allows. Within the Pennsylvania State Game Lands, PPL uses a different approach to its ROW maintenance. In these areas, PPL allows larger hardwoods to grow, uses no herbicides, encourages a reduced ROW width, and, whenever possible, places towers on points of highest elevation to provide opportunities for maximum spanning between support towers. During the period when the Federally listed Indiana bat (*Myotis sodalis*) could use trees for roosting and rearing young (May to October), PPL will not cut any tree over 5 in. (13 cm) in diameter at breast height, unless that tree is a danger tree (i.e., trees outside of the ROW that could come in contact with transmission lines). The transmission lines are inspected by aircraft annually and by foot patrol once every 3 years. No significant changes in the maintenance of the transmission lines or their ROWs are anticipated during the SSES license renewal period.

2.2 Plant Interaction with the Environment

Sections 2.2.1 through 2.2.8 provide general descriptions of the environment near SSES 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 associated with other Federal project activities.

2.2.1 Land Use

SSES is located in Salem Township, Luzerne County, Pennsylvania, along the Susquehanna River in an area of open deciduous woodlands, interspersed with grasslands and orchards (PPL 2006a). PPL Susquehanna owns 2355 ac (950 ha) on both sides of the Susquehanna River (PPL 2007f). SSES is on the west side of the Susquehanna River on 1574 ac (637 ha) that includes the SSES (1173 ac [475 ha]) and the Susquehanna Riverlands (401 ac [162 ha]), a strip of land between the power generating facilities and the Susquehanna River (PPL 2004b; Figure 2-3). PPL land on the west side of the river is jointly owned with Allegheny Electric Cooperative (10 percent). The 401-ac (162-ha) Susquehanna Riverlands consists of natural and recreational areas open to the public (PPL 2004b):

- <u>Riverlands Nature Center</u>. The Nature Center is located in the Susquehanna Energy Information Center at the entrance to the Recreation Area (Figure 2-3).

- <u>Susquehanna Riverlands</u>. This nature preserve and recreation area on the west side of the river is a popular spot for picnicking, group outings, hiking, sports, and playing.

- <u>Lake Took-A-While</u>. A 30-ac (12-ha) fishing lake and a restored section of the North Branch Canal provide fishing opportunities and are open to the public. Boating is allowed, but no gasoline engines are permitted.

- <u>Wetlands Nature Area</u>. This 94-ac (38-ha) tract of riverine forest, marsh, swamp, and vernal pools has been set aside as an area for nature study and education. A portion of the long-abandoned North Branch Canal runs north-south across the property.

The developed portion of the SSES is approximately 487 ac (197 ha), 233 ac (94 ha) of which are within the Exclusion Area (see Figure 2-3). The Exclusion Area is surrounded by security fencing; access to this part of the site is through the main entrance off U.S. Route 11. U.S. Route 11 separates the SSES from the 401-ac Susquehanna Riverlands nature preserve and recreation area.

PPL owns most of the 717 ac (290 ha) on the east side of the Susquehanna River (PPL 2007f). This includes approximately 275 ac (110 ha) of natural, recreational, and wildlife lands; 360 ac (146 ha) of crop and timber lands; and 82 ac (33 ha) of land in use by the utility. Part of the natural and recreational area is the Council Cup Scenic Overlook, a 700-ft (200-m)-high bluff that affords a spectacular view of the Susquehanna River Valley. This scenic overlook (owned by PPL Electric Utilities) is the dominant natural topographic feature of the Susquehanna Riverlands and was used in the past as a lookout and meeting place for Native Americans. Gould Island, a 65-ac (26-ha) island that lies just upstream of the Susquehanna Riverlands, is also owned by PPL (PPL 2007e).

2.2.2 Water Use

2.2.2.1 Surface Water

As described in detail in Section 2.1.3, SSES uses cooling water from the Susquehanna River and discharges heated water back to the river at a point approximately 600 ft (180 m) downstream of the intake structure. The Susquehanna River is 440 mi (710 km) long and flows from its source at Lake Otsego, New York, to Havre de Grace, Maryland, where it flows into Chesapeake Bay. River levels are measured at SSES and used to determine flow past the station (PPL 2006a). Average monthly flows range from 6970 to 38,200 cfs (197 to 1080 m^3/s) (Ecology III 2007a), or 4530 to 24,800 mgd (17 to 94 billion L/d). The average annual flow rate is 9427 mgd (36 billion L/d) (NRC 2007). The EPU approved by NRC in 2008 (NRC 2008) is included in the license renewal evaluation and after implementation will increase the average intake flow rate from the river to 60.9 mgd (230 million L/d) from 58.3 mgd (220 million L/d), with a maximum daily withdrawal of 66 mgd (250 million L/d) (NRC 2007). The average withdrawal represents a relatively small increase (4.5 percent) in intake water and is not expected to significantly affect the Susquehanna River (NRC 2007).

The intake and discharge areas in the Susquehanna River are maintained through periodic dredging of sediment from the river bottom near the pipe openings. The dredging is performed under the authorization of the U.S. Army Corps of Engineers (USACE) pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act (USACE 2006). When dredging occurs every few years, SSES removes approximately 200 yd^3 (150 m^3) of silt and sediment from in front of the intake structure and removes 20 to 30 yd^3 (15 to 23 m^3) from inside the discharge diffuser pipe (PPL 2007d, USACE 2006). The dredged material is removed as a maintenance activity to an upland disposal site (fill area) owned by SSES. This maintenance dredging is conducted under Pennsylvania State Programmatic General Permit-3 (PASPGP-3), which is included by reference in the USACE authorization. The permit does not require sampling of the dredged material before deposition on land, and sampling is not conducted.

Consumptive surface water use at SSES is regulated by the SRBC under 18 CFR Part 803, Application 19950301 (SRBC 2007a). PPL's water use permit has been modified to account for the EPU (SRBC 2007a). According to the water use monitoring plan included as Attachment C of the permit, total surface water withdrawal is calculated as the sum of (a) total cooling tower water loss, (b) cooling tower blowdown, and (c) make-up flow to the emergency spray pond. Further, under the SRBC permit, SSES is required to compensate for the consumptive use of water from the Susquehanna River. SSES compensates for the consumptive use of water by sharing in the costs of modification and operation by the USACE of the Cowanesque Lake Reservoir.

2.2.2.2 Groundwater

The SSES site was glaciated several times during the Pleistocene Epoch when the ice reworked and deposited glacial sediment including glacial till and outwash. The till is poorly sorted, ranging in size from clay to boulders, and does not typically serve as an aquifer in this area. The outwash consists of sand and gravel-size sediment interbedded with silt and clay and is usually capable of yielding usable quantities of groundwater to wells (Meiser & Earl 2000). The thickness of glacial deposits at the SSES site ranges from less than 10 ft (3 m) to over 100 ft (30 m), with the thickest deposits in a buried valley located north of the plant. It is in these deposits north of the plant where the site's main production wells, TW-1 and TW-2, are located.

SSES does not use municipal water. Well TW-2 is the SSES main production well for providing potable water. TW-2 is 75 ft (23 m) deep and has a maximum yield of 150 gpm (570 L/min) with an average rate of withdrawal of 65 gpm (250 L/min) (PPL 2006a). Well TW-1, also located in the buried valley area north of the plant, is also 75 ft (23 m) deep and can yield 50 gpm (190 L/min) to the potable water system. Well TW-1 is rarely used, but is coupled to provide backup to well TW-2.

Combined groundwater withdrawal from TW-2 and TW-1 of 125,000 gpd (473,000 L/d) has been approved by SRBC (2007a). The consumptive use of groundwater by SSES is low because most of the pumped groundwater is returned to the Susquehanna River after use and treatment (SRBC 2007a). SSES well system operation began in 1974, and the total current groundwater withdrawal is 94,000 gpd (355,700 L/d) (Fields 2005).

There are three other domestic wells located on SSES property used for potable water only. Combined consumptive use of the three wells is less than the 125,000 gpd (473,000 L/d) SRBC consumptive use approval requirement. The first is a well located at the Energy Information Center to a depth of 100 ft (30 m), which produces water for potable and sanitary use for six employees and visitors to the facility. This well is capable of yielding groundwater at a rate of 15 gpm (57 L/min), or 21,600 gpd (82,000 L/d). The second is a well installed to a depth of 105 ft (32 m) located at the Riverlands Recreational Facility, which provides potable and sanitary water for users of the recreational area from mid-April through October. This well is capable of yielding water at a rate of 30 gpm (114 L/min), or 43,200 gpd (164,000 L/d). The third well is located at the SSES West Building, is 55 ft (17 m) deep, and capable of yielding 30 gpm (114 L/min), or 43,200 gpd (164,000 L/d) (PPL 2006a).

2.2.3 Water Quality

Water quality in the Susquehanna River in the SSES area of Pennsylvania has apparently improved since monitoring began in 1971. The improvement has been attributed to the reduction of point source pollutants following continued enforcement of the Federal Water Pollution Control Act Amendments of 1972 (FWPCAA) and the termination of upriver anthracite coal mining (Ecology III 2007a).

Pursuant to the FWPCAA, the water quality of the station's effluents is regulated through the NPDES. The NPDES permit specifies the discharge standards and monitoring requirements for each discharge. Compliance with the NPDES process is expected to meet other provisions of the FWPCAA (e.g., Sections 316(a), 316(b), 401, 404).

Surface water and wastewater discharges at SSES are regulated by the PDEP via NPDES permit No. PA0047325 (PDEP 2005a). The SSES NPDES permit includes no thermal discharge limits, but SSES must adhere to river temperature and water quality standards set by the Commonwealth of Pennsylvania in Section 93.7 of the Pennsylvania Water Quality Standards (NRC 2007). Liquid effluents from SSES are discharged to the Susquehanna River through the common discharge structure located about 600 ft (180 m) downstream of the intake structure, as described in Section 2.1.3.

Treated sewage plant effluent discharges to the river through a concrete outfall (079) structure located between the intake and discharge structures (PPL 2006a). Sampling of sewage effluent is done daily for pH and chlorine and monthly for total suspended solids, carbonaceous biochemical oxygen demand (CBOD), and fecal coliform (PDEP 2005a).

SSES has ten NPDES-permitted discharge locations as described in Table 2-1.

Table 2-1. NPDES-Permitted Discharge Locations at SSES

Discharge Location	Flow Rate	Description	NOVs[a]
Outfall 070	No limit	Storm water – S-2 sedimentation pond	One on March 7, 2007 – missing DMR[b]
Outfall 071	12.09 mgd (45.8 million L/d)	Cooling tower blowdown	
Outfall 072	0.02 mgd (0.08 million L/d)	Service and administration building low-volume waste sump	
Outfall 073	0.032 mgd (0.12 million L/d)	Unit 1 turbine building low-volume waste sump	
Outfall 074	0.016 mgd (0.6 million L/d)	Unit 2 turbine building low-volume waste sump	
Outfall 075	No limit	Storm water – Peach Stand Pond	
Outfall 079	0.08 mgd (0.30 million L/d)	Sewage treatment plant	One in April 2007 – BOD[c] exceedence
Outfall 080	No limit	Storm water – C-1 Pond	One on March 7, 2007 – missing DMR
Outfall 171	None given in permit	Radioactive waste – treatment plant effluent	
Outfall 371	None given in permit	Neutralization basin discharge	

(a) NOV = Notice of Violation.
(b) DMR = discharge monitoring report.
(c) BOD = biochemical oxygen demand.
Source: PDEP 2005a, PPL 2007d, PPL 2007j

Outfall 071, cooling tower blowdown, and Outfall 079, sewage treatment plant, discharge effluent to the Susquehanna River. Outfall 171, the radioactive waste treatment plant effluent, and Outfall 371, the neutralization basin discharge, both discharge through Outfall 071. All of the other outfalls (primarily storm water) discharge to Lake Took-A-While (PPL 1999).

The Notices of Violation (NOVs) of the NPDES permit are limited to the few shown above as described during the site audit interview with the PDEP Northeast Regional Office representative. No previous NOVs have been identified. The NOV related to storm water discharge monitoring was a reporting error; the analytical data obtained from Outfall 075 should have also been reported on DMR forms for Outfalls 070 and 080 (PPL 2007j). These forms were sent to PDEP by PPL on April 5, 2007, along with a request to allow all three outfalls to be listed on the same form in the future. The other NOV occurred during the spring 2007 outage when the plant worker population increased and the sewage treatment plant could not keep up with the biochemical oxygen demand (BOD) requirements of the discharge. After the outage was over, effluent from the sewage treatment plant Outfall 079 returned to permitted levels.

Cooling tower blowdown samples and upstream and downstream river water samples are collected once a quarter by PPL to monitor potential nonradiological SSES impacts on the Susquehanna River. Blowdown water typically has high conductivity and dissolved solids concentrations. Except for total zinc and total chromium, the discharge permit requires no detectable priority pollutants due to the addition of chemicals for cooling tower maintenance. Water treatment of the circulating water system includes the addition of the following chemicals:

- Polymeric dispersant to prevent silt settlement.
- Scale inhibitor to prevent calcium scale formation.
- Sulfuric acid for pH control.
- Sodium hypochlorite and sodium bromide for microbiological control.
- Quaternary amine for mollusk control.

Results of sampling have indicated that river water quality is improving over the stretch of river both above and below SSES, mostly as a result of decreased dissolved iron concentrations due to the reduction of acid mine drainage in the watershed. Concentrations of total dissolved solids, conductivity, and sulfates are higher downstream of SSES, but are within the PDEP criteria for the river (Ecology III 2003).

The SSES Preparedness, Prevention, and Contingency Plan (PPL 2006a) documents 15 pollution incidents onsite from 1980 through 1995. Most of these incidents were related to fuel product spills and were quickly remediated. The only other significant incidents were acid leaks – the first, a sulfuric acid leak in August 1988 from an acid injection line used for circulating water treatment. Seventeen hundred gallons (6400 L) of concentrated sulfuric acid were spilled along with 6800 gal (26,000 L) of water. The soil was tested and low pH values were detected. The soil was neutralized and some was excavated and disposed of offsite. No long-term effects on site soils have been detected, and no further reporting to PDEP is required. Sulfuric acid is no longer used for circulating water treatment.

The second incident occurred in January 1990 when 50 gal (190 L) of diluted sulfuric acid leaked from a sump drainpipe into a small excavation. The liquid was pumped out and the surrounding soil was neutralized and placed in a 55-gal (208-L) drum. In 2004, a spill occurred on the roofs of the turbine buildings where mist from lube oil removal tanks accumulated and washed down the storm drain to the discharge area near Lake Took-A-While. The drains were cleaned, and the lube oil has since been collected before spilling on the roof. The SSES has a proactive secondary spill containment program, which has reduced reportable spills since 1995 to fewer than one per year.

The main groundwater source is a buried valley aquifer consisting of stratified glacial outwash material. Groundwater pumped at approximately 65 gpm (250 L/min) from the supply wells is chlorinated prior to onsite use. The well field, comprised of wells TW-1 and TW-2, is monitored using three 2-in. (5-cm)-diameter piezometers to track water levels. Only minor fluctuations in saturated thickness of the aquifer have been recorded. Water from the well field is pumped to a 500,000-gal (1.9-million L) aboveground storage tank onsite. In the tank, a minimum of 180,000 gal (680,000 L) are maintained as a reserve for fire protection.

No groundwater contamination has been identified at SSES; however, a groundwater monitoring program is being developed, which will add six onsite wells where samples for tritium analysis will be obtained. PPL does not sample private wells on nearby properties. The closest well is a domestic well near the southeast corner of the facility.

2.2.4 Air Quality

2.2.4.1 Climate and Meteorology

SSES lies near the town of Berwick, Pennsylvania, within the Ridge and Valley Province of the Appalachian Mountains. The Ridge and Valley Province is 80 to 100 mi (130 to 160 km) wide and characterized by parallel ridges and valleys oriented northeast-southwest. The mountain ridges vary from 1300 to 1600 ft (400 to 490 m) above sea level, with local relief 600 to 700 ft (180 to 210 m). The Ridge and Valley Province is not rugged enough for a true mountain type of climate, but it does have many of the characteristics of such a climate. SSES is located within Wyoming Valley, and is bordered by the Susquehanna River on its eastern flank. The Wyoming Valley is located between two mountain ridges with high elevations of 1120 ft (340 m) mean sea level (MSL) on the western edge and 1220 ft (370 m) MSL to the east. The elevation at SSES is approximately 675 ft (205 m) MSL. Elevations along that portion of the river valley generally range between 500 and 700 ft (150 to 210 m) MSL with hills reaching 1000 to 1200 ft (300 to 365 m) MSL within 2 mi (3 km) north of Berwick. Lee Mountain, about 4 mi (6 km) north of the town, rises some 1500 to 1700 ft (460 to 520 m) MSL, while Nescopeck Mountain, about 4 mi (6 km) to the south, reaches elevations of 1400 (430 m) to more than 1600 ft (490 m).

Northeastern Pennsylvania has been characterized as having a highly variable continental climate, with a large range of both diurnal and annual temperatures and considerable diversity in areas short distances apart. The surrounding mountains influence the temperature and precipitation, causing wide departures in both within a few miles of the station. Because of the proximity of the mountains, the climate is relatively cool in summer, with frequent shower and thunderstorm activity, usually of brief duration. The mountain- and valley-influenced air movements cause somewhat greater temperature extremes than are experienced in the southeastern part of the State. The winter temperatures in the valley are not usually severe, and the occurrence of subzero temperatures and severe snowstorms is infrequent. A high percentage of the winter precipitation occurs as rain (NWS 2007a).

The dominant wind direction throughout Pennsylvania is from the west, with some seasonal variation. Locally, however, wind direction is primarily influenced by changes in topography and can often travel parallel to the long, sinuous ridgelines of the Appalachians or nearly perpendicular to those ridgelines in the presence of a windbreak. Thus, in the vicinity of the SSES, the predominating wind direction generally parallels the long axis of the north-south-trending Wyoming Valley and Susquehanna River. The average annual wind speed for the National Weather Service Station located in Wilkes-Barre, Pennsylvania, (approximately 25 mi [40 km] northeast of SSES) is 4.8 mph (2.1 m/s) (NWS 2007a).

While the prevailing westerly winds result in most of the air masses that affect Pennsylvania originating from the interior of the continent, the Atlantic Ocean does have a limited influence upon the climate of the State. Coastal storms can affect the day-to-day weather, especially in eastern sections. It is here that storms of tropical origin have the greatest effect within the State, causing floods in some instances.

The tendency for cool air masses to flow down into the valleys at night from the ridgelines results in a shortening of the growing season because frost occurs later in spring and earlier in fall than would otherwise happen. The growing season in this section is longest near Harrisburg, where it averages about 165 days, and shortest in Schuylkill and Carbon Counties, averaging less than 130 days. The annual precipitation in this area has a mean value of 3 or 4 in. (8 or 10 cm), greater than in the southeastern part of the State, but its geographic distribution is less uniform. Seasonal snowfall of the Ridge and Valley Province varies considerably within short distances. It is greatest in Somerset County, averaging 88 in. (224 cm) in the vicinity of Somerset, and least in Huntingdon, Mifflin, and Juniata Counties, averaging about 37 in. (94 cm) (Pennsylvania State Climatologist undated). Quarterly average temperature calculations based on historical monthly average temperatures for the period from 1955 to present indicate that values vary from a lowest value of 21.4°F (–5.9°C) for the December to February period to the highest value of 73.3°F (22.9°C) for the June to August period (NWS 2007b).

Severe weather events in Pennsylvania are uncommon. Severe snowstorms are infrequent, but when they do occur, they can approach blizzard conditions. High winds have been known to cause huge drifts that can continue to disrupt normal routines for several days. While the incidence of tornadoes is very low, the region has occasionally been hit with these storms, which caused loss of life and great property damage. Fifteen tornadoes were reported in Luzerne County from 1950 to March 2007, according to the National Climatic Data Center (NCDC), with 5 at F0, 6 at F1, and 4 at F2 strengths.[a] The area has felt the effects of thunderstorms with high winds. Considerable wind damage has occasionally occurred, but the most devastating damage has come from flooding caused by the large amounts of precipitation deposited by the storms (NCDC 2007). The worst natural disaster to hit the region was the result of the flooding caused by hurricane Agnes in 1972 (NWS 2007c).

SSES operates a meteorological system that consists of weather instruments mounted on a primary 200-ft (60-m) tower and 32.8-ft (10-m) backup tower, which provides alternative measurements and serves as a secondary data source in the event of sensor failure on the primary tower. There are wind sensors, mounted at the 10-m (32.8-ft) and 60-m (200-ft) levels of the primary tower that allow calculation of horizontal wind direction standard deviation. Vertical temperature differential is measured with redundant sensor pairs between both levels. Ambient temperature and dew point sensors are located at the 10-m (32.8-ft) level. Precipitation is measured at ground level.

There is an established real-time review and data quality assurance program for meteorological data. These functions are performed primarily by a contractor in accordance with the SSES meteorological program (Procedure CH-RM-005); however, the program allows for others (operators in the reactor control room, for example) to observe meteorological data in real time and initiate notifications when questionable data are observed or the data stream has been interrupted. The quality control process involves routine comparison of onsite data with data obtained from the onsite backup tower, a supplemental offsite tower located in Susquehanna River plain, and regional National Weather Service observing sites in Williamsport and Avoca, Pennsylvania. The quality-assured meteorological data are then compiled into monthly, quarterly, and annual reports (PPL 2007h). Such reports also include explanations of periods when spurious or unreliable data were being accumulated, the root causes of such conditions, and their subsequent resolution.

(a) The Fujita six-point scale (F0 to F5) is used to rate the intensity of a tornado based on the damage it inflicts to structures and vegetation. Lowest intensity is F0; highest is F5. Fujita scale categories are based on estimated (not measured) sustained wind speeds compared against observed structural damage. An enhanced Fujita Scale replaced the original Fujita Scale in February 2007. The Enhanced Fujita Scale still uses six categories of tornado intensity (EF0 to EF5), but defines those categories differently. For additional information about the Fujita Scales, see the following National Oceanic and Atmospheric Administration (NOAA) website: http://www.spc.noaa.gov/faq/tornado/f-scale.html.

2.2.4.2 Air Quality Impacts

SSES is located in Luzerne County, Pennsylvania, which is part of the Northeast Pennsylvania-Upper Delaware Valley Interstate Air Quality Control Region (AQCR) designated by the EPA. All of northeastern Pennsylvania, including the Scranton-Wilkes-Barre metropolitan region, is in attainment for all National Ambient Air Quality Standards (NAAQS) except the standard for 8-hour ozone. There are 10 counties within a 50-mi (80-km) radius of SSES that are in nonattainment status for the 8-hour ozone standard, including Luzerne County. With the exception of Wyoming County, all other counties in nonattainment status for 8-hour ozone are located to the east or south of SSES. There are three counties within a 50-mi (80-km) radius of SSES that are in nonattainment status for $PM_{2.5}$ (fine particulate matter with an average aerodynamic diameter of 2.5 micrometers or less). All of these counties are located south of SSES and range from 32 to 49 mi (51 to 79 km) away from the plant site.

The Bureau of Air Quality (BAQ) of the PDEP has primary responsibility for regulating air emission sources within Pennsylvania. BAQ also monitors the ambient air quality for conformance with the NAAQS at various monitoring stations throughout the State. SSES lies within the jurisdiction of the BAQ Northeastern Regional Office (Region 2). The monitoring station closest to SSES is located in Nanticoke, Pennsylvania.

SSES has a number of stationary emission sources, such as four standby emergency power supply diesel generators, one backup generator, and auxiliaries required for safe starting and continuous operation, that do not require the facility to secure a Title V permit (PDEP 2003). SSES is recognized as a "synthetic minor" facility by Pennsylvania State regulators due to the quantities of emissions and restrictions on the hours of operation of its stationary sources of criteria pollutants; therefore, operation of the sources is regulated by a "State Only Operating Permit for Synthetic Minor Facility" (PPL 2007h). The generators are tested periodically to ensure their continued ability to perform their intended function, and there are procedures in place to ensure continuous monitoring, sampling, and filtering of the oil. Used oil is not disposed of onsite through burning for energy recovery; instead, it is collected for offsite disposal. Used oil disposal is discussed further in the waste management section.

SSES utilizes two natural draft cooling towers equipped with modern and highly efficient drift eliminators in order to effectively dissipate large heat loads. No significant increase in drift is expected with the increase of water flow after EPU implementation, as an SSES evaluation report shows (PPL 2006d).

Sections 101(b)(1), 110, 169(a)(2), and 301(a) of the Clean Air Act as amended (42 USC 7410, 7491(a)(2), 7601(a)) established Mandatory Class I Federal Areas where visibility is the most important value. There are no Mandatory Class I Federal Areas in Pennsylvania or proximate to SSES; no adverse impacts on Class I areas are anticipated from SSES operation.[a]

2.2.5 Aquatic Resources

SSES is located west of the North Branch of the Susquehanna River, just south of Gould Island, within the Middle Susquehanna Subbasin. Between the SSES property and the river is the Riverlands Recreation Area and Lake Took-A-While, a restored section of the North Branch Canal. As described in detail in Section 2.1.3, the Susquehanna River provides make-up water for and receives the plant's blowdown from SSES's cooling towers. Transmission line ROW maintenance activities in the vicinity of stream and river crossings include procedures to minimize erosion and prevent chemical herbicides from entering water bodies (PPL Electric Utilities Corp. 2007). In addition, application of chemical herbicides is restricted to prevent them from entering water bodies (NRC 1981).

All three transmission lines associated with SSES cross water bodies. The 30-mi (48-km)-long Stanton-Susquehanna #2 transmission line crosses at least 15 water bodies, including the Susquehanna River, Lake Took-A-While, Reyburn Creek, and Shickshinny Creek. The 76-mi (122-km)-long Susquehanna-Wescosville-Alburtis line crosses approximately 35 water bodies, including the Susquehanna River, Lehigh River, Pohopoco Creek, Aquashicola Creek, and Jordan Creek. The 44-mi (71-km)-long Sunbury Susquehanna #2 transmission line crosses approximately 20 water bodies, including the Susquehanna River, Lake Took-A-While, Nescopeck Creek, Catawissa Creek, Roaring Creek, and Shamokin Creek.

2.2.5.1 Description of the Aquatic Resources in the Vicinity of SSES

The Susquehanna River drains over 17.5 million ac (7.1 million ha) as it flows about 440 mi (710 km) from Otsego Lake, New York, to the Chesapeake Bay, where it provides 50 percent of the Chesapeake Bay's freshwater flow of approximately 19 million gpm (1200 m^3/s; 42,000 cfs) (SRBC 2006; PPL 2006a). The Middle Susquehanna Subbasin where SSES is located drains almost 2.5 million ac (1 million ha) (SRBC 2007b). In the vicinity of the site, the grade of the river is about 1.6 ft/mi (0.3 m/km) (NRC 1981), water depths range from 3.3 to 26.2 ft (1.0 to 8.0 m), and river widths vary from 328 to 1575 ft (100 to 480 m) (NRC 1981). The river bed is mostly rock and gravel (NRC 1981), and areas along the shoreline exhibit varying degrees of erosion. Here the average flow rate of the Susquehanna River ranges from 4.25×10^{11} to 4.83×10^{11} ft^3 per year (380 to 430 m^3/s; 13,500 to 15,300 cfs) (PPL 2006a), and daily mean flows in 2005 ranged from 806 to 198,000 cfs (23 to 5,600 m^3/s) (Ecology III 2007a).

(a) Mandatory Class I Federal Areas are listed in 40 CFR 81.400, et seq.

Daily mean river temperatures in 2005 ranged from 0.0°C (32.0°F) in the winter to 29.4°C (84.9°F) in the summer. Three months in 2005 had the warmest monthly mean temperatures for the respective months in the past 31 years, at 25.3°C (77.5°F) (June), 27.5°C (81.5°F) (July), and 23.2°C (73.8°F) (September) (Ecology III 2007a).

Water quality is monitored at two control sites and one indicator site. The control sites are upstream of the intake and discharge from SSES, and the indicator site is downstream of the plant (as shown in Figure 2-4). Ecology III (2007a) compared data from SSES to the PDEP water quality criteria for the following parameters: alkalinity, ammonia, nitrogen, chloride, dissolved oxygen, fluoride, total and dissolved iron, manganese, nitrate, pH, sulfate, temperature, and total dissolved solids. Ecology III (2007a) reported that in 2005 the water quality of the area of the river near SSES was found to be improving, as it has been for a number of years. Concentrations of total iron, sulfate, and acidity have decreased at four major mine effluents, and pH and alkalinity have increased. The level of total iron in the river has decreased, associated with the 1972 cessation of anthracite coal mining upstream from SSES. In addition, wastewater facilities along the river have been built or upgraded, which have led to further water quality improvements (Ecology III 2003, 2007a). Dilution from high river flow causes values at the control and indicator sites to be similar for most parameters. Total mineral solid levels are higher at the indicator site due to concentrations of solids in the blowdown, but do not exceed PDEP restrictions or design limits for SSES (Ecology III 2007a). More information regarding water quality is provided in Section 2.2.3.

Algae (periphyton and phytoplankton) were monitored in the Susquehanna River in the vicinity of SSES until 1994. Samples were taken at one control site and two indicator sites (as shown in Figure 2-4). In 1994, densities of periphyton and phytoplankton were higher at the control sites than at the indicator sites. Compared to preoperational surveys, algal densities have decreased over the duration of plant operation. This decrease was found at both control and indicator sites, however, and is therefore not related to plant operation. The composition of periphyton has shifted from green algae and diatoms to predominantly diatoms since the plant began operation. Concentrations of blue-green algae have generally remained low. Similarly, the composition of phytoplankton has shifted from higher preoperational densities of green algae to higher operational densities of diatoms (Ecology III 1995).

In 2006, the SRBC conducted an assessment of the Susquehanna River, and made designations of the biological condition based on a variety of macroinvertebrate metrics (Hoffman 2006). The two closest stations to SSES – one located upstream from SSES near Shickshinny, Pennsylvania, the other downstream near Berwick, Pennsylvania – both rated overall as moderately impaired. For the upstream station, nine samples were moderately impaired and one was slightly impaired; for the downstream station, six samples were moderately impaired and four were slightly impaired (Hoffman 2006). Nevertheless, monitoring of benthic macroinvertebrates at SSES, which continued until 1994 at control and indicator

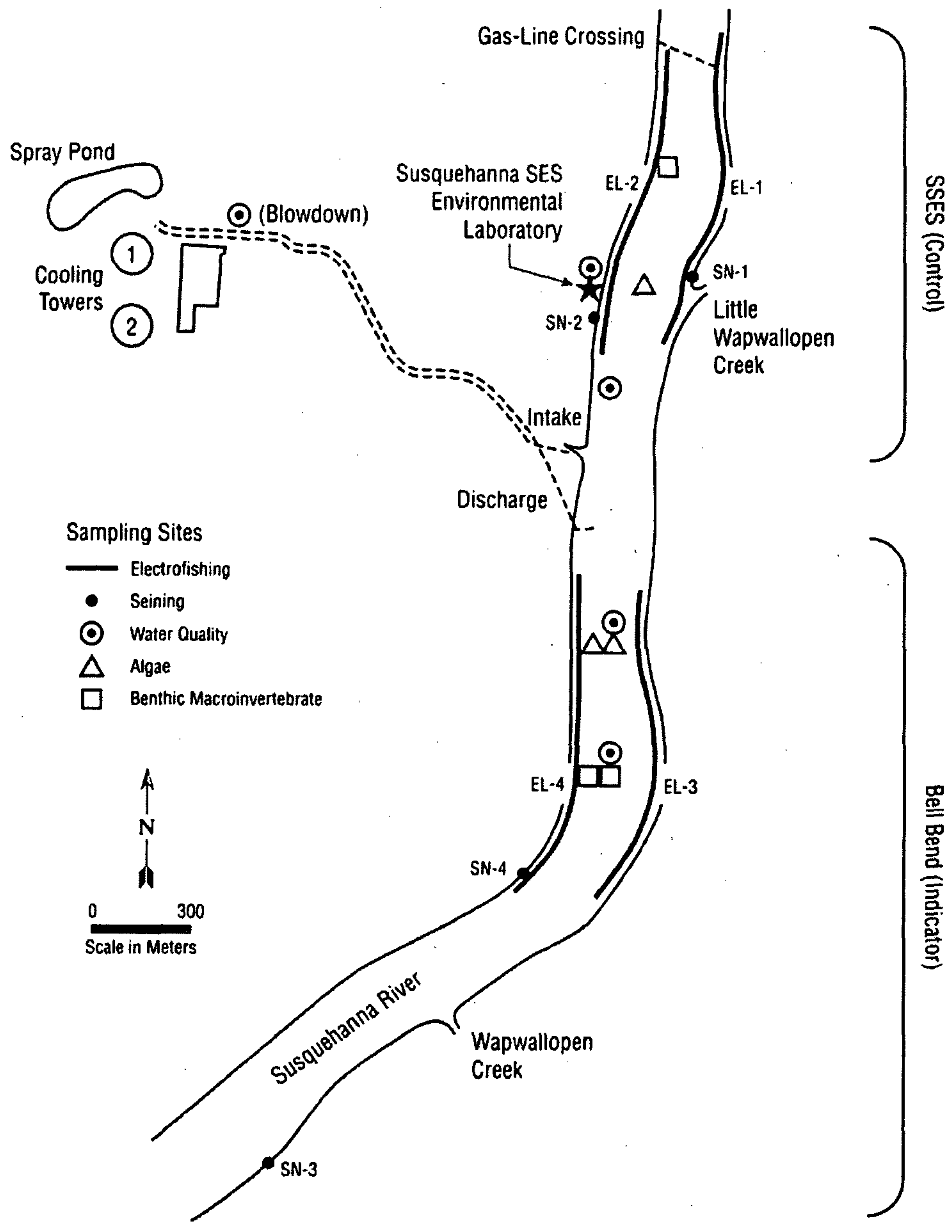

Figure 2-4. Sampling Sites for Water Quality, Algae, Benthic Macroinvertebrates, Electrofishing (EL), and Seining (SN) at SSES and Bell Bend on the Susquehanna River. Sampling for Benthic Macroinvertebrates and Algae Ceased in 1994. (Sources: Adapted from Ecology III 1995, 2005)

locations, has indicated that water quality in the vicinity of SSES is good. The dominant orders in both preoperational and operational monitoring were Ephemeroptera (mayflies) and Trichoptera (caddisflies), with a greater total mean biomass at the control site than at the indicator site (Ecology III 1995). Both orders are considered indicators of good water quality (EPA 2006).

Black flies in the *Simulium jenningsi* species group have become an increasing problem around the Susquehanna River, as well as many other rivers and streams of Pennsylvania. The State has established the Pennsylvania Black Fly Suppression Program, which monitors and treats 1500 mi (2400 km) of 54 rivers and streams in Pennsylvania, including the Susquehanna River. *Bacillus thuringiensis israelensis*, a naturally occurring bacterium, is aerially sprayed onto the water bodies to reduce the adult black fly populations, targeting the four species that are bothersome to people (PDEP 2007a).

Annual surveys have not discovered zebra mussels (*Dreissena polymorpha*) in the vicinity of SSES; however, the Asiatic clam (*Corbicula fluminea*) was first reported in the Susquehanna River in 1980, and has recently been found in the North Branch of the Susquehanna River (Mangan 2002). Both species are invasive and can have significant negative effects to the environment, by competing with native species. Both species can also cause biofouling of power plant and other industrial water systems. In the event that zebra mussels are found, SSES's NPDES permit provides instructions for seeking approval to treat the area with molluscicides or other chemicals (PDEP 2005a). SSES has no procedures in place for treating Asiatic clams.

Four sites – two control (upriver of SSES intake structure, one on each bank of the river) and two indicator (downstream of the SSES discharge, one on each bank of the river) – have been consistently sampled for fish by electrofishing and seining since 1976 (see Figure 2-4 for sampling locations) (Ecology III 2007a). In total, the Susquehanna River watershed is home to at least 93 fish species (Pennsylvania Fish and Boat Commission 2007). At least 35 species have been collected in the vicinity of SSES in recent years (Ecology III 1995, 2007a, 2007b). In 1984 and 1986, 52 species were sampled in the vicinity (Ichthyological Associates 1985; Ecology III 1987). Abundant species in the Susquehanna River in the vicinity of SSES include smallmouth bass (*Micropterus dolomieu*), walleye (*Sander vitreus*), channel catfish (*Ictalurus punctatus*), quillback (*Carpiodes cyprinus*), northern hog sucker (*Hypentelium nigricans*), muskellunge (*Esox masquinongy*), shorthead redhorse (*Moxostoma macrolepidotum*), spottail shiner (*Notropis hudsonius*), white sucker (*Catostomus commersonii*), spotfin shiner (*Cyprinella spiloptera*), and bluntnose minnow (*Pimephales notatus*) (Ecology III 2007a; PPL 2006a). Based on angler surveys conducted before operation began and in the mid-1980s, operation of SSES has not noticeably changed the use of the area by anglers, and fluctuations in angler effort have been due to conditions unrelated to SSES operations (Ecology III 1987). Recent ecological studies in the area have not included angler surveys, so it is not known if this trend has continued since 1986.

The EPA has outlined a nationwide program for the analysis of fish to establish fish consumption advisories. This program includes a listing of parameters for tissue analysis including PCBs, pesticides, and heavy metals. To comply with this program, the Commonwealth has conducted fish tissue contaminant monitoring throughout the State since 1976. Public health advisories, based on fish tissue contaminant levels, are published annually in the Pennsylvania Fish and Boat Commission's annual summary of fishing regulations and laws. Since 2002, the Commonwealth has issued a general statewide advisory recommending that people consume no more than one meal per week of recreationally caught sport fish. More restrictive advisories are issued for specific water bodies.

For the reach of the Susquehanna River within which the SSES facility occurs (from Falls, Pennsylvania), the Commonwealth issued the following water body-specific advisories: (1) do not consume more than two meals per month of smallmouth bass (due to mercury contamination); (2) do not eat any suckers (due to PCB contamination); and (3) do not consume more than one meal per month of channel catfish, quillback, carp, or walleye (due to PCB contamination) (PDEP 2006).

The American shad (*Alosa sapidissima*) is an anadromous species that once migrated upstream to the headwaters of the Susquehanna River. However, the creation of dams prevented the shad from using the Susquehanna River for spawning. Since then, the Susquehanna River Anadromous Fish Restoration Committee has attempted to restore the population through stocking programs (see Section 4.8.1 for more detail). When requested, PPL has monitored impingement of American shad at SSES in order to assist in the assessment of the success of the stocking programs (Ichthyological Associates 1983; PPL 2001, 2002, 2003, 2004a, 2005a, 2006a; SRAFRC 1992, 1993, 1994; Ecology III 1991). From 2001 to 2005, only one shad was collected from the intake screens.

2.2.5.2 Threatened or Endangered Aquatic Species

No Federally listed threatened, endangered, proposed, or candidate aquatic species occur in the Susquehanna River in the vicinity of SSES. Also, no designated critical habitat for aquatic species occurs in the site vicinity. Aquatic species that are listed as threatened or endangered by the U.S. Fish and Wildlife Service (FWS) or the Commonwealth of Pennsylvania and that have the potential to occur in Luzerne County or in Carbon, Columbia, Leigh, Montour, Northampton, Northumberland, or Snyder Counties (counties crossed by SSES-associated transmission lines) are presented in Table 2-2.

Table 2-2. Federally and State-Listed Aquatic Species Potentially Occurring in Luzerne County or in Counties Crossed by Associated Transmission Line ROWs

Scientific Name	Common Name	Federal Status[a]	State Status[a]
Fish			
Notropis chalybaeus	Ironcolor shiner	NL	E
Molluscs			
Alasmidonta heterodon	Dwarf wedgemussel	E	E
Alasmidonta varicosa	Brook floater	NL	PE

(a) E = endangered, PE = proposed endangered, NL = not listed.
Source: PHNP 2007a

2.2.6 Terrestrial Resources

2.2.6.1 Description of the Terrestrial Resources in the Vicinity of SSES

The SSES facility is located in the Wyoming Valley, on a floodplain about 200 ft (60 m) above the shore of the Susquehanna River. In this part of Pennsylvania, the terrain is gently rolling to moderately rugged, with mountain ridges and valleys separated by up to 500 ft (150 m) of vertical distance (AEC 1973). Since the formation of the Appalachian Mountains, this area has been shaped by erosion and deposition processes associated with the movement of glaciers and the Susquehanna River. Sediments transported by glaciers were deposited in this area at various times beginning around 770,000 years ago and ending between 22,000 to 17,000 years ago (PDCNR 2006). When the glaciers retreated around 12,000 years ago, they formed additional sediment deposits and lakes (Nature Conservancy 2006).

The Susquehanna River transports sediments within its floodplain. This river basin is one of the nation's most flood-prone watersheds, with floods occurring every 20 years on average. Severe floods occurred in 1936, 1955, 1972, 1975, 1996, and 2004. Of these, the 1972 flood resulting from Tropical Storm Agnes caused the worst recorded flooding (SRBC 2006). These processes have created different habitats in different portions of the floodplain.

Figure 2-5 shows the previously disturbed area within the SSES boundary. Most of the property including the entire exclusion area west of U.S. Route 11 between Route 419 and Route 438 is considered disturbed. Disturbed areas include buildings, parking lots, storage areas, pipeline ROWs, roads, landscaped areas, and restored and natural areas. Over half of the disturbed

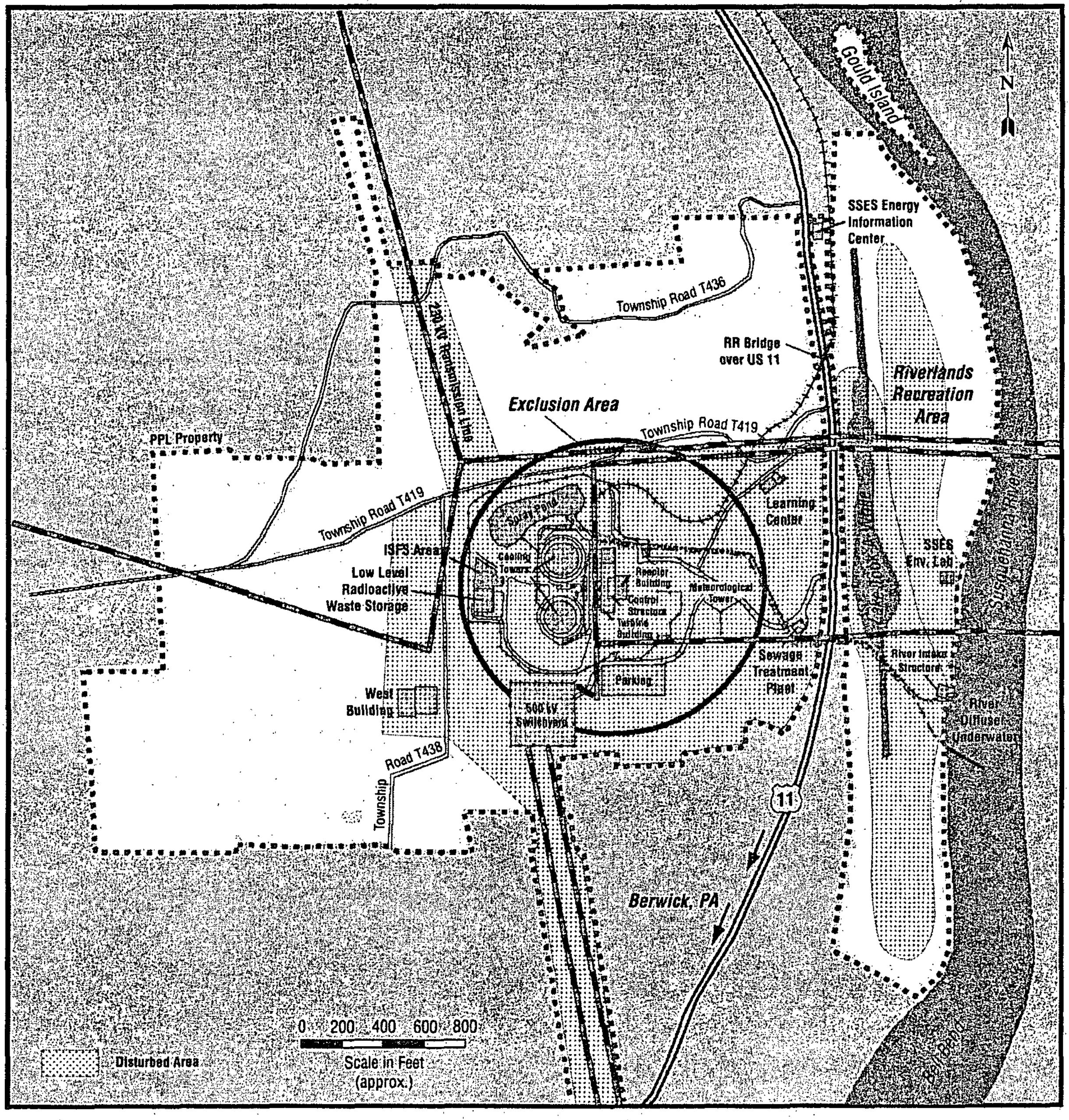

Figure 2-5. Disturbed Areas on the SSES Site (Source: Adapted from PPL 2006a)

area is now forested land, wetlands, or waterbodies. The Susquehanna Riverlands, Lake Took-A-While, and the Wetlands Natural Area are all considered disturbed.

Prior to the construction of SSES, plant communities on the site included river floodplain forest, upland forest, abandoned fields, open marsh and ponds, and agricultural fields (NRC 1981). These plant communities are similar to those currently present on the property, except that some of the abandoned fields have gone through succession and become forests.

The FWS National Wetlands Inventory database indicates that there are wetland areas at the SSES site. These include freshwater emergent wetlands, forested/shrub wetlands, freshwater ponds, and other wetland types (FWS 2006b). PPL estimates that there are approximately 70 ac (30 ha) of wetlands and ponds on the property (PPL 2006a). Several of the wetlands at the SSES site have been delineated by PPL staff and their consultants; however, the majority of wetland habitats have not been officially delineated. There are many wetlands in the area near the site, including beaver ponds, vernal pools, and riparian wetlands. Plant surveys performed onsite between 1972 and 1974 and in 1977 identified 568 species (NRC 1981).

There are five general types of plant communities on the SSES site or in the direct vicinity of SSES – river floodplain forest, upland forest, abandoned fields, open marsh and ponds, and agricultural fields (PPL 2006a). Common tree species found in river floodplain forests are silver maple (*Acer saccharinum*), river birch (*Betula nigra*), and northern red oak (*Quercus rubra*). Nonwoody species found in river floodplain forests include ostrich fern (*Matteuccia struthiopteris*), mayapple (*Podophyllum peltatum*), dame's rocket (*Hesperis matronalis*), false mermaid (*Floerkea proserpinacoides*), Dutchman's breeches (*Dicentra cucullaria*), jumpseed (*Polygonum virginianum*), common blue violet (*Viola papilionacea*), and trout lily (*Erythronium americanum*).

Upland forest plant communities on the SSES are comprised of primarily Virginia pine (*Pinus virginiana*), sweet birch (*Betula lenta*), flowering dogwood (*Cornus florida*), white oak (*Quercus alba*), northern red oak, black oak (*Quercus velutina*), and tuliptree (*Liriodendron tulipifera*). Common nonwoody species include fan-shaped clubmoss (*Lycopodium flabelliforme*), intermediate woodfern (*Dryopteris intermedia*), white avens (*Geum canadense*), common cinquefoil (*Potentilla simplex*), common blue violet, and Swan's sedge (*Carex swanii*).

Abandoned fields in and near SSES support young gray birch (*Betula populifolia*), Allegheny blackberry (*Rubus allegheniensis*), and northern dewberry (*Rubus flagellaris*). Nonwoody species include white heath aster (*Symphyotrichum ericoides*), white panicle aster (*Symphyotrichum lanceolatum*), wrinkleleaf goldenrod (*Solidago rugosa*), common sheep sorrel (*Rumex acetosella*), common cinquefoil (*Potentilla simplex*), yellowfruit sedge (*Carex annectens*), creeping bentgrass (*Agrostis stolonifera*), little bluestem (*Andropogon scoparius*), poverty oatgrass (*Danthonia spicata*), and common timothy (*Phleum pretense*).

Open marshes and ponds support plants such as arrowleaf tearthumb (*Polygonum sagittatum*), broadleaf arrowhead (*Sagittaria latifolia*), fringed sedge (*Carex crinita*), broom sedge (*Carex scoparia*), woolgrass (*Scirpus cyperinus*), rice cutgrass (*Leersia oryzoides*), common rush (*Juncus effusus*), and broadleaf cattail (*Typha latifolia*).

In addition to the species listed above, invasive non-native plant species like tree-of-heaven (*Ailanthus altissima*), Oriental bittersweet (*Celastrus orbiculatus*), ground ivy (*Glechoma hederacea*), and garlic mustard (*Alliaria officinalis*) have encroached into woodland areas, while purple loosestrife (*Lythrum salicaria*), wild hops (*Humulus japonicus*), and Japanese knotweed (*Polygonum cuspidatum*) have colonized areas along the Susquehanna River, where they may crowd out native species and degrade the habitat of some animal species (Nature Conservancy 2006).

The Susquehanna River corridor supports the largest area of relatively undeveloped terrestrial habitat on the SSES site. Due to frequent disturbance by flooding, there are many unique biological communities near the river. The same disturbance system that creates these environments also makes this area vulnerable to colonization by non-native invasive plant species, as listed above.

Across the Susquehanna River from the SSES site are the Council Cup Cliffs, a geologically and historically important area that supports one of the northernmost stands of Virginia pine, and has served as a nesting location for peregrine falcons (*Falco peregrinus*); and the Wapwallopen Gorge, a locally significant property owned by the Lance Corporation and open for public recreation (Nature Conservancy 2006). South of the SSES site are the Briggsville vernal pools, which are fragile, important breeding areas for reptiles and amphibians and have been identified as "a top priority for conservation in the county" (Nature Conservancy 2006). To the northwest lies the Summer Hill Bog, a locally significant wetland site, which has not been studied in depth, and Little Shickshinny Creek, which has a high level of plant and bird diversity (Nature Conservancy 2004).

Other important terrestrial habitats near the facility include Hawk Mountain Sanctuary, 45 mi (72 km) south of SSES, over which birds of prey and other species migrate each year, and Arbutus Peak, approximately 55 mi (89 km) east of SSES, a "barren" environment which is one of the richest habitats for moths and butterflies in the Northeast (Nature Conservancy 2006). Additionally, the Pennsylvania Natural Heritage Program identified the following natural communities of concern near the site: an acidic shrub swamp, identified as "vulnerable"; scrub oak-heath-pitch pine barrens, identified as "critically imperiled"; a talus cave community, identified as "apparently secure" to "imperiled"; and a ridgetop dwarf-tree forest, identified as "vulnerable" (PNHP 2007b; PPL 2006a).

Local parks include Ricketts Glen State Park, 20 mi (30 km) north of the site; Moon Lake County Park, 15 mi (25 km) northeast of the site; Frances Slocum State Park, 20 mi (30 km) northeast of the site; Nescopeck Creek State Park, 10 mi (16 km) east of the site; Hickory Run and Lehigh Gorge State Parks, 20 mi (30 km) east of the site; Locust Lake State Park, 25 mi (40 km) south of the site; Tuscarora State Park, 25 mi (40 km) south of the site; and Briar Creek Lake Park, 6 mi (10 km) west of the site. Hunting is allowed on portions of the SSES site and in nearby State Gameland 055, State Gameland 260, and State Gameland 224.

A variety of mammals, birds, reptiles, amphibians, and insects are found at the SSES site and in the surrounding area. Surveys for plants, mammals, birds, reptiles, and amphibians were performed between 1972 and 1974, prior to station operation, and can be found in the Final Environmental Statements for construction and operation (AEC 1973; NRC 1981). Additionally, information on the diversity of animal life at the SSES site can be found in the SSES ER (PPL 2006a) and materials developed by the Audubon Society (Audubon Pennsylvania and PDCNR 2004).

Migratory songbirds and waterfowl commonly pass through this area, which is part of the Atlantic flyway (NRC 1981). The Susquehanna River and riparian wetlands near the river at SSES are utilized by several special-status bird species, especially during autumn and spring migrations (PPL 2006a). The cooling tower, lights, buildings, and transmission lines have been identified as potential hazards to migratory birds. A bird collision study was conducted in September and October of 1978 for the meteorological tower and cooling tower, which was still under construction. These studies found 82 birds that were apparently killed by collisions with the towers. While there were 15 species of birds in this sample, the vast majority were red-eyed vireos (*Vireo olivaceus*) and various species of wood warblers (subfamily Parulinae). No endangered or threatened bird species were found (NRC 1981). PPL is required to file annual environmental reports to the NRC, and to report and document any significant bird impacts, if they occur. No reports of significant bird strikes have been documented.

Wildlife management plans currently exist for the SSES property. The site provides productive habitat for wildlife, and measures are taken to actively encourage wildlife by maintaining terrestrial habitats on the SSES site. Hunting is allowed on the property for deer and small game (Audubon Pennsylvania and PDCNR 2004). Currently, PPL has maintenance procedures in place for its terrestrial habitats on the SSES site. Some herbicide application and chemicals are used, and PPL follows EPA-approved guidelines. Most of the property is not landscaped and is expected to remain undeveloped during the renewal term.

PPL owns and manages the 401-ac (162-ha) Susquehanna Riverlands area, that includes trails, camping sites, wildlife feeding areas, parking lots, picnic facilities, a nature center, fishing areas, and wetland study areas in the Susquehanna floodplain (PPL 2006a). This area provides recreational and educational opportunities for members of the public and habitat for wildlife.

The Susquehanna Riverlands is part of the Susquehanna River Birding and Wildlife Trail, and is recognized as a Pennsylvania Important Bird Area (Audubon Pennsylvania and PDCNR 2004; Crossley 1999, as cited in Nature Conservancy 2006). Over the last 5 years, the Riverlands have received more than 100,000 visitors each year (PPL 2007b).

The construction of the transmission lines to connect SSES to the electric grid converted many acres of interior forest to edge forest, small trees, shrubs, and herbaceous vegetation. Prior to construction, this change was expected to favor species that prefer open, early successional habitats (e.g., Eastern cottontail (*Sylvilagus floridanus*), woodchucks (*Marmota monax*), mice (*Peromyscus* spp.), whitetail deer (*Odocoileus virginianus*), and various bird species) and to disfavor species that prefer the forest interior (AEC 1973). Continued maintenance of these lines would ensure that these conditions continue, to the benefit of edge species and the detriment of remaining forest interior species. Many invasive species prefer edge habitats, and may colonize such areas faster than unbroken forest (University of Connecticut 2001).

Although various construction projects have occurred recently at SSES including security upgrades, new parking lots, and construction of independent spent fuel storage installations (ISFSIs), no refurbishment activities are anticipated at the SSES site, within the Susquehanna Riverlands property, or in the transmission line ROWs. Appendix B of the applicant's current operating license requires proposed changes with the potential for significant environmental impacts to be reported to and approved by the NRC before implementation. This condition would remain in the operating license if it is renewed.

2.2.6.2 Threatened or Endangered Terrestrial Species

Surveys for plants, mammals, birds, reptiles, and amphibians were performed between 1972 and 1974, prior to station operation. Of the species that were Federally listed as threatened or endangered at the time, only transient bald eagles (*Haliaeetus leucocephalus*) and peregrine falcons were seen at the SSES site (NRC 1981). Both of these species have been removed from the Federal list of threatened and endangered species (although both are currently State-listed as endangered). Rare terrestrial species potentially occurring in the vicinity of SSES and associated transmission lines are listed in Table 2-3.

Federally Listed Threatened and Endangered Species

The NRC staff initiated consultation with FWS, Pennsylvania Field Office, concerning Federally listed threatened and endangered species. In a letter dated October 11, 2007, FWS stated that the range of the endangered Indiana bat (*Myotis sodalis*) includes the proposed project area (FWS 2007a). In the same letter, FWS concluded that the proposed action of license renewal would not have a significant adverse effect on the overall habitat quality for the Indiana bat, and license renewal is not likely to adversely affect the species. The FWS stated that this

Table 2-3. Federally and State-Listed Terrestrial Species Potentially Occurring in Luzerne County or in Counties Crossed by Associated Transmission Line ROWs

Scientific Name	Common Name	Federal Status[(a)]	State Status[(a)]	Habitat
Plants				
Agalinis auriculata	eared false-foxglove	NL	E	Prairies, dry woods, and open fields
Alisma triviale	broad-leaved water-plantain	NL	E	Along roads, open fields
Alopecurus aequalis	short-awn foxtail	NL	S	Wet meadows, marshes, along water bodies
Amaranthus cannabinus	waterhemp ragweed	NL	R	Tidal marshes
Andromeda polifolia	bog-rosemary	NL	R	Bogs
Aplectrum hyemale	puttyroot	NL	R	Deciduous forests with rich, moist soils
Arabis missouriensis	Missouri rock-cress	NL	E	Open woodlands
Arethusa bulbosa	swamp-pink	NL	E	Forested wetlands, ponds, and swamps
Aristida purpurascens	arrow-feathered three awn	NL	T	Forested wetlands, ponds, and swamps
Asplenium bradleyi	Bradley's spleenwort	NL	T	Forested wetlands, ponds, and swamps
Bouteloua curtipendula	tall gramma	NL	T	Grasslands, open fields
Carex alata	broad-winged sedge	NL	T	Wetlands, ponds, marshes
Carex bicknellii	Bicknell's sedge	NL	E	Wetlands, ponds, marshes
Carex bullata	bull sedge	NL	E	Wetlands, ponds, marshes
Carex collinsii	Collin's sedge	NL	E	Wetlands, ponds, marshes
Carex crinita var. *brevicrinis*	short hair sedge	NL	E	Wetlands, ponds, marshes
Carex disperma	soft-leaved sedge	NL	R	Wetlands, ponds, marshes
Carex eburnea	ebony sedge	NL	E	Wetlands, ponds, marshes
Carex flava	yellow sedge	NL	T	Wetlands, ponds, marshes
Carex lasiocarpa	slender sedge	NL	R	Wetlands, ponds, marshes
Carex oligosperma	few-seeded sedge	NL	T	Wetlands, ponds, marshes

Table 2-3. (contd)

Scientific Name	Common Name	Federal Status[a]	State Status[a]	Habitat
Plants (contd)				
Carex paupercula	bog sedge	NL	T	Wetlands, ponds, marshes
Carex polymorpha	variable sedge	NL	E	Wetlands, ponds, marshes
Carex prairea	prairie sedge	NL	T	Wetlands ponds, marshes
Carex retrorsa	backward sedge	NL	E	Wetlands, ponds, marshes
Carex schweinitzii	Schweinitz's sedge	NL	T	Wetlands, ponds, marshes
Carex sterilis	sterile sedge	NL	T	Wetlands, ponds, marshes
Carex tetanica	a sedge	NL	T	Wetlands, ponds, marshes
Carex typhina	cattail sedge	NL	E	Wetlands, ponds, marshes
Chenopodium foggii	Fogg's goosefoot	NL	E	Woodlands, forest openings, rock outcrops
Cladium mariscoides	twig rush	NL	E	Moist forest; wetland habitat
Conioselinum chinense	hemlock-parsley	NL	E	Forested swamp areas
Cyperus diandrus	umbrella flatsedge	NL	E	Low areas along ponds and rivers
Cyperus retrorsus	retrorse flatsedge	NL	E	Low areas along ponds and rivers
Cyperus schweinitzii	Schweinitz's flatsedge	NL	R	Low areas and grasslands
Cypripedium calceolus var. *parviflorum*	small yellow lady's-slipper	NL	E	Moist woods, bogs
Cypripedium reginae	showy lady's-slipper	NL	T	Bogs, swamps, wet meadows
Dicentra eximia	wild bleeding-hearts	NL	E	Rocky slopes, forests
Dodecatheon meadia	common shooting-star	NL	E	Prairies, upland forests
Dodecatheon radicatum	jeweled shooting-star	NL	T	Prairies, upland forests
Echinochloa walteri	Walter's barnyard-grass	NL	E	Wetlands, marshes
Eleocharis compressa	flat-stemmed spike-rush	NL	E	Prairies, meadows, along ponds and streams
Eleocharis intermedia	matted spike-rush	NL	T	Marshes, mudflats, wetlands
Eleocharis olivacea	capitate spike-rush	NL	R	Prairies, along waterbodies
Ellisia nyctelea	Aunt Lucy	NL	T	Moist woods, forest habitats
Epilobium strictum	downy willow-herb	NL	E	Bogs and swamps

Table 2-3. (contd)

Scientific Name	Common Name	Federal Status[a]	State Status[a]	Habitat
Plants (contd)				
Eriophorum gracile	slender cotton-grass	NL	E	Bogs, wetlands
Eriophorum tenellum	rough cotton-grass	NL	E	Bogs, wetlands
Eriophorum viridicarinatum	thin-leaved cotton-grass	NL	T	Bogs, wetlands
Gaultheria hispidula	creeping snowberry	NL	R	Open woodlands
Gaylussacia dumosa	dwarf huckleberry	NL	E	Pine forests, open forests
Geranium bicknellii	cranesbill	NL	E	Dry, open, woodlands, and uplands
Helianthemum bicknellii	Bicknell's hoary rockrose	NL	E	Open woodlands, rocky slopes
Huperzia porophila	rock clubmoss	NL	E	Forests, upland areas
Hydrastis canadensis	golden-seal	NL	V	Shady forested areas
Hypericum densiflorum	bushy St. John's-wort	NL	T	Bogs, moist to dry woods
Ilex opaca	American holly	NL	T	Wetlands, moist forests, along ponds and streams
Iris cristata	crested dwarf iris	NL	E	Wooded areas, lowlands, rich soil
Iris prismatica	slender blue iris	NL	E	Woodlands, meadows, wetlands
Juncus arcticus var. *littoralis*	Baltic rush	NL	T	Fresh emergent, wetlands
Juncus dichotomus	forked rush	NL	E	Prairies, meadows, along ponds and streams
Juncus filiformis	thread rush	NL	R	Prairies, meadows, along ponds and streams
Juncus gymnocarpus	Coville's rush	NL	R	Prairies, meadows, along ponds and streams
Juncus militaris	bayonet rush	NL	E	Prairies, meadows, along ponds and streams
Juncus scirpoides	scirpus-like rush	NL	E	Prairies, meadows, along ponds and streams
Juncus torreyi	Torrey's rush	NL	T	Prairies, meadows, along ponds and streams
Ledum groenlandicum	common Labrador-tea	NL	R	Bogs and wetlands

Table 2-3. (contd)

Scientific Name	Common Name	Federal Status[a]	State Status[a]	Habitat
Plants (contd)				
Linum sulcatum	grooved yellow flax	NL	E	Dry open woodlands, fields, and uplands
Lipocarpha micrantha	common hemicarpa	NL	E	Wetland and lowland areas
Lobelia kalmii	brook lobelia	NL	E	Bogs, shores, wet meadows, wetlands
Ludwigia polycarpa	false loosestrife seedbox	NL	E	Moist woodlands, wetlands
Lupinus perennis	lupine	NL	R	Sandy, wooded areas
Lycopus rubellus	bugleweed	NL	E	Wet meadows, wetland areas, wet, shady forests
Lyonia mariana	stagger-bush	NL	E	Swamps, moist forests, wetland habitats
Magnolia tripetala	umbrella magnolia	NL	T	Bottomland forests, upland areas
Malaxis bayardii	Bayard's malaxis	NL	R	Dry, open woodlands
Megalodonta beckii	Beck's water-marigold	NL	E	Clear water
Minuartia glabra	Appalachian sandwort	NL	T	Granitic outcrops
Monarda punctata	spotted bee-balm	NL	E	Sandy soil
Muhlenbergia uniflora	fall dropseed muhly	NL	E	Bogs, wet shores
Myrica gale	sweet-gale	NL	T	Peat-bogs
Myriophyllum farwellii	Farwell's water-milfoil	NL	E	Ponds, small lakes
Myriophyllum heterophyllum	broad-leaved water-milfoil	NL	E	Ponds, lakes
Myriophyllum sibiricum	northern water-milfoil	NL	E	Lakes, ponds, streams
Myriophyllum verticillatum	whorled water-milfoil	NL	E	Lakes, ponds, marshes, muddy shores
Orontium aquaticum	golden club	NL	R	Shallow water, swamps
Oryzopsis pungens	slender mountain-ricegrass	NL	E	Mountains
Panicum scoparium	velvety panic-grass	NL	E	Dry fields
Panicum xanthophysum	slender panic-grass	NL	E	Fields

Table 2-3. (contd)

Scientific Name	Common Name	Federal Status[a]	State Status[a]	Habitat
Plants (contd)				
Parnassia glauca	Carolina grass-of-parnassus	NL	E	Bogs, swamps, moist woods
Poa paludigena	bog bluegrass	NL	T	Wet woods, bogs, sedge meadows
Polemonium vanbruntiae	Jacob's-ladder	NL	E	Open peatlands in mountainous areas
Polygala cruciata	cross-leaved milkwort	NL	E	Wet sandy meadows, marshes
Polygonum careyi	Carey's smartweed	NL	E	Sandy, peaty wetlands
Polystichum braunii	Braun's holly fern	NL	E	Deciduous woods
Potamogeton confervoides	Tuckerman's pondweed	NL	T	Aquatic habitats
Potamogeton friesii	Fries' pondweed	NL	E	Brackish waters
Potamogeton gramineus	grassy pondweed	NL	E	Ponds, lakes, streams
Potamogeton pulcher	spotted pondweed	NL	E	Shallow water, muddy shore
Potamogeton richardsonii	red-head pondweed	NL	T	Lakes, streams
Potamogeton vaseyi	Vasey's pondweed	NL	E	Small lakes
Potamogeton zosteriformis	flat-stem pondweed	NL	R	Ponds, lakes
Potentilla fruticosa	shrubby cinquefoil	NL	E	Wide variety of habitats from rocks to riparian communities
Potentilla tridentata	three-toothed cinquefoil	NL	E	Sandy or rocky shores, mountaintops
Pycnanthemum torrei	Torrey's mountain-mint	NL	E	Fields, open woods
Ranunculus fascicularis	tufted buttercup	NL	E	Woods, rocky hillsides
Rhynchospora capillacea	capillary beaked-rush	NL	E	Open wetlands
Rotala ramosior	tooth-cup	NL	R	Wet soils
Salix candida	hoary willow	NL	T	Bogs, marshes
Salix serissima	autumn willow	NL	T	Bogs, fens, swamps

Table 2-3. (contd)

Scientific Name	Common Name	Federal Status[(a)]	State Status[(a)]	Habitat
Plants (contd)				
Scheuchzeria palustris	pod-grass	NL	E	Marshes, bogs
Schoenoplectus acutus	hard-stemmed bulrush	NL	E	Marshes, muddy shores, shallow water
Schoenoplectus fluviatilis	river bulrush	NL	R	Marshes, wet shores
Schoenoplectus torreyi	Torrey's bulrush	NL	E	Inundated wetlands, lake margins
Scirpus ancistrochaetus	northeastern bulrush	E	E	Small wetlands
Scleria pauciflora	few flowered nutrush	NL	T	Moist, sandy soils, wet fields, bogs
Scleria verticillata	whorled nutrush	NL	E	Marshes, bogs, savannahs, moist meadows
Sisyrinchium atlanticum	eastern blue-eyed grass	NL	E	Fields, meadows, open woods, edges of salt marshes
Sparganium androcladum	branching bur-reed	NL	E	Swamps, shallows
Streptopus amplexifolius	white twisted-stalk	NL	E	Moist woods and thickets
Trichostema setaceum	blue-curls	NL	E	Dry woods and fields, sandy soils
Triphora trianthophora	nodding pogonia	NL	E	Dense forest
Trollius laxus	spreading globeflower	NL	E	Swamps, meadows, wet woods
Utricularia intermedia	flat-leaved bladderwort	NL	T	Bogs, swamps, ponds
Insects				
Citheronia sepulcralis	pine devil moth	NL	S	Pitch pine barrens, forests, and occasionally pine plantations (Nature Conservancy 2004; MSU and NBII 2007f)
Enodia anthedon	northern pearly-eye	NL	S	Damp deciduous woods (usually near marshes or waterways) and mixed or grassy woodlands (MSU and NBII 2007e); known to occur at the site

Table 2-3. (contd)

Scientific Name	Common Name	Federal Status[a]	State Status[a]	Habitat
Insects (contd)				
Euphydryas phaetonis	Baltimore checkerspot	NL	S	Wet meadows, bogs, and marshes (MSU and NBII 2007b); known to occur at the site
Hesperia leonardus	Leonard's skipper	NL	S	Prairie and barren areas (Reese 2007)
Hemileuca maia	barrens buckmoth	NL	S	Pitch pine, scrub oak, or barrens (Nature Conservancy 2004)
Metaxaglaea semitaria	footpath sallow moth	NL	S	Bogs and swamps (Nature Conservancy 2004)
Nannothemis bella	elfin skimmer	NL	S	Fens, bogs, wetlands, and ponds (Bright and O'Brien 1999)
Papalperna sp. 1	flypoison borer moth	NL	S	Open woodlands with moist soils (Nature Conservancy 2004; University of Pennsylvania 2002)
Polites mystic	long dash	NL	S	Meadows, marshes, streamsides, open fields, and wood edges (MSU and NBII 2007c); known to occur at the site
Poanes massasoit	mulberry wing	NL	S	Freshwater marshes or bogs (MSU and NBII 2007d); known to occur at the site
Enodia anthedon	Aphrodite fritillary	NL	S	Prairies, bogs, and open fields (MSU and NBII 2007a); known to occur at the site
Xestia elimata	southern variable dart moth	NL	S	Pine forests (Bugwood Network et al. 2004)
Reptiles				
Clemmys muhlenbergii	bog turtle	T	E	Wetlands, bogs, fens, and meadows (Harding 2002)
Birds				
Asio flammeus	short-eared owl	NL	E	Marshes and bogs (Doan 1999); occasionally seen at SSES site
Bartramia longicauda	upland sandpiper	NL	T	Bogs, fens, agricultural fields, and grasslands (NatureServe 2006a); once recorded at SSES

Table 2-3. (contd)

Scientific Name	Common Name	Federal Status[(a)]	State Status[(a)]	Habitat
Birds (contd)				
Botaurus lentiginosus	American bittern	NL	E	Freshwater wetlands and shorelines (Harris 1999); occasionally seen at SSES site
Casmerodius alba	great egret	NL	E	Aquatic and wetland habitats (Jones 2002); occasionally seen at SSES site
Chlidonias niger	black tern	NL	E	Wetland habitats (Forbush & May 1955, as cited in Null 1999); once recorded at SSES
Cistothorus platensis	sedge wren	NL	T	Wetlands, bogs, fens, and grasslands (Natureserve 2006b); once recorded at SSES
Falco peregrinus	peregrine falcon	NL	E	Open habitats, such as grasslands and meadows; nests on cliffs (White et al. 2002); occasionally seen at SSES site
Haliaeetus leucocephalus	bald eagle	NL	E	Forests near water bodies (Harris 2002); occasionally seen near the site
Ixobrychus exilis	least bittern	NL	E	Dense marshes containing cattails and reeds (Pennsylvania Game Commission 2003); occasionally seen at SSES site
Pandion haliaetus	osprey	NL	T	Near shallow water bodies such as lakes, bogs, reservoirs, or rivers (Poole 1989, Poole 1994 as cited in Kirschbaum and Watkins 2000); commonly seen near the SSES site during migrations
Mammals				
Neotoma magister	Allegheny woodrat	NL	T	Rocky forested areas (NatureServe 2006c)
Myotis sodalis	Indiana bat	E	E	Wooded areas and caves (Newell 1999)
Myotis leibii	small-footed myotis	NL	T	Wooded areas and caves (Blasko 2001)

Table 2-3. (contd)

Scientific Name	Common Name	Federal Status[(a)]	State Status[(a)]	Habitat
Mammals (contd)				
Sciurus niger vulpinus	southeastern fox squirrel	NL	T	Deciduous and mixed forest; may be extirpated in Pennsylvania (Pennsylvania Game Commission 2005)

(a) E = endangered, NL = not listed, R = rare, S = Pennsylvania species of special concern, T = threatened, V = vulnerable
Sources: PPL 2006a; USDA/NRCS 2007; PNHP 2007b

determination is valid for two years, ending October 11, 2009. If the license renewal process is not complete by this date, FWS recommends additional consultation (FWS 2007a).

The Indiana bat is a chestnut-brown, medium-sized bat that forages for insects near streamside and upland forests (FWS 2006a). These bats roost and hibernate in caves or mines, known as hibernacula, or under the loose bark of recently dead trees. Reasons for the decline of this species include natural mortality, human disturbance of hibernating bats, and deforestation, especially the removal of dead standing trees and trees near streams (FWS 1983).

Two other Federally listed species – the northeastern bulrush (*Scirpus ancistrochaetus*) and bog turtle (*Clemmys muhlenbergii*) – have distributions that include the SSES area, but neither are known to occur on either the SSES site or along associated transmission line ROWs. Neither of these species was identified by the FWS in its consultation letter (FWS 2007a).

State-Listed Threatened, Endangered, and Rare Species

There are 124 plant species that are considered rare or are listed by the State as threatened or endangered, and that could occur in the vicinity of SSES and associated transmission lines (PNHP 2007b). Of these, 89 occur in aquatic habitats, riparian areas, or wetland areas; 18 occur in grasslands, open fields, or early growth forest areas; and 17 occur in forested areas. One of these species, the northeastern bulrush, is also Federally listed as endangered. The northeastern bulrush occurs in wetlands of the area, but has not been observed on the SSES site or associated transmission line ROWS.

There are 12 butterfly, skipper, and moth species that are considered species of special concern in the State, and that could occur in the vicinity of SSES and associated transmission lines (PNHP 2007b). According to PDCNR, five of these species are known to occur at or in the vicinity of the SSES site (PDCNR 2007). These are the northern pearly-eye (*Enodia anthedon*), long dash (*Polites mystic*), mulberry wing (*Poanes massasoit*), Aphrodite fritillary (*Speyeria* *aphrodite*), and Baltimore checkerspot (*Euphydryas phaetonis*). The PDCNR has suggested to PPL that populations of these species on SSES could be enhanced by encouraging the growth of host species including willows (*Salix* spp.), poplars (*Populus* spp.), milkweed (*Asclepias* spp.), mountain laurel (*Kalmia latifolia*), bluegrasses (*Poa* spp.), upright sedge (*Carex stricta*), violets (*Viola* spp.), and turtlehead (*Chelone glabra*) (PDCNR 2007).

Additionally, there are 10 bird species, 1 reptile, and 4 mammal species that are State-listed as either threatened or endangered (PHNP 2007b). Two of these species are also Federally listed – the bog turtle and the Indiana bat. Although both the peregrine falcon (*Falco peregrinus*) and bald eagle (*Haliaeetus leucocephalus*) have been removed from the Federal list of threatened and endangered species, they remain on the State list as endangered.

No other Federally or State-protected species have been identified as occurring near SSES or the associated transmission lines.

2.2.7 Radiological Impacts

SSES conducts a Radiological Environmental Monitoring Program (REMP) in which radiological impacts to employees, the public, and the environment in and around the Susquehanna site are monitored, documented, and compared to the appropriate Federal standards. The objectives of the REMP are to:

- Measure and evaluate the effects of facility operation on the environs and verify the effectiveness of the controls on radioactive effluents.

- Monitor natural radiation levels in the environs of the SSES site.

- Demonstrate compliance with the requirements of applicable Federal regulatory agencies, including SSES technical specifications and the ODCM.

The REMP includes monitoring of the waterborne environment (surface water, sediment from shoreline); airborne environment (radioiodine and particulates, direct radiation); and ingestion pathways (milk, fish, food products). The results of the REMP are summarized in the Annual Radiological Environmental Reports. During 2006, there were no plant-related activation, corrosion, or fission products detected in airborne particulate and radioiodine filters, groundwater, drinking water, broadleaf vegetation, crops, terrestrial vegetation, soil, or milk samples. Activation, corrosion, or fission products attributable to plant operation were detected during 2006 in surface water, fish, and bottom sediment samples (PPL 2007b). However, the reported data on the radionuclides detected in environmental samples were below applicable NRC reporting levels and showed no significant or measurable impact from the operations at SSES.

In addition to the routine REMP, the applicant, in July 2006, established an onsite groundwater monitoring program. The program is designed to monitor the onsite environment for an indication of leaks from plant systems and pipes carrying liquids with radioactive material (PPL 2007f).

The PDEP, Bureau of Radiation Protection, also performs sampling and analysis of selected environmental media in conjunction with SSES. PDEP environmental radiation monitoring programs include 30 dosimeter stations, two water sampling stations, and four air sampling stations, located within 20 mi (32 km) from the SSES site. The program also takes samples of milk, fish, produce, and sediment in the vicinity of SSES site (PDEP 2005c). The NRC staff reviewed the published data for the years 2001 and 2002; the most current available. The data indicated that the radiation levels observed in the environment around SSES did not exceed any of the Federal guidelines (PDEP 2005c).

Radiological releases are summarized in SSES Annual Radioactive Effluent Release Reports. Limits for all radiological releases are specified in the SSES ODCM and used to meet Federal radiation standards. A review of historical radiological release data during the period 2002 through 2006 and the resultant dose calculations revealed that the calculated doses to maximally exposed individuals in the vicinity of SSES were a small fraction of the limits specified in the SSES ODCM to meet the dose design objectives in Appendix I to 10 CFR Part 50, as well as the dose limits in 10 CFR Part 20 and EPA's 40 CFR Part 190. The results are described in the 2006 *Radioactive Effluent Release Report* (PPL 2007a). A breakdown of the calculated maximum dose to an individual located at the SSES site boundary from liquid and gaseous effluents and direct radiation shine during 2006 is summarized as follows:

- The calculated maximum whole-body dose to an offsite member of the general public from liquid effluents was 1.80×10^{-3} mrem (1.80×10^{-5} mSv), well below the 3 mrem (0.03 mSv) dose design objective in Appendix I to 10 CFR Part 50.

- The calculated maximum organ (adult liver) dose to an offsite member of the general public from liquid effluents was 2.14×10^{-3} mrem (2.14×10^{-5} mSv), well below the 15 mrem (0.15 mSv) dose design objective in Appendix I to 10 CFR Part 50.

- The calculated maximum gamma air dose at the site boundary from noble gas discharges was $1.23 \text{ X } 10^{-2}$ mrad ($1.23 \text{ X } 10^{-4}$ mGy), well below the 10 mrad (0.10 mGy) dose design objective in Appendix I to 10 CFR Part 50.

- The calculated maximum beta air dose at the site boundary from noble gas discharges was $2.48 \text{ X } 10^{-3}$ mrad ($2.48 \text{ X } 10^{-5}$ mGy), well below the 20 mrad (0.20 mGy) dose design objective in Appendix I to 10 CFR Part 50.

- The calculated maximum organ (child thyroid) dose to an offsite member of the general public from gaseous iodine, tritium, and particulate effluents was 4.93 X 10^{-1} mrem (4.93 X 10^{-3} mSv), well below the 15 mrem (0.15 mSv) dose design objective in Appendix I to 10 CFR Part 50.

- The calculated maximum total body dose to an offsite member of the public from all radioactive emissions (radioactive gaseous and liquid effluents and direct radiation shine) was 5.27 X 10^{-1} mrem (5.27 X 10^{-3} mSv), well below the 25 mrem (0.25 mSv) limit in EPA's 40 CFR Part 190.

The NRC staff found that the 2006 radiological data are consistent with the five year historical radiological effluent releases and resultant doses. These results confirm that SSES is operating in compliance with Federal radiation standards contained in Appendix I to 10 CFR Part 50, 10 CFR Part 20, and 40 CFR Part 190 (PPL 2003, 2004a, 2005a, 2006c, 2007a).

For the EPU, the applicant estimated that the total dose to a member of the public from radioactive gaseous and liquid effluents, and direct shine radiation would increase approximately in proportion to the EPU power increase (14 percent) (PPL 2006b). This would change the typical calculated maximum annual total body dose from all sources of radioactive emissions from 5.27 X 10^{-1} mrem (5.27 X 10^{-3} mSv) to 5.94 X 10^{-1} mrem (5.94 X 10^{-3} mSv), which is well below the 25 mrem (0.25 mSv) limit in EPA's 40 CFR Part 190. The increase in the radiation dose from an EPU is typical for boiling water reactors because of the increased radioactive steam flow which increases the dose from gaseous effluents and the dose from direct radiation shine. The dose from radioactive liquid discharges is typically minimized through the use of the liquid radioactive waste treatment system (as discussed in Section 2.1.4.1). Based on experience from EPUs at other plants, the NRC staff concludes that this is an acceptable estimate. EPA regulation 40 CFR Part 190 and NRC regulation 10 CFR Part 20 limit the annual dose to any member of the public to 25 mrem (0.25 mSv) to the whole body from the nuclear fuel cycle. The offsite dose from all sources, including radioactive gaseous and liquid effluents and direct radiation, would still be well within this limit after the proposed EPU is implemented. Therefore, the NRC staff, in the SSES EPU EA, concludes that there would be a small environmental impact from the additional amount of environmental dose generated following implementation of the proposed EPU (NRC 2007).

Following the EPU, the applicant does not anticipate any significant changes to the radioactive effluent releases or exposures from SSES operations during the renewal period, and the impacts to the environment are therefore not expected to change. Based on the NRC staff's review of the applicant's data, the staff supports the applicant's assessment.

2.2.8 Socioeconomic Factors

This section describes current socioeconomic factors that have the potential to be directly or indirectly affected by changes in operations at SSES. SSES and the communities that support it can be described as a dynamic socioeconomic system. The communities provide the people, goods, and services required by SSES operations. SSES operations, in turn, create the demand and pay for the people, goods, and services in the form of wages, salaries, and benefits for jobs and dollar expenditures for goods and services. The measure of the communities' ability to support the demands of SSES depends on their ability to respond to changing environmental, social, economic, and demographic conditions.

The socioeconomics region of influence (ROI) is defined by the areas where SSES employees and their families reside, spend their income, and use their benefits, thereby affecting the economic conditions of the region. The SSES ROI consists of a two-county area (Luzerne and Columbia Counties) where approximately 88 percent of SSES employees reside, and includes the City of Wilkes-Barre. The following sections describe the housing, public services, offsite land use, visual aesthetics and noise, population demography, and the economy in the ROI surrounding the SSES site.

SSES employs a permanent workforce of approximately 1200 employees (PPL 2006a). *Approximately 97 percent live in Montour, Schuylkill, Northumberland, Luzerne, and Columbia* Counties, Pennsylvania (Table 2-4). The remaining 3 percent of the workforce are divided among 11 counties in Pennsylvania with numbers ranging from 1 to 13 employees per county. Given the residential locations of SSES employees, the most significant impacts of plant operations are likely to occur in Luzerne and Columbia Counties. The focus of the analysis in this SEIS is therefore on the impacts of SSES in these two counties.

SSES schedules refueling outages at 24-month intervals. During refueling outages, site employment increases by 1400 workers for approximately 25 to 30 days (PPL 2006a). Most of these workers are assumed to be located in the same geographic areas as the permanent SSES staff.

Table 2-4. SSES Employee Residence by County in 2006

County	Number of SSES Personnel	Percentage of Total
Columbia	553	45
Luzerne	525	43
Montour	27	2
Northumberland	47	4
Schuylkill	35	3
Other	40	3
Total	1227	100

Source: PPL 2007f

2.2.8.1 Housing

Table 2-5 lists the total number of occupied housing units, vacancy rates, and median value in the ROI. According to the 2000 census, there were over 172,000 housing units in the ROI, of which approximately 156,000 were occupied. The median value of owner-occupied units was $83,500 in Luzerne County, which was lower than Columbia County. The vacancy rate was lower in Luzerne County (9.7 percent) and higher in Columbia County (10.2 percent). In 2005, the total number of housing units in Luzerne County grew by more than 2000 units to 146,911, and the total number of occupied units grew by only 650 units to 131,333. As a result, the number of available vacant housing units increased by more than 1500 units to 15,578, or 10.6 percent of the available units (USCB 2007).

2.2.8.2 Public Services

This section presents a discussion of public services including water supply, education, and transportation.

Water Supply

SSES provides potable water onsite for drinking, pump seal cooling, sanitation, and fire protection through the onsite groundwater well system. Three additional wells provide water to the Energy Information Center, Riverlands Recreation Area, and the West Building (former Emergency Operations Facility). SSES does not use water from a municipal system.

Table 2-5. Housing in Luzerne and Columbia Counties, Pennsylvania, in 2000

	Luzerne	Columbia	ROI
Total	144,686	27,733	172,419
Occupied housing units	130,687	24,915	155,602
Vacant units	13,999	2818	16,817
Vacancy rate (percent)	9.7	10.2	9.8
Median value (dollars)	83,500	85,800	84,650

Source: USCB 2007

Surface water is the primary source of drinking water for the majority of Luzerne County residents. Sources include lakes, rivers, reservoirs, and their tributaries, but not the Susquehanna River. Currently, both surface and groundwater sources in the county provide an adequate supply for the population. Although water quality has been an issue at some source locations, most sources and municipal water suppliers are able to provide enough water to sustain both domestic and nondomestic uses.

Columbia County has 13 surface water sources and 11 groundwater sources. Columbia County's Comprehensive Plan (Columbia County 1993) states that most sources are able to provide enough water to sustain both domestic and nondomestic uses through 2010.

Tables 2-6 and 2-7 list the largest municipal water suppliers (serving more than 4500 people) in Luzerne and Columbia Counties, respectively.

Education

SSES is located in the Berwick Area School District (PDE 2004), Columbia County, which had an enrollment of approximately 3300 students in 2005 (PDE 2005). Including the Berwick Area School District, Columbia County has 6 school districts (PDE 2005). In 2000, there were approximately 11,400 students enrolled in public schools in the county (PDE 2001). Luzerne County has a total of 11 school districts (PDE 2005). Total enrollment in Luzerne County public schools in 2005 was approximately 42,000 students (PDE 2006).

Transportation

Access to SSES is via U.S. Route 11 (US 11), a two-lane paved road running along the west side of the Susquehanna River (Figure 2-2). SSES lies to the west of US 11 and the Susquehanna River. Approximately 4 mi (6 km) north of SSES, US 11 intersects with State

Table 2-6. Major Public Water Supply Systems in Luzerne County, Average Daily and Maximum Daily Production and System Design Capacity (gpd)

Water Supplier[a]	Water Source[a]	Average Daily Production[b]	Maximum Daily Production[b]	Design Capacity[b]
Freeland borough Municipal Water Authority	GW[c]	430,438	709,000	1,613,200
HCA Water System Filter Plant – Hazleton	SW[c]	5,394,000	7,700,000	10,000,000
Pennsylvania American Water Company – Ceasetown[d]	SW	3,500,000	3,950,000	NA[c]
Pennsylvania American Water Company – Crystal Lake	SW	3,420,000	5,000,000	6,000,000
Pennsylvania American Water Company – Huntsville[e]	SW	NA	4,500,000	NA
Pennsylvania American Water Company – Nesbitt[e]	SW	10,000,000	11,000,000	12,000,000
Pennsylvania American Water Company – Watres[d]	SW	10,000,000	16,000,000	16,000,000
United Water Pennsylvania – Dallas	GW	462,000	569,000	1,566,000

(a) Source: EPA 2004
(b) Source: PDEP 2004
(c) GW = groundwater, SW = surface water, NA = not applicable or no information available.
(d) Ceasetown and Watres are part of the same water system.
(e) Huntsville and Nesbitt are part of the same water system.

Table 2-7. Major Public Water Supply Systems in Columbia County, Average Daily and Maximum Daily Production and System Design Capacity (gpd)

Water Supplier[a]	Water Source[a]	Average Daily Production[b]	Maximum Daily Production[b]	Design Capacity[b]
Pennsylvania American Water Company – Berwick	GW[c]	1,739,000	2,477,000	4,600,000
United Water Pennsylvania – Bloomsburg	SW[c]	2,581,000	3,479,000	4,147,000

(a) Source: EPA 2004
(b) Source: PDEP 2004
(c) GW = groundwater, SW = surface water.

Route (SR) 239. East of this intersection, SR 239 crosses the Susquehanna River. Several miles south of SSES, US 11 intersects with SR 93. East of this intersection, SR 93 crosses the Susquehanna River. East of the intersection of SR 93 and the Susquehanna River, SR 93 intersects SR 339. Five to ten miles south of SSES, SRs 93 and 339 intersect with Interstate 80 (I-80). Five to ten miles southeast of SSES, I-80 intersects with I-81. Employees traveling from the north or northwest of SSES would use SR 239 and US 11 to reach the station. Employees traveling from the northeast would use US 11. Employees traveling from the south or southwest of SSES could use varying combinations of the following roads to reach the station: I-80, SR 339, SR 93, and US 11. Employees traveling from the east and southeast could use SR 239, Interstates 80 and 81, SR 93, and US 11. When nearing SSES, all employees must use US 11.

Public transit in the Luzerne County area is based in the cities of Hazleton and Kingston Borough (with the hub located in Wilkes-Barre). The Luzerne County Transportation Authority and the City of Hazleton manage these systems. The Luzerne County Rail Corporation operates rail services within Luzerne County. Services include freight and limited passenger rail service.

The interstate highway system in Luzerne County provides access to Scranton, Wilkes-Barre, Hazleton, and regional access to New York City, Philadelphia, and other major northeast cities. I-80 runs east-west through the southern half of Luzerne County, providing direct access east to New Jersey and New York City, less than 100 mi (160 km) away, and access to Ohio and the western states. I-80 is a four-lane divided highway built to accommodate large volumes of passenger vehicles and motor freight. Interstates 81 and 476 (the Pennsylvania Turnpike Northeast Extension) run north and south through the county. I-81 runs north through Hazleton and Wilkes-Barre into upstate New York and south to Harrisburg and the Maryland border. The Pennsylvania Turnpike Northeast Extension (I-476) is a direct route from I-80 north to Wilkes-Barre and Scranton terminating at I-81. The Northeast Extension provides access to regional centers to the south, including Allentown and Philadelphia. US 11 runs northeast-southwest through Wilkes-Barre, connecting it with Harrisburg and New York State.

Traffic volumes are measured in terms of average annual daily traffic (AADT), which is an average of daily traffic for every day of the year. In Luzerne County, traffic volumes are the highest on the interstate highways such as I-80, I-81, and I-476. Heavier traffic volumes are especially concentrated around the cities of Wilkes-Barre and Hazleton (Lackawanna/Luzerne Counties 2003).

Between 1992 and 2001, traffic has grown on all interstate highways in Luzerne County. Between 1992 and 2001, increases in traffic volumes on I-80 have ranged from 24 percent to 110 percent or from 4550 to over 15,000 AADT (Lackawanna/Luzerne Counties 2003). On some roadway segments, truck traffic has increased at a greater rate than passenger vehicle traffic. Historic traffic volume data have shown that this has occurred on sections of I-80 in

Luzerne County. In an effort to maintain the ability to accommodate an ever-increasing number of vehicles, State and local authorities have implemented a number of maintenance and improvement projects to alleviate problems (Lackawanna/Luzerne Counties 2003).

The two primary east-west corridors in Columbia County are US 11 and I-80, which travel through Columbia County's midsection. These primary roadways are intersected by several north-south corridors that provide immediate access to Bloomsburg and Berwick. Similar to Luzerne County, Columbia County's primary roadway network has experienced a substantial increase in traffic volume. In an effort to maintain the ability to accommodate an increasing number of vehicles, State and local authorities have implemented a number of maintenance and improvement projects.

In determining the levels of transportation impacts for license renewal, the NRC uses the Transportation Research Board's level of service (LOS) definitions. The Pennsylvania Department of Transportation also makes LOS determinations for roadways involved in specific projects. However, there are no current LOS determinations for the roadways in the vicinity of SSES. Because LOS data are unavailable, AADT volumes were substituted. Table 2-8 lists roadways in the vicinity of SSES and the AADT volumes, as determined by the Pennsylvania Department of Transportation.

2.2.8.3 Offsite Land Use

This section focuses on Luzerne and Columbia Counties because the majority of the SSES workforce lives in these counties.

Luzerne County

SSES is located in Luzerne County in northeastern Pennsylvania. The county covers approximately 891 mi^2 (2300 km^2) of land (USCB 2000a) and has 76 municipalities. Land use in the county is classified as follows: forest – 73.4 percent, pasture – 9.8 percent, residential – 4.3 percent, commercial/industrial/transportation – 3.2 percent, row crops – 3.1 percent, quarry/strip mine – 2.3 percent, open water – 2.3 percent, wetlands – 1.5 percent, and transitional – 0.2 percent (King's College 2002).

According to the 2000 census, two thirds of the more than 300,000 county residents live in urban areas. Most development (residential, commercial, industrial, recreational, and public/quasi-public) is concentrated in the northeast quadrant of the county along the U.S. Route 11 corridor along the Susquehanna River. This quadrant contains the communities of Pittston, Nanticoke, Wilkes-Barre, Dallas, and Kingston and the Frances Slocum State Park. The southeast quadrant of the county contains rural, forested, and mined lands. It also

Table 2-8. Average Annual Daily Traffic Volumes in the Vicinity of SSES in 2002[(a)]

Roadway and Location	Annual Average Daily Traffic (AADT)
US 11 – east of the intersection with I-80	17,000
US 11 – between Secondary Route 4037 and the intersection with SR 93	11,000
US 11 – between Secondary Route 4037 and the intersection with Secondary Route 4002	8300
US 11 – between the intersection with Secondary Route 4002 and the intersection with Secondary Route 4004	6600
US 11 – east of the intersection with SR 239	11,000
US 11 – between the intersection with SR 239 and the intersection with Secondary Route 4016	7200
US 11 – between the intersection with Secondary Route 4016 and the confluence of US 11 and SR 29	11,000
US 11 – near the intersection with Secondary Route 0011	18,000
SR 239 – between the intersection with US 11 and the intersections with Secondary Routes 4010, 4007, and 4012	5700
SR 93 – just south of the intersection with US 11	12,000
I-80 – near the intersection with SR 93	32,000
SR 93 – between the intersection with I-80 and the intersection with Secondary Route 3036	5500 to 5900
SR 339 – between the intersection with I-80 and the intersection with SR 93	2300 to 6500

(a) All AADTs represent traffic volume during the average 24-hour day during 2002.
Source: PDOT 2004

contains Freeland Borough. The northwestern quadrant is composed primarily of forested land and land that is undeveloped, open, or agricultural. It includes part of the Ricketts Glen State Park. The southwestern quadrant is characterized by forests, open, undeveloped, agricultural, mined, and developed land. The developed portions of this quadrant are located in and around the city of Hazleton and the eastern outskirts of Berwick Borough.

From 1970 to 2000, the overall population of Luzerne County has decreased. The majority of the population decrease has occurred in the urban centers. Areas adjacent to urban centers and rural areas have experienced population increases, a trend similar to that in many American towns, as people migrate from the commercial/industrial centers of town to the suburbs and beyond.

There is currently an ongoing effort by EPA, State and local governments, and private stakeholders to reclaim the abandoned mine lands and make these lands useful for residential and commercial/industrial development. Two of the largest economic development initiatives currently under way in Luzerne County are (1) the development of Keystone Opportunity Zones and (2) the remediation and conversion of mine-contaminated lands by the Earth Conservancy (Lackawanna/Luzerne Counties 2003). Many acres of land have already been successfully reclaimed (EPA 2000). In Luzerne County, the largest number of vacant parcels available for development can be found between I-81 and the Susquehanna River in the City of Wilkes-Barre, the City of Hazleton, Hanover Township, Nanticoke City, and Newport Township. In Hazleton, there are plans to cleanup three unpermitted landfills, abandoned mine lands, and other environmental problems at a 277-ac (112-ha) redevelopment site (PDEP 2005b).

Columbia County

Columbia County covers approximately 486 mi^2 (1259 km^2) (USCB 2000b). Land use in the county falls into 10 categories: agricultural – 40.4 percent, woodland – 52.4 percent, residential – 4.0 percent, mining/quarry – 0.7 percent, public/quasi-public – 0.3 percent, commercial – 0.3 percent, recreation – 0.2 percent, industrial – 0.3 percent, transportation – 1.4 percent, and public utilities – 0.2 percent (Columbia County 1993).

Most development (residential, commercial, industrial, recreational, and public/quasi-public) is located in the North Central Planning Area. Most of the county's population is concentrated in this planning area, which consists of the Town of Bloomsburg and Berwick Borough, as well as several other municipalities containing substantial development, including Briar Creek, Scott, and South Centre Townships, and Briar Creek Borough (Columbia County 1993).

The land adjacent to US 11 serves as a high-density mixed-use development corridor within the county. Beyond this corridor, both north and south, the county is dominated by woodlands with large pockets of low-density residential development. Three exceptions to these rural outlying areas are the Millville, Benton, and Catawissa Boroughs. Agricultural land is currently being protected in Columbia County through three incentive programs: differential assessment, agricultural security areas, and purchase of agricultural conservation easements (Columbia County 1993).

Population and employment projections have been used by the county to develop estimates of future land use needs. The county estimates that approximately 3680 to 16,000 ac (1490 to 6475 ha) will be needed to accommodate future population increases. Columbia County has approximately 67,000 undeveloped acres (27,000 ha) with no impediments to development and 102,400 undeveloped acres (41,440 ha) restricted from development because the soil does not provide adequate percolation to meet sewage treatment requirements. The restricted acreage could be developed if a centralized wastewater collection/treatment system were to be constructed. It is evident, when comparing future total projected land use acreage needs to the available unrestricted land, that sufficient land area is available to accommodate future growth (Columbia County 1993).

2.2.8.4 Visual Aesthetics and Noise

The SSES reactors are on a rolling plateau above the river at an approximate elevation of 675 ft (206 m) MSL (NRC 1981). The major visible structures are the reactor building (which houses both reactors), the turbine building, the radiological waste building, the service and administration building, and the two cooling towers. The SSES buildings are only visible in the immediate vicinity of the station due to the rolling terrain. The tops of the cooling towers are visible for a greater distance during both day and night (with lights) because they protrude above the hilltops.

The FES for operation of SSES (NRC 1981) evaluated potential noise impacts from station operation; it indicated that SSES's cooling towers and large pumps and cooling water system motors (e.g., four make-up water pumps in the river intake structure) would be the most significant sources of noise. In the FES, the NRC staff predicted that pump and motor noise would not exceed ambient (baseline) levels in offsite areas and that cooling tower noise would be audible (exceeding ambient levels) for no more than a mile (1.6 km) offsite to the west, southwest, and southeast of the station (NRC 1981). The NRC staff concluded that "noise emissions during station operation will not cause other than minor nuisance problems" with the possible exception of a small area 670 to 915 m (2200 to 3000 ft) southwest of the station where the noise level was projected to be 56 dBA. This estimate was slightly higher than the noise level (55 dBA) that the EPA generally uses as a threshold level to protect against excess noise during outdoor activities. However, according to the EPA, this threshold does "not constitute a standard, specification, or regulation," but was intended to provide a basis for State and local governments establishing noise standards.

Noise surveys were performed in 1985 after commercial operation of both units began and in 1995 following a power uprate (Wood and Barnes 1995). The June 1995 noise measurements were similar to those reported in 1985, and no noise complaints were received following the uprate. The 1995 noise survey concluded that no noise mitigation was needed (Wood and Barnes 1995).

2.2.8.5 Demography

In 2000, approximately 330,488 persons lived within a 20-mi radius of SSES, which equates to a population density of 263 persons per square mile. This density translates to a Category 4 (greater than or equal to 120 persons per square mile within 20 mi [32 km]), using the *Generic Environmental Impact Statement* (GEIS) measure of sparseness (PPL 2006a). At the same time, there were approximately 1,684,794 persons living within a 50-mi (80-km) radius of the plant, for a density of 215 persons per square mile. Therefore, SSES falls into Category 4 (greater than or equal to 190 persons per square mile within 50 mi (80 km), on the NRC sparseness and proximity matrix). A Category 4 value indicates that SSES is in a high-density population area.

Table 2-9 shows population projections and growth rates from 1970 to 2050 in Luzerne and Columbia Counties. The growth rate in Luzerne County showed a decline of 2.7 percent for the period of 1990 to 2000. The population is expected to continue to decline at a relatively constant rate of 2.8 to 2.9 percent. In Columbia County, the population has grown and is projected to continue to grow through 2050.

The 2000 demographic profile of the region of influence population is included in Table 2-10. Persons self-designated as minority individuals comprise 3.8 percent of the total population. This minority population is composed largely of Black or African American and Asian residents.

Table 2-9. Population and Percent Growth in Luzerne and Columbia Counties, Pennsylvania, from 1970 to 2000 and Projected for 2010 and 2050

	Luzerne County		Columbia County	
Year	Population	Percent Growth[a]	Population	Percent Growth[a]
1970	342,301	–[b]	55,114	–
1980	343,079	0.2	61,967	12.4
1990	328,149	–4.4	63,202	2.0
2000	319,250	–2.7	64,151	1.5
2010	312,174	–2.2	68,195	6.3
2020	303,766	–2.7	71,030	4.2
2030	295,357	–2.8	73,864	4.0
2040	286,949	–2.8	76,699	3.8
2050	278,541	–2.9	79,533	3.7

(a) Percent growth rate is calculated over the previous decade.
(b) — = No data available.
Sources: Population data for 1970 through 2000 (USCB 2007); projected population data for 2010 to 2050 (calculated)

Transient Population

Within 50 mi of SSES, colleges and recreational opportunities attract daily and seasonal visitors who create demand for temporary housing and services. In 2000 in Luzerne County, 1.7 percent of all housing units were considered temporary housing for seasonal, recreational, or occasional use. By comparison, temporary housing accounts for only 4.7 percent and 2.8 percent of total housing units in Columbia County and Pennsylvania, respectively (USCB 2007). In 2004, there were approximately 66,000 students attending colleges and universities within 50 mi (80 km) of SSES (NCES 2007).

Table 2-10. Demographic Profile of the Population in the SSES Region of Influence in 2000

	Luzerne County	Columbia County	Region of Influence
Total Population	319,250	64,151	383,401
Race (2000) (percent of total population, Not-Hispanic or Latino)			
White	96.0	97.1	96.2
Black or African American	1.6	0.7	1.5
American Indian and Alaska Native	0.1	0.1	0.1
Asian	0.6	0.5	0.6
Native Hawaiian and Other Pacific Islander	0.0	0.0	0.0
Some other race	0.0	0.0	0.0
Two or more races	0.5	0.5	0.5
Ethnicity			
Hispanic or Latino	3,713	609	4,322
Percent of total population	1.2	0.9	1.1
Minority Population (including Hispanic or Latino ethnicity)			
Total minority population	12,722	1882	14,604
Percent minority	4.0	2.9	3.8

Source: USCB 2007

Migrant Farm Labor

Migrant farm workers are individuals whose employment requires travel to harvest agricultural crops. These workers may or may not have a permanent residence. Some migrant workers may follow the harvesting of crops, particularly fruit, throughout the northeastern U.S. rural areas. Others may be permanent residents near SSES who travel from farm to farm harvesting crops.

Migrant workers may be members of minority or low-income populations. Because they travel and can spend a significant amount of time in an area without being actual residents, migrant workers may be unavailable for counting by census takers. If uncounted, these workers would be "underrepresented" in U.S. Census Bureau (USCB) minority and low-income population counts.

Luzerne and Columbia Counties host relatively small numbers of migrant workers. According to *2002 Census of Agriculture* estimates, 409 temporary farm laborers (those working fewer than 150 days per year) were employed on 59 farms in Luzerne County, and 1408 were employed on 196 farms in Columbia County (USDA 2004).

2.2.8.6 Economy

This section contains a discussion of the economy, including employment and income, unemployment, and taxes.

Employment and Income

Between 2000 and 2005, the civilian labor force in the Luzerne County area decreased 8.9 percent to the 2005 level of 146,042. The civilian labor force in the Columbia County area grew 5.1 percent to the 2005 level of 34,040.

In 2005, educational services, health care, and social assistance employment represented the largest sectors of employment in both counties followed closely by manufacturing, retail, and the service industry. The largest employer in Luzerne County in 2006 was Wyoming Valley Health Care System with 3500 employees (Table 2-11). The majority of employment in Luzerne County is located in the cities of Wilkes-Barre and Hazelton.

Income information for the SSES ROI is included in Table 2-12. There are slight differences in the income levels between the two counties. The median household and per capita income in Luzerne and Columbia Counties were both well below the Pennsylvania average. In 1999, only 11.1 percent of the population in Luzerne County was living below the official poverty level, while in Columbia County, 13.1 percent of the population was below the poverty level (USCB 2007).

Table 2-11. Major Employers in Luzerne County in 2006

Firm	Number of Employees
Wyoming Valley Health Care System	3500
Procter & Gamble Paper Products Co.	2450
Keystone Automotive Operations	1425
Commonwealth telephone Enterprises	1350
PG Energy	1269
Pride Mobility Products Corp.	1200
Berwick Offray, LLC	1100
Blue Cross of Northeastern Pennsylvania	1100
Geisinger Wyoming Valley Medical Center	1100
Bank of America	1050
PPL Susquehanna, LLC	1000
Department of Veteran Affairs Medical Center	994
RCN Corporation	900
Mercy Health Partners c/o Mercy Hospital	890
TJ Maxx Distribution Center	840
Benco Dental Supply Company	804
Offset Paperback Mfrs., Inc.	790

Source: Luzerne County Business 2006

Table 2-12. Income Information for the SSES Region of Influence

	Luzerne County	Columbia County	Pennsylvania
Median household income 1999 (dollars)	33,771	34,094	40,106
Per capita income 1999 (dollars)	18,228	16,973	20,880
Percent of persons below the poverty line (2000)	11.1	13.1	11.0

Source: USCB 2007

Unemployment

In 2005, the annual unemployment averages in the Luzerne and Columbia Counties were 8.2 and 5.7 percent, respectively, which were higher and lower than the annual unemployment average of 6.7 percent for Pennsylvania (USCB 2007).

Taxes

SSES is assessed annual property taxes by Berwick Area School District, Luzerne County, and Salem Township. Property taxes paid to Luzerne County and the Salem Township fund services such as transportation, education, public health, and public safety (see Table 2-13).

In the past, PPL paid real estate taxes to the Commonwealth of Pennsylvania for power generation, transmission, and distribution facilities. Under authority of the Pennsylvania Utility Realty Tax Act (PURTA), real estate taxes collected from all utilities (water, telephone, electric, and railroads) were redistributed to the taxing jurisdictions within the Commonwealth. In

Table 2-13. Berwick Area School District, Luzerne County, Salem Township Tax Revenues, 2002 to 2005; SSES Property Tax, 2002 to 2005; and SSES Property Tax as a Percentage of Tax Revenues

Entity	Year	Tax Revenues (in millions of dollars, 2005)	Property Tax Paid by SSES (in millions of dollars, 2005)	SSES Property Tax as Percentage of Tax Revenues
Berwick Area School District	2002	30.9	1.9	6.2
	2003	31.7	1.9	6.0
	2004	40.5	2.4	5.8
	2005	38.7	2.8	7.1
Luzerne County	2002	60.6	1.1	1.9
	2003	61.3	1.1	1.8
	2004	68.5	1.2	1.8
	2005	67.2	1.2	1.7
Salem Township	2002	0.123	0.062	50.3
	2003	0.123	0.062	50.3
	2004	0.119	0.064	53.9
	2005	0.117	0.061	52.5

Source: PPL 2007e, PPL 2007i

Pennsylvania, these jurisdictions include counties, cities, townships, boroughs, and school districts. The distribution of PURTA funds was determined by formula, and was not necessarily based on the individual utility's effect on a particular government entity.

In 1996, Electricity Generation Customer Choice and Competition Act became law, which allows consumers to choose among competitive suppliers of electrical power. As a result of utility restructuring, Act 4 of 1999 revised the tax base assessment methodology for utilities from the depreciated book value to the market value of utility property. Additionally, as of January 1, 2000, PPL was required to begin paying real estate taxes directly to local jurisdictions, ceasing payments to the Commonwealth's PURTA fund.

PPL currently pays annual real estate taxes to the Berwick Area School District, Luzerne County, and Salem Township.

From 2002 through 2004, the Berwick Area School District collected between $31 and $41 million annually in total real estate tax revenues. Between 2002 and 2004, SSES's real estate taxes represented 5.8 to 6.2 percent of the Berwick Area School District's total tax revenues (see Table 2-13).

Luzerne County revenues fund county operations, judicial services, correctional facilities, emergency management services, parks and recreation, public works, social services, public safety, the community college, nursing homes, libraries, and conservation and development projects (Lackawanna/Luzerne Counties 2003). From 2002 through 2004, Luzerne County collected between $61 and $69 million annually in total real estate tax revenues. Between 2000 and 2004, SSES's real estate taxes represented 1.8 to 1.9 percent of Luzerne County's total real estate tax revenues (see Table 2-13).

From 2002 to 2004, Salem Township collected between $118,000 and $123,000 in municipal and street taxes. Between 2000 and 2004, SSES's real estate taxes represented 50.3 to 53.9 percent of Salem Township's municipal and street taxes (see Table 2-13).

The continued availability of SSES and the associated tax base is an important feature in the ability of the Luzerne County and Salem Township communities to continue to invest in infrastructure and to draw industry and new residents.

2.2.9 Historic and Archaeological Resources

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

2.2.9.1 Cultural Background

The region around SSES contains prehistoric and historic Native American and Euro-American cultural resources. SSES is located along what is known as the Bell Bend portion of the Susquehanna River, where the floodplain reaches its maximum breadth 0.75 mi (1.2 km) wide (CAI 1981). There are 60 properties in Luzerne and Columbia Counties listed in the *National Register of Historic Places* (NRHP), 5 of which fall within approximately 6 mi (9.6 km) of SSES (PPL 2006a). No NRHP listed sites are located in areas affected by operation of SSES.

Paleo-Indians occupied North America approximately 15,000 to 10,000 years ago, subsisting on hunting game and gathering plant material. In the Pennsylvania area, Paleo-Indians migrated into an environment changed by retreating glacial ice. Evidence from archaeological work in the State suggests that small game and plants played a significant role in the lives of the people. This period is largely characterized by the Clovis point, a distinctive, fluted, lanceolate point that is widely distributed throughout Pennsylvania, especially in the Susquehanna and Delaware River drainages (PPL 2006a). Regional studies indicate that there is a higher probability for Clovis points to be found in the Susquehanna River drainage (Kent et al. 1971). Other tools commonly found at Pennsylvania Paleo-Indian sites include scrapers; spurred-end scrapers; drills; cores; bifaces; microblades; and small uniface, biface, and flake knives (PPL 2006a).

During the Archaic Period, from approximately 10,000 years ago until about 3000 years ago, subsistence strategies underwent local changes to adapt to resources. As the glaciers retreated northward toward Canada and larger fauna became extinct, humans adapted to exploit modern flora and smaller game animals. Archaic peoples subsisted on animals such as deer, elk, rabbits, squirrels, and vegetable products of the forest (PPL 2006a). As both resource quality and the cultural means to access resources improved, the population of Archaic peoples also increased. Archaeologists find evidence of larger populations by the end of the Archaic Period, at a time when climate reached its modern condition. Archaic people collected, hunted, and gathered most of what they needed for survival in their home territory. Large base camps found near major water sources provided a focal point for groups during the winter months. During other seasons, camps divided and people engaged in more mobile foraging activities.

The "Woodland" culture occupied the region between 3000 years ago until European contact around 1500 A.D. In the Woodland culture, Native Americans became regionally distinct cultural entities. Woodland people ultimately became dependent on maize agriculture, lived in villages, and introduced the bow and arrow in hunting. A major trait delineating the Woodland period is the introduction of ceramics (PPL 2006a). Another trait is the construction of earthen mounds for burial of the dead (PPL 2006a).

The area surrounding SSES had a number of prehistoric populations. Subsistence village sites and trails associated with the Delaware, Nanticoke, Shawnee, Iroquois, Susquehannock, and other Native American Tribes were located in the Susquehanna Valley (PPL 2006a). The Native Americans used the Susquehanna River and several overland paths and trails as their primary transportation routes (Weed and Wenstrom 1992a).

The Native American societies in the region shared several important characteristics at the time they were first contacted by Europeans. These included an economic base that combined hunting and gathering with growing domesticated plants and an annual settlement pattern that varied in population size between semipermanent river-side villages in summer, large camps in winter, and population dispersal among scattered camps in the spring and fall.

In the 1600s, Europeans first came to the Pennsylvania area and came into contact with Late Woodland peoples known as the Delaware, Nanticoke, Shawnee, Iroquois, and Susquehannock (PPL 2006a). The SSES site is located on land once occupied by the Susquehannocks, an Iroquoian-speaking Tribe who lived along the Susquehanna River in Pennsylvania and Maryland. Susquehannock populations were reduced by diseases brought by Europeans and by attacks from Marylanders and the Iroquois. The Susquehannocks engaged in many wars. However, by 1675, the Susquehannocks ceased to exist as a Nation (PPL 2006a).

The rise of nation-states in Europe coincided with the gaining of lands in North America. Wars in southern Germany caused many Germans to migrate to Pennsylvania. The struggle for religious freedom in England brought Quakers, Puritans, and Catholics to Pennsylvania (PHMC undated-a). Captain John Smith was the first European to explore the region. In 1608, Smith journeyed from Virginia up the Susquehanna River and made contact with the Susquehannock Indians. Between 1609 and 1681, the Dutch, Swedes, and English inhabited and fought over the region that would later become eastern Pennsylvania. Ultimately, the English prevailed and the area fell under English rule (PPL 2006a).

William Penn was a member of the Society of Friends, or Quakers, a persecuted sect in England. Penn sought a haven in the New World for persecuted Friends and on March 4, 1681, his petition was granted, and was officially proclaimed on April 2. The King named the new colony in honor of William Penn's father (PHMC undated-a). Although William Penn was granted all of the land in Pennsylvania by the King, he and his heirs chose not to grant or settle any part of it without first buying the claims of Native Americans who lived there. Using this recourse, most of Pennsylvania was purchased by 1768. The remaining portion was purchased by the Commonwealth by 1789 (PHMC undated-a).

English Quakers were the dominant settlers, although many were Anglican. Thousands of Germans were also attracted to the colony and, by the time of the American Revolution, they comprised a third of the population. Another immigrant group was the Scotch-Irish, who migrated from about 1717 until the American Revolution in a series of waves caused by hardships in Ireland (PHMC undated-a). Other Quakers were Irish and Welsh. They, together with the French Huguenots, Jews, Dutch, Swedes, and other groups, contributed in smaller numbers to the development of colonial Pennsylvania (PHMC undated-a).

By the mid-eighteenth century, settlers began to occupy and lay claim to the Luzerne and Columbia County areas. In the years that followed, periods of unrest and war were frequent as various European pioneers, and Native American groups sought possession of what would become Luzerne and Columbia Counties (PPL 2006a). Luzerne County was created on September 25, 1786, from part of Northumberland County. Wilkes-Barre, the county seat, was laid out in 1772. It was incorporated as a borough on March 17, 1806, and as a city on May 4, 1871 (PHMC undated-b). Columbia County was created on March 22, 1813, from part of Northumberland County. Bloomsburg, the county seat, was incorporated as a town on March 4, 1870, and is the only incorporated town in the State. Berwick, the borough in Columbia County nearest SSES, was laid out in 1783 (PHMC undated-b).

By the beginning of the 20th century, the economic base of Luzerne and Columbia Counties had shifted from agriculture, fishing, and lumbering to mining and manufacturing centered in three urban areas: Wilkes-Barre, Hazleton, and Pittston (NRC 1981). The North Branch Canal was created in the 1830s to provide a reliable means of transportation to markets outside the county. Later, railroads became the predominant mode of freight transportation, which resulted in the abandonment of the canals (Berwick Historical Society 2007). Even with this change in transportation, the coal and lumber industries yielded to competition by the 1930s. Abandoned coal mines are numerous and spread throughout eastern Pennsylvania. Presently, Luzerne County produces about one fourth of the anthracite coal in the State, mostly by surface operations. Economically, the county has had heavy unemployment since World War II, although new mining machines had made mining labor-efficient long before the market diminished in the 1960s (PHMC undated-b).

2.2.9.2 Historic and Archaeological Resources at the SSES Site

The FES for construction of SSES listed eight important historic landmarks in Luzerne and Columbia Counties (AEC 1973). The Atomic Energy Commission concluded that the construction of SSES would have no effect on any national historical landmarks. The FES also reported that State officials concurred that the SSES project would not adversely impact any known archaeological or historical resources of value (AEC 1973).

Prior to the issuance of the FES for operation of SSES in 1981, PPL funded two cultural resource studies of the SSES property (NRC 1981). The first study, conducted in 1978, was in response to an effort by PPL to develop land across the Susquehanna River from the SSES site. The study and subsequent salvage excavation focused on an area called the Knouse site

(36-LU-43) (PPL 2006a). The Knouse site appears to be the remains of a large Delaware village, which also contains evidence of a large Archaic site. Twenty-one Native American burials and associated artifactual materials were removed by the Pennsylvania Historical and Museum Commission (PHMC) from the site for further study (NRC 1981). In June of 2007, PHMC repatriated the remains to the Delaware Nation for reinterment.

In 1980, PPL funded a second archaeological investigation at the SSES site (CAI 1981). The investigation identified 8 sites on SSES property. Of the eight sites, three were considered to be significant (36-LU-16, 36-LU-49, 36-LU-51) and one potentially eligible (36-LU-15) for recommendation to the NRHP by the Pennsylvania State Archaeologist. Site 36-LU-16 is an early to middle Woodland site with intact subsurface features. The next site, 36-LU-49, dates to the Transitional period, a pivotal prehistoric time between the late Archaic and early Woodland period (1500 BC). The deposits associated with 36-LU-49 are deeply buried (1.5 m below the surface) and contain intact cultural features. Another significant site is 36-LU-51, a Woodland period occupation that contains the potential for intact features. The final site of note from this survey is 36-LU-15, a late Archaic occupation. While the site has been altered by construction of the SSES Biological Laboratory, intact portions of this site may remain. Therefore, 36-LU-15 was determined to be potentially eligible.

Of the three significant sites, only one (36-LU-16) was considered to be in danger of adverse impact (PPL 2006a). Mitigating actions were recommended at site 36-LU-16, and, at the time of publication of the 1980 study, PPL was in the process of implementing the recommendations (CAI 1981). During the NRC audit, the NRC staff confirmed that PPL implemented the mitigation measures. In this investigation, it was concluded that, "[n]one of these recommendations should significantly alter PPL's plans or schedule of activities for completion of the SES project" (CAI 1981).

PPL conducted a field review of the four archaeological sites on October 11, 2004. The sites have been monitored occasionally since the initial report of 1981 and additional mitigation actions have not been warranted (PPL 2006a).

In the FES for operation of SSES, the NRC concluded that direct impacts of the station's operation on cultural resource sites would be expected to be minimal if known prehistoric sites were protected by a well-designed mitigation/avoidance program, and if care was exercised to recognize and protect cultural resources discovered during operational activities involving disruption of topsoil or vegetation (NRC 1981).

An additional archaeological survey was conducted in the late 1980s on Gould Island. Gould Island is approximately 65 ac (26 ha) and is located in the Susquehanna River. The island is currently undeveloped and is owned by PPL Susquehanna, LLC. Gould Island is bordered on the east by the main channel of the river and on the west by a smaller channel that developed from a backchannel slough (Weed and Wenstrom 1992a). The slough gradually deepened and became a fully integrated part of the river around 4000 BC (Weed and Wenstrom 1992a).

Archaeological investigations were conducted on the northern end of the island in 1992 for the Transcontinental Gas Pipeline Corporation expansion of the Leidy line and Market area facilities. Historic research conducted for the project revealed that the island had been used for agricultural purposes from 1850 until about 1920. Three structures once stood on the island, with at least one being a residence. Additionally, records mentioned a ferry landing on the north end of the island with a companion feature on the west bank dating to the turn of the century. Material culture associated with the historic occupation have been recorded by surveys.

Fieldwork conducted for the project identified site 36-LU-105, a large multi-component prehistoric site on the island. The site contains evidence of multiple occupations with material ranging in age from 1500 BC to 1500 AD. Material concentrated at several depths with some found over a meter below the surface. The site was recommended potentially eligible by the cultural resources contractor (Weed and Wenstrom 1992b).

2.2.10 Related Federal Project Activities and Consultations

The NRC staff reviewed the possibility that activities of other Federal agencies might impact the renewal of the operating license for SSES. Any such activity could result in cumulative environmental impacts and the possible need for a Federal agency to become a cooperating agency in the preparation of the SSES SEIS.

The NRC staff has determined that there are no Federal projects that would make it desirable for another Federal agency to become a cooperating agency in the preparation of the SEIS. Federal facilities and National Parks within 50 mi of SSES are listed below. There are no known American Indian lands within 50 mi of SSES.

- Tobyhanna Army Depot, Tobyhanna – 38 mi (61 km)

- Fort Indiantown Gap, Annville – 50 mi (80 km)

- Appalachian National Scenic Trail – various areas (closest is 32 mi [51 km] near Hawk Mountain; farthest is 47 mi [77 km] near Fort Indiantown Gap)

- Steamtown National Historic Site, Scranton – 34 mi (55 km)

- U.S. Penitentiary (USP) Lewisburg, Lewisburg – 45 mi (72 km)

- Federal Correctional Complex (FCC) Allenwood, Allenwood – 40 mi (64 km)

- Federal Correctional Institution (FCI) Schuylkill, Minersville – 28 mi (45 km)

NRC is required under Section 102(2)(c) of the National Environmental Policy Act of 1969 (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. Federal agency consultation correspondence and comments on the draft SEIS are presented in Appendix E.

2.3 References

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

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

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

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

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

18 CFR Part 803. *Code of Federal Regulations*, Title 18, *Conservation of Power and Water Resources*, Part 803, "Review and Approval of Projects."

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

40 CFR Part 260. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 260, "Hazardous Waste Management System: General."

40 CFR Part 261. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 261, "Identification and Listing of Hazardous Waste."

40 CFR Part 262, *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 262, "Standards Applicable to Generators of Hazardous Waste."

40 CFR Part 266. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 266, "Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities," Subpart N, "Conditional Exemption for Low-Level Mixed Waste Storage and Disposal."

40 CFR Part 273. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 273, "Standards for Universal Waste Management."

25 PA Code Article IX. *Pennsylvania Code*, Title 25, *Environmental Protection*, Article IX, "Residual Waste Management."

25 PA Code Article VII. *Pennsylvania Code*, Title 25, *Environmental Protection*, Article VII, "Hazardous Waste Management."

25 PA Code § 266a.20. *Pennsylvania Code*, Title 25, *Environmental Protection*, Chapter 266a, "Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities," Subchapter C, "Recyclable Materials Used in a Manner Constituting Disposal."

25 PA Code § 266b. *Pennsylvania Code*, Title 25, *Environmental Protection*, Chapter 266b, "Universal Waste Management: General."

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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 characteristics.

(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 draft Supplemental Environmental Impact Statement (SEIS) 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 Sections
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 Susquehanna Steam Electric Station, Units 1 and 2 (SSES) because they are related to plant design features or site characteristics not found at SSES 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. PPL Susquehanna, LLC (PPL) indicated that it has performed an evaluation of structures and components pursuant to Title 10, Part 54, Section 54.21, of the *Code of Federal Regulations* (10 CFR 54.21) to identify activities that are necessary to continue operation of SSES 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 (PPL 2006).

Table 3-2. Category 2 Issues for Refurbishment Evaluation

ISSUE–10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections	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 an applicant plans to undertake refurbishment activities for license renewal, environmental justice must be addressed in the applicant's Environmental Report and the U.S. Nuclear Regulatory Commission (NRC) staff's Environmental Impact Statement.

However, PPL 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; NRC 1981). In addition, PPL'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 SSES beyond the end of the existing operating licenses. Therefore, refurbishment is not considered in this draft SEIS.

3.1 References

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

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

PPL Susquehanna, LLC (PPL). 2006. *Susquehanna Steam Electric Station Units 1 and 2 Application for License Renewal, Appendix E: Applicant's Environmental Report – Operating License Renewal Stage*. Allentown, Pennsylvania. (September 2006). ADAMS No. ML062630235.

U.S. Atomic Energy Commission (AEC). 1973. *Final Environmental Statement Related to Construction of Susquehanna Steam Electric Station, Units 1 and 2.* Pennsylvania Power & Light Company. Docket Nos. 50-387 and 50-388. Washington, D.C. (June 1973).

U.S. Nuclear Regulatory Commission (NRC). 1981. *Final Environmental Statement Related to the Operation of Susquehanna Steam Electric Station*. Pennsylvania Power & Light Company and Allegheny Electric Cooperative, Inc. Dockets Nos. 50-387 and 50-388. Washington, D.C. (June 1981).

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

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 characteristics.

(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.

This chapter addresses the issues related to operation during the renewal term that are listed in Table B-1 of Title 10, Part 51, of the *Code of Federal Regulations* (10 CFR Part 51), Subpart A, Appendix B, and are applicable to the Susquehanna Steam Electric Station, Units 1 and 2 (SSES). Section 4.1 addresses issues applicable to the SSES cooling system. Section 4.2 addresses issues related to transmission lines and onsite land use. Section 4.3 addresses the radiological impacts of normal operation, and 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, while Section 4.6 discusses the impacts of

(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.

renewal-term operations on threatened and endangered species. Section 4.7 addresses potential new information that was raised during the scoping period, and Section 4.8 discusses cumulative impacts. The results of the evaluation of environmental issues related to operation during the renewal term are summarized in Section 4.9. Category 1 and Category 2 issues that are not applicable to SSES because they are related to plant design features or site characteristics not found at SSES 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 SSES cooling system operation during the renewal term are listed in Table 4-1. PPL stated in its Environmental Report (ER) (PPL 2006a) that it is not aware of any new and significant information associated with the renewal of the operational licenses (OLs) for SSES Units 1 and 2. The NRC staff has not identified any new and significant information during its independent review of the SSES ER (PPL 2006a), or the site audit, the scoping process, and evaluation of other available information, such as operation of SSES at a combined total power level of 7904 megawatts thermal (MW(t)) as a result of the recently-approved extended power uprate (EPU) license amendment. Therefore, the NRC staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of the issues, the NRC staff concluded in the GEIS that the impacts would be SMALL, and additional plant-specific mitigation measures are not likely to be sufficiently beneficial to warrant implementation.

A brief description of the NRC staff's review and the GEIS conclusions, as codified in 10 CFR Part 51, Table B-1, for each of these issues follows:

Table 4-1. Category 1 Issues Applicable to the Operation of the SSES 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
Temperature effects on sediment transport capacity	4.2.1.2.3
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
Discharge of sanitary wastes and minor chemical spills	4.2.1.2.4
Discharge of other metals in wastewater	4.2.1.2.4

AQUATIC ECOLOGY (FOR ALL PLANTS)	
Accumulation of contaminants in sediments or biota	4.2.1.2.4
Entrainment of phytoplankton and zooplankton	4.2.2.1.1
Cold shock	4.2.2.1.5
Thermal plume barrier to migrating fish	4.2.2.1.6
Distribution of aquatic organisms	4.2.2.1.6
Premature emergence of aquatic insects	4.2.2.1.7
Gas supersaturation (gas bubble disease)	4.2.2.1.8
Low dissolved oxygen in the discharge	4.2.2.1.9
Losses from predation, parasitism, and disease among organisms exposed to sublethal stresses	4.2.2.1.10
Stimulation of nuisance organisms	4.2.2.1.11
AQUATIC ECOLOGY (FOR PLANTS WITH COOLING-TOWER-BASED HEAT DISSIPATION SYSTEMS)	
Entrainment of fish and shellfish in early life stages	4.3.3
Impingement of fish and shellfish	4.3.3
Heat shock	4.3.3
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

- 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information, such as the environmental assessment (EA) that evaluated impacts of the EPU at SSES (NRC 2007a). Therefore, the NRC staff concludes that there would be no impacts of altered current patterns at intake and discharge structures during the renewal term beyond those discussed in the GEIS.

- <u>Temperature effects on sediment transport capacity</u>. 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information, such as the EA that evaluated a proposed uprate at SSES (NRC 2007a). Therefore, the NRC staff concludes that there would be no impacts of temperature effects on sediment transport capacity during the renewal term beyond those discussed in the GEIS.

- <u>Scouring caused by discharged cooling water</u>. 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information, such as the EA that evaluated impacts of the EPU at SSES (NRC 2007a). Therefore, the NRC staff concludes that there would be no impacts of scouring caused by discharged cooling water during the renewal term beyond those discussed in the GEIS.

- <u>Eutrophication</u>. 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information, such as the EA that evaluated impacts of the

EPU at SSES (NRC 2007a). Technical reports reviewed included *Environmental Studies in the Vicinity of the Susquehanna Steam Electric Station – Water Quality and Fishes* and annual reports for the years of 1986, 1994, 2003, and 2005 (Ecology III 1987a, 1995, 2003, 2007). Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information, such as the EA that evaluated impacts of the EPU at SSES (NRC 2007a). Documents reviewed included the current Pennsylvania National Pollutant Discharge Elimination System (NPDES) permit for SSES (Permit No. PA-0047325), contained in the SSES ER as Attachment F (PPL 2006a), and the U.S. Environmental Protection Agency's (EPA's) *Envirofacts Data Warehouse*, which lists no past or current NPDES violations for SSES (EPA 2007). Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information, such as the EA that evaluated impacts of the EPU at SSES (NRC 2007a). Documents reviewed included the current SSES NPDES permit and the EPA's *Envirofacts Data Warehouse*, which lists no past or current NPDES violations for SSES (EPA 2007), as well as the "Pollution Incident History," located in Attachment 22A, Revision 9, of the SSES *Preparedness Prevention and Contingency (PPC) Plan* (PPL 2007). Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information, such as the EA that evaluated impacts of the EPU at SSES (NRC 2007a). Documents reviewed included the current SSES NPDES permit and the EPA's *Envirofacts Data Warehouse*, which lists no past or current NPDES violations for SSES (EPA 2007). Therefore, the NRC staff concludes that there would be no impacts of discharges of other metals in wastewater 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of available information, such as the EA that evaluated impacts of the EPU at SSES (NRC 2007a). Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information, such as the EA that evaluated impacts of the EPU at SSES (NRC 2007a). Documents reviewed included *Environmental Studies in the Vicinity of the Susquehanna Steam Electric Station – Water Quality and Fishes* and annual reports for the years of 1984, 1986, and 1994 (Ecology III 1985, 1987a, 1995). Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information, such as the EA that evaluated impacts of the EPU at SSES (NRC 2007a). Documents reviewed included the Final Environmental Statement (FES) for the operation of SSES (NRC 1981) and *Thermal Plume Studies in the Susquehanna River at the Discharge Diffuser of the Susquehanna Steam Electric Station, 1986-87* (Ecology III 1987b). Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information, such as the EA that evaluated impacts of the EPU at SSES (NRC 2007a). Documents reviewed included the FES for the operation of SSES (NRC 1981) and *Thermal Plume Studies in the Susquehanna River at the Discharge Diffuser of the Susquehanna Steam Electric Station, 1986-87* (Ecology III 1987b). Therefore, the NRC staff concludes that there would be 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 affect the larger geographical distribution of aquatic organisms.

  The NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information, such as the EA that evaluated impacts of the EPU at SSES (NRC 2007a). Documents reviewed included *Environmental Studies in the Vicinity of the Susquehanna Steam Electric Station – Water Quality and Fishes* and annual reports for the years of 1986, 1994, 2003, and 2005 (Ecology III 1987a, 1995, 2003, 2007). Therefore, the NRC staff concludes that there would be no impacts on 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information, such as the EA that evaluated impacts of the EPU at SSES (NRC 2007a). Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information, such as the EA that evaluated impacts of the EPU at SSES (NRC 2007a). Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information, such as the EA that evaluated impacts of the EPU at SSES (NRC 2007a). Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information, such as the EA that evaluated impacts of the EPU at SSES (NRC 2007a). Documents reviewed included *Environmental Studies in the Vicinity of the Susquehanna Steam Electric Station – Water Quality and Fishes* and annual reports for the years of 1986, 1994, 2003, and 2005 (Ecology III 1987a, 1995, 2003, 2007). Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information, such as the EA that evaluated impacts of the EPU at SSES (NRC 2007a). Therefore, the NRC staff concludes that there would be no impacts from stimulation of nuisance organisms during the renewal term beyond those discussed in the GEIS.

- Entrainment of fish and shellfish in early life stages (cooling-tower-based heat dissipation). Based on information in the GEIS, the Commission found that

> Entrainment of fish has not been found to be a problem at operating nuclear power plants with this type of cooling system and is not expected to be a problem during the license renewal term.

The NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information, such as the EA that evaluated impacts of the EPU at SSES (NRC 2007a). Documents reviewed included the *Susquehanna Steam Electric Station 316(b) Entrainment Demonstration Program for National Pollution Discharge Elimination System Permit No. Pa. 004735 Special Condition C, Part C*, dated July 1982 (PPL 1982). Therefore, the NRC staff concludes that there would be no impacts of entrainment of fish and shell fish in early life stages for cooling-tower-based systems during the renewal term beyond those discussed in the GEIS.

- Impingement of fish and shellfish (cooling-tower-based heat dissipation). Based on information in the GEIS, the Commission found that

> The impingement of fish and shellfish has not been found to be a problem at operating nuclear power plants with this type of cooling system and is not expected to be a problem during the license renewal term.

The NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information, such as the EA that evaluated impacts of the EPU at SSES (NRC 2007a). Documents reviewed included the *Susquehanna Steam Electric Station Annual Environmental Operating Report (Nonradiological)* for the years from 1999 to 2005, which each include a discussion of annual impingement rates (PPL 2000, 2001, 2002, 2003, 2004, 2005a, 2006c). As discussed in Section 4.3.3 of the GEIS, even low rates of impingement at closed-cycle cooling systems can be a concern when an unusually important resource is affected, such as an anadromous fish undergoing restoration. As an example, the GEIS cites the American shad (*Alosa sapidissima*) in the Susquehanna River, and reports that losses of shad at SSES are minimal or nonexistent; however, periodic monitoring is recommended. As part of its annual environmental monitoring program, SSES routinely monitors its intake screens for aquatic organisms, paying particular attention to the American shad. From 2001 to 2005, only one shad was collected from the intake screens. Therefore, the NRC staff concludes that there would be no impacts of impingement of fish and shellfish for cooling-tower-based systems during the renewal term beyond those discussed in the GEIS.

- <u>Heat shock (cooling-tower-based heat dissipation)</u>. Based on information in the GEIS, the Commission found that

> Heat shock has not been found to be a problem at operating nuclear power plants with this type of cooling system and is not expected to be a problem during the license renewal term.

The NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information, such as the EA that evaluated impacts of the EPU at SSES (NRC 2007a). Documents reviewed included the FES for the operation of SSES (NRC 1981) and *Thermal Plume Studies in the Susquehanna River at the Discharge Diffuser of the Susquehanna Steam Electric Station, 1986-87* (Ecology III 1987b). Therefore, the NRC staff concludes that there would be no impacts of heat shock for cooling-tower-based systems during the renewal term beyond those discussed in the GEIS.

- <u>Cooling tower impacts on crops and ornamental vegetation</u>. 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information, such as the EA that evaluated impacts of the EPU at SSES (NRC 2007a). Documents reviewed included *Effects of Simulated Salt Drift from the Susquehanna Steam Electric Station Cooling Towers on Field Crops Summary Report* (Ecology III 1987c). Therefore, the NRC staff concludes that there would be no cooling tower impacts on crops and ornamental vegetation during the renewal term beyond those discussed in the GEIS.

- <u>Cooling tower impacts on native plants</u>. 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information, such as the EA that evaluated impacts of the EPU at SSES (NRC 2007a). Therefore, the NRC staff concludes that there would be no cooling tower impacts on native plants during the renewal term beyond those discussed in the GEIS.

- <u>Bird collisions with cooling towers</u>. 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information, such as the EA that evaluated impacts the EPU at SSES (NRC 2007a). Documents reviewed included *Environmental Studies in the Vicinity of the Susquehanna Steam Electric Station – Water Quality and Fishes* and annual reports for the years of 1984, 1986, and 1994 (Ecology III 1985, 1987a, 1995). A bird collision study was conducted in September and October of 1978 for the meteorological tower and cooling tower, which was still under construction. These studies found 82 birds that were apparently killed by collisions with the towers. While there were 15 species of birds in this sample – the vast majority were red-eyed vireos (*Vireo olivaceus*) and various species of wood warblers – no endangered or threatened bird species were found (NRC 1981b). PPL is required to report and document any significant bird impacts, if they occur. No reports of significant bird strikes have been made by PPL to date. Therefore, the NRC staff concludes that there would be no impacts of bird collisions with cooling towers during the renewal term beyond those discussed in the GEIS.

- <u>Microbiological organisms (occupational health)</u>. 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information, such as the EA that evaluated impacts of the EPU at SSES (NRC 2007a). Therefore, the NRC staff concludes that there would be no impacts of microbiological organisms on occupational health during the renewal term beyond those discussed in the GEIS.

- <u>Noise</u>. 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information, such as the EA that evaluated impacts of the EPU at SSES (NRC 2007a). Therefore, the NRC staff concludes that there would be 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 SSES Units 1 and 2 are discussed in the sections that follow and are listed in Table 4-2.

4.1.1 Water Use Conflicts (Make-Up from a Small River)

NRC specifies in 10 CFR 51.53(c)(3)(ii)(A) that "if the applicant's plant uses cooling towers or cooling ponds and withdraws make-up water from a river whose annual flow rate is less than 3.15×10^{12} cubic feet per year (ft^3/yr) (9×10^{10} cubic meters per year), an assessment of the impact of the proposed action on the flow of the river and related impacts on instream and riparian ecological communities must be provided." For water use conflicts, the NRC further states in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, "The issue has been a concern at nuclear power plants with cooling ponds and at plants with cooling towers. Impacts on instream and riparian communities near these plants could be of moderate significance in some situations." This issue is applicable to SSES because the plant uses cooling towers and the annual mean flow of the Susquehanna River at the location of SSES is approximately

Table 4-2. Category 2 Issues Applicable to the Operation of the SSES 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
PUBLIC HEALTH			
Microbiological organisms (public health) (plants using lakes or canals, or cooling towers or cooling ponds that discharge to a small river)	4.3.6	G	4.1.2

4.6×10^{11} ft^3/yr (1.3×10^{10} m^3/yr) (Ecology III 2003), thus meeting the NRC's definition of a small river. Consumptive water use can adversely impact riparian vegetation and associated animal communities by reducing the amount of water available for plant growth, maintenance, and reproduction.

Once the EPU is implemented, SSES will withdraw an average of about 60.9 million gallons per day (mgd) (230 million L/d) of water from the Susquehanna River for cooling tower evaporative losses and other plant needs, with a maximum daily water withdrawal estimate of 65.4 mgd (248 million L/d). This represents a 4.5 and 12.2 percent increase, respectively, in intake water withdrawn from the Susquehanna River from pre-EPU conditions (NRC 2007a). Some of this water would be returned to the river as cooling tower blowdown, with the difference equaling the amount of consumptive water use by SSES. Consumptive water use due to evaporation and drift of cooling water through the SSES cooling towers is expected to increase from 38 mgd (144 million L/d) to 44 mgd (166 million L/d). Based on the Susquehanna River's annual mean flow rate, an average annual loss of 0.5 percent of river water at the SSES location would result. During low-flow conditions, which usually occur in late August, the average evaporative loss at SSES could approach 1 percent of river flow (PPL 2006b).

Consumptive water usage at SSES is regulated by the Susquehanna River Basin Commission (SRBC), an independent agency that manages water usage along the entire length of the Susquehanna River, from New York State, through Pennsylvania and Maryland. The prior permit granted for SSES operation by SRBC allowed average monthly consumptive water usage up to 40 mgd (6.25×10^6 ft^3/d) (1.8×10^5 m^3/d) (Permit No. 19950301-1 EPUL-0578). In December 2006, PPL submitted an application to SRBC to eliminate the 40 mgd average monthly consumption limit and to approve a maximum daily river water withdrawal of 66 mgd (2.97×10^5 m^3/d) (Fields 2007). SRBC has approved this increase (SRBC 2007a). The SRBC permit is required for SSES operation, and PPL must adhere to the prescribed water usage limits and any applicable mitigative measures. SSES currently meets SRBC requirements by providing additional water (from the Cowanesque Lake Reservoir, operated by the U.S. Army Corps of Engineers) to the Susquehanna River during low-flow conditions (PPL 2006a).

The NRC staff has reviewed the available information, including that provided by the applicant, the site audit, the scoping process, discussions with SRBC, and other available sources. The NRC staff assumes that PPL would continue to adhere to SRBC regulations regarding consumptive water use and appropriate mitigative measures (given SRBC's regulatory authority), and, as such, the impact of water use would be SMALL.

The staff identified several measures that could mitigate potential impacts resulting from continued operation of the SSES cooling water system, although it should be noted the NRC cannot impose mitigation requirements on the applicant. Mitigation measures to reduce consumptive surface water use from the SSES cooling water system include reducing planned power production in order to use less cooling water, or providing dry cooling to supplement the natural draft cooling system. Reducing SSES power production may create a need for replacement power.

The staff did not identify cost/benefit studies applicable to these mitigation measures. The SRBC has the authority to require or enforce mitigation measures related to consumptive water use.

4.1.2 Microbiological Organisms (Public Health)

The effects of microbiological organisms on human health are listed as a Category 2 issue and require plant-specific evaluation before license renewal for those plants with closed-cycle cooling on a small river. The average annual flow of Susquehanna River in the vicinity of the SSES site is approximately 4.83×10^{11} ft^3/yr (1.37×10^{10} m^3/yr) (PPL 2006a), which is less than the 3.15×10^{12} ft^3/yr (9×10^{10} m^3/yr) threshold value in 10 CFR 51.53(c)(3)(ii)(G) for thermal discharge to a small river. Hence, the effects of its discharge on microbiological organisms must be addressed for SSES.

PPL consulted the Pennsylvania Department of Environmental Protection (PDEP), Bureau of Water Supply and Wastewater Management, Division of Water Quality Assessment and Standards, to determine whether there was any concern about the potential occurrence of thermophilic microorganism in the Susquehanna River at the SSES location (PPL 2005b). The PDEP indicated that it does not collect any microorganism data in the vicinity of the SSES site on the North Branch Susquehanna River (PDEP 2005a). Nevertheless, recreational uses of the Susquehanna River in the vicinity of the plant, which include boating, fishing, and canoeing, create the potential for human exposure to microbiological organisms.

The Category 2 designation is based on the magnitude of the potential public health impacts associated with thermal enhancement of enteric pathogens such as *Salmonella* spp. and *Shigella* spp., the *Pseudomonas aeruginosa* bacterium, the thermophilic Actinomyces fungi, the pathogenic strain of the free-living amoebae *Naegleria* spp., and a number of species from genus *Legionella* (NRC 1996). Thermophilic bacteria generally occur at temperatures of 77 to 176°F (25 to 80°C), with optimal growth occurring between 122 and 150°F (50 and 66°C) and minimum tolerance of 68°F (20°C) (Joklik and Willett 1976). However, thermal preference and tolerances vary across the bacteria family. Pathogenic microorganisms that are of concern in the nuclear power reactor operation typically have optimal growing temperatures of approximately 99°F (37°C) (Joklik and Smith 1972). Some of these microorganisms are discussed below.

Pseudomonas aeruginosa is an opportunistic pathogen that causes serious and sometimes fatal infections in immunocompromised individuals. The organism produces toxins that are harmful to humans and animals. It has an optimal growth temperature of 99°F (37°C) (Todar 2007). *Legionella* spp. consists of at least 46 species and 70 serogroups, and is responsible for Legionnaires' disease with the onset of pneumonia in the first two weeks of exposure. Risk groups for *Legionella* spp. include the elderly, cigarette smokers, persons with chronic lung or immunocompromising disease, and persons receiving immunosuppressive drugs. *Legionella* spp. grows best at 90 to 105°F (32 to 41°C) (CDC 2007a). *Salmonella typhimurium* and *S. enteritidis* are the two of the more common species of the Enterobacteriaceae that cause fever, abdominal cramps, and diarrhea (sometimes bloody).

Salmonella spp. can occasionally establish localized infection (e.g., septic arthritis) or progress to sepsis. The affected groups include all ages, but groups at greatest risk for severe or complicated disease include infants, the elderly, and persons with compromised immune systems. *Salmonella* spp. occur at temperatures between 50 and 120°F (10 and 49°C) (Aserkoff et al. 1970; CDC 2007b), with optimal growth occurring at 95 to 99°F (35 to 37°C) (ESR 2001). The pathogenic amoeba flagellate *Naegleria fowleri* is the causative agent of human primary amoebic meningoencephalitis. The affected groups include all ages, but groups at greatest risk for severe or complicated disease include infants, the elderly, and persons with compromised immune systems. *Naegleria* spp. is ubiquitous in nature and can be enhanced in thermally altered water bodies at temperatures ranging from 95 to 106°F (35 to 41°C) or higher, but this organism is rarely found in water cooler than 95°F (35°C), and infection rarely occurs at this water temperatures (Tyndall et al. 1989).

The ambient temperatures of the Susquehanna River near the SSES site vary from freezing (approximately 32°F [0.0°C]) in the winter to 85°F (29°C) in the summer. Therefore, ambient river conditions are not likely to support the proliferation of pathogenic organisms of concern.

During August, ambient river temperatures average 77°F (25°C) with a maximum temperature of 85°F (29°C) (NRC 1981). Blowdown temperature is 92°F (33°C) at an ambient river temperature of 85°F (29°C). Temperatures at the edge of the mixing zone were calculated to be 86°F (30°C) and 87°F (30.6°C) at medium and low river discharge flows of 3400 cfs (96,300 L/s) and 880 cfs (25,000 L/s), respectively (NRC 1981). These mixing zones are located 140 ft (43 m) and 115 ft (35 m) downstream of the discharge pipe, respectively (NRC 1981). The small mixing zone plume of <0.4 acre (0.16 ha) is at the lower range of the optimal growth rate for several of the thermophilic microbiological organisms. However, these organisms would be entrained through this thermal plume for about 0.5 to <8 min, based on river velocities of 0.3 to 5.5 ft/s (0.1 to 1.7 m/s) (NRC 1981). As the growth rate for microbiological organisms is measured in hours to days (e.g., Hendricks 1972), it is not expected that the short period of plume passage would notably affect growth rates of microbiological organisms compared to ambient river temperatures.

The current NPDES permit requires SSES to monitor fecal coliforms in the plant's sewage treatment effluent. Fecal coliform bacteria are classified within the family Enterobacteriaceae. The most common species of fecal coliform is *Escherichia coli*, which are prokaryotic, gram-negative, rod-shaped bacteria. The value of determining fecal coliform concentrations in a water source is to establish the extent to which the Susquehanna River has been polluted with fecal wastes. Its presence in the water is indicative of the potential for other pathogenic microbes, including those that cause typhoid fever, bacterial or viral gastroenteritis, or hepatitis A (NAS 2004). SSES has been collecting river water samples once per month for fecal coliform analysis and has been implementing a disinfection program of the SSES sewage treatment plant effluent in compliance with SSES NPDES permit requirements. In addition, the

NPDES permit requires SSES to control disease-producing organisms during the swimming season (May 1st through September 30th) through "effective disinfection" and impose a fecal coliform count limit of 200 cells per 100 milliliters.

The NRC staff independently reviewed the SSES ER, visited the SSES site, and reviewed the applicant's Commonwealth of Pennsylvania NPDES permit. Based on the evaluation presented above, thermophilic microbiological organisms are not likely to present a public health hazard as a result of SSES's discharges to the Susquehanna River. The NRC staff concludes that impacts on public health from thermophilic microbiological organisms from continued operation of SSES in the license renewal period would be SMALL. The staff identified a variety of measures that could mitigate potential thermophilic microbiological organism impacts resulting from continued operation of the SSES. These mitigation measures would include periodically monitoring for thermophilic microbiological organisms in the water and sediments near the discharge, as well as not allowing recreational use near the discharge plume. These mitigation measures could reduce human health impacts by minimizing public exposures to thermophilic microbiological organisms. The staff did not identify any cost benefit studies applicable to these mitigation measures.

4.2 Transmission Lines

The FES for SSES (AEC 1973; NRC 1981) described three short 230-kV ties, one 230-kV transmission line (Stanton-Susquehanna #2 line) and two 500-kV lines (Susquehanna-Wescosville-Alburtis and Sunbury-Susquehanna #2 lines), that connect SSES with the regional transmission grid. The transmission lines, as well as their ownership and responsibilities for their maintenance, are described in Section 2.1.7 of this draft SEIS. All of the transmission lines within the scope of this review are owned and operated by PPL.

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

ISSUE–10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
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 wetlands on power line right-of-way	4.5.7

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

ISSUE–10 CFR Part 51, Subpart A, Appendix B, Table B-1	GEIS Sections
AIR QUALITY	
Air quality effects of transmission lines	4.5.2
LAND USE	
Onsite land use	4.5.3
Power line rights-of-way	4.5.3

Category 1 issues in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 that are applicable to the within-scope transmission lines from SSES are listed in Table 4-3. PPL stated in its ER (PPL 2006a) that it is not aware of any new and significant information associated with issuance of the renewed SSES OLs. The NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information. Therefore, the NRC staff concludes that there would be no impacts related to these issues beyond those discussed in the GEIS. For all of those issues, the NRC staff concluded in the GEIS that the impacts would be SMALL, and that additional plant-specific mitigation measures would not likely be sufficiently beneficial to be warranted.

A brief description of the NRC staff's review and GEIS conclusions, as codified in 10 CFR Part 51, Table B-1, 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, consultation with the U.S. Fish and Wildlife Service (FWS), and evaluation of other information. Therefore, the NRC staff concludes that there would be no impacts of power line right-of-way maintenance 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, consultation with the FWS, and evaluation of other information. Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other information. Therefore, the NRC staff concludes that there would be no impacts of electromagnetic fields on flora and fauna during the renewal term beyond those discussed in the GEIS.

- Floodplains and wetland 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, consultation with the FWS, and evaluation of other information. Therefore, the NRC staff concludes that there would be no impacts of power line rights-of-way (ROWs) 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other information. Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other information. Therefore, the NRC staff concludes that there would be no onsite land-use impacts during the renewal term beyond those discussed in the GEIS.

- Power line rights-of-way. Based on information in the GEIS, the Commission found that

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

    The NRC staff has not identified any new and significant information during its independent review of the ER, or the site audit, the scoping process, and evaluation of other information. Therefore, the NRC staff concludes that there would be no impacts of power line ROWs on land use during the renewal term beyond those discussed in the GEIS.

There is one Category 2 issue related to transmission lines, and another issue related to transmission lines is being treated as a Category 2 issue, although it was not assigned a specific category in the GEIS. 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 the SSES Transmission Lines 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
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[(a)]	4.2.2

(a) Not addressed.

4.2.1 Electromagnetic Fields – Acute Effects

Based on the GEIS, the Commission found that electric shock resulting from direct access to energized conductors or from induced charges in metallic structures has not been found to be a problem at most operating plants and generally is not expected to be a problem during the license renewal term (see Table 4-4). However, site-specific review is required to determine the significance of the electric shock potential along the portions of the transmission lines that are within the scope of this Supplemental Environmental Impact Statement (SEIS).

In the GEIS, the NRC staff found that without a review of the conformance of each nuclear plant transmission line with National Electrical Safety Code (NESC) (IEEE 2002) 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 impact of the proposed action on the potential shock hazard from the transmission lines 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.

All transmission lines associated with SSES were constructed in accordance with NESC and industry guidance in effect at that time. The transmission facilities are maintained to ensure continued compliance with current standards. Since the lines were constructed, a new criterion has been added to the NESC for power lines with voltages exceeding 98 kV. This criterion states that the minimum clearance for a line must limit induced currents due to static effects to 5 milliamperes (mA).

PPL (2006a) has reviewed the transmission lines for compliance with this criterion. PPL indicated that all transmission lines within the scope of this review have been restudied and the results show there are no locations under the transmission lines that have the capacity to induce more than 5 mA in a vehicle parked beneath the lines. No induced shock hazard to the public should occur, since the lines are operating within original design specifications and meet current NESC clearance standards and land use adjacent to the lines has not changed.

The NRC staff has reviewed the available information, including the applicant's evaluation and computational results. Based on this information, the NRC staff evaluated the potential impacts for electric shock resulting from operation of SSES and its associated transmission lines. It is the NRC staff's conclusion that the potential impacts from electric shock during the renewal period would be SMALL.

The staff identified a variety of measures that could mitigate potential acute EMF impacts resulting from continued operation of the SSES's transmission lines. These mitigation measures would include erecting barriers along the length of the transmission line to prevent unauthorized access to the ground beneath the conductors, installing road signs at road crossings, and raising the elevation of the lowest energized conductor to increase the distance between it and a potentially exposed individual directly beneath it. These mitigation measures could reduce human health impacts by minimizing public exposures to electric shock hazards. NESC rules as specified in Part 2, Rules 232C1c and 232D3c contain provisions that are considered necessary for the protection of employees and the public from acute EMF hazards associated with transmission lines, including during the license renewal period. PPL currently meets these rules. The staff did not identify any cost benefit studies applicable to the mitigation measures mentioned above.

4.2.2 Electromagnetic Fields – Chronic Effects

In the GEIS, the chronic effects of 60-Hertz (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).

The report by NIEHS (1999) contains the following conclusion, which is supported by the World Health Organization's recently published Environmental Health Criteria Monograph No.238 (WHO 2007):

> 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 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 noncancer health outcomes provide sufficient evidence of a risk to currently warrant concern.

This statement is not sufficient to cause the NRC staff to change its position with respect to the chronic effects of electromagnetic fields. The NRC 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 SSES in regard to radiological impacts are listed in Table 4-5. PPL stated in its ER (PPL 2006a) that it is not aware of any new and significant information associated with the renewal of the SSES OLs. The NRC staff has not identified any new and significant information during its independent review of the PPL ER, or the site audit, the scoping process, and evaluation of other available information. Therefore, the NRC staff concludes that there would be no impacts related to these issues beyond those discussed in the GEIS. For these issues, the NRC 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 4-5. 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 Sections
HUMAN HEALTH	
Radiation exposures to public (license renewal term)	4.6.2
Occupational radiation exposures (license renewal term)	4.6.3

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

Radiation exposures to the 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information. Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information. Therefore, the NRC staff concludes that there would be 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. As stated in the GEIS, the impacts associated with these Category 1 issues were determined to be SMALL, and plant-specific mitigation measures would not be sufficiently beneficial to be warranted. The NRC staff reviewed and evaluated the SSES ER, scoping comments, other available information, and visited the SSES site in search of new and significant information that would change the conclusions presented in the GEIS. No new and significant information was identified during this review. Therefore, it is expected that there would be no impacts related to these Category 1 issues during the renewal term beyond those discussed in the GEIS.

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 Sections
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

The results of the NRC staff's review and a brief statement of GEIS conclusions, as codified in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, for each of the socioeconomic Category 1 issues are provided below:

- 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information. Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information. Therefore, the NRC staff concludes that there would be no impacts on education during the renewal term beyond those discussed in the GEIS.

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

  No significant impacts are expected during the license renewal term.

  The NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information. Therefore, the NRC staff concludes that there would be no aesthetic impacts during the renewal term beyond those discussed in the GEIS.

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

  No significant impacts are expected during the license renewal term.

  The NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information. Therefore, the NRC staff concludes that there would be 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 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 plant-specific reviews.

4.4.1 Housing Impacts During Operations

Appendix C of the GEIS presents a population characterization method based on two factors, "sparseness" and "proximity" (GEIS, Section C.1.4). Sparseness measures population density within 20 mi (32 km) of the site, and proximity measures population density and city size within 50 mi (80 km). 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).

According to the 2000 census, approximately 330,488 people lived within 20 mi (32 km) of SSES, which equates to a population density of 263 persons per square mile (PPL 2006a). This density translates to the least sparse Category 4 (greater than or equal to 120 persons per square mile within 20 mi [32 km]). Approximately 1,684,794 people live within 50 mi (80 km) of SSES (PPL 2006a). This equates to a population density of 215 persons per square mile. Applying the GEIS proximity measures, SSES is classified as proximity Category 4 (greater than or equal to 190 persons per square mile within 50 mi [80 km]). Therefore, according to the sparseness and proximity matrix presented in the GEIS, the SSES ranks of sparseness Category 4 and proximity Category 4 result in the conclusion that SSES is located in a high-population area.

Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, states that impacts on housing availability are expected to be of small significance in a high-population area where growth-control measures are not in effect. Since SSES is located in a high-population area and Luzerne and Columbia Counties are not subject to growth-control measures that would limit housing development, any SSES employment-related impact on housing availability would likely be SMALL. Since PPL has indicated that there would be no major plant refurbishment, employment levels at SSES would remain relatively unchanged with no additional demand for housing during the license renewal term. In addition, the number of available housing units has kept pace with or exceeded the low growth in the area population. Based on this information, there would be no impact on housing during the license renewal term.

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 demand; thus, there is no need to add capital facilities. Impacts are considered MODERATE if service capabilities are overtaxed during periods of peak demand. Impacts are considered LARGE if services (e.g., water, sewer) are substantially degraded and additional capacity is needed to meet ongoing demand. The GEIS indicated 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.

Analysis of impacts on the public water and sewer systems considered both plant demand and plant-related population growth. Section 2.1.3 of this draft SEIS describes the SSES permitted withdrawal rate and actual use of water.

As previously discussed in Section 2.2.8.2, SSES provides potable water for drinking, pump seal cooling, sanitation, and fire protection through the onsite groundwater well system. Three additional wells provide water to the Energy Information Center, Riverlands Recreation Area, and the West Building (former Emergency Operations Facility). SSES does not use water from a municipal system, and plant groundwater usage during the renewed license period of operations would be considered small. Further, no increase in plant demand is projected.

SSES operations during the license renewal term would also not increase plant-related population growth demand for public water and sewer services. Since PPL has indicated that there would be no major plant refurbishment, overall employment levels at SSES would remain relatively constant with no additional demand for public services. Both public and private water systems in the region would be adequate to provide the capacity and to meet the demand of residential and industrial customers in the area. Therefore, there would be no impact to public water and sewer services.

4.4.3 Offsite Land Use During Operations

Offsite land use during the license renewal term is a Category 2 issue (10 CFR Part 51, Subpart A, Appendix B, Table B-1). Table B-1 of 10 CFR Part 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 a result of plant operation during the license renewal term as follows:

SMALL – Little new development and minimal changes to an area's land-use pattern.

MODERATE – Considerable new development and some changes to the land-use pattern.

LARGE – Large-scale new development and major changes in the land-use pattern.

Tax revenue can affect land use because it enables local jurisdictions 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. If the plant's tax payments are projected to be a dominant source of the community's total revenue, new tax-driven land-use changes would be LARGE. This would be especially true where the community has no pre-established pattern of development or has not provided adequate public services to support and guide development.

Population-Related Impacts

Since PPL has estimated that at most, five non-outage employees may be needed during the license renewal period, there would be no noticeable change in land-use conditions in the vicinity of the SSES site. Therefore, the NRC staff concluded that there would be no land-use impacts during the license renewal term.

Tax Revenue-Related Impacts

In the past, PPL paid real estate taxes to the Commonwealth of Pennsylvania for power generation, transmission, and distribution facilities. Under authority of the Pennsylvania Utility Realty Tax Act (PURTA), real estate taxes collected from all utilities (water, telephone, electric, and railroads) were redistributed to the taxing jurisdictions within the Commonwealth. In Pennsylvania, these jurisdictions include counties, cities, townships, boroughs, and school districts. The distribution of PURTA funds was determined by formula, and was not necessarily based on the individual utility's effect on a particular government entity.

In 1996, Electricity Generation Customer Choice and Competition Act became law, which allows consumers to choose among competitive suppliers of electrical power. As a result of utility restructuring, Act 4 of 1999 revised the tax base assessment methodology for utilities from the depreciated book value to the market value of utility property. Additionally, as of January 1, 2000, PPL was required to begin paying real estate taxes directly to local jurisdictions, ceasing payments to the Commonwealth's PURTA fund.

As previously discussed in Chapter 2, PPL pays annual real estate taxes to Luzerne County, Berwick Area School District, and Salem Township. For the 5-year period from 2000 through 2004, tax payments to Luzerne County represented between 1.8 and 2.4 percent of the County's total annual property tax revenues, and payments to the Berwick Area School District represented approximately 5.5 to 6.9 percent of the School District's total revenues. PPL's tax payments to Salem Township make up a much larger percentage of that township's tax collection. For the period 2001 through 2004, tax payments to Salem Township represented 50.3 to 53.9 percent of the township's total revenues. Since PPL started making payments to local jurisdictions, population levels and land use conditions in Salem Township have not changed significantly, which might indicate that these tax revenues have had little or no effect on land-use activities within the township. However, discontinuing the current level of tax revenues would likely have a significant negative economic impact on the township.

PPL has indicated that there would be no major plant refurbishment or license renewal-related construction activities necessary to support the continued operation of the SSES during the license renewal period. Accordingly, there would be no increase in the assessed value of SSES and annual property taxes to Salem Township, the Berwick Area School District, and Luzerne County would remain relatively constant throughout the license renewal period. Based on this information, there would be no tax revenue-related land-use impacts during the license-renewal term.

4.4.4 Public Services: Transportation Impacts During Operations

Table B-1, 10 CFR Part 51, states: "Transportation impacts (level of service) of highway traffic generated ... during the term of the renewed license are generally expected to be of small significance. However, the increase in traffic associated with additional workers and the local road and traffic control conditions may lead to impacts of moderate or large significance at some sites." All applicants are required by 10 CFR 51.53(c)(3)(ii)(J) to assess the impacts of highway traffic generated by the proposed project on the level of service of local highways during the term of the renewed license.

Since PPL has estimated that at most, five non-outage employees may be needed during the license renewal period, there would be no noticeable change in traffic volume and levels of service on roadways in the vicinity of the SSES site. Therefore, there would be no transportation impacts during the license renewal term.

4.4.5 Historic and Archaeological Resources

The National Historic Preservation Act (NHPA), as amended, requires Federal agencies to take into account the effects of their undertakings on historic properties. Historic properties are defined as resources that are eligible for listing on the NRHP. The historic preservation review process mandated by Section 106 of the NHPA is outlined in regulations issued by the Advisory Council on Historic Preservation in 36 CFR Part 800. The issuance of a renewed OL for a nuclear power plant is an undertaking that could possibly affect either known or currently undiscovered historic properties that may be located on or near the plant site. In accordance with the provisions of the NHPA, the NRC is required to make a reasonable effort to identify historic properties in the areas of potential effect. If no historic properties are present or affected, the NRC is required to notify the State Historic Preservation Office (SHPO) before proceeding. If it is determined that historic properties are present, the NRC is required to assess and resolve possible adverse effects of the undertaking.

As discussed in Chapter 2, PPL contacted the Pennsylvania Historical and Museum Commission (PHMC) on March 24, 2005, regarding preparation of its application for license renewal (PPL 2006a). By letter dated May 20, 2005, the PHMC agreed that license renewal will have no adverse effect on significant cultural resources in the project area. In accordance with 36 CFR 800.8(c), the NRC contacted the PHMC (NRC 2006a), the Advisory Council on Historic Preservation (NRC 2006b), and the appropriate Federally recognized Native American Tribes with current and historic ties to the region in November 2006. These letters are listed in Appendix C.

On May 14, 2007, the NRC staff conducted a search of the PHMC files for the region around SSES. The area in and around the Susquehanna River Basin is rich in prehistoric deposits.

Since the construction of SSES, three onsite surveys have been conducted. The first survey examined the Knouse site, 36-LU-43, located on the eastern side of the Susquehanna River. The second survey focused on the western floodplain and identified three significant (36-LU-16, 36-LU-49, 36-LU-51) and one potentially significant (36-LU-15) prehistoric sites. Material from the sites range in date from Archaic to late Woodland periods, with one site containing material from the rare Transitional period between the Archaic and Woodland periods. The third survey examined the northern end of Gould Island and identified site 36-LU-105, a potentially eligible multi-component Archaic/Woodland site. In total, six prehistoric archaeological sites and several isolated finds have been identified on PPL property. Various other surveys conducted in close proximity to the SSES site have also identified archaeological sites dating from the late Archaic to Woodland periods. Consequently, there is the potential for historic and archaeological resources to be present on both undisturbed and minimally disturbed areas of the SSES site.

In addition to the prehistoric sites mentioned above, the SSES property also contains historic remains. Evidence of 19th and 20th century farmsteads is known to exist onsite. While no standing structures remain on these farmsteads, archaeological evidence may remain from these occupations. Portions of the North Branch Canal cross PPL property. PPL restored and maintains a section of the historic North Branch Canal. This canal is located at the Riverlands Recreation Area. Several historic (Native American) trails are reported to have followed the river. This also increases the potential for resources to be present onsite.

No impacts to known historic and archaeological resources are expected from license renewal. There are no planned expansions of the existing facilities and there are no planned refurbishment activities to support license renewal (PPL 2006a). Continued operations at SSES would likely protect any known archaeological sites present within the SSES site boundary by protecting those lands from development and providing secured access. PPL has demonstrated this by avoiding areas where known historic and archaeological sites are present. PPL has employed avoidance measures and has implemented mitigation measures recommended by the PHMC for sites that were deemed sensitive to operational activities. However, there is the potential for impacts to unknown historic and archaeological resources from continued operations. PPL maintains environmental review procedures to protect against impacts to historic and archaeological resources; however, the procedures only consider known historic and archaeological resources on plant property. There is a high potential for additional unknown cultural resources to be present at the SSES site, and the procedures do not address the treatment of inadvertent discoveries.

Based on the NRC staff's review of the PPL environmental review procedures, the PHMC files, archaeological reviews, surveys, assessments, and other information, the NRC staff concludes that the potential impacts on historic and archaeological resources at SSES could be MODERATE. PPL could mitigate this MODERATE impact by developing and implementing improved procedures or by examining the entire plant site for historic and archaeological resources. All resources would then be known and protected accordingly. Revised procedures would need to consider the potential impacts of plant operations on both known and unknown historic and archaeological resources at SSES. Additionally, training of PPL staff in the Section 106 process would ensure that informed decisions are made when considering the effects of projects on historic and archaeological resources. Lands not previously surveyed would require investigation by a professional archaeologist prior to any ground disturbing activities. Any changes to these procedures should be developed in consultation with the PHMC. The staff did not identify any cost benefit studies applicable to these mitigation measures.

4.4.6 Environmental Justice

Under Executive Order 12898 (Volume 59, p. 7629, of the *Federal Register* (59 FR 7629)), Federal agencies are responsible for identifying and addressing potential disproportionately high and adverse human health and environmental impacts on minority and low-income populations. In 2004, the Commission issued a *Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions* (69 FR 52040), which states, "The Commission is committed to the general goals set forth in E.O. 12898, and strives to meet those goals as part of its NEPA review process."

The Council on Environmental Quality (CEQ) provides the following information in *Environmental Justice: Guidance Under the National Environmental Policy Act* (CEQ 1997):

> **Disproportionately High and Adverse Human Health Effects.** Adverse health effects are measured in risks and rates that could result in latent cancer fatalities, as well as other fatal or nonfatal adverse impacts on human health. Adverse health effects may include bodily impairment, infirmity, illness, or death. Disproportionately high and adverse human health effects occur when the risk or rate of exposure to an environmental hazard for a minority or low-income population is significant (as defined by NEPA and appreciably exceeds the risk or exposure rate for the general population or for another appropriate comparison group.
>
> **Disproportionately High and Adverse Environmental Effects.** A disproportionately high environmental impact that is significant (as defined by NEPA) refers to an impact or risk of an impact on the natural or physical environment in a low-income or minority community that appreciably exceeds the environmental impact on the larger community. Such effects may include ecological, cultural, human health, economic, or social impacts. An adverse environmental impact is an impact that is determined to be both harmful and significant (as defined by NEPA). In assessing cultural and aesthetic environmental impacts, impacts that uniquely affect geographically dislocated or dispersed minority or low-income populations or American Indian Tribes are considered.

The environmental justice analysis assesses the potential for disproportionately high and adverse human health or environmental effects on minority and low-income populations that could result from the operation of SSES during the renewal term. In assessing the impacts, the following CEQ (1997) definitions of minority individuals and populations and low-income population were used:

> **Minority individuals.** Individuals who identify themselves as members of the following population groups: Hispanic or Latino, American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, or two or more races meaning individuals who identified themselves on a census form as being a member of two or more races, for example, Hispanic and Asian.
>
> **Minority populations.** Minority populations are identified when (1) the minority population of an affected area exceeds 50 percent or (2) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.
>
> **Low-income population.** Low-income populations in an affected area are identified with the annual statistical poverty thresholds from the Census Bureau's Current Population Reports, Series PB60, on Income and Poverty.

Minority Population in 2000

According to 2000 census data, an average 3.8 percent of the population residing within a 50-mi (80-km) radius of SSES were minority individuals. The largest minority group was Hispanic (2.7 percent), followed by Black or African American (1.8 percent). About 4 percent of the Luzerne County population are minorities, with Black or African American being the largest minority group (1.6 percent), followed by Hispanic (1.2 percent).

Census block groups with minority populations exceeding 3.8 percent were considered minority block groups. Based on 2000 census data, Figure 4-1 shows minority block groups that exceeded the average for the area within 50 mi (80 km) of SSES.

Low-Income Population in 2000

According to 2000 census data, approximately 10.3 percent of the population residing within a 50-mi radius of SSES were identified as living below the Federal poverty threshold. The 1999 Federal poverty threshold was $17,029 for a family of four. According to 2000 census data, the median household income for Pennsylvania in 1999 was $40,106, while 11 percent of the State population was determined to be living below the 1999 Federal poverty threshold.

Luzerne County had one of the lower median household incomes ($33,771) and a similar percentage (11.1 percent) of individuals living below the poverty level when compared to the State. Columbia County also had one of the lower median household incomes ($34,094) and the highest percentage (13.1 percent) of individuals living below the poverty level when compared to other counties in the area.

Census block groups were considered low-income block groups if the percentage of the population living below the Federal poverty threshold exceeded 11 percent. Figure 4-2 shows low-income block groups within a 50-mi (80-km) radius of SSES, based on 2000 census data.

Analysis of Impacts

Consistent with the impact analysis for the public and occupational health and safety, the affected populations are defined as minority and low-income populations who reside within a 50-mi (80-km) radius of SSES. Based on the analysis of impacts for other resource areas, there would be no high and adverse impacts from the operation of SSES during the license renewal period.

The NRC staff also analyzed the risk of radiological exposure through the consumption patterns of special pathway receptors, including subsistence consumption of fish, native vegetation, surface waters, sediments, and local produce; absorption of contaminants in sediments through the skin; and inhalation of plant materials. The special pathway receptors analysis is important to the environmental justice analysis because consumption patterns may reflect the traditional or cultural practices of minority and low-income populations in the area.

Subsistence Consumption of Fish and Wildlife

Section 4-4 of Executive Order 12898 (1994) directs Federal agencies, whenever practical and appropriate, to collect and analyze information on the consumption patterns of populations who rely principally on fish and/or wildlife for subsistence and to communicate the risks of these consumption patterns to the public. In this draft SEIS, NRC considered whether there were any means for minority or low-income populations to be disproportionately affected, by examining impacts to American Indian, Hispanic, and other traditional lifestyle special pathway receptors. Special pathways that took into account the levels of contaminants in native vegetation, crops, soils and sediments, surface water, fish, and game animals on or near the SSES site were considered.

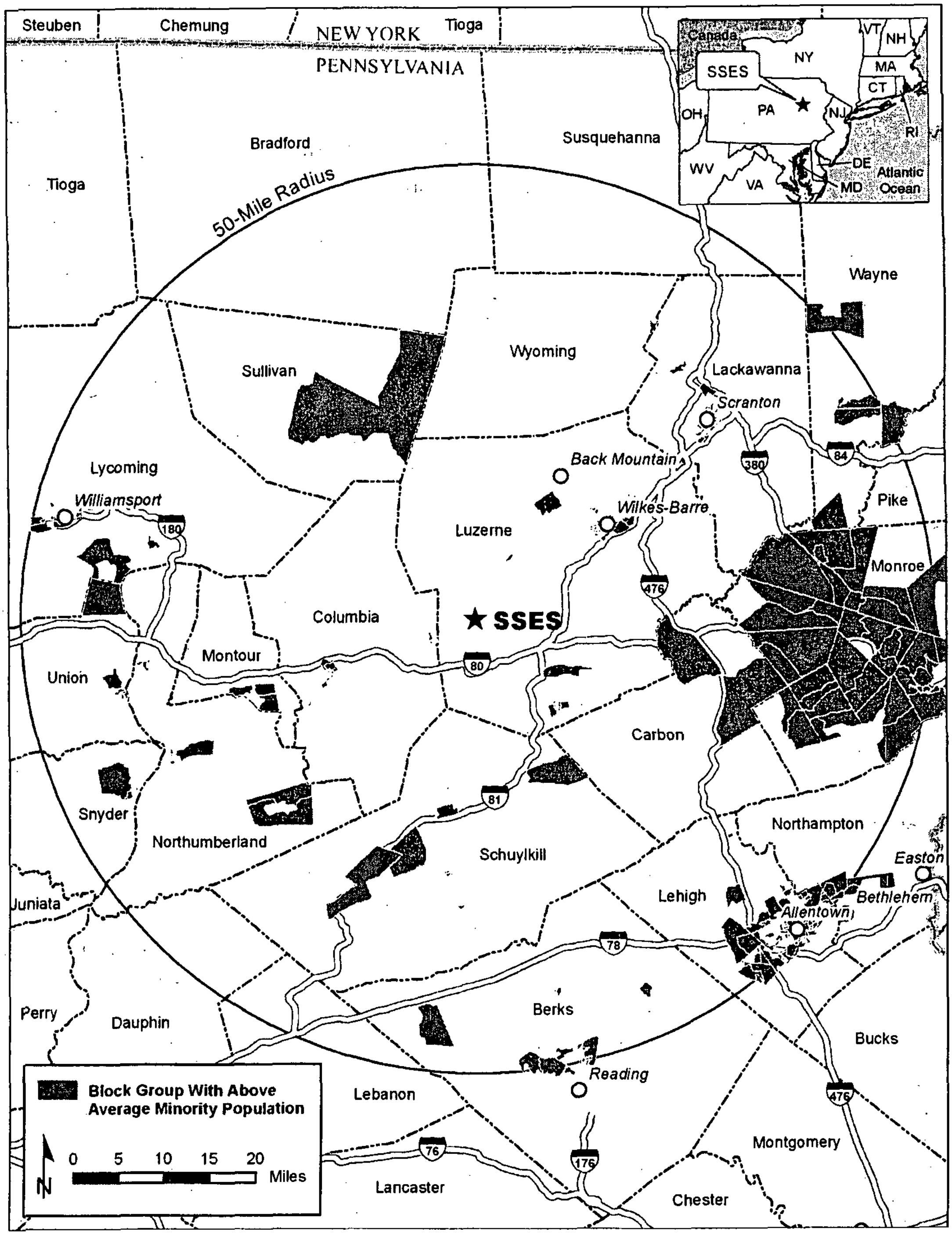

Figure 4-1. Minority Block Groups in 2000 Within a 50-mi (80-km) Radius of SSES (Source: USCB 2007)

PPL has a comprehensive Radiological Environmental Monitoring Program (REMP) at SSES to assess the impact of site operations on the environment. Samples are collected from the aquatic and terrestrial pathways applicable to the site. The aquatic pathways include fish, surface waters, and sediment. The terrestrial pathways include airborne particulates and radioiodine, milk, food products, and direct radiation. During 2005, 1245 analyses were performed on 884 collected samples of environmental media as part of the required REMP and showed no significant or measurable radiological impact from SSES operations. Cesium-137 was detected in soil samples at very low levels and was attributed to fallout from historic aboveground nuclear weapons testing, conducted in locations around the world (none near SSES) and carried to the SSES site by wind currents. The 2005 results for all samples are consistent with the previous 5-year historical results and exhibit no adverse trends (PPL 2006d).

The results of the 2005 REMP demonstrate that the routine operation at the SSES site had no significant or measurable radiological impact on the environment. No elevated radiation levels were detected in the offsite environment as a result of plant operations and the storage of radioactive waste. The results of the REMP continue to demonstrate that the operation of the plant did not result in a significant measurable dose to a member of the general population or adversely impact the environment as a result of radiological effluents (PPL 2006d). The REMP continues to demonstrate that the dose to a member of the public from the operation of SSES remains significantly below the Federally required dose limits specified in 10 CFR Part 20, 40 CFR Part 190, and 10 CFR Part 72.

The PDEP, Bureau of Radiation Protection (BRP), maintains a comprehensive environmental radiation monitoring program in Pennsylvania, as required by the Radiation Protection Act (No. 1984-147). The purpose of the program is to evaluate long-term trends in environmental radiation levels; assess the environmental impact of particular sites, such as SSES; and provide this information to the public. The BRP currently maintains offsite environmental radiation monitoring programs around five nuclear power plants in Pennsylvania, including SSES.

Monitoring stations serve as indicators of any effects from plant operation and at control locations that are beyond the measurable influence of the facility. These stations also provide verification of utility effluent monitoring programs during routine operations.

Each year, BRP collects dosimetry, air, water, milk, fish, produce, and sediment samples in the vicinity of SSES. Fish samples are collected in the vicinity of the SSES discharge, and produce samples of pumpkin are collected from a truck garden 3.3 mi (5.3 km) southwest of the plant. The truck garden is irrigated with water drawn from downstream of the station discharge. In 2001 and 2002, BRP found traces of cesium-137 in two milk samples taken at different locations and different times of the year near SSES. Cesium-137 was also found in all sediment samples collected from both upstream and downstream of station discharges. The

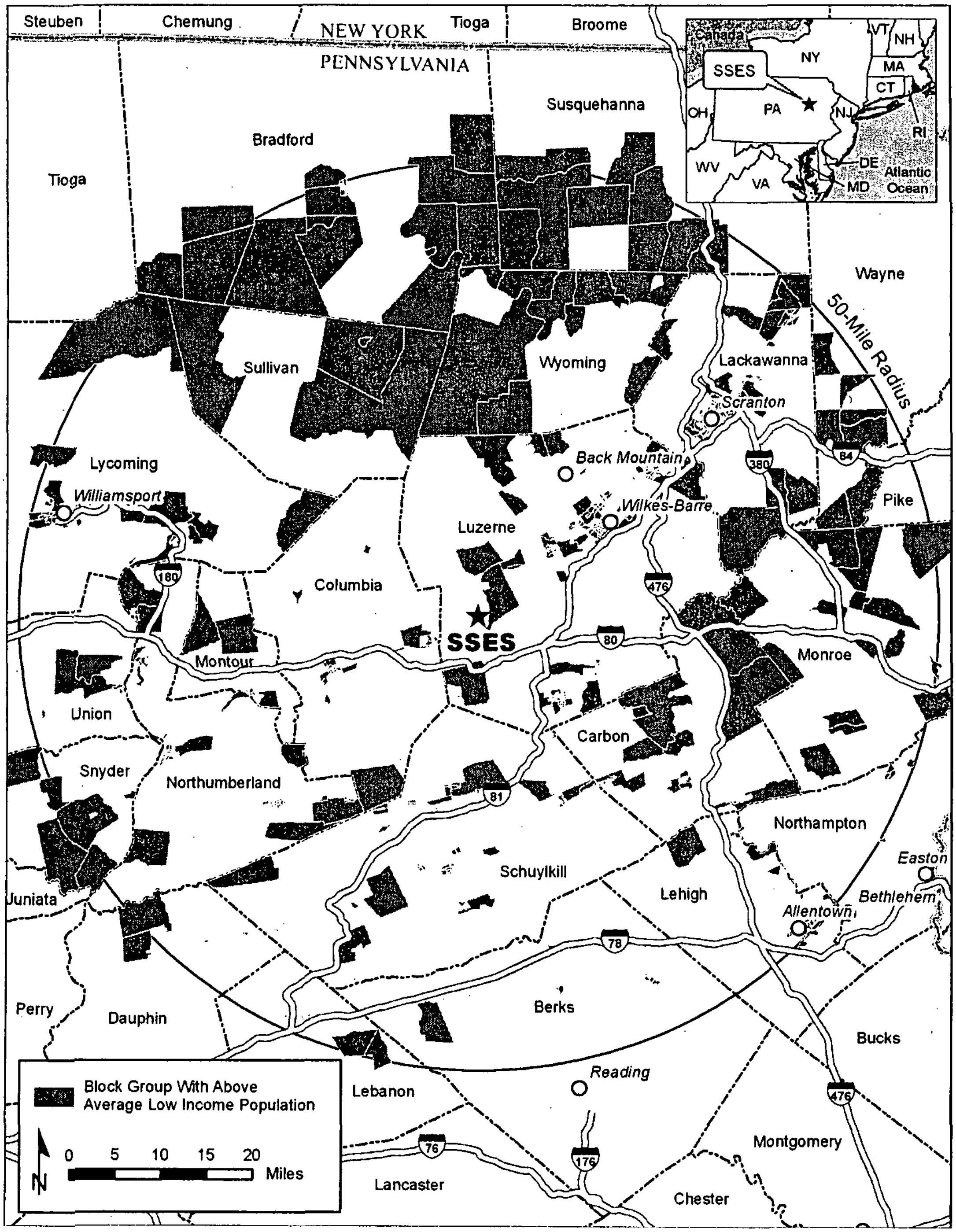

Figure 4-2. Low-Income Block Groups Within a 50-mi (80-km) Radius of SSES (Source: USCB 2007)

presence of this isotope is attributed to fallout from past weapons testing and the accident at Chernobyl in April 1986. The 2001 and 2002 environmental sampling program found no reactor-related radioisotopes in the fish or produce samples (PDEP 2005b).

The Academy of Natural Sciences of Philadelphia also conducts radiological environmental monitoring in the vicinity of SSES, which parallels (and partially overlaps) the SSES REMP. Called the Safety Net Program (SNP), this monitoring was initiated by PPL in 1979 as an extra measure to verify that the environment and public health are not impacted by the SSES. This non-mandatory program relies on the expertise provided by a consortium of independent, academically based experts to examine features of the natural environment not regularly studied by the REMP. The SNP monitors the aquatic and terrestrial pathways, and periodically expands the level of monitoring in each of these pathways.

Each year, the SNP consists of regular monitoring components and special research studies. Regular monitoring elements of the program are designed to maintain a continuous record of radionuclide concentrations in key living components of the terrestrial and aquatic environments near the SSES. Special studies conducted as part of the SNP have included a variety of activities in recent years, such as research projects designed to quantify radionuclide movement through aquatic and terrestrial food webs and surveys of angler and hunter activity and game meat consumption near the SSES. Using maximum concentrations of radionuclides measured in the 2000 SNP, the Academy calculated that the small hypothetical whole body effective dose that a person could expect to receive from the ingestion of food stuffs found in the vicinity of the SSES is primarily due to natural sources of radiation; these results were comparable to those found in previous years (Academy of Natural Sciences 2001).

As a special study in the 2000 SNP, the Academy performed an expanded, in-depth assessment of the health of the terrestrial environment. This consisted of a more rigorous radionuclide monitoring survey of terrestrial biota, including groups of animals and plants that have been examined historically as part of the SNP (e.g., squirrels, rabbits, and deer) as well as some groups (e.g., game birds) that have not been examined previously as part of the SNP. As was the case in previous years of the SNP, the Academy found in both the regular monitoring components and special research studies that no man-made radionuclides from the SSES were detected in the environment at concentrations that would pose any risk to either man or the natural ecosystem (Academy of Natural Sciences 2001).

Based on recent monitoring results, concentrations of contaminants in native vegetation, crops, soils and sediments, surface water, fish, and game animals in areas surrounding SSES have been quite low (at or near the threshold of detection) and seldom above background levels (PPL 2006d). Consequently, the NRC staff concludes that no disproportionately high and adverse human health impacts would be expected in special pathway receptor populations in the region as a result of subsistence consumption of fish and wildlife.

4.5 Groundwater Use and Quality

Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, shows the Category 1 issues potentially applicable to each license renewal site. The item "groundwater use conflicts (potable and service water; plants that use <100 gallons per minute (gpm))" is applicable to SSES (see Table 4.8). PPL stated in its ER (PPL 2006a) that it is not aware of any new or significant information associated with the issuance of renewed SSES OLs including the EPU planned for

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	
Groundwater use conflicts (potable and service water; plants that use <100 gpm)	4.8.1.1

2007. Evaluation by the NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and other report reviews. Therefore, the NRC staff concludes there would be no impacts related to this issue beyond those discussed in the GEIS. For the issue, the NRC staff concluded in the GEIS that the impact would be SMALL and that additional mitigative measures are not likely to be sufficiently beneficial to warrant implementation.

A brief description of the NRC staff's review and the GEIS conclusions, as codified in 10 CFR Part 51, Table B-1, follows:

- Groundwater-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, SSES groundwater use is less than 100 gpm (400 L/min). The NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information. Therefore, the NRC staff concludes that there would be no groundwater-use conflicts during the renewal term beyond those discussed in the GEIS.

The Category 2 issue related to groundwater use and quality during the renewal term is listed in Table 4-9. This issue requires a plant-specific analysis.

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 Sections	10 CFR Part 51.53(a)(3)(ii) Subparagraph	SEIS Section
GROUNDWATER USE AND QUALITY			
Groundwater-use conflicts (plants using cooling towers withdrawing make-up water from a small river)	4.8.1.3; 4.4.2.1	B	4.5

The issue of groundwater-use conflicts due to a plant taking make-up water from a small river is of potential concern because such surface water withdrawals could impact recharge to local groundwater resources. This issue is applicable to SSES because the plant uses cooling towers and the annual mean flow of the Susquehanna River at the location of SSES is approximately 4.6×10^{11} ft^3/yr (1.3×10^{10} m^3/yr) (Ecology III 2003), thus meeting the NRC's definition of a small river.

Including the recently-approved EPU, the amount of consumptive water usage due to evaporation and drift of cooling water through the SSES cooling towers is expected to increase from 38 mgd to 44 mgd (144 to 167 million L/d). Based on the Susquehanna River's annual mean flow rate, this results in an average annual loss of 0.5 percent of river water at the SSES location. During low-flow conditions, which usually occur in late August, the average evaporative loss at SSES may approach 1 percent of the low-flow river value (PPL 2006a). This relatively low amount of surface water loss is expected to have negligible effect on the recharge of local shallow aquifers.

The NRC staff has reviewed the available information, including that provided by the applicant, the NRC staff's site audit, the scoping process, discussions with SRBC, and other available sources. The NRC staff assumes that PPL and SSES will continue to adhere to SRBC regulations regarding consumptive water use and appropriate mitigative measures given SRBC's regulatory authority. As SSES uses a small fraction of the Susquehanna River's flow even during low-flow conditions, and as SRBC will continue to regulate SSES' water withdrawal and consumption, the impact of water use from continued operation would be SMALL.

The NRC staff identified several measures that could mitigate potential impacts resulting from SSES ground water use, although the NRC cannot impose mitigation requirements on the applicant. Mitigation measures addressing the plant's groundwater consumption could include a reduction in potable water use or recycling of gray water. Mitigation measures that would reduce the quantity of water removed from the Susquehanna River could include reducing planned power production to use less cooling water or providing dry cooling to supplement the existing natural draft cooling, as discussed in 4.1.1.

The staff did not identify cost/benefit studies applicable to these mitigation measures. Further, the SRBC holds the authority to require or enforce mitigation measures related to consumptive water use.

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 Category 2 issue requires consultation with appropriate agencies to determine whether threatened or endangered species are present and whether they would be adversely affected by continued operation of SSES during the license renewal term. The characteristics and habitat of threatened or endangered species in the vicinity of the SSES site are discussed in Sections 2.2.5 and 2.2.6 of this draft SEIS.
On November 15, 2006, the NRC contacted FWS to request information on Federally listed threatened and endangered species and the impacts of license renewal (NRC 2006c). In response, on October 11, 2007, FWS provided information regarding Federally listed species that could occur in the vicinity of SSES or along the transmission line ROWs (FWS 2007).

On November 17, 2006, the NRC contacted the Pennsylvania Department of Conservation and Natural Resources (PDCNR) to request information on State-listed threatened and endangered species and the impacts of licensing renewal (NRC 2006d). In response, on January 8, 2007, PDCNR provided information regarding State-listed species that could occur in the vicinity of SSES or along the transmission line ROWs (PDCNR 2007a).

4.6.1 Aquatic Species

The NRC staff has reviewed the information provided by the applicant and publicly available information and has contacted the FWS, the PDCNR, and the Pennsylvania Fish and Boat Commission. No Federally listed threatened or endangered aquatic species or critical habitat occur in the Susquehanna River, in the vicinity of the SSES site, or in the water bodies crossed by the transmission line ROWs. Therefore, the NRC staff concludes that license renewal of SSES would have no effect on any Federally listed aquatic species.

4.6.2 Terrestrial Species

As discussed in Section 2.2.6.2, one Federally listed species – the endangered Indiana bat (*Myotis sodalis*) – was identified by the FWS as occurring near the SSES site and its associated transmission lines (FWS 2007). Due to the proximity of hibernacula, Indiana bats may occur at the site and along the transmission line ROWs. Because this species roosts and raises its young in trees in the summertime, impacts to the species could occur if large trees were disturbed or removed. The FWS has requested consultation regarding the removal of any trees larger than 5 in. (13 cm) diameter. Assuming the applicant continues the current practice of avoiding removal of large trees during months when Indiana bats may be roosting in trees (May to October) and consults with the FWS if such removal is necessary, no significant adverse impacts to the Indiana bat during the license renewal term are anticipated (FWS 2007).

As presented in Section 2.2.6.2, a number of State-listed species have been identified as occurring at or near the SSES site or transmission line ROWs. These include several birds – short-eared owl (*Asio flammeus*), upland sandpiper (*Bartramia longicauda*), American bittern (*Botaurus lentiginosus*), black tern (*Chlidonias niger*), least bittern (*Ixobrychus exilis*), osprey (*Pandion haliaetus*), bald eagle (*Haliaeetus leucocephalus*), peregrine falcon (*Falco peregrinus*), sedge wren (*Cistothorus platensis*); butterflies and skippers: the northern pearly-eye (*Enodia anthedon*), long dash (*Polites mystic*), mulberry wing (*Poanes massasoit*), Aphrodite fritillary (*Speyeria aphrodite*), and Baltimore checkerspot (*Euphydryas phaetonis*); and a wide variety of plant species.

PPL has environmental procedures – essentially instructional checklists – in place for new projects such as new roads, parking lots, and other construction activities related to operations during the license renewal term. These procedures currently consist of a generic evaluation performed by a biologist to determine potential impacts to threatened or endangered species and wetlands.

During the NRC staff's review, no significant adverse impacts to federally-listed terrestrial threatened or endangered species have been identified or are expected (FWS 2007). If PPL successfully applies existing environmental procedures during the license renewal term, the NRC staff believes that adverse impacts during the renewal term would be SMALL.

The staff identified a variety of measures that could mitigate potential impacts to listed species resulting from continued operation of SSES. Mitigation measures could include increasing the time period during which PPL avoids removing trees in transmission line ROWs, preventing development or degradation of current onsite or ROW habitats, providing nesting or roosting sites for threatened or endangered bird species, and preserving or establishing butterfly habitat. The staff did not identify any cost benefit studies applicable to these mitigation measures.

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

The NRC staff has not identified new and significant information on environmental issues listed in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, related to operation during the renewal term. The NRC staff also determined that information provided during the public comment period did not identify any new issues that require site-specific assessment. The NRC staff reviewed the discussion of environmental impacts in the GEIS and conducted its own independent review (including public scoping meetings) to identify new and significant information. Processes for identification and evaluation of new information are described in Section 1.2.2.

4.8 Cumulative Impacts

The NRC staff considered potential cumulative impacts on the environment resulting from the incremental impact of license renewal when added to other past, present, and reasonably foreseeable future actions. For the purposes of this analysis, past actions are those related to the resources at the time of the power plant licensing and construction, present actions are those related to the resources at the time of current operation of the power plant, and future actions are considered to be those that are reasonably foreseeable through the end of plant operation, including the 20-year license renewal term. The geographic area over which past, present, and future actions are assessed is dependent on the affected resource.

The impacts of the proposed action, as described in Chapter 4, are combined with other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. These combined impacts are defined as "cumulative" in 40 CFR 1508.7 and include individually minor but collectively significant actions taking place over a period of time. It is possible that an impact that may be SMALL by itself could result in a MODERATE or LARGE impact when considered in combination with the impacts of other actions on the affected resource. Likewise, if a resource is regionally declining or imperiled, even a SMALL individual impact could be important if it contributes to or accelerates the overall resource decline.

The NRC staff has has identified reasonably foreseeable actions occurring in the future that are considered in this review for its cumulative impacts on the environment. A potentially-significant reasonably foreseeable future action involves an application to construct and operate one or two new nuclear reactor units at the SSES site.

Two letters of intent to submit a combined construction and operating license (COL) application for a new unit at the site were sent to the NRC by PPL on May 24 and June 13, 2007 (PPL Generation 2007). The letters state that a COL application could be submitted to the NRC during the third quarter of 2008. In addition, in a conference call held on July 19, 2007, between the NRC staff and representatives of PPL Susquehanna, LLC and PPL Generation, PPL Generation indicated that either one or two additional units are being considered for the SSES site (NRC 2007b).

The specific cumulative impacts of the COL action will depend on the actual design, characteristics, and construction practices that could be proposed by the applicant. Such details are not available at this time, but if such an application is submitted to the NRC the detailed environmental impacts of the COL action at the SSES site would be analyzed and addressed in a separate NEPA document prepared by NRC staff.

Submitting a COL application does not commit PPL to build one or two new nuclear units, and does not constitute approval of the proposal by the NRC. If such an application is submitted, it will be evaluated on its merits and after considering the safety and environmental implications of the proposal, the NRC will decide whether to approve or deny a license.

The following sections include a qualitative discussion of potential impacts associated with one or two additional nuclear generating units at the site, as well as the impacts associated with other past, present, and reasonably foreseeable future actions. While the description might be limited due to unavailability of specific information, the NRC staff based its assessment on scientific principles and professional judgment.

4.8.1 Cumulative Impacts on Aquatic Resources and Surface Water

This section assesses the impacts of the proposed action that relate to the withdrawal and discharge of river water by the SSES closed-cycle cooling system, combined with other past, present, and reasonably foreseeable future actions that occur within the defined geographic area of the Susquehanna River. The Susquehanna River Basin encompasses land in New York, Pennsylvania, and Maryland. The SRBC has divided the basin into subbasins according to geographic features of the land and the corresponding drainage area. For the purpose of this analysis, the geographic area considered for cumulative impacts on aquatic resources at SSES focuses on the portion of the Susquehanna River in the Middle Susquehanna Subbasin (Figure 4-3). Starting at the northern end of the Middle Susquehanna Subbasin, the Susquehanna River runs southeast through Towanda, in Bradford County, continues through the center of Wyoming County, and joins the Lackawanna River before turning and flowing southwest through Luzerne and Columbia Counties to Sunbury (SRBC 2007b). SSES is located in Luzerne County about 2 mi (3 km) upstream from where Wapwallopen Creek enters the river.

The drainage area of the Middle Susquehanna Subbasin is almost 2.5 million ac (1 million ha), and the Lackawanna River is the major tributary to the river. Approximately 16 percent of the entire Susquehanna River Basin population resides in the Middle Susquehanna Subbasin. The major population area of the Middle Susquehanna Subbasin is Wyoming Valley, stretching from Carbondale in the north and along the Lackawanna River to Nanticoke in the south, along the Susquehanna River. Scranton, Wilkes-Barre, Carbondale, and Sunbury are the major cities that comprise this highly populated coal mining region (SRBC 2007b). Pollution from commercial, residential, and industrial development and agricultural practices in the Middle Susquehanna Subbasin has contributed to water quality issues in the Susquehanna River. According to the Chesapeake Bay Foundation (CBF), more than 60 percent of the Susquehanna River's phosphorous, nitrogen, and sediment pollution can be attributed to agricultural runoff, including livestock manure, fertilizers, and topsoil, and urban and suburban storm water flows. Other sources of anthropogenic pollution in the Middle Susquehanna Subbasin include improperly treated wastewater, vehicle exhaust, coal-fired power plant emissions, industrial discharges, and illegal dumping (CBF 2005). Anthropogenic sources of pollution will likely be an ongoing issue for the Susquehanna River. However, SRBC, PDEP, and other environmental groups such as the CBF are working collaboratively in their efforts to conduct basin-wide monitoring and promote watershed protection and management, and water quality regulations will continue to be enforced by the PDEP through the NPDES permitting program.

Almost a century of intensive anthracite coal mining within the Wyoming Valley seriously impaired the Susquehanna River water quality and its ecological resources. The river was the recipient of the highly acidic, iron-rich drainage from numerous mining sites that operated in the Middle Susquehanna Subbasin from the late 1800s through the early 1970s. Anthracite mining reached its peak at about 1930 and ceased almost entirely in 1972, due to the evolving fossil fuel economy. However, the mines still leaked iron-contaminated acidic runoff to the river for many years following their abandonment. Prior to construction of SSES, during low-flow periods the Susquehanna River had a yellow cast due to the high iron content caused by the upstream mining effluents. In addition to high levels of total iron, mining effluents were also responsible for the high sulfate content and low pH and dissolved oxygen levels in the river. The impaired water quality of the river resulted in major fish kills (AEC 1973).

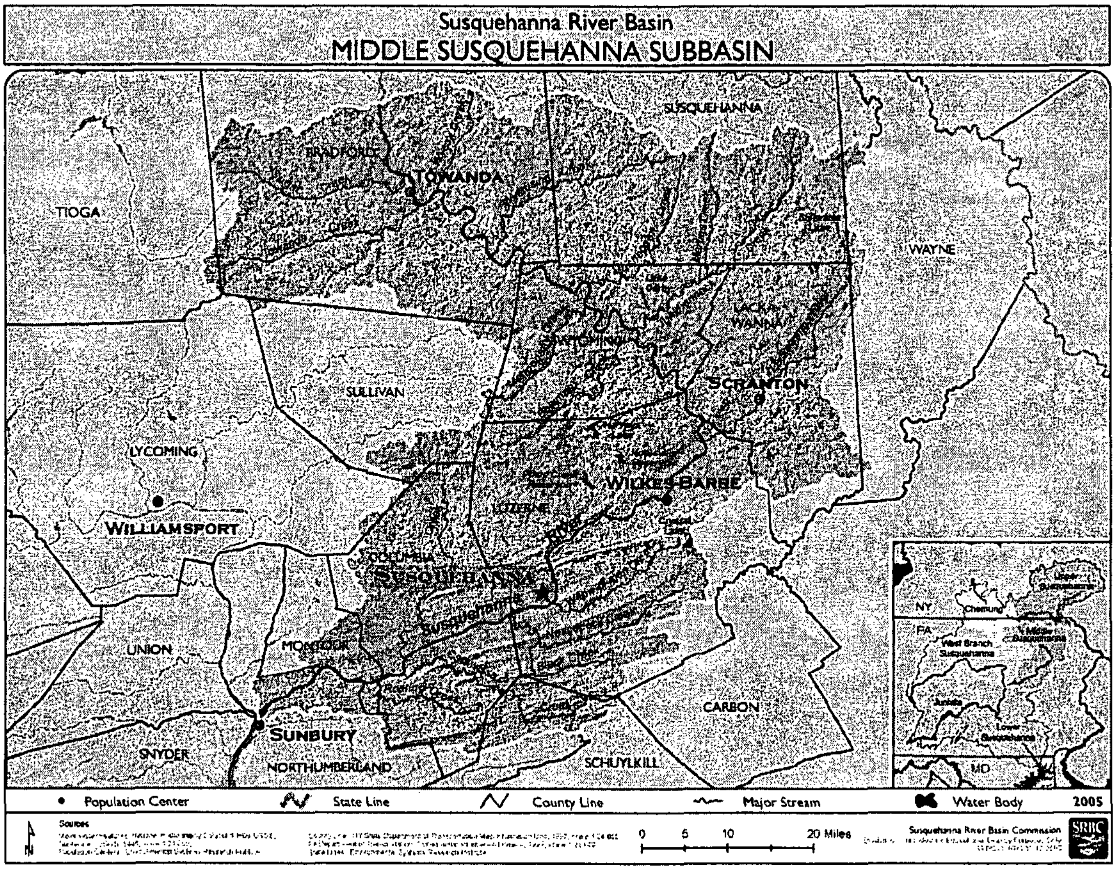

Figure 4-3. Middle Susquehanna Subbasin (Source: Adapted from SRBC 2007c)

Between 1972 and 1981, considerable improvement in the water quality of the Susquehanna River was noted. During this period, the volume of mining effluents being discharged to the river decreased. Dissolved solids, iron, and sulfate concentrations decreased, while pH and alkalinity of the river increased (NRC 1981). The water quality of the Susquehanna River has continued to improve, with the most significant change being a significant decrease in total iron levels, associated with the cessation of upriver mining (Ecology III 2007).

Municipal and industrial effluents to the Susquehanna River are, and will continue to be, regulated through NPDES permits issued by the PDEP Bureau of Water Supply and Wastewater Management. The PDEP periodically reviews and renews NPDES permits, thus it is reasonable to predict that the improving trends in Susquehanna River water quality will likely continue throughout the license renewal period.

Construction of hydroelectric dams on the river has also created significant impacts. As discussed in Section 2.2.5, the American shad is an anadromous species that was once of major sport and commercial importance within the Susquehanna River. Presently, American shad are rarely found in the upper reaches of the river because dams constructed in the last 100 years have blocked the species' natural upstream migration. Between 1904 and 1932, four hydroelectric dams were constructed on the Susquehanna River. Fish passage facilities on these early dams were primitive and failed to allow shad to pass. The 1928 construction of the 95-ft (29-m)-high Conowingo Dam, located just 10 mi (16 km) above the mouth of the Susquehanna River, effectively decimated the Susquehanna River shad migration, since authorities at the time deemed the dam too high to include fish passage (PFBC 2007).

Shad restoration attempts began in the mid-twentieth century with feasibility studies conducted by the Pennsylvania Fish Commission (now the Pennsylvania Fish and Boat Commission). From 1970 through 1980, the first Conowingo fish lift was built, and hatchery cultures of fry were stocked in the Susquehanna River and various tributaries. From 1985 through 1994, increasing numbers of fry were stocked, and over 125,000 adult shad were stocked above the Conowingo dam. Fry were stocked in the North Branch Susquehanna River in Pennsylvania and New York, the Chemung River in New York, the West Branch Susquehanna River, the Juniata River, the Susquehanna River near Montgomery Ferry, Conodoguinet Creek, the Conestoga River, Swatara Creek, and West Conewago Creek. During this period, the annual return of shad grew from 1500 to 60,000. From 1988 through 1997, a permanent fish passage facility was built at Conowingo Dam, multiple settlements with utilities that owned upstream dams were reached, and fish elevators were constructed at the Holtwood and Safe Harbor dams. In 1997, the shad return at Conowingo exceeded 100,000. In 1999 and 2000, a 500,000-shad fish ladder was completed at the Three Mile Island east channel dam, and smaller upriver dams along the Susquehanna River and major tributaries were reopened to natural shad migration through Binghamton, New York (PFBC 2007). The stocking program continues to be conducted annually in efforts to rebuild the American shad population in the Susquehanna River.

During the early shad restoration efforts, the FWS required SSES to monitor impingement rates of juvenile shad. Thus, as part of its annual environmental monitoring program, SSES routinely monitored its intake screens for aquatic organisms, paying particular attention to the impingement of shad. From 2001 to 2005, only one shad was collected from the intake screens. Because SSES uses a closed-cycle cooling water system, impingement at SSES has had a negligible impact upon shad restoration efforts.

Under EPU conditions, SSES will withdraw an average of about 60.9 mgd (230 million L/d) of water from the Susquehanna River for cooling tower evaporative losses and other plant needs, with a maximum daily water withdrawal estimate of 65.4 mgd (248 million L/d). This represents a 4.5 and 12.2 percent increase, respectively, in intake water withdrawn from the Susquehanna River from pre-EPU conditions (NRC 2007a). Some of this water would be returned to the river as cooling tower blowdown, with the difference equaling the amount of consumptive water use by SSES. Consumptive water use due to evaporation and drift of cooling water through the SSES cooling towers is expected to increase from 38 mgd (144 million L/d) to 44 mgd (166 million L/d). Based on the Susquehanna River's annual mean flow rate, an average annual loss of 0.5 percent of river water at the SSES location would result. During low-flow conditions, which usually occur in late August, the average evaporative loss at SSES could approach 1 percent of the river flow (PPL 2006b).

Consumptive water use at SSES, and at all facilities withdrawing water from the Susquehanna River, is regulated by SRBC, an independent agency that manages water usage along the entire length of the Susquehanna River. Water use in the Middle Susquehanna Subbasin consists of 40.7 percent power generation, 37.6 percent municipal use, 15.2 percent industrial use, 4.1 percent agricultural use, and 2.4 percent domestic use (SRBC 2007b). To ensure the water resources of the Susquehanna River Basin continue to meet the needs of the basin population, SRBC coordinates with other State and Federal agencies and conducts extensive water resource monitoring, project review, water withdrawal registration, drought coordination, low-flow management (i.e., water storage), reservoir feasibility studies, and groundwater management (SRBC 2007d). In December 2006, PPL submitted an application to SRBC to eliminate the 40 mgd (150 million L/d) average monthly consumption limit and to approve a maximum daily river water withdrawal of 66 mgd (250 million L/d) (Fields 2007). SRBC has approved this increase (SRBC 2007a). SSES expects to consume an average of 44 mgd (167 million L/d) after the EPU (NRC 2007a), which represents less than 1 percent of the total average flow in the Susquehanna River in this area. Under regulation by SRBC, the operation of SSES for an additional 20 years beyond the original license term would not be expected to affect Susquehanna River surface water availability.

As noted above, PPL submitted to the NRC letters of intent to file a COL application for a third reactor at the SSES site. A third and possible fourth unit at the SSES would increase the amount of surface water withdrawn from the Susquehanna River, thus increasing consumptive water use and blowdown discharged to the river. Should one or two additional units be constructed, water demands would presumably be approximately double current consumption depending on unit size and cooling system characteristics. If the EPU water consumption rate is increased by 100 percent and compared to the average flow of the Susquehanna River, the consumption would be less than 2 percent of the river flow. SRBC would also regulate surface water withdrawals for the new reactors, setting consumptive water use limits and prescribing mitigative measures during low-flow conditions. Based on the independent review by NRC staff, the impacts of increased consumptive use would likely be SMALL.

The increase in water withdrawal from the Susquehanna River would likely increase rates of impingement and entrainment. Because the new units would also use closed-cycle cooling, the additional entrainment and impingement impacts would be minimal, and they would be monitored and controlled in a manner similar to that for the current two units. Construction for the new units could also have temporary effects, including runoff, sedimentation, and dredging. The increased footprint of the new units could also lead to additional runoff throughout operations. A complete review of the impacts from construction and operation of the new units would be included in future NEPA documentation if PPL proceeds with its application.

The NRC staff has determined that the cumulative impacts on aquatic resources resulting from all past, present, and reasonably foreseeable future actions, including non-SSES actions, would be MODERATE to LARGE, due mostly to past actions including local anthracite mining and dam construction along the Susquehanna River. The NRC staff concludes, however, that the SMALL impacts of the SSES closed-cycle cooling system operations, including entrainment and impingement of fish and shellfish, heat shock, or any of the cooling system-related Category 1 issues, would not contribute to an overall decline in water quality or status of aquatic resources. Therefore, the NRC staff concludes that the potential contribution of SSES operations during the license renewal term on cumulative impacts to aquatic resources would be SMALL.

4.8.2 Cumulative Impacts on Terrestrial Resources

This section analyzes past, present, and future actions that could result in adverse cumulative impacts on terrestrial resources. For the purposes of this analysis, the geographic area considered includes Carbon, Columbia, Lehigh, Luzerne, Montour, Northampton, Northumberland, and Snyder Counties, which contain SSES and its associated transmission lines. Impacts that have occurred since station construction and that are likely to occur until the end of the license renewal term were considered, with some historical information provided to establish background.

At the time of station construction, terrestrial habitats on the site and along transmission lines were disturbed or destroyed. Continued operation and maintenance of the SSES site and transmission line ROWs maintain these areas in an altered condition. For some species, this impact has been offset by wildlife improvement programs.

In some areas, the construction of the transmission lines passed through forested areas, splitting them into smaller forested areas or fragments. This forest fragmentation effect converted areas of cool, shady interior forest to warm, open edge forest, with small trees, shrubs, and herbaceous vegetation within the ROW. This change favors plants that prefer warmer, drier, windier conditions, and animals that prefer a mix of herbs, shrubs, and trees (including Eastern cottontails [*Sylvilagus floridanus*], woodchucks [*Marmota monax*], mice [e.g., *Peromyscus* spp.], whitetail deer [*Odocoileus virginianus*], and various bird species), and disfavors species that prefer cooler, moister, calmer conditions found in the forest interior (AEC 1973). Allegheny wood-rats (*Neotoma magister*), wood thrush (*Hylocichla mustelina*), eastern wood-pewee, (*Contopus virens*), and scarlet tanager (*Piranga olivacea*) are on the decline in Pennsylvania, and forest fragmentation has been identified as a potential cause (PDCNR 2007b). In fragmented woods, native birds and mammals, including blue jays (*Cyanocitta cristata*), raccoons (*Procyon lotor*), foxes, squirrels, and feral house cats (*Felis silvestris)*, can prey more easily on warblers and their nests (Fergus 2004). Additionally, brown-headed cowbird (*Molothrus ater*) nest parasitism is exacerbated by forest fragmentation, and many forest interior birds have declined as a result of this parasitism. Many woodland nesting birds have declined in the State, and wetlands and grasslands have also declined (Moyer 2003).

Additionally, fragmentation can form a barrier to movement for some animal species, particularly insects and small mammals, which may have difficulty crossing transmission line ROWs (Forman 2001). Some species do not like to approach forest edges, so the effects of even a small break in the forest can be greater on these species than would be expected. When populations of a species become fragmented, the resulting subpopulations may become vulnerable to extinction, as individuals may lose access to habitat and mates.

Invasive species consist of plants and animals that are introduced from other areas and can quickly outcompete native species. Many invasive species prefer edge habitats, and may encroach into areas that are periodically cleared faster than areas of unbroken forest. Some species are already present along the Susquehanna River, and have demonstrated an ability to replace native species. These invasive species include the tree-of-heaven (*Ailanthus altissima*), Oriental bittersweet (*Celastrus orbiculatus*), and garlic mustard (*Alliaria officinalis*), and they have encroached into woodland areas, while purple loosestrife (*Lythrum salicaria*), wild hops (*Humulus japonicus*), and Japanese knotweed (*Polygonum cuspidatum*) have colonized areas along the Susquehanna River, where they may outcompete native species and degrade the habitat of some animal species (Nature Conservancy 2001). PPL does not have a plan in place to prevent the spread of invasive species, and, in the transmission line ROWs, encourages some low-growth invasive species, such as autumn olive (*Elaeagnus umbellata*).

Maintenance of the transmission line ROWs are expected to continue regardless of the decision regarding license renewal. This maintenance will continue to favor invasive species. Open areas like transmission line ROWs have lower wind resistance than forests, potentially allowing wind-borne seeds to spread farther through transmission corridors than adjacent forests (Forman 2001). Construction and maintenance of the transmission lines have created potential pathways for the spread of these species. Potential preventative and mitigative measures would include periodically monitoring the site and transmission lines for these species, and removing them if they become established. This might be done while performing other vegetation removal activities, using mechanical or chemical methods. These species could drastically alter local ecosystems, without proper controls. Maintenance at the site and transmission lines would only contribute to these impacts if these species were present and allowed to spread along the corridors into new areas.

PPL Electric Utilities has proposed the creation of a new transmission line within the license renewal term (NRC 2007b). Although this transmission line is considered out of the scope of license renewal, it is included in this discussion on cumulative impacts. The construction of this transmission line would likely run northeast through Pennsylvania, possibly into New Jersey or New York. Any construction of a new transmission line and ROW would result in the loss of forest and other terrestrial habitats. This new transmission line could potentially alter more than 1000 ac (405 ha) of terrestrial habitats.

PPL has procedures in place to evaluate the environmental impacts of new projects such as new roads or parking lots. These procedures currently consist of a generic checklist form comprised of a list of potential environmental impacts that is reviewed by a biologist to determine whether these potential impacts occur on SSES. The definition of a potential impact is determined by PPL management. PPL considered all land in the protected area, some of which are forest and wetland habitat, to be previously disturbed. Any such disturbance would likely have potential cumulative impacts to terrestrial resources.

PPL has indicated its intention to apply for a COL for a third and possibly a fourth reactor unit, which would be located on previously disturbed land adjacent to the current units (PPL Generation 2007, NRC 2007b,). The construction of the new units would likely destroy forest and other habitats currently on the SSES site. The operation of the new units would result in an increase in water consumption from the Susquehanna River. Although new transmission lines may need to be added to SSES, PPL does not anticipate the need for additional ROWs with the addition of the new unit.

The largest contribution to the cumulative impact on terrestrial resources in the SSES area results from a wide variety of land developments and disturbances. Much of the area has been developed for commercial, industrial, and residential use, agricultural purposes, and resource extraction. This development has resulted in the loss or alteration of a large percentage of the terrestrial habitats in the area. Future developments, especially for residential and industrial purposes, will result in continued terrestrial habitat loss within the vicinity of the SSES site. In addition to direct loss of terrestrial habitats, future development will result in additional runoff from roads and impervious surfaces, and an increase in waste releases could have future impacts on adjacent terrestrial habitats.

There are numerous coal-powered plants within the vicinity of the SSES site. These and other fossil-fuel plants release carbon dioxide, mercury, nitrous oxides, and sulfur dioxide, among other air emissions. Nitrous oxides and sulfur dioxides can combine with water to form acid rain, which can lead to erosion and changes in soil pH levels. Mercury can be deposited on soils and surface water, which may then be taken up by plant or animal species, and poses the risk of bioaccumulation. For these reasons, fossil-fuel power plants are likely to have current and future impacts to the terrestrial environment on the SSES site and surrounding area.

The NRC staff has determined that the cumulative impacts on terrestrial resources resulting from all past, present, and reasonably foreseeable future actions, including non-SSES actions, would be MODERATE to LARGE, due mostly to past and possible future land development and disturbance. The NRC staff notes, however, that continued operations during the license renewal term (the proposed action) would likely represent either no change or a SMALL incremental effect over the current level of cumulative impact.

4.8.3 Cumulative Human Health Impacts

The radiological dose limits for protection of the public and workers have been developed by the EPA and NRC to address the cumulative impact of acute and long-term exposure to radiation and radioactive material. These dose limits are codified in 40 CFR Part 190 and 10 CFR Part 20. For the purpose of this analysis, the area within a 50-mi (80-km) radius of the SSES site was included. The REMP conducted by PPL in the vicinity (approximately a 5 mi, or 8 km, radius) of the Susquehanna site measures radiation and radioactive materials from all sources, including the SSES; therefore, the monitoring program measures cumulative radiological impacts. There are no other nuclear power plants within a 50-mi (80-km) radius of SSES. However, the Safety Light Corporation (SLC), which is located in Columbia County, Pennsylvania, is within a 50-mi (80-km) radius of the SSES site. SLC is currently an operating facility manufacturing a self-illuminated exit sign, and holds a license with the NRC. The SLC site was added to the National Priority List on April 27, 2005, due to various radioactive isotopes and hazardous substances that have been found in the soil and groundwater at the site.

Monitoring results for the 5-year period from 2002 to 2006 were reviewed as part of the cumulative impacts assessment. Additionally, in Sections 2.2.7 and 4.3, the NRC staff concluded that impacts of radiation exposure to the public and workers (occupational) from operation of SSES during the renewal term are SMALL. The NRC and the Commonwealth of Pennsylvania would regulate any future actions in the vicinity of the Susquehanna site that could contribute to cumulative radiological impacts.

PPL has indicated that it has intentions of pursuing a COL for one or two reactor units on the SSES site. However, cumulative radiological doses from all uranium fuel cycle facilities, including the existing and any future reactors, within a 50-mi (80-km) radius of the SSES site have to be within the dose limits codified in 40 CFR Part 190 and 10 CFR Part 20.

Therefore, the NRC staff concludes that cumulative radiological impacts are SMALL.

The NRC staff determined that the electric-field-induced currents from the SSES transmission lines are well below the National Electrical Safety Code (NESC) recommendations for preventing electric shock from induced currents. Therefore, the SSES transmission lines do not detectably affect the overall potential for electric shock from induced currents within the analysis area. With respect to chronic effects of electromagnetic fields, although the NRC staff considers the GEIS finding of "not applicable" to be appropriate in regard to SSES, the SSES transmission lines are not likely to detectably contribute to the regional exposure to extremely low frequency-electromagnetic fields (ELF-EMFs). The SSES transmission lines pass through a sparsely populated, rural area with very few residences or businesses close enough to the lines to have detectable ELF-EMFs. Therefore, the NRC staff has determined that the cumulative impacts of the continued operation of the SSES transmission lines will be SMALL.

4.8.4 Cumulative Socioeconomic Impacts

As discussed in Section 4.4 of this draft SEIS, the continued operation of SSES during the license renewal term would have no impact on socioeconomic conditions in the region beyond those already being experienced. Since PPL has indicated that there would be no major plant refurbishment, overall expenditures and employment levels at SSES would remain relatively constant with no additional demand for housing, public utilities, and public services. In addition, since employment levels and the value of SSES would not change, there would be no population- and tax revenue-related land use impacts. There would also be no disproportionately high or adverse health or environmental impacts on minority and low-income populations in the region. Based on this and other information presented in the draft SEIS, there would be no cumulative socioeconomic impacts from the continued operation of the SSES during the license renewal term and no mitigation would be required.

Should PPL submit the application for a COL, receive approval by the NRC, and decide to construct one or two new nuclear power plant units at the SSES site, the cumulative short-term construction impacts of this action could be MODERATE to LARGE in the immediate vicinity of the SSES. These impacts would be caused by the short-term increased demand for rental housing and other commercial and public services by construction workers during the years of plant construction. During peak construction periods, there would be a noticeable increase in the number and volume of construction vehicles on roads in the immediate vicinity of the SSES site.

The cumulative long-term operations impacts of this action during the operation of the potential new power plants would be SMALL to MODERATE. These impacts would be caused by the increased demand for permanent housing and other commercial and public services, such as schools, police and fire, and public water and electric services by operations workers during the years of plant operations. During shift changes, there would be a noticeable increase in the number of commuter vehicles on roads in the immediate vicinity of the SSES site.

The specific impact of this action would depend on the actual design, characteristics, and construction practices that could be proposed by the applicant. Such details are not available at this time, but if such application is submitted to the NRC, the detailed socioeconomic impacts of this action at the SSES site would be analyzed and addressed in a separate NEPA document that would be prepared by the NRC.

Continued operation of SSES during the license renewal term has the potential to impact both known and unknown historic and archaeological resources. Impacts to known resources are likely to be well-managed by existing procedures, though impacts to unknown resources could result in a MODERATE impact. Cumulative impacts to historic and archaeological resources can result from the incremental loss of unique site types. For example, site 36-LU-49 (on the SSES property) dates to the Transitional period between the Archaic and Woodland periods (1500 B.C). The site is very rare for the SSES plant region and if altered could represent a significant cumulative impact. No major plant expansions or refurbishment activities are planned as part of license renewal.

As noted earlier, PPL Generation has indicated that it may pursue one or two new reactor units on the SSES site (NRC 2007b). This expansion has the potential to impact historic and archaeological resources in the immediate vicinity of the SSES plant. If PPL Generation files an application for any new reactor units, the appropriate environmental reviews would take place, including the Section 106 process of the National Historic Preservation Act of 1966, as amended. Any potential impacts to known historic and archaeological resources resulting from new construction would include consideration of unique site types. The appropriate mitigation for cumulative impacts to any known unique site types would likely be developed at that time.

Given that SSES plant property has the potential for extensive unknown resources – and in light of potential future actions onsite and past disturbance to the site – the NRC staff concludes that potential cumulative impacts on historic and archaeological resources could range from MODERATE to LARGE. Cumulative impacts could be partly mitigated through application of the mitigation measures discussed in Section 4.4.5.

4.8.5 Cumulative Impacts on Groundwater Use and Quality

Groundwater is used at SSES for potable domestic supply only, and withdrawals do not affect the long-term use of aquifers in the region. Average groundwater use from the wells at SSES is 65 gpm (260 L/min) with no measurable effects beyond the immediate vicinity of each well. The possible construction of one or two additional units would increase the need for domestic water supply somewhat, although economies of scale would likely limit the increase to less than 100 percent more than current demands. No significant groundwater contamination has been observed at the site, but future plans include an expansion of the SSES monitoring well network. Independent review by NRC staff indicates the cumulative impacts on groundwater use and quality, when compared to or combined with those of other users in the region, are SMALL.

4.8.6 Cumulative Impacts on Air Quality

This section analyzes past, present, and future actions that could result in adverse cumulative impacts on air quality. For the purposes of this analysis, the geographic area considered is within a 50-mi radius of the plant. As discussed in Section 2.2.4, SSES is located within the Northeast Pennsylvania-Upper Delaware Valley Interstate Air Quality Control Region (AQCR) (Pennsylvania-New Jersey) designated by the EPA. Because of its limited potential to release criteria pollutants and hazardous air pollutants (HAPs), SSES has had minimal adverse impact on the attainment status of ambient air quality in the AQCR in which it is located.

The NRC is aware that PPL is planning to submit an application for a COL in 2008 and may ultimately pursue two additional units onsite. The plant's systems and footprint will depend upon the reactor design PPL ultimately chooses to pursue. Other plant systems (including cooling system selection) will also depend on the reactor design chosen. The plant will require river intake and outflow structures separate from the existing SSES facility and will have separate ancillary support systems such as diesel-fueled emergency generators.

Sources of criteria pollutant emissions associated with construction of the proposed facility would include exhaust emissions from construction equipment and from vehicles for earthmoving and material-handling activities and workforce traffic, as well as fugitive particulate emissions from various construction activities. PPL will be expected to outline necessary mitigation measures for minimizing the impact of construction activities on air quality in an environmental report at the time of COL application submittal.

The pollutant emissions of concern would be $PM_{2.5}$ (particulate matter with an average aerodynamic diameter of less than 2.5 micrometers), reactive organic gases, oxides of nitrogen, carbon monoxide, and sulfur dioxides from internal combustion engines of the construction vehicles and equipment, the material transport vehicles, and the private vehicles of the construction workforce. Fugitive particulate emissions can also be expected from material laydown areas and the construction site, due to ground disturbances such as grading, excavation, and construction vehicle travel on unpaved surfaces and from the concrete batching operation that could be operational onsite. Emissions of volatile organic compounds (VOCs) can also be expected from the onsite storage of vehicle and equipment fuels and from refueling activities.

Estimates of actual emissions cannot be made at this time. However, the Environmental Report contained in PPL's COL application will contain a construction plan and schedule, along with quantitative projections of air quality impacts. All construction-related activities will be conducted in accordance with the Pennsylvania Department of Environmental Protection's Bureau of Air Quality (BAQ) requirements for visible and fugitive dust emissions as well as emission standards for stationary and mobile sources. Also, if open burning of cleared vegetation and construction debris is proposed, it would proceed under an appropriate State-issued permit. Because of the presence of nonattainment areas within the study area (a 50-mi [80-km] radius of SSES), PPL will be required to conduct a federal air conformity determination or full air conformity analysis. Additional controls may result from the conclusions of such analyses. It is reasonable to assume that with all necessary permits secured and appropriate mitigative actions identified and implemented, air quality impacts from new reactor construction would be minimal and of relatively short duration.

Once construction is completed, operation of one or two new nuclear units would result in increases of some criteria pollutant emissions at the site as a result of the coincident operation of ancillary support systems such as emergency generators. Resulting emissions would be of approximately the same nature and magnitude as the emissions from analogous support systems of the existing units at SSES. The plant is expected to continue to have negligible adverse impacts on near-field ambient air quality. Therefore, the NRC staff has determined that the cumulative impacts are SMALL.

4.8.7 Conclusions Regarding Cumulative Impacts

The NRC staff considered the potential impacts resulting from operation of SSES during the license renewal term and other past, present, and future actions in the vicinity of SSES. The NRC staff's determination is that the potential contribution to cumulative impacts resulting from SSES operation during the license renewal term would be SMALL for most areas of impact. If one or two additional units are built at the site, cumulative impacts on socioeconomics could be MODERATE to LARGE, as could cumulative impacts to historical and archaeological resources. In some resource areas – such as terrestrial resources, aquatic resources, and surface water – past human actions independent of SSES operations or constructing potential future units onsite have already created MODERATE to LARGE cumulative impacts.

4.9 Summary of Impacts of Operations During the Renewal Term

Neither PPL nor the NRC staff is aware of information that is both new and significant related to any of the applicable Category 1 issues associated with SSES operation during the renewal term. Consequently, the NRC 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 would not likely be sufficiently beneficial to warrant implementation.

Plant-specific environmental evaluations were conducted for 11 Category 2 issues applicable to SSES operation during the renewal term, as well as for environmental justice and chronic effects of electromagnetic fields. For 10 issues and environmental justice, the NRC staff concludes that the potential environmental impact of renewal term operations of SSES would be of SMALL significance in the context of the standards set forth in the GEIS. For historic and archaeological resources, the NRC staff's conclusion is that the impact resulting from license renewal would be MODERATE. In addition, the NRC staff determined that a consensus has not been reached by appropriate Federal health agencies regarding chronic adverse effects from electromagnetic fields.

Cumulative impacts of past, present, and reasonably foreseeable future actions were considered, regardless of what agency (Federal or non-Federal) or person undertakes such other actions. The NRC staff concluded that the impacts of continued operation of SSES during the license renewal period could contribute to SMALL to LARGE cumulative impacts. Constructing one or two additional units onsite would also contribute to these cumulative impacts. A complete review of impacts from construction and operation of the new units would be included in future NEPA documentation if PPL proceeds with its COL application.

4.10 References

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

10 CFR Part 52. *Code of Federal Regulations*, Title 10, *Energy*, Part 52, "Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants."

10 CFR Part 72. *Code of Federal Regulations*, Title 10, *Energy*, Part 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater than Class C Waste."

36 CFR Part 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, 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 characteristics.

(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.

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 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 U.S. Nuclear Regulatory Commission (NRC) approval to operate a nuclear power facility, an applicant for an initial operating license (OL) 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.

Design-basis accidents (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 Title 10, Part 50 and Part 100, of the *Code of Federal Regulations* (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 OL. The results of these evaluations are found in license documentation such as the applicant's Final Safety Analysis Report (FSAR), the NRC staff's Safety Evaluation Report (SER), the Final Environmental Statement (FES), and Section 5.1 of this Supplemental Environmental Impact Statement (SEIS). A 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 maximally 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, DBAs 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 makes 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 Susquehanna Steam Electric Station (SSES), 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 Sections
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.

PPL Susquehanna, LLC (PPL) stated in its Environmental Report (ER) (PPL 2006) that it is not aware of any new and significant information associated with the issuance of renewed PPL OLs. The NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information. Therefore, the NRC staff concludes that there are no impacts related to DBAs beyond those discussed in the GEIS.

5.1.2 Severe Accidents

Severe nuclear accidents are those that are more severe than DBAs because they could result in substantial damage to the reactor core, regardless of offsite consequences. In the GEIS, the NRC staff assessed the impacts of severe accidents 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.

Severe accidents initiated by external phenomena, such as tornadoes, floods, earthquakes, fires, and sabotage, traditionally have not been discussed in quantitative terms in FESs and were not specifically considered for the SSES site in the GEIS. However, in the GEIS, the NRC staff did evaluate existing impact assessments performed by the NRC and by the industry at 44 nuclear plants in the United States and concluded that the risk from beyond-design-basis earthquakes at existing nuclear power plants is SMALL. The GEIS for license renewal performed a discretionary analysis of terrorist acts in connection with license renewal, and concluded that the core damage and radiological release from such acts would be no worse than the damage and release expected from internally initiated events. In the GEIS, the Commission concludes that the risk from sabotage and beyond-design-basis earthquakes at existing nuclear power plants is small and, additionally, that the risks from other external events are adequately addressed by a generic consideration of internally initiated severe accidents (GEIS, Vol. 1, pp. 5–18).

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 groundwater, 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 SSES, 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 NRC staff has not identified any new and significant information with regard to the consequences from severe accidents during its independent review of the SSES ER (PPL 2006), or the site audit, the scoping process, and evaluation of other available information. Therefore, the NRC 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 NRC staff has reviewed severe accident mitigation alternatives (SAMAs) for SSES. 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 NRC staff has not previously evaluated SAMAs for an 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 SSES; therefore, the remainder of Chapter 5 addresses those alternatives.

5.2.1 Introduction

This section summarizes the SAMA evaluation for SSES conducted by PPL and the NRC staff's review of that evaluation. The NRC staff performed its review with contract assistance from Information Systems Laboratories, Inc. The NRC staff's review is available in full in Appendix G; the SAMA evaluation is available in full in PPL's ER (PPL 2006).

The SAMA evaluation for SSES was conducted using a four-step approach. In the first step, PPL quantified the level of risk associated with potential reactor accidents using the plant-specific probabilistic risk assessment (PRA) and other risk models.

In the second step, PPL examined the major risk contributors and identified possible ways (SAMAs) of reducing that risk. Common ways of reducing risk are changes to components, systems, procedures, and training. PPL initially identified 15 potential SAMAs for SSES. PPL then screened out four SAMAs from further consideration because they were determined to provide no measurable benefit or to have estimated costs that would exceed the dollar value associated with completely eliminating all severe accident risk at SSES. The remaining 11 SAMAs were subjected to further evaluation.

In the third step, PPL estimated the benefits and the costs associated with each of the remaining SAMAs. Estimates were made of how much each SAMA could reduce risk. Those estimates were developed in terms of dollars in accordance with NRC guidance for performing regulatory analyses (NRC 1997). The cost of implementing the proposed SAMAs was also estimated.

Finally, in the fourth step, the costs and benefits of each of the remaining SAMAs were compared to determine whether each SAMA was cost-beneficial, meaning that the benefits of the SAMA were greater than the cost (a positive cost-benefit). PPL found two SAMAs to be potentially cost-beneficial in the baseline analysis and three additional SAMAs to be potentially cost-beneficial when analysis uncertainties are considered (PPL 2006).

The potentially cost-beneficial SAMAs do not relate to adequately managing the effects of aging during the period of extended operation; therefore, they need not be implemented as part of license renewal pursuant to 10 CFR Part 54. PPL's SAMA analyses and the NRC's review are discussed in more detail below.

5.2.2 Estimate of Risk

PPL submitted an assessment of SAMAs for SSES as part of the ER (PPL 2006). This assessment was based on the most recent SSES PRA available at that time, a plant-specific offsite consequence analysis performed using the MELCOR Accident Consequence Code System 2 (MACCS2) computer program, and insights from the SSES Individual Plant Examination (IPE) (PPL 1991) and Individual Plant Examination of External Events (IPEEE) (PPL 1994).

The baseline core damage frequency (CDF) for the purpose of the SAMA evaluation is approximately 2.0×10^{-6} per year. This CDF is based on the risk assessment for internally initiated events. PPL did not include the contribution to risk from external events within the SSES risk estimates; however, it did account for the potential risk-reduction benefits associated with external events by increasing the estimated benefits for internal events by a factor of two. The breakdown of CDF by initiating event is provided in Table 5-3. The results shown are for Unit 1, but are also representative of those for Unit 2.

Table 5-3. SSES Core Damage Frequency

Initiating Event	CDF (Per Year)	Percent Contribution to CDF
Loss of offsite power	1.4×10^{-6}	72
Trip w/o MSIV[(a)] closure	1.8×10^{-7}	9
Interfacing system LOCA[(a)]	1.1×10^{-7}	6
Loss of DC power bus	8.8×10^{-8}	4
Small LOCA	4.9×10^{-8}	3
MSIV closure	4.4×10^{-8}	2
Manual shutdown	1.8×10^{-8}	1
Medium LOCA	1.6×10^{-8}	1
Internal flooding	1.5×10^{-8}	1
Excessive rupture	1.0×10^{-8}	1
Others	1.8×10^{-8}	1
Total CDF	**2.0×10^{-6}**	**100**

(a) MSIV = main steam isolation valve; LOCA = loss of coolant accident.

As shown in Table 5-3, events initiated by loss of offsite power (LOOP) are the dominant contributors to the CDF. Although not separately reported, station blackout (SBO) sequences contribute roughly 3.2×10^{-7} per year (17 percent of the total internal events CDF), while anticipated transient without scram (ATWS) sequences contribute 9.5×10^{-8} per year (about 5 percent of the total internal events CDF).

PPL estimated the dose to the population within 50 mi (80 km) of the SSES site to be approximately 0.019 person-Sieverts (person-Sv) (1.9 person-rem) per year. The breakdown of the total population dose by containment release mode is summarized in Table 5-4. Containment failures within the intermediate time frame (greater than 6 hours but less than 24 hours following accident initiation) dominate the population dose risk at SSES.

5.2.3 Potential Plant Improvements

Once the dominant contributors to plant risk were identified, PPL searched for ways to reduce that risk. In identifying and evaluating potential SAMAs, PPL considered insights from the plant-specific PRA and SAMA analyses performed for other operating plants that have submitted license renewal applications. PPL identified 15 potential risk-reducing improvements (SAMAs) to plant components, systems, procedures, and training.

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

Containment Release Mode	Population Dose (Person-rem[a] per Year)	Percent Contribution
Early containment failure	0.52	27
Intermediate containment failure	1.20	63
Late containment failure	0.18	9
Intact containment	Negligible	Negligible
Total	1.90	100

(a) One person-rem = 0.01 person-Sv.

The NRC staff has reviewed PPL's data and evaluation methods and concludes that the quality of the risk analyses is adequate to support an assessment of the risk reduction potential for candidate SAMAs. Accordingly, the NRC staff based its assessment of offsite risk on the CDFs and offsite doses reported by PPL.

PPL removed four SAMAs from further consideration because they were determined to provide no measurable benefit or to have estimated costs that would exceed the dollar value associated with completely eliminating all severe accident risk at SSES. A detailed cost-benefit analysis was performed for each of the 11 remaining SAMAs.

The NRC staff concludes that PPL used a systematic and comprehensive process for identifying potential plant improvements for SSES, and that the set of potential plant improvements identified by PPL is reasonably comprehensive and, therefore, acceptable.

5.2.4 Evaluation of Risk Reduction and Costs of Improvements

PPL evaluated the risk-reduction potential of the remaining 11 SAMAs. The SAMA evaluations were performed using realistic assumptions with some conservatism.

PPL estimated the costs of implementing the 11 candidate SAMAs through the application of engineering judgment and use of other licensees' estimates for similar improvements. The cost estimates conservatively did not include the cost of replacement power during extended outages required to implement the modifications, nor did they include contingency costs associated with unforeseen implementation obstacles.

The NRC staff reviewed PPL's bases for calculating the risk reduction for the various plant improvements and concludes that the rationale and assumptions for estimating risk reduction are reasonable and generally conservative (i.e., the estimated risk reduction is similar to or somewhat higher than what would actually be realized). Accordingly, the NRC staff based its estimates of averted risk for the various SAMAs on PPL's risk reduction estimates.

The NRC staff reviewed the bases for the applicant's cost estimates. For certain improvements, the NRC staff also compared the cost estimates 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 NRC staff found the cost estimates to be reasonable, and generally consistent with estimates provided in support of other plants' analyses.

The NRC staff concludes that the risk reduction and the cost estimates provided by PPL are sufficient and appropriate for use in the SAMA evaluation.

5.2.5 Cost-Benefit Comparison

The cost-benefit analysis performed by PPL was based primarily on NUREG/BR-0184 (NRC 1997) and was executed consistent with this guidance. NUREG/BR-0058 has recently been revised to reflect the NRC's revised policy on discount rates. Revision 4 of NUREG/BR-0058 states that two sets of estimates should be developed – one at three percent and one at seven percent (NRC 2004). PPL provided both sets of estimates (PPL 2006).

PPL identified two potentially cost-beneficial SAMAs in the baseline analysis contained in the ER (using a three percent discount rate). The potentially cost-beneficial SAMAs are:

- SAMA 2a – Install minimal hardware changes and modify procedures to provide a cross-tie capability between the 4 kilovolt (kV) alternating current (AC) emergency buses.

- SAMA 6 – Procure an additional portable 480 volt (V) AC station diesel generator to power battery chargers in scenarios where AC power is unavailable.

PPL performed additional analyses to evaluate the impact of parameter choices and uncertainties on the results of the SAMA assessment (PPL 2006). Three additional SAMA candidates were determined to be potentially cost-beneficial, if the benefits were increased by a factor of 2.1 to account for uncertainties:

- SAMA 2b – Improve the cross-tie capability between 4 kV AC emergency buses, i.e., between A or D emergency buses and B or C emergency buses (a more flexible cross-tie option than SAMA 2a).

- SAMA 3 – Modify procedures to stagger reactor pressure vessel (RPV) depressurization when fire protection system injection is the only available makeup source.

- SAMA 5 – Modify portable station diesel generator to automatically align to 125 V direct current (DC) battery chargers.

After reviewing PPL Susquehanna's SAMA analysis, the NRC staff concludes that the costs of all other SAMAs evaluated are greater than their associated benefits.

5.2.6 Conclusions

The NRC staff reviewed PPL's analysis and concluded that the methods used and the implementation of those methods were sound. The treatment of SAMA benefits and costs support the general conclusion that the SAMA evaluations performed by PPL are reasonable and sufficient for the license renewal submittal. Although the treatment of SAMAs for external events was somewhat limited by the unavailability of an external event PRA, the likelihood of there being cost-beneficial enhancements in this area was minimized by improvements that have been realized as a result of the IPEEE process, and increasing the estimated SAMA benefits for internal events by a factor of two to account for potential benefits in external events.

Based on its review of the SAMA analysis, the NRC staff concurs with PPL's identification of areas in which risk can be further reduced in a cost-beneficial manner through the implementation of all or a subset of potentially cost-beneficial SAMAs. Given the potential for cost-beneficial risk reduction, the staff considers that further evaluation of these SAMAs by PPL is warranted. However, none of the potentially cost-beneficial SAMAs relate to adequately managing the effects of aging during the period of extended operation. Therefore, they need not be implemented as part of the license renewal pursuant to 10 CFR Part 54.

5.3 References

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

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

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

10 CFR Part 73. *Code of Federal Regulations*, Title 10, *Energy*, Part 73, "Physical Protection of Plants and Materials."

10 CFR Part 100. *Code of Federal Regulations*, Title 10, *Energy*, Part 100, "Reactor Site Criteria."

Pennsylvania Power & Light Company (PPL). 1991. Letter from Harold W. Keiser, PPL, to C.L. Miller, NRC. Subject: "Susquehanna Steam Electric Station Submittal of the IPE Report." (December 13, 1991).

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U.S. Nuclear Regulatory Commission (NRC). 1997. *Regulatory Analysis Technical Evaluation Handbook*. NUREG/BR-0184, 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, Vol. 1, Addendum 1, Washington, D.C.

U.S. Nuclear Regulatory Commission (NRC). 2004. *Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission*. NUREG/BR-0058, Rev. 4, Washington, D.C.

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 characteristics.

(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 (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 Title 10, Part 51, of the *Code of Federal Regulations* (10 CFR Part 51), Subpart A, Appendix B, and are applicable to the Susquehanna Steam Electric Station, Units 1 and 2 (SSES). 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,

(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.

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 Impact of Transportation of Fuel and Waste to and from One Light-Water-Cooled Nuclear Power Reactor." The U.S. Nuclear Regulatory Commission (NRC) 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 SSES from the uranium fuel cycle and solid waste management are listed in Table 6-1. There are nine Category 1 issues related to the fuel cycle and waste management. There are no Category 2 issues.

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 HLW)	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 HLW disposal)	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
Onsite 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

PPL Susquehanna, LLC (PPL) stated in its Environmental Report (ER) (PPL 2006) that it is not aware of any new and significant information associated with issuance of the renewed SSES operating licenses (OLs). The NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information. Therefore, the NRC staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For these issues, the NRC 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 NRC staff review and the GEIS conclusions, as codified in Table B-1, 10 CFR Part 51, for each of these issues follows:

- <u>Offsite radiological impacts (individual effects from other than the disposal of spent fuel and HLW)</u>. Based on information in the GEIS, the Commission found that

  > Offsite impacts of the uranium fuel cycle have been considered by the Commission in Table S-3 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information. Therefore, the NRC staff concludes that there would be no offsite radiological impacts of the uranium fuel cycle during the renewal term beyond those discussed in the GEIS.

- <u>Offsite radiological impacts (collective effects)</u>. 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, HLW and spent fuel disposal excepted, is calculated to be about 14,800 person-rem (148 person-sieverts), 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 United States. 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 that will not ever be mitigated (e.g., 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 judgment as to the regulatory National Environmental Policy Act (NEPA) implications of these matters should be made and it makes no sense to repeat the same judgment in every case. Even taking the uncertainties into account, the Commission concludes that these impacts are acceptable in that these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the collective effects of the fuel cycle, this issue is considered Category 1.

The NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information. Therefore, the NRC staff concludes that there would be 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 HLW 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* (NAS 1995), 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 mrem (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 mrem (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 mrem (1 mSv) per year. The lifetime individual cancer risk from a 100 mrem (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 U.S. 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 1000 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, the U.S. Environmental Protection Agency's (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 the 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 1000 premature cancer deaths worldwide for a 100,000-metric ton (MTHM) repository.

> Nevertheless, despite all the uncertainty, some judgment as to the regulatory NEPA implications of these matters should be made and it makes no sense to repeat the same judgment in every case. Even taking the uncertainties into account, the Commission concludes that these impacts are acceptable in that these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, while the Commission has not assigned a single level of significance for the impacts of spent fuel and HLW disposal, this issue is considered Category 1.

On February 15, 2002, based on a recommendation by the Secretary of the U.S. 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 high-level nuclear waste. The U.S. Congress approved this recommendation on July 9, 2002, in Joint Resolution 87, which designated Yucca Mountain as the repository for spent nuclear waste. On July 23, 2002, the President signed Joint Resolution 87 into law; Public Law 107-200, 116 *Statutes at Large* (Stat.) 735 (2002), designates Yucca Mountain as the repository for spent nuclear waste. This development does not represent new and significant information with respect to the offsite radiological impacts from license renewal related to disposal of spent nuclear fuel and high-level nuclear waste.

The EPA developed Yucca-Mountain-specific repository standards, which were subsequently adopted by the NRC in 10 CFR Part 63. In an opinion, issued July 9, 2004, the U.S. Court of Appeals for the District of Columbia Circuit (the Court) vacated the EPA's radiation protection standards for the candidate repository, which required compliance with certain dose limits over a 10,000-year period. The Court's decision also vacated the compliance period in NRC's licensing criteria for the candidate repository in 10 CFR Part 63. In response to the Court's decision, the EPA issued its proposed revised standards to 40 CFR Part 197 on August 22, 2005 (EPA 2005). In order to be consistent with the EPA's revised standards, the NRC proposed revisions to 10 CFR Part 63 on September 8, 2005 (NRC 2005).

Therefore, for the HLW and spent fuel disposal component of the fuel cycle, there is some uncertainty with respect to regulatory limits for offsite releases of radioactive nuclides for the current candidate repository site. However, prior to promulgation of the affected provisions of the Commission's regulations, the NRC staff assumed that limits would be developed along the lines of the 1995 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 that would comply with such limits could and likely would be developed at some site.

Despite the current uncertainty with respect to these rules, some judgment as to the regulatory NEPA implications of offsite radiological impacts of spent fuel and HLW disposal should be made. The NRC staff concludes that these impacts are acceptable in that the impacts would not be sufficiently large to require the NEPA conclusion that the option of extended operation under 10 CFR Part 54 should be eliminated.

The NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information. Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information. Therefore, the NRC staff concludes that there would be 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 onsite land that may be required for low-level waste storage during the term of a renewed license and associated impacts will be small. Nonradiological impacts on air and water will be negligible. The radiological and nonradiological environmental impacts of long-term disposal of low-level waste from any individual plant at licensed sites are small. In addition, the Commission concludes that there is reasonable assurance that sufficient low-level waste disposal capacity will be made available when needed for facilities to be decommissioned consistent with NRC decommissioning requirements.

The NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information. Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information. Therefore, the NRC staff concludes that there would be 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 onsite with small environmental effects through dry or pool storage at all plants if a permanent repository or monitored retrievable storage is not available.

The NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information. Therefore, the NRC staff concludes that there would be 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information. Therefore, the NRC staff concludes that there would be no nonradiological waste impacts during the renewal term beyond those discussed in the GEIS.

- Transportation. Based on information contained 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 the 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 10 CFR 51.52(c).

  SSES meets the fuel-enrichment and burnup conditions set forth in Addendum 1 to the GEIS. The NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information. Therefore, the NRC staff concludes that there would be 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 Part 51. *Code of Federal Regulations*, Title 10, *Energy,* Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions."

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

10 CFR Part 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 Part 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 Part 197. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 197, "Public Health and Environmental Radiation Protection Standards for Yucca Mountain, Nevada."

Joint Resolution Approving the Site at Yucca Mountain, Nevada, for the Development of a Repository for the Disposal of High-Level Radioactive Waste and Spent Nuclear Fuel, Pursuant to the Nuclear Waste Policy Act of 1982. 2002. Public Law 107-200. 116 Stat. 735.

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U.S. Nuclear Regulatory Commission (NRC). 2005. "Implementation of a Dose Standard After 10,000 Years." *Federal Register*, Vol. 70, No. 173, pp. 53313–53320. Washington, D.C. (September 8, 2005).

7.0 Environmental Impacts of Decommissioning

Environmental impacts from the activities associated with the decommissioning of any reactor before or at the end of an initial or renewed license are evaluated in the *Generic Environmental Impact Statement for Decommissioning of Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors*, NUREG-0586, Supplement 1 (NRC 2002). The U.S. Nuclear Regulatory Commission (NRC) staff's evaluation of the environmental impacts of decommissioning presented in NUREG-0586, Supplement 1, identifies a range of impacts for each environmental issue.

The incremental environmental impacts associated with decommissioning activities resulting 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 were 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 characteristics.

(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.

(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.

7.1 Decommissioning

Category 1 issues in Table B-1 of Title 10, Part 51, of the *Code of Federal Regulations* (10 CFR Part 51), Subpart A, Appendix B, that are applicable to Susquehanna Steam Electric Station, Units 1 and 2 (SSES) decommissioning following the renewal term are listed in Table 7-1. PPL Susquehanna, LLC (PPL) stated in its Environmental Report (ER) (PPL 2006) that it is aware of no new and significant information regarding the environmental impacts of SSES license renewal. The NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information. Therefore, the NRC staff concludes that there are no impacts related to these issues beyond those discussed in the GEIS. For all of these issues, the NRC staff concluded in the GEIS that the impacts are SMALL, and additional plant-specific mitigation measures would not likely be sufficiently beneficial to be warranted.

Table 7-1. Category 1 Issues Applicable to the Decommissioning of SSES

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

Decommissioning would occur regardless if SSES is shut down at the end of its current operating license or at the end of the period of extended operation. There are no Category 2 issues related to decommissioning.

A brief description of the NRC 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 person-rem caused by buildup of long-lived radionuclides during the license renewal term.

The NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information. Therefore, the NRC staff concludes that there would be no radiation dose impacts associated with decommissioning following the license renewal term 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information. Therefore, the NRC staff concludes that there would be no impacts from 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information. Therefore, the NRC staff concludes that there would be no impacts on air quality associated with decommissioning following the license renewal term 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information. Therefore, the NRC staff concludes that there would be no impacts on water quality associated with decommissioning following the license renewal term 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information. Therefore, the NRC staff concludes that there would be no impacts on ecological resources associated with decommissioning following the license renewal term 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 NRC staff has not identified any new and significant information during its independent review of the SSES ER, or the site audit, the scoping process, and evaluation of other available information. Therefore, the NRC staff concludes that there would be no socioeconomic impacts associated with decommissioning following the license renewal term beyond those discussed in the GEIS.

7.2 References

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

PPL Susquehanna, LLC (PPL). 2006. *Susquehanna Steam Electric Station Units 1 and 2 Application for License Renewal, Appendix E: Applicant's Environmental Report – Operating License Renewal Stage*. Allentown, Pennsylvania. (September 2006). ADAMS No. ML062630235.

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

U.S. Nuclear Regulatory Commission (NRC). 2002. *Generic Environmental Impact Statement for Decommissioning of Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors*. NUREG-0586, Supplement 1, Washington, D.C.

8.0 Environmental Impacts of Alternatives

This chapter examines the potential environmental impacts associated with alternatives to issuing renewed operating licenses (OLs) for Susquehanna Steam Electric Station, Units 1 and 2 (SSES). The U.S. Nuclear Regulatory Commission (NRC) staff considers the following alternatives: (1) denying the issuance of renewed OLs (i.e., the no-action alternative); (2) implementing electric generating sources other than SSES; (3) purchasing electric power from other sources to replace power generated by SSES; and (4) implementing a combination of generation and conservation measures.

The NRC staff evaluated environmental impacts across 12 categories – land use, ecology, surface water use and quality, groundwater use and quality, air quality, waste, human health, socioeconomics, transportation, aesthetics, historic and archaeological resources, and environmental justice – using the NRC's three-level standard of significance: SMALL, MODERATE, or LARGE. The NRC developed these standards by using Council on Environmental Quality guidelines. The NRC staff outlined these standards in the footnotes to Table B-1 of Title 10, Part 51, of the *Code of Federal Regulations* (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.

The impact categories evaluated in this chapter are the same categories used in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2 (NRC 1996, 1999),[a] with the additional impact category of environmental justice and transportation.

(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.

8.1 No-Action Alternative

NRC regulations implementing the National Environmental Policy Act (NEPA), 10 CFR Part 51, Subpart A, Appendix A(4), specify that the no-action alternative be discussed in an NRC Environmental Impact Statement (EIS). For license renewal, the no-action alternative refers to a scenario in which the NRC would not issue the renewed SSES OLs, and PPL Susquehanna, LLC (PPL) would then cease plant operations in accordance with 10 CFR 50.82. If, after performing safety and environmental reviews of the SSES license renewal application, the NRC were to act to issue renewed SSES OLs, then PPL may choose to continue operating SSES throughout the renewal term. If this were to occur, then shutdown of the unit and decommissioning activities would be postponed for up to an additional 20 years. The NRC staff expects that the impacts of decommissioning after 60 years of operation would not differ significantly from those that would occur after 40 years of operation.

The NRC staff addressed the environmental impacts of decommissioning in several documents, including the *Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities*, NUREG-0586, Supplement 1 (NRC 2002); Chapter 7 of the GEIS; and Chapter 7 of this draft Supplemental Environmental Impact Statement (SEIS). These analyses either directly address or bound the environmental impacts of decommissioning whenever PPL ceases operating SSES.

These documents do not, however, address environmental impacts that occur after plant shutdown and before the actual decommissioning process begins. The environmental impacts from plant shutdown are discussed for each category, and are summarized in Table 8-1.

- **Land Use**

  Onsite land use would not be affected by the plant shutdown. Plant structures and other facilities would remain in place until decommissioning. Transmission lines at SSES would remain in service after the plant stops operating. PPL noted in the Environmental Report (ER), however, that plant shutdown and construction of a new power plant at an alternative site other than SSES would, however, cause offsite land use impacts. PPL would need to construct 50 mi (80 km) of new transmission line to remedy a "load pocket" created by an SSES shutdown (PPL 2006). Maintenance of existing transmission lines would continue as before. The amount of land used for transmission lines may noticeably increase if PPL constructs the new transmission line in an undisturbed area. Impacts on land use from plant shutdown would range from SMALL, if new transmission lines follow existing routes, to MODERATE, if they require new rights-of-way (ROWs).

Table 8-1. Summary of Environmental Impacts of Shutdown under the No-Action Alternative

Impact Category	Impact	Comment
Land use	SMALL to MODERATE	Impact is expected to be SMALL to MODERATE because plant shutdown would require the construction of an additional 50 mi (80 km) of transmission lines to address a load pocket. Onsite land use would not change prior to decommissioning.
Ecology	SMALL to MODERATE	Impact is expected to be SMALL to MODERATE. Though aquatic impacts would generally be smaller than during operation, terrestrial impacts would increase due to construction and maintenance of new transmission lines and associated ROWs.
Water use and quality – surface water	SMALL	Impact is expected to be SMALL because surface water intake and discharges would decrease.
Water use and quality – groundwater	SMALL	Impact is expected to be SMALL because groundwater use would decrease.
Air quality	SMALL	Impact is expected to be SMALL because emissions related to plant operation and worker transportation would decrease.
Waste	SMALL	Impact is expected to be SMALL because generation of high-level waste would stop and generation of low-level and mixed waste would decrease.
Human health	SMALL	Impact is expected to be SMALL because radiological doses to workers and members of the public, which are within regulatory limits, would decrease. The likelihood of accidents also would decrease.
Socioeconomics	MODERATE to LARGE	Impact is expected to be MODERATE to LARGE because of loss of employment and tax revenues.
Transportation	SMALL	Impact is expected to be SMALL because the loss of employment would reduce traffic.
Aesthetics	SMALL	Impact is expected to SMALL because plant structures would remain in place.
Historic and archaeological resources	MODERATE	Impact is expected to be MODERATE. While plant shutdown would decrease onsite land disturbance, impacts from the new transmission line would depend on location and presence of resources and could be significant.
Environmental justice	MODERATE to LARGE	Impact is expected to be MODERATE to LARGE because of the loss of jobs and tax revenue; decline in social services may occur.

- **Ecology**

  Ecology would be minimally affected by plant shutdown, although the need to construct additional transmission lines could have a noticeable effect. In Chapter 4 of this draft SEIS, the NRC staff concluded that the terrestrial and aquatic ecological impacts of continued plant operation would be SMALL. As indicated in Land Use, above, maintenance of the ROWs – the primary terrestrial ecology impact – would continue as before, although PPL would need to construct roughly 50 mi (80 km) of new transmission lines to address a potential load pocket that would be created by plant shutdown. If the plant were to cease operating, impacts to aquatic ecology would decrease, as the plant would withdraw and discharge less water than during operations. Shutdown would reduce the already SMALL impacts to aquatic ecology, although transmission line construction would increase impacts to terrestrial ecology. Overall, the likely increase in terrestrial impacts would be greater than the likely decrease in aquatic impacts, given the greater number of sensitive terrestrial species. As such, the NRC staff concludes that ecological impacts from shutdown of the plant would be SMALL to MODERATE. Some portion of this impact could be mitigated by constructing new transmission lines in existing ROWs to as large an extent possible.

- **Water Use and Quality – Surface Water**

  Surface-water use and quality impacts would decrease following reactor shutdown, as the plant would withdraw less water from the Susquehanna River for cooling-tower makeup, and would discharge less water to the Susquehanna River from blowdown and domestic and service-water usage. In Chapter 4 of this draft SEIS, the NRC staff concluded that impacts of continued plant operation on surface-water use and quality would be SMALL. Since operational impacts were already SMALL, the NRC staff concludes that a decrease in impact levels from plant shutdown means that impacts would remain SMALL.

- **Water Use and Quality – Groundwater**

  In the event of plant shutdown, impacts to groundwater use and quality would decrease. The plant currently relies on groundwater for domestic uses, as well as some industrial uses. After shutdown, wells would need to be properly closed as the plant stops using groundwater. Since the plant would require less groundwater after shutdown than it does during operations – and as the NRC staff determined that continued operations would have a SMALL impact on surface-water use and quality – the NRC staff concludes that groundwater use and quality impacts from shutdown of the plant would be SMALL.

- **Air Quality**

  Air quality impacts would decrease following plant shutdown. When the plant stops operating, there would be a reduction in emissions from activities related to plant operation, such as use of diesel generators and worker transportation. In Chapter 4, the NRC staff concluded that the impact of continued plant operation on air quality would be SMALL. Therefore, the NRC staff concludes that the impact on air quality from shutdown of the plant would be SMALL.

- **Waste**

  The plant would generate smaller volumes of nonradioactive and radioactive waste following shutdown. The NRC staff characterized the impacts of waste generated by continued plant operation as SMALL in Chapter 6 and also characterized impacts of low-level and mixed waste from plant operation as SMALL. When the plant stops operating, the plant would stop generating high-level waste and generation of low-level and mixed waste associated with plant operation and maintenance would decrease. As the NRC staff determined that operational waste impacts were SMALL, reduced impacts during shutdown would also be SMALL.

- **Human Health**

  Human health impacts would be smaller following plant shutdown. The plant – which is currently operating within regulatory limits – would emit less gaseous and liquid radioactive material to the environment. In addition, following shutdown, the variety of potential accidents at the plant (radiological or industrial) would be reduced to a limited set associated with shutdown events and fuel handling and storage. In Chapter 4 of this draft SEIS, the NRC staff concluded that the impacts of continued plant operation on human health would be SMALL. In Chapter 5, the NRC staff concluded that the impacts of accidents during operation were SMALL. Therefore, as radioactive emissions to the environment decrease, and as the likelihood and variety of accidents decrease following shutdown, the NRC staff concludes that the impacts to human health following plant shutdown would be SMALL.

- **Socioeconomics**

  Plant shutdown would have a noticeable negative impact on socioeconomic conditions in the region around SSES. Plant shutdown would eliminate up to 1227 jobs and would reduce tax revenue in the region. These losses could be partially offset by decommissioning activities, or by construction and operation of a new power plant on or near the current SSES site. The socioeconomic impacts of plant shutdown would range from MODERATE to LARGE. See Appendix J of NUREG-0586, Supplement 1 (NRC 2002), for additional discussion of the potential socioeconomic impacts of plant decommissioning.

- **Transportation**

  Traffic volumes on the roads in the vicinity of SSES would be reduced after plant shutdown. Most of the reduction in traffic volume would be associated with the loss of jobs. There would also be a reduction in shipment of material to and from the plant prior to decommissioning. Transportation impacts would be SMALL as a result of plant shutdown. Transportation impacts would increase if a new reactor or alternative energy facility were constructed on the SSES site or in the immediate vicinity.

- **Aesthetics**

  Plant structures and other facilities would likely remain in place until decommissioning, although plumes from the plant's cooling towers would likely disappear entirely. Noise caused by plant operation would cease. A new transmission line would introduce aesthetic impacts in offsite areas. The NRC staff concludes that the aesthetic impacts of plant closure would be SMALL.

- **Historic and Archaeological Resources**

  Plant shutdown would likely have no noticeable impacts on historic and archaeological resources. Prior to decommissioning, it is unlikely that plant staff would begin site deconstruction or remediation; existing transmission lines would remain energized. As such, plant staff would continue to maintain the transmission line ROWs. Should PPL construct a new transmission line to address the load pocket created by plant shutdown, PPL would need to survey any lands disturbed by construction and land clearing. In Chapter 4, the NRC staff concluded that the impacts of continued plant operation on historic and archaeological resources would be MODERATE. Although land-disturbing activities may decrease at the archaeologically rich SSES site, construction and land clearing for 50 mi (80 km) of transmission line would introduce potential new effects dependent on location and presence of resources. Given the potential for resources in the area, the NRC staff concludes that the impacts on historic and archaeological resources from plant shutdown would also be MODERATE.

- **Environmental Justice**

  Plant shutdown could disproportionately impact minority and low-income populations because of the loss of jobs and employment opportunities in the region. Impacts from plant shutdown on minority and low-income populations could range from MODERATE to LARGE, and could be compounded if the loss of tax revenue from the SSES plant causes a reduction in social services. Some impacts could be offset if new power generating facilities are built at or near the SSES site. See Appendix J of NUREG-0586, Supplement 1 (NRC 2002), for additional discussion of these impacts.

Since NRC assumes that a need exists for power from plants seeking license renewal, the NRC staff assumes that other forms of power supply or demand reduction (i.e., conservation) would meet this need if the NRC selects the no-action alternative. In addition, if the NRC decides to issue renewed licenses for SSES Units 1 and 2, utility- and State-level planners may nevertheless elect to pursue other forms of electrical generation or load reduction. As such, the NRC staff discusses the impacts of alternatives that meet system needs in Section 8.2. The alternatives considered in Section 8.2 are distinct alternatives to license renewal, although their environmental impacts may also be considered potential consequences of the no-action alternative.

8.2 Alternative Energy Sources

This section discusses the environmental impacts associated with alternative sources of electric power to replace the power generated by SSES, as well as conservation. The order of presentation does not imply which alternative energy source would most likely replace the power generated by SSES, or would have the least environmental impacts.

The NRC staff considers the following single-source generation alternatives in detail:

- Coal-fired generation at the SSES site and at an alternate site (Section 8.2.1)

- Natural gas-fired generation at the SSES site and at an alternate site (Section 8.2.2), and

- New nuclear power generation at the SSES site and at an alternate site (Section 8.2.3).

The alternative of purchasing power from other sources to replace power generated at SSES is discussed in Section 8.2.4. Other power-generation and conservation alternatives the NRC staff considered but found not to be reasonable replacements for SSES are discussed in Section 8.2.5. Section 8.2.6 discusses the environmental impacts of a combination of generation and conservation alternatives.

Each year the Energy Information Administration (EIA), a branch of the U.S. Department of Energy (DOE), issues its updated Annual Energy Outlook, which is a forecasting document that analyzes trends and issues in energy production, supply, and consumption in order to project future energy developments. The comprehensiveness and policy neutrality of the Annual Energy Outlook is unique among forecasting documents. In the *Annual Energy Outlook 2007 with Projections to 2030*, the EIA projects a continued nationwide increase in energy consumption and generating capacity (EIA 2007). Early in this period – through 2010 – the EIA projects that gas-fired combined-cycle or combustion turbine technology will account for most generating capacity additions. As natural gas prices increase, coal-fired generation begins to account for the largest share of capacity additions (EIA 2007). The EIA projects that coal will account for most – 54 percent – of new capacity through 2030 and that advanced coal technologies – such as coal-fueled integrated gasification combined-cycle (IGCC) generation – will continue to decline in cost relative to improved natural-gas-fired combined-cycle technologies (EIA 2007). The EIA also projects that U.S. generators will increase total nuclear and renewable generation capacity throughout the forecast term, due partly to tax credits and other incentives. As a proportion of installed capacity, however, nuclear generation will decrease slightly through 2030, while renewable generation remains relatively constant. The EIA indicates that changes in electricity generation costs – which are highly dependent on emission control costs – will drive utilities' choices in generating technologies (EIA 2007).

The EIA asserts that oil-fired plants will account for virtually no new generation capacity in the United States through 2030, projecting a 0.6 percent annual decrease in electric sector oil consumption because of higher fuel costs and lower efficiencies (EIA 2007). Given EIA's analysis, the NRC staff will not consider an oil-fired alternative for SSES.

SSES will have a combined net rating of approximately 2600 megawatts electric (MW(e)), if the NRC grants PPL the extended power uprate for the units. For the purposes of this draft SEIS, 2600 MW is the amount of capacity an alternative would need to provide. PPL staff indicated that alternatives providing 2400 MW(e) would adequately approximate the amount of capacity provided by an uprated SSES, and would allow the alternatives analysis to make use of commercially-available gas-fired units (PPL 2006). The NRC staff believes this approximation would provide a reasonable analysis, but notes that this assumption may understate the environmental impacts of replacing the 2600 MW(e) from Susquehanna Units 1 and 2.

PPL staff proposed several possible alternatives, all of which could be constructed at the current SSES site (PPL 2006). Given the availability of water and transmission lines at SSES, the NRC staff evaluated impacts for each alternative energy source at the existing SSES site, as well as impacts for each alternative at an alternate site. NRC staff assumed that an alternative site would allow access to adequate cooling water, but would not yet have transmission or other infrastructure.

8.2.1 Coal-Fired Generation

The NRC staff evaluated a coal-fired alternative at the SSES site and an alternate site, which may or may not have been previously developed. Regardless of plant location, the NRC staff believes that a new coal-fired alternative large enough to replace the capacity of SSES would likely make use of the higher efficiencies available from operating at supercritical steam conditions.[a]

PPL assumed a heat rate[b] of 10,200 Btu/kWh for a coal-fired alternative that would consist of four units having a net capacity of 600 MW(e) (2553 MW(e) gross output assuming 6 percent internal consumption (PPL 2006)). The NRC staff notes that PPL's heat rate is higher than the heat rate the NRC would expect from a new supercritical coal-fired alternative. The NRC staff has reevaluated PPL's analysis assuming a heat rate of 8844 Btu/kWh, the value reported by EIA as the 2005 heat rate for new, scrubbed coal plants in *Assumptions to the Annual Energy Outlook 2006 With Projections to 2030* (EIA 2006b). This would reduce by approximately 13.3 percent the level of emissions and wastes that a new coal-fired alternative would produce.

In analyzing a coal-fired alternative, the NRC staff reviewed the information in the SSES ER (PPL 2006) and compared it to environmental impact information in the GEIS, as well as to reference information available from EIA, the U.S. Environmental Protection Agency (EPA), and electric industry sources. Although the operating license renewal period is only 20 years, the NRC staff considers the impact of operating the coal-fired alternative for 40 years as a reasonable projection of the alternative's operating life.

The coal-fired alternative, with a gross electric output of 2553 MW(e), would consume approximately 6.50 million metric tons (MT) (7.16 million tons) per year of pulverized bituminous coal with an ash content of approximately 14.9 percent and a higher heating value of 11,741 Btu/lb, which are average for coal consumed in Pennsylvania (DOE 2006c). As in PPL's analysis (PPL 2006), the NRC staff assumed a capacity factor[c] of 0.85 for the coal-fired alternative. The coal-fired alternative would produce approximately 969,000 MT (1.07 million

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(a) Supercritical coal-fired plants have steam cycles that operate at higher pressures (>3207 psi) than subcritical plants. They can be significantly more efficient. Even higher efficiencies are possible with ultra-supercritical coal plants or by using integrated gasification combined-cycle (IGCC) technologies. Currently, the United States has no ultra-supercritical plants and one relatively small IGCC facility.

(b) Heat rate is a measure of generating station thermal efficiency. In English units, it is generally expressed in British thermal units (Btu) per net kilowatt hour (kWh). It is computed by dividing the total Btu content of the fuel burned for electric generation by the resulting kWh generation.

(c) The capacity factor is the ratio of electricity generated, for the period of time considered, to the energy that could have been generated at continuous full-power operation during the same period.

tons) of ash in a year. After combustion, PPL assumes that 90 percent of the ash, or 872,000 MT (961,000 tons), would be collected and marketed for beneficial reuse. Since the coal-fired alternative's operators would likely control sulfur dioxide (SO_2) emissions using lime-based scrubbers, the coal-fired alternative would generate approximately 621,000 MT (684,000 tons) of scrubber sludge (disposed of at the plant site according to PPL), based on annual lime usage of approximately 210,000 MT (231,000 tons).[a]

The NRC staff assumes that a coal-fired alternative located at either the SSES site or an alternate site would use a closed-cycle cooling system, as SSES currently does. Locating a plant at an alternate site would require construction of 50 mi (80 km) of new transmission line to remedy the load pocket created by an SSES shutdown (PPL 2006). PPL did not analyze an alternate site for a coal-fired alternative in its ER.

At the SSES site, coal and lime would likely be delivered by rail. The coal-fired alternative would likely require nearly two unit trains per day of coal, given that one unit train contains 100 cars with 91 MT (100 tons) each, 9070 MT (10,000 tons) of coal total per train. The existing rail spur would need to be improved to allow for these deliveries. On any given day, up to four train trips may occur on the rail spur as trains come and go. At an alternate site, crews would need to construct a rail spur to receive deliveries. Following combustion, ash for beneficial reuse would likely leave the site by train, as well. Occasional deliveries of lime would also occur by rail. The environmental impacts of the coal-fired alternative are discussed in the following sections and are summarized in Table 8-2. Impacts at an alternate site would vary with characteristics of the site selected.

- **Land Use**

  A new coal-fired power plant located at the SSES site would use existing facilities and infrastructure to the extent practicable, thereby limiting the amount of new construction that would be required. A new coal-fired power plant may be able to use the existing cooling towers, switchyard, offices, and transmission lines, as well as the rail spur. Much of the land that would be used has been previously disturbed. Improvements to the existing rail line may be required in order to support coal and lime deliveries, although impact from this upgrade would be short-lived.

  The coal-fired alternative would require approximately 1050 ac (425 ha; 690 ac – 280 ha - for powerblock and coal storage and 360 ac – 145 ha – for waste management) for industrial use, based on PPL estimates. Additional land adjacent to the SSES site may be required.

(a) The NRC staff notes that some portion of the scrubber sludge could potentially be recycled rather than landfilled.

Table 8-2. Summary of Environmental Impacts of Coal-Fired Generation at the SSES Site and an Alternate Greenfield Site Using Closed-Cycle Cooling

Impact Category	Susquehanna Site		Alternate Site	
	Impact	**Comments**	**Impact**	**Comments**
Land use	MODERATE	Uses existing facilities to the extent practical to reduce land requirements for power plant, waste disposal, and rail spur; additional offsite land use impacts for coal and limestone mining.	MODERATE to LARGE	Uses more land for plant, offices, parking, transmission lines, and rail spur; additional offsite land use impacts for coal and limestone mining, as well as a transmission line to eliminate a potential load pocket at SSES.
Ecology	MODERATE	Uses mostly previously disturbed but currently unused areas at current SSES site, plus existing rail and transmission corridors; may result in habitat loss and fragmentation in coal-mining areas. Reduced water requirement may benefit aquatic ecology.	SMALL to LARGE	Impact depends on location and ecology of the site, surface water body used for intake and discharge, and transmission line and rail routes; potential habitat loss and fragmentation; reduced productivity and biological diversity.
Water use and quality – surface water	SMALL	The coal-fired alternative would use the existing cooling tower system, although runoff from coal and waste piles could affect water quality, if not properly managed.	SMALL to MODERATE	With closed-cycle cooling, the impact would likely be SMALL, although it could be MODERATE depending on characteristics of the surface water body.
Water use and quality – groundwater	SMALL	Groundwater use, as at the current SSES, would likely be limited to domestic and some industrial purposes.	SMALL to MODERATE	Impact would depend on the volume of water withdrawn and the characteristics of the aquifers, although groundwater would likely not be used for cooling.
Air quality	MODERATE	Luzerne, Columbia, and several nearby counties are nonattainment areas for ozone. The coal-fired alternative would emit:	MODERATE	Potentially same impacts as the Susquehanna site, although pollution-control standards may vary.

Table 8-2. (contd)

Impact Category	Susquehanna Site		Alternate Site	
	Impact	Comments	Impact	Comments
Air quality (contd)		Sulfur oxides • 13,200 tons/yr Nitrogen oxides • 1790 tons/yr Particulates • 534 tons/yr of total suspended particulates • 123 tons/yr of PM_{10} Carbon monoxide • 1790 tons/yr It would also emit small amounts of mercury, other hazardous air pollutants, some naturally occurring radioactive materials, and unregulated CO_2.		
Waste	MODERATE	Total waste mass would be approximately 791,000 tons/yr of ash and scrubber sludge requiring approximately 360 ac (146 ha) for disposal during the 40-year life of the plant. Ninety percent of ash is recycled. Construction impacts would be SMALL, with land-clearing waste disposed onsite.	MODERATE	Same impacts as SSES site; waste disposal constraints may vary.
Human health	SMALL	Impacts are uncertain, but considered SMALL, given that plant must comply with health-based emission standards and offset its emissions of ozone-producing NO_x.	SMALL	Likely similar impacts as at the SSES site.

Table 8-2. (contd)

Impact Category	Susquehanna Site		Alternate Site	
	Impact	**Comments**	**Impact**	**Comments**
Socioeconomics	SMALL to MODERATE	Construction impacts would be MODERATE. Up to 2500 workers during the peak period of the 5-year construction period, followed by reduction from current SSES Units 1 and 2 workforce of 1227 to 640. Tax base would generally be preserved in Luzerne County. Impacts during operation would be SMALL.	SMALL to LARGE	Construction impacts would depend on location, but could be LARGE if plant is located in a rural area. Luzerne and surrounding counties would lose tax revenue and employment. Impacts at a site near to an urban area may be SMALL to MODERATE. Impacts during operation would be SMALL.
Transportation	SMALL to MODERATE	Transportation impacts during construction would be MODERATE, and traffic impacts during operation would be SMALL. For rail transportation of coal and lime, the impact likely would be MODERATE, depending on routing of coal train.	SMALL to MODERATE	Transportation impacts would be MODERATE primarily during construction. Impacts during operation would be SMALL to MODERATE. For rail transportation of coal and lime, the impact is likely to be MODERATE, depending on routing of coal trains.
Aesthetics	SMALL to MODERATE	Visual aesthetic impact would be SMALL, given existing structures and screening from topography and vegetation. Noise impacts from plant operations would be SMALL to MODERATE.	SMALL to LARGE	The greatest impacts would be from the construction of new transmission lines, plant stacks, and rail lines. Overall, impacts would depend on site characteristics. Noise impacts could be noticeable, depending on proximity to residences and businesses.

Table 8-2. (contd)

Impact Category	Susquehanna Site		Alternate Site	
	Impact	Comments	Impact	Comments
Historic and archeological resources	MODERATE	Some construction would affect previously developed but non-industrial parts of the SSES site; the site's extensive resources increase sensitivity and the potential for impacts.	SMALL to MODERATE	Cultural resource studies would be required so that construction would avoid highly sensitive areas.
Environmental justice	SMALL	Impacts on minority and low-income populations would be similar to those experienced by the population as a whole, which are SMALL. Some additional impacts on rental housing may occur during construction.	SMALL to MODERATE	Impacts would vary depending on population distribution and makeup at the site. Impacts of lost employment and tax base at SSES increase impact levels.

Improvements to the rail spur would affect land onsite, but this disturbance would be limited to the land along the current rail spur. Construction impacts would be short-lived and would likely result in little additional land use impact.

The coal-fired alternative would require approximately 360 ac (146 ha) of land area over the 40-year plant life[(a)] for waste disposal. The impact of a coal-fired alternative on land use, because of the amount of land required to support a coal-fired alternative at the existing SSES site, would likely be MODERATE.

The coal-fired alternative at an alternate site could impact up to 1700 ac (688 ha) for a 1000 MW(e) generating station. This land would support plant structures and associated infrastructure. A 2400 MW(e) plant could require up to 4080 ac (1651 ha) of land. This amount of land would include the plant site, transmission line ROWs, and a rail spur. In addition, 50 mi (80 km) of transmission line ROW would need to be cleared and maintained to eliminate the load pocket area near SSES. These impacts could range from MODERATE to LARGE, depending on the location of the plant. Some of this impact could be mitigated by building in existing ROWs whenever possible.

Coal mining introduces offsite land use impacts in addition to land use impacts from the construction and operation of new power plants. Land disturbance from coal mining

(a) Only half of the land area needed for waste disposal is directly attributable to the alternative of renewing the Susquehanna Units 1 and 2 operating licenses for 20 years.

would likely occur mostly in Pennsylvania (EIA 2006c). Approximately 22,000 ac (8903 ha) could be affected for mining coal and waste disposal to support a 1000 MW(e) coal plant during its operational life (NRC 1996). A total of approximately 56,200 ac (22,744 ha) of land would be required to support a new coal-fired power plant. Partially offsetting this offsite land use would be the elimination of the need for uranium mining to supply fuel for Units 1 and 2. Approximately 1000 ac (405 ha) would be used for mining and processing uranium. For SSES, roughly 2500 ac (1016 ha) of uranium mining area would no longer be needed.

- **Ecology**

Locating a coal-fired power plant at the SSES site would alter site ecology, although it would primarily affect terrestrial resources. Constructing the coal-fired alternative onsite would require converting roughly 1050 ac (425 ha) of land to industrial use (plant, coal storage, ash, and scrubber sludge disposal). However, some of this land would have been previously disturbed. Coal mining operations would also affect terrestrial ecology in offsite coal mining areas, although some of this land is likely already disturbed by mining operations.

Aquatic impacts would likely be similar to the impacts of the existing SSES, as the onsite option may make use of the existing plant's cooling, intake, and outflow structures. The greater thermal efficiency of the coal-fired alternative versus the proposed action means that the coal-fired alternative would consume less water for cooling and blowdown than SSES. In aggregate, this difference would not significantly affect the overall impact level for this option. Impacts to ecology from a coal-fired alternative at the existing site would likely be MODERATE.

Siting a coal-fired power plant at an alternate site would incur rather larger ecological impacts. In addition to onsite impacts, crews would need to disturb land to construct transmission lines and a rail spur, which would require continued maintenance even as transmission lines leading from the SSES site remain in service. The new plant's cooling system would need a source of water for the plant cooling system (likely cooling towers), as well as a discharge point for plant cooling tower blowdown. Decreases in withdrawal from and discharge to the Susquehanna River may partially offset some aquatic impacts at an alternate site. Constructing a new transmission line to remedy the load pocket created when generation at SSES ceases would create additional impacts from ROW clearing and maintenance, as well as construction activities. These impacts would be similar to the impacts of constructing new transmission lines to serve the new plant, but would be at a different location.

Overall impacts for a coal-fired alternative at an alternate site would likely be SMALL to LARGE, and may include habitat loss and fragmentation, as well as reduced productivity and biological diversity, depending on previous levels of disturbance and proximity to existing infrastructure.

- **Water Use and Quality**

Surface Water. PPL staff asserts that the coal-fired alternative at the Susquehanna site could use the existing cooling water system, which would minimize incremental water quality impacts from construction of a new cooling system. Given the coal-fired alternative's greater thermal efficiency, it is likely that it would use less water than the existing Units 1 and 2. Surface-water impacts thus are expected to remain SMALL. The Susquehanna River Basin Commission (SRBC) would continue to regulate consumptive water use.

Like the current plant's discharge, the coal-fired alternative's liquid effluent would continue to consist mostly of cooling tower blowdown, with the discharge having a higher temperature and increased concentration of dissolved solids relative to the receiving body of water and intermittent low concentrations of biocides, although the amount discharged would be smaller than the current discharge. A new NPDES permit would be required to address any new pollutants introduced from emission controls or other aspects of operation. The smaller workforce associated with a coal-fired power plant would also create less sewage, which after treatment is currently discharged to the Susquehanna River. Process waste water could also be discharged.

A coal-fired power plant located at an alternative site would likely rely on surface water for cooling and use a closed-cycle cooling system with cooling towers. For alternate sites, the impact on the surface water would depend on the volume of water needed for makeup water, the plant's discharge volume, and the characteristics of the receiving body of water. Withdrawal of water may be under the control of a commission, depending on the water body in question, while discharges to any surface body of water would be regulated by the State of Pennsylvania Division of Environmental Protection (PDEP). Surface water impacts would likely be SMALL to MODERATE at an alternate site.

Groundwater. The current plant uses groundwater for a variety of domestic and industrial purposes. It does not use groundwater for plant cooling. The coal-fired alternative may continue to use the existing wells for domestic purposes, and may or may not require groundwater for industrial applications (like pump seal maintenance). Because the coal-fired alternative would have many fewer employees than the existing SSES, it is likely that it would use less groundwater than the current plant. Disposal of coal wastes, however, may have a greater impact on groundwater resources, especially if onsite disposal results in any contaminants reaching groundwater. Applicable waste disposal regulations would help to mitigate this impact. Additionally, since currently used aquifers are shallow and run toward the Susquehanna River, impacts from coal waste are unlikely to impair groundwater resources for other potential users. Impacts to groundwater from the coal-fired alternative at the SSES site would likely be SMALL.

At an alternate site, impacts would depend on whether the plant would use groundwater for any purposes, as well as the characteristics of local aquifers. Regardless of location, the NRC staff finds it highly unlikely that a coal-fired power plant would rely on groundwater for plant cooling, and believes that groundwater and waste-management regulations would result in SMALL to MODERATE impacts at an alternate site.

- **Air Quality**

The air quality impacts of a coal-fired power plant are considerably greater than those of the current SSES due to emissions of sulfur oxides (SO_x, typically expressed as SO_2), nitrogen oxides (NO_x), particulates, carbon monoxide (CO), hazardous air pollutants such as mercury, and naturally occurring radioactive materials.

Currently, Luzerne County and the neighboring counties of Lackawanna, Wyoming, Monroe, and Carbon are nonattainment areas for the 8-hour ozone standard under the Clean Air Act (CAA). These counties are either in attainment or unclassified for other criteria pollutants.

A new coal-fired power plant located in Luzerne County or other parts of the Scranton-Wilkes-Barre area would likely need a nonattainment area permit and a Title V operating permit under the CAA. The plant would need to comply with the new source performance standards for such plants set forth in 40 CFR Part 60, Subpart da. The standards establish limits for particulate matter and opacity (40 CFR 60.42da), SO_2 (40 CFR 60.43da), NO_x (40 CFR 60.44da), and mercury (40 CFR 60.45da).

The EPA has various regulatory requirements for visibility protection in 40 CFR Part 51, Subpart P, including a specific requirement for review of any new major stationary source in an area designated as attainment or unclassified under the CAA.

Section 169A of the CAA (Title 42, Section 7491, of the *United States Code*, 42 USC 7491) establishes a national goal of preventing future and remedying existing impairment of visibility in mandatory Class I Federal areas (identified in 40 CFR 81.400, et seq.) when impairment results from man-made air pollution. The EPA's haze rule specifies that for each mandatory Class I Federal area located within a State, the State must establish goals that provide for reasonable progress towards achieving natural visibility conditions. The reasonable progress goals must provide for an improvement in visibility for the most-impaired days over the period of the implementation plan and ensure no degradation in visibility for the least-impaired days over the same period (40 CFR 51.308(d)(1)). If the coal-fired alternative were located close to a mandatory Class I area, additional air pollution control requirements could be imposed. Pennsylvania, however, contains no Class I areas.

Impacts for particular pollutants would be as follows:

Sulfur oxides emissions. PPL's ER (PPL 2006) proposes that the coal-fired alternative would use lime-based scrubbers to remove sulfur oxides. Its total SO_2 emissions would be approximately 13,200 tons/yr (11,983 MT/yr), based on EPA emissions factors (EPA 1998a).

A new coal-fired power plant would be subject to the requirements in Title IV of the CAA. Title IV was enacted to reduce emissions of SO_2 and NO_x, the two principal precursors of acid rain, by restricting emissions of these pollutants from power plants. Title IV caps aggregate annual power plant SO_2 emissions and imposes controls on SO_2 emissions through a system of marketable allowances. The EPA issues one allowance for each ton of SO_2 that a unit is allowed to emit. New units do not receive allowances, but are required to have allowances to cover their SO_2 emissions. Owners of new units must therefore either acquire allowances, purchase from owners of other power plants, or reduce SO_2 emissions at other power plants they own. Allowances can be banked for use in future years. Thus, the coal-fired alternative would not add to net regional SO_2 emissions, although it might do so locally.

Regardless, SO_2 emissions at the site would be greater for the coal-fired alternative than the operating license renewal alternative.

Nitrogen oxides emissions. Title IV of the CAA establishes technology-based emission limitations for NO_x emissions. A new coal-fired power plant would be subject to the new source performance standards for such plants at 40 CFR 60.44a(d)(1). This regulation, issued on September 16, 1998 (EPA 1998a), limits the discharge of any gases that contain nitrogen oxides (expressed as nitrogen dioxide) in excess of 300 nanograms per joule (ng/J) of gross energy output (0.70 lb/million Btu), based on a 30-day rolling average.

PPL projects that the coal-fired alternative would use low-NO_x burners with overfire air and selective catalytic reduction (SCR). Given these control technologies, the NRC staff estimates that the total annual NO_x emissions for the coal-fired alternative would be approximately 1790 tons/yr (1625 MT/yr), or less than 5 percent of the new source performance standard emission rate. As SSES is located in an ozone nonattainment area, and as NO_x is an ozone precursor, the plant operator would need to purchase emission allowances to offset this amount of emissions. This level of NO_x emissions would be greater, however, than the operating license renewal alternative.

In addition, the total amount of NO_x that could be emitted by Pennsylvania in the year 2007 ozone season (May 1 to September 30) was set at 40 CFR 51.121(e). The total permitted amount is 257,928 tons (234,152 MT). The coal-fired alternative would need to offset its emissions through credit purchases or from a set-aside pool so that future statewide allowable limits would not be violated.

Particulate emissions. Based on EPA emissions factors (1998b), the NRC staff estimates that the total annual stack emissions would include approximately 534,000 tons (484,776 MT) of filterable total suspended particulates and approximately 123,000 tons (111,584 MT) of particulate matter (PM) having an aerodynamic diameter less than or equal to 10 μm (PM_{10}) (40 CFR 50.6a).[a] Fabric filters or electrostatic precipitators would be used for control, resulting in a total emission of 534 tons/yr (485 MT/yr) and 123 tons/yr (112 MT/yr), respectively. Coal-handling equipment would also introduce fugitive particulate emissions. Particulate emissions would be greater under the coal-fired alternative than under the operating license renewal alternative.

During the construction of the coal-fired alternative, onsite activities at any location would generate fugitive dust. In addition, vehicles and motorized equipment would create exhaust emissions during the construction process. These impacts, however, would be intermittent and short-lived. In addition, to minimize dust generation, construction crews would use applicable dust-control measures.

Carbon monoxide emissions. The NRC staff estimates that the total CO emissions from the coal-fired alternative would be approximately 1790 tons/yr (1625 MT/yr) based on EPA emissions factors (EPA 1998b). This level of emissions is greater than that of the operating license renewal alternative.

Hazardous air pollutants including mercury. In December 2000, the EPA issued regulatory findings on emissions of hazardous air pollutants from electric utility steam-generating units (EPA 2000a). The EPA determined that coal- and oil-fired electric utility steam-generating units are significant emitters of hazardous air pollutants. Coal-fired power plants were found by the EPA to emit arsenic, beryllium, cadmium, chromium, dioxins, hydrogen chloride, hydrogen fluoride, lead, manganese, and mercury

(a) See also 40 CFR 50.7a for $PM_{2.5}$ standards.

(EPA 2000a). The EPA concluded that mercury is the hazardous air pollutant of greatest concern. The EPA found that (1) there is a link between coal combustion and mercury emissions; (2) electric utility steam-generating units are the largest domestic source of mercury emissions; and (3) certain segments of the U.S. population (e.g., the developing fetus and subsistence fish-eating populations) are believed to be at potential risk of adverse health effects due to mercury exposures resulting from consumption of contaminated fish (EPA 2000a). Accordingly, on March 15, 2005, the EPA issued the Clean Air Mercury Rule to permanently cap and reduce mercury emissions from coal-fired power plants (EPA 2007).

Uranium and thorium. Coal contains uranium and thorium, among other naturally occurring radioactive elements. One researcher indicated that uranium concentrations are generally in the range of 1 to 10 parts per million (ppm) and thorium concentrations are generally about 2.5 times this level (Gabbard 1993). The U.S. Geological Survey (USGS) indicates that Western and Illinois Basin coals contain uranium and thorium at roughly equal concentrations, mostly between 1 and 4 ppm, but also indicates that some coals may contain concentrations as high as 20 ppm of both elements (USGS 1997). Gabbard indicates that a 1000 MW(e) coal-fired plant could release roughly 4.7 MT (5.2 tons) of uranium and 11.6 MT (12.8 tons) of thorium to the atmosphere (Gabbard 1993). USGS and Gabbard indicate that almost all of the uranium, thorium, and most decay products remain in solid coal wastes, especially in the fine glass spheres that constitute much of coal's fly ash. Modern emission controls, such as those included for this coal-fired alternative, allow for recovery of greater than 99 percent of these solid wastes (EPA 1998b), thus retaining most of coal's radioactive elements in solid form rather than releasing them to the atmosphere. Even after concentration in coal waste, the level of radioactive elements remains relatively low – typically 10 to 100 ppm – and consistent with levels found in naturally occurring granitic rocks, shales, and phosphate rocks (USGS 1997).

Carbon dioxide. The coal-fired alternative would also have unregulated carbon dioxide (CO_2) emissions that could contribute to climate change. Based on EIA emission factors for bituminous coal combustion, this coal-fired alternative would result in 17.3 million tons (15.6 million MT) (EIA 2007b). The level of CO_2 emissions from the coal-fired alternative would be greater than that for the operating license renewal alternative.

Summary. The NRC staff analysis indicates that emissions from a coal-fired alternative would be substantial. The GEIS notes that potential effects of these emissions include global warming from unregulated CO_2 emissions and acid rain from SO_x and NO_x emissions as potential impacts. Adverse human health effects such as cancer and emphysema have also been associated with the products of coal combustion. The appropriate characterization of air impacts from the coal-fired alternative would be

MODERATE, since extensive emissions controls would be necessary to meet air quality standards. These controls mean impacts would be clearly noticeable, but would not destabilize air quality.

Siting the coal-fired alternative at a site other than Susquehanna would not significantly change air quality impacts, although it could result in installing more or less stringent pollution-control equipment to meet applicable local requirements. Therefore, the impacts would be MODERATE.

- **Waste**

Coal combustion generates waste in the form of ash, and equipment for controlling air pollution generates additional ash and scrubber sludge.[a] A coal-fired power plant having a gross capacity of 2553 MW(e) would generate approximately 1.59 million MT (1.75 million tons) of this waste annually for 40 years. Of this waste, approximately 872,000 MT (961,000 tons; 90 percent of the ash content) would be recycled for beneficial reuse, according to PPL, leaving a total of approximately 718,000 MT (791,000 tons) that would be landfilled onsite, accounting for approximately 360 ac (146 ha) of land area over the 40-year plant life. Waste impacts to groundwater and surface water could extend beyond the operating life of the plant if leachate and runoff from the waste storage area occurs. If this does occur, given the hydrologic characteristics of the site, this contamination may also spread to the Susquehanna River. Disposal of the waste could noticeably affect land use and groundwater quality, but with appropriate management and monitoring, it would not destabilize any resources. After closure of the waste site and revegetation, the land could be available for other uses.

In May 2000, the EPA issued a "Notice of Regulatory Determination on Wastes from the Combustion of Fossil Fuels" (EPA 2000b). In it, the EPA indicated that it would issue regulations for disposal of coal combustion waste under Subtitle D of the Resource Conservation and Recovery Act. The EPA has not yet issued these regulations.

In summary, the appropriate characterization of impacts from waste generated from burning coal is MODERATE; the impacts would be clearly noticeable, but would not destabilize any important resource.

Crews would generate debris during construction activities. These would likely be disposed onsite, when possible. Overall, this amount of waste is small compared to

(a) Radionuclides (e.g., uranium and thorium) are present in coal fly ash exist at levels equivalent to those in naturally occurring granitic, phosphate, and shale rocks (USGS 1997).

operational waste generated, and many construction wastes can be recycled. As such, construction-stage waste impacts would be SMALL.

Siting the facility at a site other than SSES would not alter waste generation, although other sites might have more constraints on disposal locations. If the coal-fired alternative was sited on a previously developed location, then there may be fewer constraints. Independent of site location, the impacts would be MODERATE.

- **Human Health**

Coal-fired power power plants introduce worker risks from coal and limestone mining, from coal and lime transportation, and from disposal of coal combustion waste. In addition, there are public risks from inhalation of stack emissions. Emission impacts can be widespread and health risks difficult to quantify. The coal-fired alternative also introduces the risk of coal-pile fires and attendant inhalation risks.

In the GEIS, the NRC staff stated that there could be human health impacts (cancer and emphysema) from inhalation of toxins and particulates, but it did not identify the significance of these impacts.

Regulatory agencies, including the EPA and State agencies, set air emission standards and requirements based on human health impacts. These agencies also impose site-specific emission limits as needed to protect human health. Though SSES is located in a nonattainment area, emission contents and trading or offset mechanisms would prevent further degradation. Human health impacts would be SMALL. Impacts at an alternate site would also likely be SMALL.

- **Socioeconomics**

PPL projected a maximum construction workforce of 1600 (PPL 2006), though the GEIS projects a peak workforce of 1200 to 2500 per 1000 MW(e). Given a 2553 MW(e) plant, the NRC staff projects a workforce of 2500 would be required to construct the new power plant. These workers would be in addition to the 1227 currently working at SSES. It is likely that many of these workers would commute from the Scranton-Wilkes-Barre area. During construction, the surrounding communities would experience increased demand for rental housing and public services, although this would be moderated by the proximity of the site to the Scranton-Wilkes-Barre area. After construction, local communities may be affected by the loss of the construction jobs and associated loss of business. Construction of the coal-fired alternative would take approximately 5 years. Construction impacts would be MODERATE. Impacts at an alternate site would likely be MODERATE to LARGE. In the GEIS, the NRC staff stated that socioeconomic impacts at a rural site would be larger than at an urban site, because more of the construction workforce would need to move closer to the construction site.

PPL estimated an operational workforce of 197 (PPL 2006), which would be smaller than the plant's current operating workforce, while the GEIS estimated approximately 640 workers. Either number is a significant reduction from the 1227 employees currently employed at SSES. This would result in SMALL impacts. Operations impacts at an alternate site would be SMALL to MODERATE, depending on the characteristics of communities near the site.

- **Transportation**

During 5 years of construction, up to 2500 workers would be commuting to the site alongside the 1227 workers at SSES. The addition of these workers would increase traffic volumes on existing roads in the vicinity of SSES. These impacts would likely be MODERATE. Impacts at an alternate site could also be MODERATE.

Transportation impacts during plant operations would likely be SMALL. The maximum number of plant operating personnel would be approximately 640, which is smaller than the current SSES workforce. At an alternate site, these impacts would also likely be SMALL, although they could rise to MODERATE if the site has poor access to highways.

The impacts of the transport of coal and lime via rail to the SSES site would be MODERATE. Approximately 716 trains per year would be needed to deliver coal for the coal-fired alternative, and a smaller number of trips to deliver lime. The NRC staff expects a total of at least 28 train trips per week, or nearly 4 trips per day on the spur leading to the plant. For each train delivery of coal there would be a train leaving the site. Impacts at an alternate site would vary based on rail congestion in the area and would also be MODERATE.

- **Aesthetics**

Visual impacts of a coal-fired alternative at SSES would be consistent with the industrial nature of the site, and would be partially screened by surrounding topography and forested areas. Impacts from new structures would be less than the impacts of existing cooling towers. If sited at SSES, the four power plant units would be up to 200 ft (61 m) tall and may be visible offsite in daylight hours. The four exhaust stacks would be up to 600 ft (183 m) high. The current SSES cooling towers are 540 ft (165 m) tall. The units and associated stacks would also be visible offsite at night because of lighting. The visual impacts of the coal-fired alternative could be reduced by landscaping and using exterior building colors that blend in with the environment. Visual impact at night could be mitigated by the appropriate use of shielding.

Plant operations may be audible offsite, and intermittent noise from coal-handling equipment, solid-waste disposal, and rail delivery of coal and lime would be greater than currently experienced at SSES. Based on this information, aesthetic impacts would likely be SMALL to MODERATE.

At an alternate site, the coal-fired alternative's buildings, exhaust stacks, cooling towers, and cooling tower condensate plumes would introduce new aesthetic impacts that may or may not be screened by surrounding topography and vegetation. There could also be a significant aesthetic impact associated with construction of new transmission lines. Noise and light from plant operations, as well as lighting on plant structures, may be detectable offsite. Noise impacts from a rail spur, if required, would be similar to the impacts at the existing SSES site. Aesthetic impacts could be mitigated if the plant were located in an industrial area adjacent to other power plants. Overall, the aesthetic impacts associated with locating the coal-fired alternative at an alternate site can be categorized as SMALL to LARGE, depending on site location.

- **Historic and Archaeological Resources**

Before constructing a coal-fired alternative at the SSES site or an alternate site, a cultural resource inventory would need to be performed for any property that has not been previously surveyed. Other lands, if any, that are acquired to support the coal-fired alternative would also need to be surveyed for cultural resources, identification and recording of existing historic and archaeological resources, and possible mitigation of adverse effects from ground-disturbing actions. Studies would be needed for all areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission corridors, rail lines, or other ROWs).

The archaeological richness of the SSES site, coupled with existing procedures for mitigating impacts, means impacts would be MODERATE for the existing site and would likely be SMALL to MODERATE at an alternate site. Impacts may vary based on whether the site has been previously developed or disturbed.

- **Environmental Justice**

Constructing a coal-fired alternative may result in increased rental housing demand and prices during the 5-year construction period. Housing demands would be somewhat mitigated by the site's proximity to the Scranton-Wilkes-Barre area, since many construction workers would commute. Increased coal consumption may increase employment in other relatively low-income regions in Pennsylvania. Environmental justice impacts for a coal-fired alternative at the SSES site would likely be SMALL.

Constructing a coal-fired alternative at an alternate site would result in the loss of tax revenue and social services, as well as jobs at the SSES site. Depending on the alternate site's proximity to low-income and minority populations, constructing the plant at an alternate site may result in disproportionate impacts to minority or low-income populations. Overall, the environmental justice impact of constructing a coal-fired alternative at an alternate site could be SMALL to MODERATE.

8.2.2 Natural Gas-Fired Generation

The environmental impacts of a natural gas-fired alternative located at both the SSES site and at an alternate site are presented in this section. The NRC staff assumed that a replacement natural gas-fired plant would use combined-cycle technology, as it provides significant efficiency advantages over combustion turbines or gas-fired boilers. While combined-cycle plants often supply intermediate duty cycles, they are capable of supporting baseload needs.

Since the existing SSES uses closed-cycling cooling, and since new facilities are required to use measures to reduce impingement and entrainment of fish and shellfish, the NRC staff assumed that a gas-fired alternative would use a closed-cycle cooling system. For a natural gas-fired alternative onsite, the NRC staff assumed that the new plant would make use of the existing cooling system, including cooling towers, intakes, and discharges.

A new natural gas-fired plant on the SSES site would likely also make use of existing transmission lines, switchyards, and support buildings or infrastructure, like parking lots. The plant would require approximately 2 mi (3 km) of new gas pipeline to connect to an existing 24-in. (61-cm) pipeline north of the plant. Additional upgrades to the pipeline network – including a compressor station – may be necessary to support a gas-fired alternative at any site.

For comparison purposes, the NRC staff evaluated a new gas-fired combined-cycle alternative producing a net capacity of 2400 MW(e). Given that 4 percent of energy produced will meet onsite loads, the gross output for this alternative is roughly 2500 MW(e). In preparing this analysis, the NRC staff used published performance data for a new, commercially available 400 MW(e) combined-cycle unit and assumes that six such units would be necessary to provide sufficient capacity for an alternative to SSES. Each unit's heat rate would be 5690 Btu/kWh.

The NRC staff evaluated impacts for the gas-fired alternative and compared it to environmental impact information in the GEIS, emissions data developed by EPA (2000c), and performance data available from industry and other sources. The NRC staff believes that the gas-fired alternative would have a lifespan similar to the 20-year renewal period, although with refurbishment, the gas-fired alternative may be capable of operating for a longer period of time.

The overall environmental impacts of the natural gas-fired alternative are discussed in the following sections and summarized in Table 8-3. Impacts at an alternate site will be influenced by site characteristics, and will tend to be greater if the site has not been previously disturbed.

- **Land Use**

  A new gas-fired power plant located at the SSES site would use existing facilities and infrastructure to the extent practicable, limiting the amount of new construction that would be required. A new gas-fired plant may be able to use existing cooling towers, switchyard, offices, and transmission lines, as well as the rail spur. Much of the land that would be used has been previously disturbed. The GEIS assumed that 110 ac (45 ha) would be needed to construct and generate a 1000 MW(e) gas-fired plant. A gas-fired alternative equal to SSES could require up to 275 ac (111 ha). PPL assumed that only 90 ac (36 ha) would be necessary for a gas-fired plant onsite (PPL 2006). Since a gas-fired alternative at SSES would take advantage of existing structures, the NRC staff believes that 90 ac (36 ha) is an acceptable estimate. An additional 12 ac (5 ha) may be needed for a gas pipeline. Additional land may be required if a new compressor station or other improvements to local gas transmission are necessary.

  Between 90 ac (36 ha) and 275 ac (111 ha) would be needed for the plant and associated infrastructure at an alternate site (PPL 2006; NRC 1996). Additional acres could be disturbed for gas pipelines and electric transmission lines.

  Land use impacts from a natural gas-fired power plant at the SSES site would be SMALL to MODERATE. Given a lack of existing infrastructure at an alternate site, including the need to construct 50 mi (80 km) of transmission lines to eliminate the load pocket area near SSES, impacts at an alternate site may be SMALL to LARGE. Some portion of this impact could be mitigated by constructing new transmission lines in existing ROWs to as great an extent possible.

  In addition to onsite land requirements, land would be required offsite for natural gas wells and collection stations. The GEIS estimates that 3600 ac (1457 ha) would be required for wells, collection stations, and pipelines to bring the gas to a 1000 MW(e) generating facility. If this land requirement was scaled directly with generating capacity, an alternative to SSES could require 8990 ac (3638 ha) (through actual requirements could very significantly). Most of this land requirement would occur in areas where gas extraction already occurs. The NRC staff notes that some of this natural gas may arrive in the United States as liquefied natural gas (LNG), and may not be adequately reflected

Table 8-3. Summary of Environmental Impacts of Natural Gas-Fired Generation at the SSES Site and an Alternate Site Using Closed-Cycle Cooling

Impact Category	SSES Site		Alternate Site	
	Impact	**Comments**	**Impact**	**Comments**
Land use	SMALL to MODERATE	This alternative would require approximately 90 ac (36 ha) for new plant structures, and would use the existing cooling system, switchyard, transmission lines, and parking lots. A new gas pipeline may affect 12 ac (5 ha).	SMALL to LARGE	Up to 275 ac (111 ha) for power- block, offices, roads, and parking areas disturbed. Transmission lines and gas pipeline would require additional land.
Ecology	SMALL	The new plant would be able to use previously disturbed areas at current SSES site, with relatively little land disturbed for pipeline. Aquatic ecology actually benefits from the gas-fired alternative, as the combined-cycle plant rejects significantly less heat to the environment than the existing SSES, thus requiring less water.	SMALL to LARGE	Impact depends on location and ecology of the site, surface water body used for intake and discharge, and transmission and pipeline routes; potential habitat loss and fragmentation; reduced productivity and biological diversity.
Water use and quality – surface water	SMALL	Use of a closed-cycle cooling system with natural gas-fired combined-cycle units would result in a significant reduction in water use due to lower levels of heat rejection.	SMALL to MODERATE	Impact depends on volume of water withdrawal and discharge and characteristics of surface water body.
Water use and quality – groundwater	SMALL	Existing groundwater wells may remain in service, although domestic loads would be smaller with a greatly reduced worker population. Some industrial uses for water may also cease.	SMALL to MODERATE	Impact depends on volume of water withdrawal and aquifer characteristics, although, unless used for cooling makeup, the volume withdrawn is likely to be relatively small.

Table 8-3. (contd)

Impact Category	SSES Site		Alternate Site	
	Impact	Comments	Impact	Comments
Air quality	SMALL to MODERATE	Likely emissions: Sulfur oxides • 180 tons/yr Nitrogen oxides • 527 tons/yr Carbon monoxide • 120 tons/yr PM_{10} particulates • 100 tons/yr Some hazardous air pollutants; scrubbing could reduce some of the pollutants markedly; construction-stage impacts are SMALL.	SMALL to MODERATE	Likely the same emissions as at SSES site, although local regulations may vary.
Waste	SMALL	Small amount of ash produced.	SMALL	Same waste produced as at the SSES site.
Human health	SMALL	The plant would meet applicable, health-based requirements.	SMALL	Impacts likely to be similar to a plant at the SSES site.
Socioeconomics	SMALL to MODERATE	Construction impacts would be MODERATE. Up to 1200 to 1600 additional workers during the peak of the 3-year construction period, followed by reduction from current SSES workforce of 1227 to 375; tax base preserved. Impacts during operation would be SMALL.	SMALL to MODERATE	During construction, impacts would be SMALL to MODERATE, depending on location. Up to 1200 to 1600 additional workers would be onsite during the peak of the 3-year construction period. Luzerne County would lose jobs and tax base. Impacts during operation would be SMALL.
Transportation	SMALL to MODERATE	Impacts during construction would be SMALL to MODERATE. Impacts during operation would be SMALL.	SMALL to MODERATE	Transportation impacts would be SMALL to MODERATE, primarily during construction.

Table 8-3. (contd)

Impact Category	SSES Site		Alternate Site	
	Impact	**Comments**	**Impact**	**Comments**
Aesthetics	SMALL	Power plant structures would be smaller than existing SSES structures, and most would not be visible offsite. Noise would be limited.	SMALL to MODERATE	New transmission lines and cooling towers would cause the greatest impact. If used, natural draft cooling towers would have a greater impact than mechanical draft structures.
Historic and archeological resources	MODERATE	Construction would occur on previously developed parts of the SSES site; cultural resource inventory would minimize impacts on undeveloped lands, although the richness of site makes impacts possible.	SMALL to MODERATE	Cultural resource studies would be required so that construction would avoid highly sensitive areas.
Environmental justice	SMALL	Impacts on minority and low-income populations would be similar to those experienced by the general population, which are SMALL. Some additional impacts on rental housing may occur during construction, though these would not be noticeable.	SMALL to MODERATE	Impacts would vary depending on population distribution and make-up at the site. Impacts of lost employment and tax base at SSES increase impact levels.

in the GEIS estimates. Partially offsetting these offsite land requirements would be the elimination of the need for uranium fuel for Units 1 and 2. In the GEIS, the NRC staff estimated that approximately 1000 ac (405 ha) would not be needed for mining and processing uranium during the operating life of a 1000 MW(e) nuclear power plant. For SSES, roughly 2510 ac (1016 ha) of uranium mining area would no longer be needed.

- **Ecology**

Ecology impacts from siting a gas-fired alternative at the SSES site are likely to be minor. Terrestrial ecology would be minimally affected by the 90 ac (36 ha) disturbed in constructing the units. Given the nature of the site, much or all of this land may have been previously disturbed, and given the plant's small footprint, construction would be able to avoid ecologically sensitive areas. Construction activities onsite would take place over the course of 3 years. No new transmission lines or switchyards would be necessary, and the existing cooling system would remain in use. The 2 mi (3 km) of pipeline necessary to bring natural gas to the site would likely run along existing road corridors, and any additional gas infrastructure would also be installed along these corridors, thus minimizing impacts. Transmission line ROW maintenance would likely continue as before.

As the onsite gas-fired alternative would continue to use the existing cooling system, impacts to aquatic ecology would also be minimal. Most noticeably, the gas-fired alternative exhausts much less waste heat per unit of electrical output than the existing SSES. A gas-fired alternative would require less than half as much water as the existing plant due to its much higher thermal efficiency.

Ecological impacts at an alternate site would depend on the nature of the land converted for the plant (up to 275 ac [111 ha]) and the possible need for new gas infrastructure and/or transmission lines, including a 50-mi (80-km) transmission line to eliminate the load pocket created by the SSES shutdown. Construction of the transmission line and construction and/or upgrading of the gas pipeline to serve the plant would be expected to have temporary ecological impacts, although these could be large if the plant site is far from existing gas and transmission lines. Ecological impacts to the plant site and utility easements could include impacts on threatened or endangered species, wildlife habitat loss and reduced productivity, habitat fragmentation, and a local reduction in biological diversity.

At an alternate site, the cooling makeup water intake and discharge could have aquatic resource impacts. These impacts are likely to be smaller at urban or previously industrial sites, owing to generally closer access to pipelines and transmission lines than at undeveloped sites. Overall, the ecological impacts are considered SMALL at the SSES site and could range from SMALL to LARGE at a different location.

- **Water Use and Quality**

Surface Water. A gas-fired alternative located at the SSES site would use less than half as much water as the existing SSES. The plant would withdraw less cooling water, discharge less blowdown water, and would consume (evaporate) less water than the existing SSES facility (as well as less than the coal or new nuclear alternatives). Like the current plant's discharge, the gas-fired alternative's liquid effluent would continue to consist mostly of cooling tower blowdown, with the discharge having a higher temperature and increased concentration of dissolved solids relative to the receiving body of water and intermittent low concentrations of biocides, although the amount discharged would be smaller than the current discharge. The smaller workforce associated with a gas-fired power plant would also create less sewage, which after treatment is currently discharged to the Susquehanna River. Process waste water could also be discharged. All discharges would be regulated through a National Pollutant Discharge Elimination System (NPDES) permit, which would be administered by PDEP.

Some erosion and sedimentation could occur during construction of a gas-fired alternative (NRC 1996), but applicable construction-site regulations and implementation of best management practices would help to reduce these short-lived impacts. The NRC staff characterized water-quality impacts from sedimentation during construction as SMALL in the GEIS.

A natural gas-fired plant at an alternate site would likely also use a closed-cycle cooling system with cooling towers. The NRC staff assumes that surface water would be used for cooling makeup water and possibly as a source for sanitary and service water. Cooling tower blowdown, service water, and treated sanitary water would all be discharged to surface water. Intake and discharge would involve essentially the same quantities of water as would be necessary for an alternative located at the SSES site. The impact on the surface water would depend on the characteristics of the body of water. Intake from and discharge to any surface body of water would be regulated by the PDEP if located within Pennsylvania.

Impacts to surface-water quality and usage from a gas-fired alternative at the SSES site would be SMALL, while impacts at an alternate site may be slightly larger, depending on the characteristics of the water bodies the plant uses. At an alternate site, impacts may be SMALL to MODERATE.

Groundwater. SSES currently uses groundwater for domestic purposes and some industrial processes, although not for cooling water makeup. It is likely that groundwater usage would decrease with a gas-fired alternative, given the sharp reduction in number of workers onsite and reduced plant size. Some reduction may occur in the amount of water removed for industrial processes. Impacts on groundwater, then, for a gas-fired alternative at the SSES site would be SMALL.

Groundwater impacts at an alternate site may vary widely, depending on whether the plant uses groundwater for any purposes, although it is unlikely that a plant could use groundwater for cooling makeup. Assuming groundwater would only be used for domestic and maintenance purposes, groundwater impacts at an alternate site would be SMALL to MODERATE, depending on withdrawal amounts and aquifer characteristics.

- **Air Quality**

A gas-fired alternative would release a variety of air emissions. Like the coal-fired alternative, a gas-fired plant would emit criteria air pollutants, but generally in smaller quantities (except NO_x, which requires additional controls to reduce emissions).

Currently, Luzerne County and the neighboring counties of Lackawanna, Wyoming, Monroe, and Carbon are nonattainment areas for 8-hr ozone under the CAA. These counties are either in attainment or unclassified for other criteria pollutants.

A new gas-fired generating plant located in Luzerne County or other parts of the Scranton-Wilkes-Barre area would need a nonattainment area permit and a Title IV operating permit under the CAA. The plant would need to comply with the new source performance standards for such plants set forth in 40 CFR Part 60, Subpart Da. The standards establish limits for particulate matter and opacity (40 CFR 60.42(a)), SO_2 (40 CFR 60.43(a)), and NO_x (40 CFR 60.44(a)).

The EPA has various regulatory requirements for visibility protection in 40 CFR Part 51, Subpart P, including a specific requirement for review of any new major stationary source in an area designated as attainment or unclassified under the CAA.

Section 169A of the CAA (42 USC 7491) establishes a national goal of preventing future and remedying existing impairment of visibility in mandatory Class I Federal areas when impairment results from man-made air pollution. EPA's haze rule specifies that for each mandatory Class I Federal area located within a State, the State must establish goals that provide for reasonable progress towards achieving natural visibility conditions. The reasonable progress goals must provide for an improvement in visibility for the most-impaired days over the period of the implementation plan and ensure no degradation in visibility for the least-impaired days over the same period (40 CFR 51.308(d)(1)). If a gas-fired alternative were located close to a mandatory Class I area, additional air pollution control requirements could be imposed. Pennsylvania, however, contains no Class I areas.

Impacts for particular pollutants are as follows:

<u>Sulfur oxides</u>. Based on EPA emissions factors (EPA 2000c), the gas-fired alternative would produce approximately 180 tons/yr of sulfur oxides, expressed as SO_2. A new gas-fired power plant would be subject to the requirements in Title IV of the CAA. Title IV was enacted to reduce emissions of SO_2 and NO_x, the two principal precursors of acid rain, by restricting emissions of these pollutants from power plants. Title IV caps aggregate annual power plant SO_2 emissions and imposes controls on SO_2 emissions

through a system of marketable allowances. EPA issues one allowance for each ton of SO_2 that a unit is allowed to emit. New units do not receive allowances, but are required to have allowances to cover their SO_2 emissions. Owners of new units must therefore acquire allowances from owners of other power plants by purchase or reduce SO_2 emissions at other power plants they own. Allowances can be banked for use in future years. Thus, a new gas-fired power plant would not add to net regional SO_2 emissions, although it might do so locally.

While SO_2 emissions from the gas-fired alternative would be less than from the coal-fired alternative, they would be greater than for the operating license renewal alternative.

<u>Nitrogen oxides</u>. Based on EPA emissions factors (EPA 2000c), the gas-fired alternative would produce approximately 527 tons/yr (478 MT/yr) of NO_x. This level of NO_x emissions relies on dry low NO_x and selective catalytic reduction (SCR) to reduce initial NO_x emissions by more than 90 percent. As SSES is located in an ozone nonattainment area, the plant operator would need to purchase emissions allowances to offset this amount of emissions. While this level of NO_x emissions would be less than the coal-fired alternative, it would be greater than the operating license renewal alternative.

In addition to nonattainment considerations, the total amount of NO_x that can be emitted by all Pennsylvania sources in the year 2007 ozone season (May 1 to September 30) was capped according to 40 CFR 51.121(e) at 257,928 tons (233,988 MT). If a new gas-fired power plant would cause Pennsylvania to exceed the level of NO_x emissions established in caps in future years, the plant operators would need to offset its emissions through credit purchases or by borrowing from a set-aside pool of NO_x credits.

Title IV of the CAA establishes technology-based emission limitations for NO_x emissions. A new gas-fired power plant would be subject to standards published in 40 CFR 60.44a(1). This regulation, issued on September 16, 1998 (EPA 1998a), limits the discharge of any gases that contain nitrogen oxides (expressed as nitrogen dioxide) in excess of 86 ng/J of gross energy input (0.20 lb per million Btu), based on a 30-day rolling average. A gas-fired generator would be legally permitted to discharge approximately 10,600 tons (9623 MT) per year of NO_x, although the alternative considered here would emit only 527 tons (478 MT) per year.

<u>Carbon monoxide</u>. Based on EPA emissions factors (EPA 2000c), the gas-fired alternative would emit approximately 120 tons/yr (109 MT/yr) of CO. CO emissions from the gas-fired alternative are lower than those from the coal-fired alternative, but more than those emitted by the license renewal alternative.

PM10 particulates. Based on EPA emissions factors (EPA 2000c), the gas-fired alternative would produce approximately 100 tons/yr (91 MT/yr) of PM. All PM emissions generated by the gas-fired alternative would be PM_{10} emissions. Some of these may also classify as $PM_{2.5}$ emissions, which consist of particulates having an aerodynamic diameter less than or equal to 2.5 μm. PM emissions from the gas-fired alternative are lower than those from the coal-fired alternative, but more than those emitted by the license renewal alternative.

Carbon dioxide. A natural gas-fired plant would also have unregulated carbon dioxide emissions of 6.2 million tons/yr (5.6 million MT/yr) that could contribute to climate change (based on EIA emission factors (EPA 2007b). These impacts, however, are significantly smaller than the effects of the coal-fired alternative, and significantly greater than the effects of license renewal or a new nuclear power plant.

Hazardous air pollutants. In December 2000, the EPA issued regulatory findings on emissions of hazardous air pollutants from electric utility steam-generating units (EPA 2000b). Natural gas-fired power plants were found by the EPA to emit arsenic, formaldehyde, and nickel (EPA 2000b). Unlike for coal and oil-fired plants, the EPA did not determine that emissions of hazardous air pollutants from natural gas-fired power plants should be regulated under Section 112 of the CAA.

Construction-stage impacts. Construction activities would result in temporary fugitive dust, although construction crews would employ dust-control practices to limit this impact. Exhaust emissions would also come from vehicles and motorized equipment used during the construction process, although these emissions are likely to be intermittent in nature and would occur over a limited period of time. As such, construction stage air quality impacts would be SMALL.

Summary. The overall air-quality impact for a new natural gas-fired plant sited at SSES or at an alternate site is considered SMALL to MODERATE, depending on the control technology employed during the operating stage and the degree to which a gas-fired alternative affects ozone levels in nearby nonattainment areas.

- **Waste**

The primary waste component from the gas-fired alternative would be spent catalysts from SCR NO_x removal. Any ash generated from firing natural gas would be emitted by the gas-fired alternative as particulate matter. In the GEIS, the NRC staff concluded that waste generation from gas-fired technology would be minimal. Waste generation would be minor compared to the other alternatives considered.

During construction of the gas-fired alternative, crews would generate waste from land clearing and other construction activities. Most waste from land clearing could be disposed of onsite. Building on a previously developed site, like the SSES site or a site formerly used for industrial purposes, would minimize land-clearing waste. Many other wastes generated by the construction project, including metal scrap, have significant recycling value and would likely find markets for beneficial reuse.

Overall, the waste impacts would be SMALL for a natural gas-fired plant sited at SSES or at an alternate site.

- **Human Health**

Human health effects of gas-fired generation are generally low, although in Table 8-2 of the GEIS, the NRC staff identified cancer and emphysema as potential health risks from gas-fired plants. These risks are likely attributable to NO_x emissions that contribute to ozone formation, which in turn contribute to health risks. Emission controls on this gas-fired alternative maintain NO_x emissions well below air quality standards established for the purposes of protecting human health, and emissions-trading or offset requirements mean that overall NO_x in the region would not increase. Health risks to workers may also result from handling spent catalysts that may contain heavy metals. Overall, the impacts on human health of the natural gas-fired alternative sited at SSES or at an alternate site are likely to be SMALL.

- **Socioeconomics**

The NRC staff concluded in the GEIS that socioeconomic impacts from constructing and operating a natural gas-fired plant would not be very noticeable and that the small operational workforce would have the lowest socioeconomic impacts of any nonrenewable technology. Compared to the coal-fired and nuclear alternatives, the smaller size of the construction workforce, the shorter construction time frame, and the smaller size of the operations workforce would mitigate socioeconomic impacts.

PPL indicated that 1600 workers would be necessary to construct this alternative (PPL 2006). The NRC believes 1600 workers is a reasonable estimate. It is likely that many of these workers would commute from the Scranton-Wilkes-Barre area. During construction, the surrounding communities would experience increased demand for rental housing and public services, although this is moderated by the proximity of the site to urban areas. After construction, the communities may be impacted by the loss of the construction jobs and associated loss of business. Construction of the gas-fired alternative would take approximately 3 years.

Following construction, a gas-fired alternative at SSES would introduce a replacement tax base for Luzerne County, and it would also provide up to 375 jobs, based on estimates in the GEIS.

At an alternate site, 375 additional workers would be unlikely to have a major socioeconomic effect. Construction-stage impacts at an alternate site may have significant impacts, depending on whether it is located near an urban area. Alternate sites in rural areas may experience greater socioeconomic impacts during construction, including housing and social service demands, if 1200 to 1600 workers need to relocate to the area and then leave after 3 years. Tax revenue generated by a gas-fired plant would help to offset some of these negative impacts. Locating at an alternate site would impact the population around SSES, as tax revenue and jobs would be lost.

Socioeconomic impacts associated with construction and operation of a natural gas-fired power plant would be SMALL to MODERATE for siting at the SSES site, and would likely be SMALL to MODERATE if constructed at an alternate site.

- **Transportation**

Transportation impacts associated with construction and operations would depend on the population density and transportation infrastructure in the vicinity of the site. At the SSES plant site, 1200 to 1600 construction workers may be commuting alongside 1227 plant workers. Although the area has relatively good access to highways, local roadways may experience noticeable congestion during peak commuting times.

At an alternate site, transportation impacts could vary, depending on the proximity of the site to urban areas, transportation infrastructure, and the degree of existing transportation demands.

The overall transportation impacts at the SSES site would likely be SMALL to MODERATE and SMALL to MODERATE at an alternate site.

- **Aesthetics**

The six gas-fired units would be approximately 100 ft (30 m) tall, while each of the six exhaust stacks would be at least 175 ft (53 m) tall and perhaps taller to account for local topography, and some may require aircraft warning lights. On the SSES site, local topography and onsite forestation would largely screen these structures. Associated infrastructure would generally be smaller and less noticeable than that associated with the existing SSES plant. The current cooling towers would remain in service and –

along with their plumes and the six exhaust stacks – would be the only structures visible offsite during day or night.

Noise from the plant may be detectable offsite, but it is unlikely that this would be any greater than the existing plant noise.

On an alternate site, impacts may be more noticeable. In addition to the plant buildings, an alternate site would require new transmission lines and a new cooling system. Aesthetic impacts may be mitigated by siting in an area formerly developed for industrial purposes, or where local vegetation or topography provides screening for the plant.

On both sites, plant operating noise would be limited to industrial processes and communications. Unlike the other alternatives considered here, pipelines deliver fuel so no handling or other transportation equipment is necessary. Noise from pipelines may be audible offsite near compressors.

On the existing SSES site, aesthetic impacts of the gas-fired alternative would be SMALL, while impacts at an alternate site would likely be SMALL to MODERATE.

- **Historic and Archaeological Resources**

Before constructing a gas-fired alternative at the SSES site or an alternate site, a cultural resource inventory or survey would need to be performed for any property that has not been previously surveyed. Other lands, if any, that are acquired to support the gas-fired plant would also need to be surveyed for cultural resources, identification and recording of existing historic and archaeological resources, and possible mitigation of adverse effects from ground-disturbing actions. Studies would be needed for all areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission corridors, rail lines, or other ROWs).

The existing site is particularly rich in cultural resources. Impacts would likely be MODERATE for the SSES site, even though much of it has been previously disturbed, and SMALL to MODERATE at an alternate site. Impacts may vary based on whether the alternate site has been previously developed and whether significant historic properties are present.

- **Environmental Justice**

Constructing a gas-fired alternative may result in increased rental housing demand and prices during the 3-year construction period. Housing demands during construction would be mitigated by the site's proximity to the Scranton-Wilkes-Barre area. Environmental justice impacts for a gas-fired alternative at the SSES site would likely be SMALL.

Constructing a gas-fired alternative at an alternate site would result in the loss of tax revenue and social services, as well as jobs at the SSES site. Depending on the alternate site's proximity to low-income and minority populations, constructing the plant at an alternate site may result in disproportionate impacts to minority and low-income populations. Impacts to local populations would depend heavily on the populations' characteristics. Overall, the environmental justice impact of constructing a gas-fired alternative at an alternate site would likely be SMALL to MODERATE, primarily for impacts to minority and low-income populations near the current SSES site.

8.2.3 Nuclear Power Generation

Since 1997, the NRC has certified four new standard designs for nuclear power plants under 10 CFR Part 52, Subpart B. These designs are the 1300 MW(e) U.S. Advanced Boiling Water Reactor (10 CFR Part 52, Appendix A), the 1300 MW(e) System 80+ Design (10 CFR Part 52, Appendix B), the 600 MW(e) AP600 Design (10 CFR Part 52, Appendix C), and the 1100 MW(e) AP1000 Design (10 CFR Part 52, Appendix D). One additional design is awaiting certification, and five others are undergoing pre-application reviews. All of the plants currently certified or awaiting certification are light-water reactors; several of the designs in pre-certification review are not, including the Pebble Bed Modular Reactor and the Advanced Candu Reactor, ACR-700 (NRC 2007a). The NRC received several combined operating license (COL) applications in 2007, and has approved several early site permits (ESPs) The NRC expects additional COL applications in 2008, including a COL application by PPL Electric Utilities for undeveloped land at the SSES site. Given industry interest, the NRC staff considered a nuclear alternative to the current SSES. The NRC staff assumed that the new nuclear plant would have a 40-year lifetime, although license renewal could allow operation beyond the initial license.

The NRC staff summarized environmental data associated with the uranium fuel cycle in Table S-3 of 10 CFR 51.51. The data are representative of the impacts associated with a replacement nuclear power plant at SSES or an alternate site. The impacts in Table S-3 are from a 1000 MW(e) unit and would need to be adjusted to reflect impacts of a 2400 MW(e) plant. The environmental impacts associated with transporting fuel and waste to and from a power reactor are summarized in Table S-4 of 10 CFR 51.52. The summary of NRC's findings on NEPA issues for license renewal of nuclear power plants in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B, is also relevant to the operation of a replacement nuclear power plant, although not for evaluation of the environmental impacts.

NRC staff discusses overall impacts of the new nuclear alternative in the following sections, excepting those issues already addressed. The impacts are summarized in Table 8-4. The extent of impacts at an alternate site depend on location and characteristics. Analyses in this section are not based on plans by PPL Electric Utilities for an additional unit or units on property at SSES. If and when PPL Electric Utilities submits a COL application, the NRC staff will review plant- and site-specific information and develop a detailed EIS based on information contained in its COL and collected or evaluated by the NRC staff at that time.

- **Land Use**

  The new nuclear alternative would use existing facilities and infrastructure at the SSES site to the extent practicable, limiting new construction. Specifically, the NRC staff assumed that a replacement nuclear plant would use the existing cooling system, switchyard, offices, parking lots, and transmission lines. Much of the land that would be used has been previously disturbed.

  The GEIS indicates that new light-water reactors could require 500 to 1000 ac (202 to 405 ha) per reference 1000 MW(e) unit. If impacts scaled directly with plant size, a 2400 MW(e) (with 3 percent internal power consumption; 2474 MW(e), gross) new nuclear plant would require approximately 1220 to 2450 ac (494 to 991 ha). Given that this new plant would use many existing structures, it is possible that a new nuclear alternative could fit on the existing SSES site. A new plant would trigger no net change in land needed for uranium mining because uranium mined for the new nuclear plant would offset fuel mined for the existing SSES.

  The amount of land affected at an alternate site would be similar to siting at SSES, except that some land may not have been previously disturbed or used for industrial purposes. In addition, land would be needed for new transmission lines, including a 50-mi (80-km) transmission line to remedy the load pocket created by SSES shutdown. Anywhere from hundreds to thousands of acres may be necessary for all ROWs. It may also be necessary to construct a rail spur to transport equipment during construction, as well as during refueling and major maintenance activities. The need to construct transmission and rail capacity would vary with site characteristics.

  The land use impact of a replacement nuclear generating plant at the existing SSES site is best characterized as MODERATE. This impact would be greater than that of the operating license renewal alternative, as well as greater than the onsite impacts of the gas-fired alternative. It would be similar to onsite land-use impacts of a coal-fired alternative. The offsite land-use impacts from the nuclear fuel cycle, however, are smaller than those for the gas-fired and coal-fired alternatives.

Table 8-4. Summary of Environmental Impacts of New Nuclear Power Generation at the SSES Site and an Alternate Greenfield Site Using Closed-Cycle Cooling

Impact Category	SSES Site		Alternate Site	
	Impact	Comments	Impact	Comments
Land use	MODERATE	Plant uses existing facilities to the extent practicable to reduce land requirements.	MODERATE to LARGE	The plant requires a similar amount of land at an alternate site, plus additional land for transmission lines and a rail spur.
Ecology	SMALL to MODERATE	The plant uses existing structures and undeveloped but previously disturbed areas. Aquatic ecology impacts are likely to be similar to those of the existing plant.	SMALL to LARGE	Impact depends on location and ecology of the site, surface water body used for intake and discharge, and transmission line routes; this could potentially cause habitat loss and fragmentation, reduced productivity, and lost biological diversity.
Water use and quality – surface water	SMALL	Uses existing cooling tower system for cooling tower makeup and discharges blowdown to the Susquehanna River.	SMALL to MODERATE	Impact will depend on the volume of water withdrawn and discharged and the characteristics of the surface water body. Surface water would likely be used for cooling.
Water use and quality – groundwater	SMALL	The plant would use the existing cooling tower system and may make use of existing groundwater systems for domestic and industrial purposes. Groundwater usage would likely be similar to that of the existing plant, with increased demand during construction.	SMALL to MODERATE	Impact will depend on the volume of water withdrawn, as well as characteristics of the aquifer, although the plant would likely not use groundwater for cooling.

Table 8-4. (contd)

Impact Category	SSES Site Impact	SSES Site Comments	Alternate Site Impact	Alternate Site Comments
Air quality	SMALL	Construction vehicles and equipment would generate fugitive emissions and emissions during construction; diesel generators would create a small amount of emissions during operation.	SMALL	Similar impacts to those at the SSES site.
Waste	SMALL	Waste impacts for an operating nuclear power plant are set out in 10 CFR Part 51, Appendix B, Table B-1. Nonradioactive and mixed-waste generation would be similar to that at the existing plant. Debris would be generated and removed during construction, although overall impacts would be similar to the current plant.	SMALL	Similar impacts to those at the SSES site.
Human health	SMALL	Human health impacts for an operating nuclear power plant are SMALL as set out in 10 CFR Part 51, Appendix B, Table B-1.	SMALL	Human health impacts for an operating nuclear power plant are SMALL as set out in 10 CFR Part 51, Appendix B, Table B-1.
Socioeconomics	SMALL to MODERATE	Construction impacts would be MODERATE. Up to 2500 workers during peak period of the 6-year construction period. Operating workforce would be similar to SSES Units 1 and 2; tax base preserved in Luzerne County, but may change in surrounding counties if workers do not transfer from one plant to another. Impacts during operation would be SMALL.	SMALL to LARGE	Construction impacts depend on location. Impacts at a rural location could be LARGE. Impacts at a site near an urban area could be SMALL to MODERATE. Luzerne County would experience loss of tax base, while Luzerne and Columbia Counties would lose employment.

Table 8-4. (contd)

Impact Category	SSES Site		Alternate Site	
	Impact	Comments	Impact	Comments
Transportation	MODERATE	Transportation impacts during construction would be MODERATE. Transportation impacts of commuting plant personnel would be SMALL.	MODERATE	Transportation impacts would be MODERATE, primarily due to construction. Transportation impacts from operations would be SMALL to MODERATE.
Aesthetics	SMALL to MODERATE	Impact is essentially the same as the existing plant.	SMALL to LARGE	Greatest impacts result from new cooling towers and transmission lines. Overall impacts would depend on site characteristics. Noise could be detectable offsite.
Historic and archeological resources	MODERATE	Construction would affect additional onsite land. The site's extensive resources increase sensitivity and potential for impacts.	SMALL to MODERATE	Lands would need to be surveyed so construction would likely avoid highly sensitive areas. Transmission lines increase potential impacts.
Environmental justice	SMALL	Impacts on minority and low-income populations would be similar to those experienced by the general population. Some impacts on housing may occur during construction, although most personnel are expected to travel from nearby urban areas.	SMALL to MODERATE	Impacts will vary depending on population distribution and makeup at the site. Impacts of lost employment and tax base at SSES increase impact levels.

Impacts at an alternate site would be MODERATE to LARGE, depending particularly on transmission line routing and rail spur siting.

- **Ecology**

Locating a replacement nuclear power plant at the SSES site would alter ecological resources because of land needed for plant structures. Since much of this land would have been either previously disturbed or used by existing plant structures, the plant's construction would actually create little new impact. The nuclear alternative would also make use of the existing plant's transmission system.

From an aquatic perspective, a new nuclear plant would be essentially identical to the current SSES in terms of water withdrawal and discharge. Given that the new plant would continue to use the existing cooling system, no major changes would likely occur. Provided plant construction workers use adequate erosion control onsite, aquatic ecology impacts would be minor.

At an alternate site, there would be construction impacts and new incremental operational impacts. On an alternate site, the plant would require 1220 to 2450 ac (494 to 991 ha) for the plant buildings and support infrastructure, as well as hundreds to thousands of acres for all transmission line ROWs and a rail spur. Impacts could include wildlife habitat loss, reduced productivity, habitat fragmentation, and a local reduction in biological diversity, depending on the degree to which the site was previously disturbed, as well as the extent to which transmission lines and a rail spur cross sensitive habitats. Use of cooling makeup water from a nearby surface water body could have adverse aquatic resource impacts, although the plant would mitigate these impacts by using closed-cycle cooling.

Overall, the ecological impacts at SSES would likely be SMALL to MODERATE, and at an alternate site would be SMALL to LARGE, depending on previous land disturbance and proximity to existing infrastructure.

- **Surface Water Use and Quality**

The NRC staff assumes that the replacement nuclear plant alternative at the SSES site would use the existing cooling system, which would minimize water-use and quality impacts. Surface-water impacts are expected to be SMALL, and similar to the impacts from continued operation of the existing plant. The NRC staff assumes that the nuclear alternative sited on the SSES property would continue to use groundwater for domestic, sanitary, and some service applications.

At an alternate site, a new nuclear plant would likely rely on closed-cycle cooling with cooling towers, whether natural or mechanical draft. For alternate sites, the impact on the surface water would depend on the volume of water needed for make-up water, the discharge volume, and the characteristics of the receiving body of water. Intake from and discharge to any surface body of water in Pennsylvania would be regulated by the PDEP. A nuclear plant at an alternate site may or may not use surface water for domestic, sanitary, or service water.

Water use for the nuclear alternative would be greater than for the gas- or coal-fired alternatives, owing the lower thermal efficiencies from the nuclear alternative.

Surface-water use and quality impacts for a nuclear alternative at the SSES site would likely be SMALL, while the impacts at an alternate site would likely be SMALL to MODERATE.

- **Groundwater Use and Quality**

If located at the SSES site, a new nuclear power plant would likely continue to rely on groundwater for domestic, sanitary, and maintenance water. For purposes of this analysis, the NRC staff assumes that water consumption would be similar to that for the current SSES plant. Groundwater demand on the SSES site could increase during construction, when construction workers are onsite in addition to SSES staff.

Use of groundwater for a nuclear power plant sited at an alternate site is also a possibility. Any groundwater withdrawal would require a permit from the local permitting authority. If sited in Pennsylvania, PDEP would regulate groundwater withdrawal and usage. Given the amount of water a new nuclear alternative would require for cooling, the NRC staff believes that a new nuclear alternative would not rely on groundwater for plant cooling.

Overall, groundwater impacts at the current site are expected to be SMALL, and at an alternate site may be SMALL to MODERATE, provided groundwater is not used for cooling purposes.

- **Air Quality**

The nuclear alternative would have very limited effects on air quality, and would emit far less air pollution than either the coal- or gas-fired alternatives. During operation, a nuclear alternative at either SSES or an alternate site would emit essentially no air pollution except that associated with testing and usage of diesel generators. These generators run for several hours to several days per year. Operating emission impacts would be similar to those of the existing SSES, which the NRC staff found to be SMALL in Chapter 4. For information on emissions from the nuclear fuel cycle, see Table S-3 in 10 CFR 51.51.[a]

(a) Table 5-3 quantifies emissions of gases released during the fuel cycle, with the exception of unregulated CO_2. Using Table 5-3 and EIA conversion factors, a new nuclear alternative's fuel cycle would emit roughly 650,000 tons (590,000 MT) of CO_2 (EIA 2007b). EIA indicates that nuclear power plants emit no CO_2 from operations, though diesel generators add small amounts.

Construction of a new nuclear plant sited at SSES or at an alternate site would result in fugitive emissions during the construction process. Exhaust emissions would also come from vehicles and motorized equipment used during the construction process. These impacts would be relatively short-lived and intermittent.

Overall, emissions and associated impacts would be SMALL.

- **Waste**

The waste impacts associated with operation of a nuclear power plant are set out in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B. Construction-related debris would be generated during construction activities and removed to an appropriate disposal site. Overall, waste impacts would be SMALL at either SSES or an alternate site, and similar to those of the currently operating SSES plants.

- **Human Health**

In 10 CFR Part 51, Subpart A, Appendix B, Table B-1, the NRC established human health impacts for operating nuclear power reactors. Overall, the Commission determined that human health impacts would be SMALL. This determination would apply at the SSES site or at an alternate site.

- **Socioeconomics**

The construction period and the peak workforce associated with construction of a new nuclear power plant are currently unquantified (NRC 1996). For this analysis, the NRC staff assumed a construction period of 6 years and a peak workforce similar to that of a coal-fired alternative, or roughly 2500 workers. The NRC staff assumed that construction would take place while the existing nuclear units continue operation and would be completed by the time SSES permanently ceases operations.

At the SSES site, it is likely that many of these workers would commute from the Scranton-Wilkes-Barre area. During construction, the surrounding communities would experience increased demands for rental housing and public services, although this would be moderated by the proximity of the site to the Scranton-Wilkes-Barre area. After construction, local communities may be affected by the loss of the construction jobs and associated loss of business. During construction, impacts would be MODERATE.

Construction impacts at an alternate site would vary based on characteristics of the local population. In the GEIS, the NRC staff stated that socioeconomic impacts at an alternate rural site would be larger than at an alternate urban site, because more of the peak construction workforce would need to move to the area to work. Construction impacts at a rural site could be LARGE, while impacts at a site near an urban area would be SMALL to MODERATE.

The replacement nuclear units would likely have an operating workforce comparable to the 1227 workers currently working at SSES. The replacement nuclear units would provide new tax revenue to offset losses from decommissioning SSES. Impacts from operations would be SMALL.

Operating impacts at an alternate site would be SMALL, though the loss of jobs and tax base would affect the area near SSES.

- **Transportation**

During the construction period, up to 2500 workers would be commuting to the SSES site alongside the 1227 workers at SSES. The addition of these workers, machinery, and material would increase traffic volumes on existing roads. Such impacts would be MODERATE. Transportation impacts related to commuting of plant operating personnel would be similar to current impacts associated with operation of Units 1 and 2 and are considered SMALL.

Transportation-related impacts from commuting construction workers at an alternate site would be MODERATE although they could vary somewhat across sites. Effects of commuting plant workers during operations would be SMALL to MODERATE.

- **Aesthetics**

The containment buildings for a replacement nuclear power plant sited at SSES as well as other associated buildings would be consistent with existing structures and partially screened by surrounding terrain and forestation. Some new structures could be visible offsite. The existing cooling towers would remain visible for many miles during daylight hours. Visual impacts could be mitigated by landscaping and selecting a color for buildings that is consistent with the environment. Visual impact at night could be mitigated by reduced use of lighting and appropriate use of shielding. No exhaust stacks would be needed.

Noise impacts from a new nuclear plant would be similar to those from the existing SSES. Mitigation measures, such as reduced use of outside loudspeakers, can be employed to reduce noise levels. Overall impacts are SMALL to MODERATE for a new nuclear plant at the SSES site.

At an alternate site, the NRC staff expects aesthetic impact from the buildings, cooling towers, and the plume associated with the cooling towers. There could also be a significant aesthetic impact from construction of new transmission lines. Noise and light from the plant could be detectable offsite, depending on site size and characteristics. The impact of noise and light would be mitigated if the plant is located in an industrial area. Overall, the aesthetic impacts associated with locating at an alternative site can be categorized as SMALL to LARGE, depending on site location. The greatest contributors to this input level are the cooling towers and transmission lines.

- **Historic and Archaeological Resources**

At both SSES and an alternate site, a cultural resource inventory would likely be needed for any onsite property that has not been previously surveyed. Other lands, if any, that are acquired to support the new nuclear plant would also likely need to be surveyed for field cultural resources, identification and recording of existing historic and archaeological resources, and possible mitigation of adverse effects from subsequent ground-disturbing actions.

The studies would likely be needed for all areas of potential disturbance at the proposed plant site and along associated corridors where new construction would occur (e.g., roads, transmission corridors, rail lines, or other ROWs). Because the SSES site contains extensive resources, impacts would be MODERATE at the existing site and SMALL to MODERATE at an alternate site.

- **Environmental Justice**

Constructing a new nuclear alternative may result in increased rental housing demand and prices during the 6-year construction period. Housing demands would be mitigated by workers' commuting to the site from the Scranton-Wilkes-Barre area. Environmental justice impacts for a nuclear alternative at the SSES site would likely be SMALL.

Constructing a nuclear alternative at an alternate site would result in the loss of tax revenue and social services, as well as jobs at the SSES site. Depending on the alternate site's proximity to low-income and minority populations, constructing the plant at an alternate site may result in disproportionate impacts to minority and low-income populations near the alternate site. Overall, the environmental justice impact of constructing a new nuclear alternative at an alternate site could be SMALL to MODERATE.

8.2.4 Purchased Electrical Power

PPL participates in the PJM Interconnection. This restructured energy supply system allows for the sale of energy across seven States and the District of Columbia (PPL 2006). Across the PJM, coal is the predominant fuel used for generation, accounting for 53.5 percent in 2003, followed by nuclear (32.9 percent), natural gas (8.4 percent), hydroelectric (2.1 percent), oil (2.0 percent), and renewables (1.1 percent) (PPL 2006). Many of PJM's gas-fired units are actually able to burn fuel oil, as well, although gas utilization is much higher due to lower costs and emissions. In the ER, PPL asserted that purchased power would be a reasonable alternative to license renewal, and that sufficient capacity would likely exist in the future (PPL 2006).

In the area around the plant, purchased power could likely be used to meet demand for electricity, although it is also possible that the loss of SSES could produce a load pocket that would require 50 mi of additional transmission line to mitigate (PPL 2006).

Impacts would likely be similar to those of the above options located at alternate sites. If PPL's power purchases cause currently existing capacity to operate at higher capacity factors, however, rather than triggering new construction, then construction stage impacts would be eliminated. It is likely, then, that purchased power would come from older, less efficient plants, plants with once-through cooling, or plants without modern emissions controls. As such, impacts are difficult to quantify, although they are likely similar to those of other alternatives considered in Sections 8.2.1 through 8.2.3 in this draft SEIS, as well as in the GEIS.

Given the location of SSES, it is unlikely that PPL would be able to purchase power from Canada or Mexico to replace the plant's capacity, regardless of whether either country has sufficient existing export capacity.

Since purchased power may come from a variety of generating resources, including coal, natural gas, nuclear, hydroelectric, and perhaps oil-fired installations (where impacts in previous NRC documents, including the SEIS and the GEIS, were determined to be similar to or larger than those of natural-gas fired generation), NRC staff evaluation indicates that impacts from the purchased power alternative would be greater than the impacts of license renewal.

8.2.5 Other Alternatives

In this section, the NRC staff discusses energy alternatives that it has determined are not individually sufficient to serve as alternatives to issuing the renewed SSES OL.

8.2.5.1 Oil-Fired Generation

EIA projects that oil-fired plants will account for very little of the new generation capacity in the United States during the 2007 to 2030 time period, and overall oil consumption for electricity generation will decrease because of higher fuel costs and lower efficiencies (EIA 2007).

PPL has several oil-fired units and dual-fuel units capable of burning both oil and natural gas. The variable costs of oil-fired generation tend to be greater than those of the nuclear or coal-fired options, and oil-fired generation tends to have greater environmental impacts than natural-gas-fired generation. In addition, future increases in oil prices are expected to make oil-fired generation increasingly more expensive. The high cost of oil has prompted a steady decline in its use for electricity generation. As such, the NRC staff has not considered oil-fired generation as an alternative to SSES license renewal.

8.2.5.2 Wind Power

Wind power, by itself, is not suitable for large baseload capacity. As discussed in Section 8.3.1 of the GEIS, wind has a high degree of intermittency, and low average annual capacity factors (up to 30 to 40 percent). Wind power, in conjunction with energy storage mechanisms or another readily dispatchable power source, like hydropower, might serve as a means of providing baseload power. Current energy storage technologies are too expensive for wind power to serve as a large baseload generator, and Pennsylvania lacks sufficient hydropower resources to pair with wind capacity to replace SSES (INEEL 1997).

The State of Pennsylvania is mostly a wind power Class 1 region, although some areas, particularly along ridgelines, may provide wind Classes ranging from 4 to 6. Wind turbines are economical in wind power Classes 4 through 7, which have average wind speeds of 12.5 to 21.1 miles per hour (mph) (20 to 34 kmph) (DOE 2007b). The SSES site is in a wind power Class 1 to 2 area, making a wind-energy facility at SSES economically infeasible, given the current state of wind energy generation technology.

As for wind power at another site, PPL noted that the PJM region has a technical wind potential of 6658 MW(e), and also noted that actual wind resource is likely to fall in the 665 to 1995 MW(e) range. With a capacity factor of 30 to 40 percent, this is not adequate to replace SSES's current capacity (PPL 2006), and the NRC staff has not evaluated wind power as an alternative to SSES license renewal.

8.2.5.3 Solar Power

Solar technologies use the sun's energy to produce electricity. Currently, the SSES site receives approximately 4 to 4.5 kWh per square meter per day (approximately 0.4 kWh of solar radiation per square foot per day), as does much of the State of Pennsylvania (NREL 2007). Since flat-plate photovoltaics tend to be roughly 25 percent efficient, a solar-powered alternative would require at least 12,600 to14,200 ac (5099 to 5746 ha) to provide an amount of electricity equivalent to that generated by gas- and coal-fired alternatives (NRC 1996). Space between parcels and associated infrastructure would increase this land requirement. This amount of land, while large, is consistent with the land required for coal and natural gas fuel cycles. In the GEIS, the NRC staff noted that by its nature, solar power is intermittent, and the efficiency of collectors varies greatly with weather conditions. A solar powered alternative, in addition, would require energy storage or a backup power supply to provide electric power at night. Given challenges in meeting baseload requirements, the NRC has not evaluated solar power as an alternative to license renewal of SSES.

8.2.5.4 Hydropower

According to researchers at Idaho National Energy and Environmental Laboratory, Pennsylvania has an estimated 2217 MW of technically available, undeveloped hydroelectric resources at 104 sites throughout the State (INEEL 1997). This amount occurs primarily – 84 percent – in small installations generating 10 MW or less. The NRC staff notes that the total available hydropower potential is smaller than the capacity considered for the other alternatives to license renewal and all sites may not be available for development. The NRC staff has not considered hydropower as an alternative to license renewal.

8.2.5.5 Geothermal Energy

Geothermal energy has an average capacity factor of 90 percent and can be used for baseload power where available. However, geothermal electric generation is limited by the geographical availability of geothermal resources (NRC 1996). As illustrated by Figure 8.4 in the GEIS, there is no feasible eastern location for geothermal capacity to serve as an alternative to SSES Units 1 and 2. The NRC staff has concluded that geothermal energy is not a reasonable alternative to renewal of the Susquehanna Units 1 and 2 operating licenses.

8.2.5.6 Wood Waste

In 1999, DOE researchers estimated that Pennsylvania has biomass fuel resources consisting of urban, mill, agricultural, and forest residues, as well as speculative potential for energy crops. Excluding potential energy crops, DOE researchers projected that Pennsylvania had 5,090,000 tons (4,617,570 MT) of plant-based biomass available at $50 per ton delivered (Walsh et al. 2000; costs are in 1995 dollars). The Bioenergy Feedstock Development Program at Oak Ridge National Laboratory estimated that each air-dry pound of wood residue produces approximately 6400 Btu of heat (ORNL 2007). Assuming a 33 percent conversion efficiency, using all biomass available in Pennsylvania at $50 per ton – the maximum price the researchers considered – would generate roughly 6.3 terawatt hours (TWh) of electricity. This is about one third of the power produced by SSES operating at 85 percent capacity for one year.

In addition, Walsh et al. (2000) note that these estimates of biomass capacity contain substantial uncertainty, and that potential availability does not mean biomass will actually be available at the prices indicated or that resources will be usably free of contamination. Some of these plant wastes already have reuse value, and would likely be more costly to deliver. Others, such as forest residues, may prove unsafe and unsustainable to harvest on a regular basis.

Due to insufficient supplies of potential fuel, the NRC staff has not considered a wood-fired alternative to SSES license renewal.

8.2.5.7 Municipal Solid Waste

Municipal solid waste combustors incinerate waste to produce steam, hot water, or electricity. Combustors use 3 types of technologies: mass burn, modular, and refuse-derived fuel. Mass burning is currently used most in the U.S., and involves no (or little) sorting, shredding, or separation; consequently, toxic or hazardous components present in the waste stream are combusted and toxic constituents are exhausted to the air or become part of the resulting solid wastes. Currently there are approximately 89 waste-to-energy plants operating in the United States. These plants generate approximately 2700 MW(e), or an average of approximately 30 MW(e) per plant (Integrated Waste Services Association 2007). Approximately 80 average-sized plants would be necessary to provide the same level of output as the other alternatives to SSES license renewal.

Estimates in the GEIS suggest that the overall level of construction impact from a waste-fired plant should be approximately the same as that for a coal-fired power plant. Additionally, waste-fired plants have the same or greater operational impacts than coal-fired technologies (including impacts on the aquatic environment, air, and waste disposal). The initial capital costs for municipal solid-waste plants are greater than for comparable steam-turbine technology at coal-fired facilities or at wood-waste facilities, due to the need for specialized waste separation and handling equipment (NRC 1996).

The decision to burn municipal waste to generate energy is usually driven by the need for an alternative to landfills rather than energy considerations. The use of landfills as a waste disposal option is likely to increase in the near term; with energy prices increasing, however, it is possible that municipal waste combustion facilities may become attractive again.

Regulatory structures that once supported municipal solid waste incineration no longer exist. For example, the Tax Reform Act of 1986 made capital-intensive projects such as municipal waste combustion facilities more expensive relative to less capital-intensive waste disposal alternatives such as landfills. Also, the 1994 Supreme Court decision *C&A Carbone, Inc. v. Town of Clarkstown* struck down local flow control ordinances that required waste to be delivered to specific municipal waste combustion facilities rather than landfills that may have had lower fees. In addition, increasingly stringent environmental regulations have increased the capital cost necessary to construct and maintain municipal waste combustion facilities (EIA 2001).

Given the small average installed size of municipal solid waste plants and the unfavorable regulatory environment, the NRC staff has not considered municipal solid waste combustion to be a feasible alternative to SSES license renewal.

8.2.5.8 Other Biomass-Derived Fuels

In addition to wood and municipal solid-waste fuels, there are other concepts for biomass-fired electric generators, including direct burning of energy crops, conversation to liquid biofuels, and biomass gasification. In the GEIS, the NRC staff indicated that none of these technologies had progressed to the point of being competitive on a large scale or of being reliable enough to replace a baseload plant such as SSES Units 1 and 2. After reevaluating current technologies, the NRC staff believes other biomass-fired alternatives are still unable to reliably replace SSES' capacity. For this reason, the NRC staff has not considered other biomass-derived fuels to be feasible alternatives to renewal of the SSES Units 1 and 2 operating licenses.

8.2.5.9 Fuel Cells

Fuel cells oxidize fuels without combustion and its environmental side effects. Power is produced electrochemically by passing a hydrogen-rich fuel over an anode and air (or oxygen) over a cathode and separating the two by an electrolyte. The only by-products (depending on fuel characteristics) are heat, water, and carbon dioxide. Hydrogen fuel can come from a variety of hydrocarbon resources by subjecting them to steam under pressure. Natural gas is typically used as the source of hydrogen.

At the present time, fuel cells are not economically or technologically competitive with other alternatives for baseload electricity generation. EIA projects that by 2008 fuel cells may cost $4374 per installed kW (EIA 2006b), roughly three-and-a-half times the construction cost of new coal-fired capacity and more than seven times the cost of new, advanced gas-fired combined-cycle capacity. In addition, fuel cell units are likely to be small in size (EIA's reference plant is 10 MW). While it may be possible to use a distributed array of fuel cells to provide an alternative to SSES, it would be extremely costly to do so. As such, the NRC staff has not considered fuel cells as an alternative to SSES license renewal.

8.2.5.10 Delayed Retirement

PPL will retire two 140 MW(e) coal-fired units at its Martin's Creek location in September of 2007, as well as two small (2 and 3 MW(e)) diesel generators in the same month (PPL 2006). For reasons of insufficient capacity, delayed retirement of other PPL generating units would not be a feasible alternative to renewal of the SSES Units 1 and 2 operating licenses.

8.2.5.11 Utility-Sponsored Conservation

Prior to passage of Pennsylvania's Advanced Energy Portfolio Standard, the State of Pennsylvania commissioned studies to establish the potential amounts of energy and efficiency resources throughout the State. This study identified over 16,000 gigawatt hours (GWh) of energy efficiency potential available within 20 years of the study (Pletka 2004), or by 2024. This roughly matches the expiration of SSES Unit 2's OL. Units 1 and 2, however, produce approximately 19,000 GWh when operating at 85 percent, and the other alternatives considered in this section would produce roughly 18,000 GWh over the same 1-year period. While Pennsylvania's potential to reduce energy consumption versus a business-as-usual projection is substantial, it is not individually sufficient to replace the capacity of SSES.

8.2.6 Combination of Alternatives

The NRC staff considered a wide variety of alternatives to issuing renewed operating licenses for SSES, several of which the NRC staff determined to be individually capable of replacing SSES' capacity, and many of which the NRC staff determined to be incapable of replacing SSES' capacity or so expensive as to be unreasonable options. Since the decision of whether to operate the plant is up to energy planners outside NRC, any of a wide range of combination alternatives could be chosen by the relevant decisionmakers to replace capacity currently at SSES.

In this section, the NRC staff considers a combination of options that could serve as an alternative to issuing renewed OLs for SSES.

In performing this analysis, the NRC staff considered that locating a generating station at the SSES site serves an important grid reliability function, and the NRC staff also recognized that maintaining existing capacity generally creates smaller impacts than building new capacity. As such, this combination alternative considers that one SSES unit would remain in service, while the other shuts down. This option would preserve half of the generating capacity at the SSES site, and may prevent the "load pocket" phenomenon described in the SSES ER (PPL 2006). In addition, it would preserve many jobs at the SSES site, as one unit and the shared infrastructure would remain in operation. Also, decommissioning of the shutdown unit would likely be postponed until the remaining unit shuts down.

Several feasible options exist for replacing the capacity from the retired unit at the SSES site, possibly including conservation, as well as small amounts of wood-fired generation or wind power. Another option would be to site replacement gas-fired combined-cycle capacity to replace one unit at the existing site. From an environmental perspective, the NRC staff believes that relying on conservation to replace the retired unit's capacity would result in the smallest impact to the environment, as the GEIS notes that most conservation impacts are SMALL or negligible. The NRC staff recognizes that significant uncertainty exists surrounding the actual conservation potential, although the NRC staff also recognizes that estimates for conservation potential reported in Pletka (2004) were used by Pennsylvania in developing the State's Advanced Energy Portfolio Standard. Approximately 60 percent of reported conservation potential would be necessary to replace one SSES unit.

The overall impacts of this alternative would be predominantly SMALL, with some noticeable (MODERATE) effects.

Effects to land use would be SMALL, as existing site and ROW maintenance would continue unchanged, and no new construction would occur to replace the retired unit's capacity.

Ecological impacts would also be SMALL. The single-unit plant needs about half as much water as two units, ROW maintenance continues, domestic water consumption and discharge decline, and no new construction occurs. The ecological impacts of this combination alternative would thus be smaller than renewing both licenses, and smaller than coal-fired, gas-fired, and new nuclear alternatives. No additional transmission lines are necessary.

Water-use and -quality impacts would be SMALL. Surface water intake and discharge would be less than the existing two units, and likely smaller than coal-fired or new nuclear alternatives. Water consumption may be similar to that of a gas-fired alternative. Groundwater use would also be less than required for both units. Air quality impacts would be SMALL.

Renewing one license would result in less radioactive and mixed-waste generation, as well as less nonradioactive waste, than the proposed action. Conservation activities may increase nonradioactive waste generation, but with nearly 20 years to implement conservation, waste generation could be minimized by replacing items as they reach the end of their lives. In total, waste impacts would be SMALL.

Human health effects of this combination alternative would be substantially similar to the health impacts of renewing both licenses, although the GEIS notes that conservation approaches can affect indoor air quality. The GEIS indicates, however, that these effects can likely be effectively mitigated. Thus health impacts would also be SMALL.

Impacts to aesthetics would not be noticeable, and would thus be SMALL. Impacts to historic and archeological resources, however, would likely be similar to continued operation of both units. This alternative would have MODEREATE impacts on cultural resources.

This combination alternative results in noticeable impacts, however, for socioeconomics and environmental justice. If nearly half of SSES staff and tax revenues are eliminated, the surrounding communities would likely experience SMALL to MODERATE impacts. Transportation impacts would remain SMALL, however, as fewer plant staff commute to SSES. This combination alternative would also create SMALL to MODERATE environmental justice impacts, as lost tax base and employment could affect the low-income populations in the local areas.

8.3 Summary of Alternatives Considered

The environmental impacts of the proposed action (issuing renewed SSES Units 1 and 2 operating licenses) would be SMALL for most impact categories except for historic and archaeological resources, and the Category I issues of collective offsite radiological impacts from the fuel cycle and from high level waste (HLW) and spent fuel disposal. The NRC staff did not assign a single significance level to collective offsite radiological impacts from the fuel cycle and from HLW and spent fuel disposal, but the Commission determined them to be Category 1 issues nonetheless.

In addition to the proposed action, the NRC staff considered several alternative actions in depth, including the no-action alternative (discussed in Section 8.1), coal-fired generation (Section 8.2.1), natural gas-fired combined-cycle generation (Section 8.2.2), new nuclear generation (Section 8.2.3), purchased electrical power (Section 8.2.4), and a combination of alternatives (discussed in Section 8.2.6). The NRC staff selected these alternatives after reviewing a broad array of technologies, many of which the NRC staff determined would be unable to meet the needs currently served by SSES. The NRC staff briefly discussed these alternatives in Section 8.2.5.

The NRC staff notes that all of the alternatives to license renewal capable of meeting the needs currently served by SSES Units 1 and 2 entail potentially greater impacts than the proposed action of license renewal for the SSES Units 1 and 2. Since the no-action alternative would necessitate the implementation of one or a combination of alternatives, all of which have greater impacts than the proposed action, the NRC staff also concludes that the no-action alternative would have greater environmental impacts than the proposed license renewal action. As such, issuing renewed operating licenses for SSES Units 1 and 2 is the environmentally preferred alternative.

8.4 References

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

10 CFR Part 52. *Code of Federal Regulations*, Title 10, *Energy*, Part 52, "Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants."

40 CFR Part 50. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 50, "National Primary and Secondary Ambient Air Quality Standards."

40 CFR Part 51. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 51, "Requirements for Preparation, Adoption, and Submittal of Implementation Plans."

40 CFR Part 60. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 60, "Standards of Performance for New Stationary Sources."

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9.0 Summary and Conclusions

By letter dated September 13, 2006, PPL Susquehanna, LLC (PPL) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) to issue renewed operating licenses (OLs) for Susquehanna Steam Electric Station, Units 1 and 2 (SSES) for an additional 20-year period (PPL 2006a). If the OLs are renewed, State regulatory agencies and PPL 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 plants must be shut down at or before the expiration of the current OLs, which expire on July 17, 2022, for Unit 1, and March 23, 2024, for Unit 2.

Section 102 of the National Environmental Policy Act (NEPA) 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 Title 10, Part 51, of the *Code of Federal Regulations* (10 CFR Part 51). Part 51 identifies licensing and regulatory actions that require an EIS. 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 (NRC 1996, 1999).[a]

Upon acceptance of the PPL 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 (NRC 2006) on November 2, 2006. The NRC staff visited the SSES site in May 2007 and held public scoping meetings on November 15, 2006, in Berwick, Pennsylvania. The NRC staff reviewed the PPL Environmental Report (ER) (PPL 2006b) and compared it to the GEIS, consulted with other agencies, and conducted an independent review of the issues following the guidance set forth in NUREG-1555, Supplement 1: *Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal* (NRC 2000). The NRC staff also considered the public comments received during the scoping process for preparation of this draft Supplemental Environmental Impact Statement (SEIS) for SSES. 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 draft SEIS.

(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 NRC staff will hold two public meetings in Berwick, Pennsylvania, in late May 2008, to describe the preliminary results of the NRC environmental review and to answer questions to provide members of the public with information to assist them in formulating their comments on this draft SEIS. When the comment period ends, the NRC staff will consider and address all of the comments received. These comments will be addressed in Appendix A, Part 2, of the final SEIS.

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

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

> The purpose and need for the proposed action (issuing a renewed 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 evaluation criterion for the NRC 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) and in accordance with § 51.23(b).[(a)]

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 the footnotes 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 NRC staff analysis in the GEIS shows the following:

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

(2) A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts (except for collective offsite 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.

These 69 issues were identified in the GEIS as Category 1 issues. In the absence of new and significant information, the NRC staff relied on conclusions as amplified by supporting

(a) The title of 10 CFR 51.23 is "Temporary storage of spent fuel after cessation of reactor operations – generic determination of no significant environmental impact."

information in the GEIS for issues designated Category 1 in Table B-1 of 10 CFR Part 51, Subpart A, Appendix B. The NRC staff also determined that information provided during the public comment period did not identify any new issue that requires site-specific assessment.

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 also 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 (the site-specific supplement to the GEIS) documents the NRC staff's consideration of all 92 environmental issues identified in the GEIS. The NRC 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 issuing renewed OLs for SSES Units 1 and 2) and alternative methods of power generation. These alternatives were evaluated assuming that the replacement power generation plant is located at either the SSES site or some other unspecified location.

9.1 Environmental Impacts of the Proposed Action – License Renewal

PPL and the NRC staff have established independent processes for identifying and evaluating the significance of any new information on the environmental impacts of license renewal. Neither PPL nor the NRC 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, PPL, nor the NRC staff has identified any new issue applicable to the draft SSES that has a significant environmental impact. Therefore, the NRC staff relies upon the conclusions of the GEIS for all Category 1 issues that are applicable to SSES.

PPL's license renewal application presents an analysis of the Category 2 issues that are applicable to SSES Units 1 and 2, plus environmental justice and chronic effects from electromagnetic fields. The NRC staff has reviewed the PPL analysis for each issue and has conducted an independent review of each issue plus environmental justice and chronic effects from electromagnetic fields. Six Category 2 issues are not applicable because they are related to plant design features or site characteristics not found at SSES. Four Category 2 issues are not discussed in this draft SEIS because they are specifically related to refurbishment. PPL (PPL 2006b) 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 SSES 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 *Final Environmental Statement Related to Operation of Susquehanna Steam Electric Station* (NRC 1981).

The NRC staff discusses in detail 11 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, 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 10 of 11 Category 2 issues and environmental justice, the NRC staff concludes that the potential environmental effects would be of SMALL significance in the context of the standards set forth in the GEIS. For one Category 2 issue (historic and archaeological resources), the NRC staff determined that environmental impacts could be of MODERATE significance. In addition, the NRC 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 NRC staff concludes that a reasonable, comprehensive effort was made to identify and evaluate SAMAs. Based on its review of the SAMAs for SSES and the plant improvements already made, the NRC staff concludes that none of the potentially cost-beneficial SAMAs relate to adequately managing the effects of aging during the period of extended operation; therefore, they need not be implemented as part of the license renewal pursuant to 10 CFR Part 54.

Mitigation measures were considered for each Category 2 issue. For historic and archaeological resources, potential impacts could be reduced by implementing mitigation measures such as improved procedures.

Cumulative impacts of past, present, and reasonably foreseeable future actions were considered, regardless of what agency (Federal or non-Federal) or person undertakes such other actions. For purposes of this analysis, where SSES license renewal impacts are deemed to be SMALL, the NRC staff concluded that these impacts would not result in significant cumulative impacts on potentially affected resources. In some resource areas – such as terrestrial resources, aquatic resources, and surface water – past human actions independent of SSES operations or constructing potential future units onsite have already created MODERATE to LARGE cumulative impacts. Further, the NRC staff concluded that the impacts of continued operation of SSES during the license renewal period could contribute to cumulative impacts that range from SMALL to LARGE on potentially affected resources if one or two units are constructed at the site, with the largest potential impacts in areas of socioeconomics, as well as historical and archaeological resources. A complete review of the construction and operation of the new unit(s) based on proposal-specific information would be included in future NEPA documentation if PPL proceeds with its COL application.

The following sections discuss unavoidable adverse impacts, irreversible or irretrievable commitments of resources, and the relationship between local short-term use of the environment and long-term productivity.

9.1.1 Unavoidable Adverse Impacts

An environmental review conducted at the license renewal stage differs from the review conducted in support of a construction permit because the plant is in existence at the license renewal stage and has operated for a number of years. As a result, adverse impacts associated with the initial construction have been avoided, have been mitigated, or have already occurred. The environmental impacts to be evaluated for license renewal are those associated with refurbishment and continued operation during the renewal term.

The adverse impacts of continued operation identified are considered to be of SMALL significance for most resource areas, excluding historic and archaeological resources. Impacts to historic and cultural resources related to continued SSES operation would likely be MODERATE, but could be mitigated by improved procedures. Overall, the adverse impacts of likely alternatives if SSES ceases operation at or before the expiration of the current OLs would be greater than those of continued operation.

9.1.2 Irreversible or Irretrievable Resource Commitments

The commitment of resources related to construction and operation of the SSES during the current license period was made when the plant was built. The resource commitments considered in this draft SEIS are associated with continued operation of the plant for an additional 20 years. These resources include materials and equipment required for plant maintenance and operation, the nuclear fuel used by the reactors, and ultimately, permanent offsite storage space for the spent fuel assemblies.

The most significant resource commitments related to operation during the renewal term are the fuel and the permanent storage space. SSES replaces approximately one third of the fuel assemblies in each of the two units on a 24-month refueling cycle with Units 1 and 2 refueling on alternate years.

Most of the likely power generation alternatives for replacement power if SSES ceases operation on or before the expiration of the current OLs will require a commitment of resources for construction of the replacement plants as well as for fuel to run the plants. One alternative – a combination alternative including OL renewal for one unit and replacing the other unit with an equivalent amount of conservation capacity – may require a resource commitment similar to operating both SSES units. Given the long lead time to develop conservation programs prior to OL expiration, it is possible that resource commitment for conservation measures may only minimally exceed resource commitments in the absence of the measures.

9.1.3 Short-Term Use Versus Long-Term Productivity

An initial balance between short-term use and long-term productivity of the environment at the SSES site was set when the plant was approved and construction began. That balance is now well established. Renewal of the OLs for SSES and continued operation of the plant would not alter the existing balance, but may postpone the availability of the site for other uses. Denial of the application to renew the OLs would lead to shutdown of the plant and would alter the balance in a manner that depends on subsequent uses of the site. For example, the environmental consequences of turning the SSES site into a park or an industrial facility are quite different.

9.2 Relative Significance of the Environmental Impacts of License Renewal and Alternatives

The proposed action is issuance of renewed OLs for SSES. Chapter 2 describes the site, power plant, and interactions of the plant with the environment. As noted in Chapter 3, no refurbishment and no refurbishment impacts are expected at SSES. Chapters 4 through 7 discuss environmental issues associated with renewal of the OLs. The NRC staff discusses environmental issues associated with the no-action alternative and alternatives involving power generation and use in Chapter 8.

The significance of the environmental impacts from the proposed action (approval of the application for renewal of the OLs), the no-action alternative (denial of the application), alternatives involving nuclear or coal- or gas-fired generation of power at the SSES site and at an unspecified alternate site, as well as a combination of alternatives are compared in Table 9-1. Continued use of a closed-cycle cooling system for SSES is assumed for Table 9-1.

Table 9-1 shows that the significance of the environmental effects of the proposed action would be SMALL for most impact categories and MODERATE for historic and archaeological resources. No single significance level was assigned to collective offsite radiological impacts from the fuel cycle and from HLW and spent fuel disposal (see Chapter 6). The alternative actions, including the no-action alternative, may have environmental effects in at least some impact categories that reach MODERATE or LARGE significance.

Table 9-1. Summary of Environmental Significance of License Renewal, the No-Action Alternative, and Alternative Methods of Generation Using Closed-Cycle Cooling

Impact Category	Proposed Action (License Renewal)	No-Action Alternative (Denial of Renewal)	Coal-Fired Generation		Natural-Gas-Fired Generation		New Nuclear Generation		Combination of Alternatives
			SSES Site	Alternate Site	SSES Site	Alternate Site	SSES Site	Alternate Site	SSES Site
Land use	SMALL	SMALL to MODERATE	MODERATE	MODERATE to LARGE	SMALL to MODERATE	SMALL to LARGE	MODERATE	MODERATE to LARGE	SMALL
Ecology	SMALL	SMALL to MODERATE	MODERATE	SMALL to LARGE	SMALL	SMALL to LARGE	SMALL to MODERATE	SMALL to LARGE	SMALL
Water use and quality – surface water	SMALL	SMALL	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL
Water use and quality – groundwater	SMALL	SMALL	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL
Air quality	SMALL	SMALL	MODERATE	MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL	SMALL	SMALL
Waste	SMALL	SMALL	MODERATE	MODERATE	SMALL	SMALL	SMALL	SMALL	SMALL
Human health	SMALL[(a)]	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Socioeconomics	SMALL	MODERATE to LARGE	SMALL TO MODERATE	SMALL to LARGE	SMALL to MODERATE	SMALL to MODERATE	SMALL TO MODERATE	SMALL to LARGE	MODERATE
Transportation	SMALL	SMALL	SMALL to MODERATE	SMALL to MODERATE	SMALL TO MODERATE	SMALL to MODERATE	MODERATE	MODERATE	SMALL to MODERATE
Aesthetics	SMALL	SMALL	SMALL to MODERATE	SMALL to LARGE	SMALL	SMALL to MODERATE	SMALL to MODERATE	SMALL to LARGE	SMALL
Historic and archaeological resources	MODERATE	MODERATE	MODERATE	SMALL to MODERATE	MODERATE	SMALL to MODERATE	MODERATE	SMALL to MODERATE	MODERATE
Environmental justice	SMALL	MODERATE to LARGE	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL	SMALL to MODERATE	SMALL to MODERATE

(a) Except for collective offsite radiological impacts from the fuel cycle and from HLW and spent-fuel disposal, for which a significance level was not assigned. See Chapter 6 for details.

9.3 NRC Staff Conclusions and Recommendations

Based on (1) the analysis and findings in the GEIS (NRC 1996, 1999); (2) the ER submitted by PPL (PPL 2006b); (3) consultation with Federal, State, and local agencies; (4) the NRC staff's own independent review; and (5) the NRC staff's consideration of public comments received, the preliminary recommendation of the NRC staff is that the Commission determine that the adverse environmental impacts of license renewal for SSES are not so great that preserving the option of license renewal for energy-planning decisionmakers would be unreasonable.

9.4 References

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

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

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

PPL Susquehanna, LLC (PPL). 2006a. *Susquehanna Steam Electric Station Application for License Renewal.* Allentown, Pennsylvania. (September 2006).

PPL Susquehanna, LLC (PPL). 2006b. *Susquehanna Steam Electric Station Units 1 and 2 Application for License Renewal, Appendix E: Applicant's Environmental Report – Operating License Renewal Stage.* Allentown, Pennsylvania. (September 2006). ADAMS No. ML062630235.

U.S. Nuclear Regulatory Commission (NRC). 1981. *Final Environmental Statement Related to the Operation of Susquehanna Steam Electric Station.* Pennsylvania Power & Light Company and Allegheny Electric Cooperative, Inc. Docket Nos. 50-387 and 50-388. Washington, D.C. (June 1981).

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). 2006. "Notice of Intent To Prepare an Environmental Impact Statement and Conduct Scoping Process." *Federal Register*, Vol. 71, No. 212, pp. 64566–64568. Washington, D.C. (November 2, 2006).

Appendix A

Comments Received on the Environmental Review

Appendix A

Comments Received on the Environmental Review

Part I – Comments Received During Scoping

On November 2, 2006, the U.S. Nuclear Regulatory Commission (NRC) published a Notice of Intent in the *Federal Register* (Volume 71, page 64566) to notify the public of the NRC staff's intent to prepare a plant-specific supplement to the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437, Volumes 1 and 2, to support the renewal application for the Susquehanna Steam Electric Station, Units 1 and 2 (SSES) operating licenses and to conduct scoping. The plant-specific supplement to the GEIS has been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969; Council on Environmental Quality (CEQ) guidance, and Title 10, Part 51, of the *Code of Federal Regulations* (10 CFR Part 51). As outlined by NEPA, the NRC initiated the scoping process with the issuance of the *Federal Register* Notice. The NRC invited the applicant; Federal, State, and local government agencies; Native American Tribal organizations; local organizations; and individuals to participate in the scoping process by providing oral comments at the scheduled public meetings and/or by submitting written suggestions and comments no later than January 2, 2007.

The scoping process included two public scoping meetings that were held at the Eagles Building in Berwick, Pennsylvania, on November 15, 2006. Approximately 28 members of the public attended the meetings. Both sessions began with NRC staff members providing a brief overview of the license renewal process and the NEPA process. After the NRC's prepared statements, the meetings were open for public comments. Two attendees provided oral statements that were recorded and transcribed by a certified court reporter and written statements that were appended to the transcript. The afternoon and evening meeting transcripts are available from NRC's Agencywide Documents Access Management System (ADAMS) under accession numbers ML063330279 and ML063330281, respectively.

At the conclusion of the scoping period, the NRC staff and its contractors reviewed the transcripts and all written material to identify specific comments and issues. Each set of comments from a given commenter was given a unique identifier (Commenter ID), so that each set of comments from a commenter could be traced back to the transcript or letter by which the comments were submitted. Specific comments were numbered sequentially within each comment set. All of the comments received and the NRC staff responses are included in the SSES Scoping Summary Report dated April 16, 2007.

Table A-1 identifies the individuals who provided comments applicable to the environmental review and the Commenter ID associated with each person's set(s) of comments. The individuals are listed in the order in which they spoke at the public meeting, and in alphabetical order for the comments received by letter or e-mail. To maintain consistency with the Scoping Summary Report, the unique identifier used in that report for each set of comments is retained in this appendix.

Specific comments were categorized and consolidated by topic. Comments with similar specific objectives were combined to capture the common essential issues raised by the commenters. The comments fall into one of the following general groups:

- Specific comments that address environmental issues within the purview of the NRC environmental regulations related to license renewal. These comments address Category 1 or Category 2 issues or issues that were not addressed in the GEIS. They also address alternatives and related Federal actions.

- General comments (1) in support of or opposed to nuclear power or license renewal or (2) on the renewal process, the NRC's regulations, and the regulatory process. These comments may or may not be specifically related to the SSES license renewal application.

- Questions that do not provide new information.

- Specific comments that address issues that do not fall within or are specifically excluded from the purview of NRC environmental regulations related to license renewal. These comments typically address issues such as the need for power, emergency preparedness, security, current operational safety issues, and safety issues related to operation during the renewal period.

Comments applicable to this environmental review and the NRC staff's responses are summarized in this appendix. The parenthetical alphanumeric designator in parentheses after each comment is the Comment ID (from Table A-1). More than one comment number after a comment indicates that the same comment was made both orally and in a document submitted at the meeting. This information, which was extracted from the SSES Scoping Summary Report, is provided for the convenience of those interested in the scoping comments applicable to this environmental review. The comments that are general or outside the scope of the environmental review for SSES are not included in this section. More detail regarding the disposition of general or inapplicable comments can be found in the Scoping Summary Report. The ADAMS accession number for the Scoping Summary Report is ML070740684.

Table A-1. Individuals Providing Comments During Scoping Comment Period

Commenter ID[(a)]	Issue Category	Comment Source[(b)]
Sue Fracke, Sugarloaf, PA (Commenter 1)		
MC-1-1, D-1-1	A.2. General Radiological Health Effects	Evening Scoping Meeting
MC-1-2, D-1-2	A.4. Alternatives	Evening Scoping Meeting
MC-1-4, D-1-4	A.5. High-Level Radioactive Waste	Evening Scoping Meeting
Eric Epstein, TMI-Alert (Commenter 2)		
MC-2-1	A.4. Alternatives	Evening Scoping Meeting
MC-2-3	A.1. License Renewal Process	Evening Scoping Meeting
MC-2-9	A.3. Surface-Water Quality, Hydrology, and Use	Evening Scoping Meeting
MC-2-10	A.1. License Renewal Process	Evening Scoping Meeting
D-2-1	A.1. License Renewal Process	Evening Scoping Meeting
D-2-3	A.5. High-Level Radioactive Waste	Evening Scoping Meeting
D-2-8	A.3. Surface-Water Quality, Hydrology, and Use	Evening Scoping Meeting
D-2-10	A.1. License Renewal Process	Evening Scoping Meeting

(a) The Comment ID is defined as illustrated: MC-1-1 = Meeting Comment (MC), Commenter 1 (1), Comment 1 (1); D-1-1 = Document (D), Commenter 1 (1), Comment 1 (1).
(b) The ADAMS accession number for the afternoon transcript is ML063330279.. The accession number for the evening transcript is ML063330281. The accession number for the attachments to the evening transcript is ML070380454.

This accession number is provided to facilitate access to the document through the Public Electronic Reading Room at http://www.nrc.gov/reading-rm.html.

Comments in this section are grouped in the following categories:

A.1 License Renewal Process
A.2 General Radiological Health Effects
A.3 Surface-Water Quality, Hydrology, and Use
A.4 Alternatives
A.5 High-Level Radioactive Waste

A.1. Comments Concerning the License Renewal Process

Comment: And finally, we don't really have a lot of confidence in this process. As an organization we were founded in '77. We have been to the Supreme Court twice. We have litigated before the NRC almost nonstop for 30 years in just about every other venue. And as I told some of the NRC employees before, we have no confidence in the Commission or the adjudicatory process. I think the last three relicensing the first three were licensing contentions that were admitted. So that we will participate and we will be involved to the end. But I'm letting you know from the outset really since the implementation of the reactor oversight process we've seen a precipitous decline in the NRC's relationship with the communities, reactor communities. It's a shame. Because we worked hard at Peach Bottom and TMI. Against Susquehanna not as much. (MC-2-10)

Comment: NRC's industry-driven relicensing process limits public involvement, and disallows debate over factors involving a plant's safety and security record.

PPL is applying for the license renewal so early due to the rubber-stamp approach by the Bush administration's NRC. PPL wants to secure an extension to preempt public challenges over additional safety problems, which tend to increase as plant's age. (D-2-10)

Comment: I really oppose the license extensions for a couple of reasons. Number one is we think it's premature. There's 17 years left on this license. You know, this is a very strange scenario where a license has that much time and you're going to relicense it before some of the aging and safety issues manifest, which happens in an industrial application. That's reality.

Just look at Three Mile Island which obviously came on line ten years earlier. We replaced the reactor vessel head there two years ago and we're going to change out the steam generators. So there are industrial applications that are going to age that we're not going to evaluate, and I think that's a shame. I think we should wait until we get closer to the end of its initial life span.

(Page 22, Lines 9–4) Obviously, and I've raised this before, I think there's age related problems. I would really hope that Susquehanna PPL would think about postponing their relicensing until the plant is closer to the end of its initial useful period. I mean 17 years in my mind makes no sense and it's premature. (MC-2-3)

Comment: Three Mile Island Alert, Inc. (TMIA) announced its decision to oppose PPL's premature request to relicense the Susquehanna Steam Electric Station (SSES) to operate for 20 more years.

TMI-Alert believes PPL's application is premature. "It would be irresponsible for federal regulators to begin a relicensing process 17 years before the original license expires. PPL wants to secure an extension to preempt public challenges over additional safety problems, which tend to increase as plants age." (D-2-1)

Response: *The comments are in regard to license renewal and its processes in general. The purpose of the NRC staff's environmental review is to carefully consider the environmental consequences of issuing a renewed operating license. Additionally, the NRC has a safety review that focuses on managing the aging of structures, systems, and components during the renewal term.*

The NRC's environmental review process provides many avenues for public participation. As part of the scoping process, the NRC staff held two public meetings seeking comments on the scope of the Supplemental Environmental Impact Statement (SEIS) on November 15, 2006. Additionally, comments regarding the environmental review and preparation of the draft SEIS can be sent by e-mail to SusquehannaEIS@nrc.gov; by phone to the Environmental Project Manager, Drew Stuyvenberg, at 301-415-4006; or by mail to Chief, Rules and Directives Branch, Division of Administrative Services, Office of Administration, Mailstop T-6D59, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555-0001. Also, two public meetings will be held regarding the draft SEIS where members of the public can submit comments on the draft SEIS and the environmental review process.

The Commission has established a process, by rule, for the environmental and safety reviews to be conducted to review a license renewal application. Section 54.17(c) of Title 10 of the Code of Federal Regulations *(10 CFR 54.17(c)) allows licensees to submit license renewal applications up to 20 years before the expiration of the current license. Applications for license renewal are submitted years in advance for several reasons. If a utility decides to replace a nuclear power plant, it could take up to 10 years to design and construct new generating capacity to replace that nuclear power plant if license renewal is not granted. In addition, decisions to replace or recondition major components can involve significant capital investment. As such, these decisions may involve financial planning many years in advance of the extended period of operation. The comments provide no new and significant information; therefore, they will not be evaluated further.*

A.2. Comments Concerning General Radiological Health Effects

Comment: Every year 20,000 people die of cancer from naturally occurring background radiation. You would think that this fact alone would be enough to say let us not produce anymore radiation as it will kill more people. With all our other means of making energy, especially all the various kinds of solar energy that we now have the technology to do, it makes no sense to me to use a source of energy that is dangerous and will cause more people to die of cancer and other degenerative diseases.

In the Federal Register December 15, 1982 Part 2 by the Environmental Protection Agency, 40 CFR Part 61 on national emission standards for hazardous air pollutants, radionuclides final rule and notice of reconsideration stated "On December 27, 1979 the EPA listed radionuclides as a hazardous air pollutant. EPA determined that radionuclides are a known cause of cancer and genetic damage and that radionuclides cause or contribute to air pollution that may reasonably be incapacitating and anticipated to result in an increase in mortality or an increase in serious irreversible or incapacitating reversible illness and therefore, constitute a hazardous air pollutant within the meaning of section 112(a)(1). There are three major types of long term health impacts from exposure to radiation. Cancer, hereditary effects and developmental effects on fetus such as mental retardation. In addition, risk distribution from radiation from most of the sources considered for regulation show that fatal cancers occur much more frequently than nonfatal cancers and cancers generally occur more often than genetic or developmental effects." It also states that "numerous studies have demonstrated that radiation is a carcinogen. It has assumed that there is no completely risk-free level of exposure to radiation to cause cancer." Radiation corrodes metals such as in the pipes of nuclear power plants causing holes that constantly emit radiation in our air under the routine operation of the plants. Radiation is cumulative in our bodies and the effects of exposure can sometimes take many years before showing up. And we were worried that Saddam Hussein had weapons of mass destruction.

Along with radioactive air pollutants, the Environmental Protection Agency reports that in 2002 24,379 U.S. non-nuclear facilities released 4.79 billion pounds toxins into the atmosphere. Of these pollutants, 72 million pounds were known carcinogens. We have no concept of the synergistic effects of these toxins when they are mixed with radioactive pollutants. These toxins impinge on health during your entire life, even before birth. A study in New York City shows that the genetic material in fetuses still in their mother's womb is damaged by air pollution.

From the Radiation and Public Health Project in Norristown, Pennsylvania they have found that current rates of infant deaths, childhood cancer and thyroid cancer all known to be effected by emissions in nuclear reactors are elevated in Luzerne County, the site of the Susquehanna Nuclear Plant.

These findings and other data on local disease rates should be part of the federal decision on whether the U.S. Nuclear Regulatory Commission should approve the application of PPL Susquehanna LLC to operate the plant until 2044. The current license only allows operations until 2024. This information was presented at a federal hearing today in Berwick on the application.

"These high disease rates should shock all Luzerne County residents and they should demand a thorough study of the health risk posed by the Susquehanna plant," said Joseph Mangano, MPH MBA of the Radiation and Public Health Project who presented the data. "If radioactive emissions from the plant have been harmful, people should know this before the government decides whether or not to extend the license."

The 2000-2004 [2003] county rate of white infants who died in their first month was 23 percent above the U.S. rate based on 55 deaths. In that same period 43 Luzerne children under age 15 were diagnosed with cancer, a rate 38 percent above the nation. Data are taken from the National Center for Health Statistics and the Pennsylvania Cancer Registry. (3) (4) Thyroid cancer statistics may be most alarming. In the late 1980s as the two reactors at Susquehanna were starting the Luzerne rate was 20 percent below the United States. However, in 2000 to 2003 the Luzerne rate was a 100 percent above, double the nation. Radioactive iodine found only in nuclear weapons and reactors seeks the thyroid gland where it kills and impairs cells leading to cancer. (5)

Two large nuclear reactors have operated at Susquehanna beginning in 1982 and 1984 respectively. Virtually all of the 312,000 residents of Luzerne County live within 15 miles of the plant and would be most likely to receive the greatest radiation exposures. Like all reactors, Susquehanna routinely emits gases and particles into the air and water which enters human bodies by breathing and the food chain. There are over 100 radioactive chemicals in this mix, each causes cancer and is especially harmful to fetuses, infants and children.

INFORMATION ON SUSQUEHANNA NUCLEAR PLANT AND LOCAL HEALTH (submitted by commenter, 11/15/06)

1. Susquehanna reactors 1/2 went critical (began producing radioactivity) on September 10, 1982 and May 8, 1984, respectively. Source: U.S. Nuclear Regulatory Commission. www.nrc.gov.

2. From January 1, 1999 to September 30, 2006, Susquehanna 1 / 2 operated 91.8% and 93.0% of the time, an all time high. Source: U.S. Nuclear Regulatory Commission, www.nrc.gov. Reactors operated 62345 and 63193 hours out of a maximum 67919.

3. From 2000-2003, 55 Luzerne county whites under 28 days old died out of 11601 live births, a rate of 4.74 per 1000. This rate was 23% greater than the U.S. rate of 3.84. Source: National Center for Health Statistics, http://wonder.cdc.gov, underlying cause of death.

4. From 2000-2003, 43 Luzerne county children under age fifteen were diagnosed with cancer. Based on an annual average population of 52,567, the cancer incidence rate was 20.45 per 100,000, which was 38% greater than the U.S. average of 14.78. Sources: PA Cancer Registry

(www.state.pa.us) and U.S. Centers for Disease Control (http://wonder.cdc.gov, National Association of Cancer Registries – represents 39 states).

5. From 1985-1988 the Luzerne county thyroid cancer incidence rate was 3.54 per 100,000, based on 86 cases, or 20% below the U.S. rate of 4.40. From 2000-2003, the county rate was 16.41, based on 229 cases or 100% above the U.S. rate of 8.20. Sources: PA Cancer registry (www.state.pa.us) and Surveillance Epidemiology and End Results (www.seer.cancer.gov), representing 9 states and cities. (MC-1-1, D-1-1)

Response: *The NRC's primary mission is to protect the public health and safety and the environment from the effects of radiation from nuclear reactors, materials, and waste facilities. The NRC's regulatory limits for radiological protection are set to protect workers and the public from the harmful health effects of radiation on humans and can be found in 10 CFR Part 20, "Standards for Protection Against Radiation." The limits are based on the recommendations of standards-setting organizations. Radiation standards reflect extensive scientific study by national and international organizations (International Commission on Radiological Protection [ICRP], National Council on Radiation Protection and Measurements [NCRP], United Nations Scientific Committee on the Effects of Atomic Radiation [UNSCEAR], and the National Academy of Sciences [NAS]) and are conservative to ensure that the public and workers at nuclear power plants are protected.*

Health effects from exposure to radiation are dose-dependent. At low doses, radiation can be responsible for inducing cancers such as leukemia, breast cancer, and lung cancer. At very high doses (several hundred rem or higher) and dose rates, radiation has been known to cause prompt (or early, also called "acute") effects, such as vomiting and diarrhea, skin burns, cataracts, and even death.

Currently, there are no scientifically conclusive data that unequivocally establish the occurrence of cancer following exposure to low doses, below about 0.1 Sv (10 rem). However, radiation protection experts conservatively assume that any amount of radiation may pose some risk of causing cancer and that the risk is higher for higher radiation exposures. Therefore, a linear, no-threshold dose response relationship is used to describe the relationship between radiation dose and cancer induction. Simply stated, any increase in dose, no matter how small, results in an incremental increase in health risk. The NRC accepts this theory as a conservative model for estimating health risks from radiation exposure and recognizes that the model probably overestimates those risks. On the basis of this theory, the NRC conservatively establishes limits for radioactive effluents and radiation exposures for workers and members of the public, as found in 10 CFR Part 20.

The amount of radioactive material released from the Susquehanna Steam Electric Station, Units 1 and 2 (SSES) is well measured, well monitored, and known to be very small. The total *whole body dose from both ingested radionuclides due to liquid and gaseous releases and direct radiation from SSES is negligible compared with the public's exposure from natural background radiation, medical irradiation, and radiation from consumer products of more than 300 millirem per year. The annual radioactive offsite doses, since operation commenced in 1982, from the SSES have always been well below the 10 CFR Part 20 limits. These doses are so low that resulting cancers have not been observed and would not be expected.*

Although a number of studies of cancer incidence in the vicinity of nuclear power facilities have been conducted, there are no studies to date that are accepted by the scientific community that show a correlation between radiation dose from nuclear power facilities and cancer incidence in the general public. Specific studies that have been conducted include:

In 1990, at the request of Congress, the National Cancer Institute conducted a study of cancer mortality rates around 52 nuclear power plants and 10 other nuclear facilities. The study covered the period from 1950 to 1984 and evaluated the change in mortality rates before and during facility operations. The study concluded that there was no evidence that nuclear facilities may be linked causally with excess deaths from leukemia or from other cancers in populations living nearby.

In June 2000, investigators from the University of Pittsburgh found no link between radiation released during the 1979 accident at the Three Mile Island power plant and cancer deaths among nearby residents. Their study followed 32,000 people who lived within 5 mi (8 km) of the plant at the time of the accident.

In January 2001, the Connecticut Academy of Sciences and Engineering issued a report on a study around the Haddam Neck nuclear power plant in Connecticut and concluded that radiation emissions were so low as to be negligible.

The American Cancer Society in 2001 concluded that although reports about cancer clusters in some 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 evidence that links strontium-90 with increases in breast cancer, prostate cancer, or childhood cancer rates. Radiation emissions from nuclear power plants are closely controlled and involve negligible levels of exposure for nearby communities.

Also in 2001, the Florida Bureau of Environmental Epidemiology reviewed claims that there are striking increases in cancer rates in southeastern Florida counties caused by increased radiation exposures from nuclear power plants. However, using the same data to reconstruct the calculations on which the claims were based, Florida officials were not able to identify unusually high rates of cancers in these counties compared with the rest of the State of Florida and the nation.

In 2000, the Illinois Public Health Department compared childhood cancer statistics for counties with nuclear power plants to similar counties without nuclear plants and found no statistically significant difference.

Radiation exposure to the public during the license renewal term is a Category 1 issue that was evaluated in the Generic Environmental Impact Statement for License Renewal of Nuclear Plants, *NUREG-1437 (GEIS). As part of its search for new and significant information, the NRC staff will review recent results from the licensee's effluent and environmental radiological monitoring programs and perform a comprehensive evaluation. These programs and the impacts from SSES radiological effluents will be discussed in Chapters 2 and 4 of the Supplemental Environmental Impact Statement (SEIS). The staff also will consider planned changes in the status of SSES, including the planned power uprate, in the preparation of the SEIS. The comments provide no new and significant information; therefore, they will not be evaluated further.*

A.3. Comments Concerning Surface-Water Quality, Hydrology, and Use

Comment: Water supplies. I did talk to a gentleman from PPL. In the interest of open disclosure, we met with the Susquehanna River Basis Commission in Pennsylvania and especially the DEP is going through a statewide exercise in water use management. So a lot of what we do tonight may be moot in terms of FERC and also the Susquehanna River Basin Commission may rule. Again, in terms of open disclosure I've already stated to the Basin Commission we're going to oppose the license extension until in our view you view water as a commodity. It doesn't just evaporate. It comes from somewhere.

Everyday about 30 million gallons are taken from the river and not returned. That's even during a drought. That's not being a good neighbor. You know, when we're being asked to conserve water and the plant keeps churning the water, there has to be a balance. We're not saying you can't use the water, but you have to moderate your use and pay your fair share. So I think that's an issue that may not even be relevant to this particular venue, but an issue we will raise. (MC-2-9)

Comment: The magnitude of the amount of water used at a nuclear power plant is readily evidenced at the SSES every day. The Susquehanna Steam Electric Station loses 14.93 million gallons of water per unit daily as vapor out of the cooling tower stack. Eleven million gallons per day are returned to the river as cooling-tower basin blow down. On average, 29.86 million gallons per day are taken from the river and not returned; even during periods of drought! (PPL, Pennsylvania Environmental Permit Report) (D-2-8)

Response: *The consumptive use of water by SSES is regulated through the Susquehanna River Basin Commission (SRBC), which manages water usage along the entire length of the river. The current permit granted to SSES is for consumptive usage of up to 40 million gal/day (151 million L/d) (Permit # 19950301 EPUL-0578). SSES has submitted an application to the SRBC to increase the amount of consumptive water usage to 44 million gal/day (167 million L/d). The SRBC is reviewing the application and will make a decision independent of the NRC with regard to the modification of the current SSES permit to reflect the increased consumptive water usage. SSES is required to adhere to the water usage limits set by the permit and to any mitigative measures set by the SRBC for continued operation of the facility.*

A.4. Comments Concerning Alternatives

Comment: California closed down the Diablo County Nuclear Plant many years ago. Through conservation solar and other forms of energy they created over 800 new jobs and lowered their rates. Nuclear power is only 19 percent of our energy in the United States. Through conservation and solar we could close down all the nuclear power plants in our country and save thousands of lives. I know those little candlelights look cute at night in your windows. But they aren't really necessary. Turning them off may help save someone's life, maybe your child's.

Anyway who wants nuclear power plants, and our President wants 55 more in this country, should be considered a terrorist. (MC-1-2, D-1-2)

Response: *Decisions regarding energy policy and energy planning, including whether to implement energy options like solar power, conservation, or even nuclear power, are also made by the utility and State and Federal (non-NRC) decisionmakers. These decisions are based on economics, energy reliability goals, and other objectives over which the other entities may have jurisdiction. The NRC does not have the authority to make these decisions. During license renewal, the NRC does, however, conduct an environmental review that compares the potential environmental impacts of a nuclear plant during the period of extended operation with the environmental impacts of energy alternatives as part of the National Environmental Policy Act (NEPA) process. The alternatives analysis may include consideration of conservation or solar power when reasonable, often in combination with other alternatives. In addition to an environmental review, NRC staff also evaluates nuclear plant safety and aging management in the course of license renewal. If the NRC decides to renew a plant's license, the decision of whether to operate the nuclear power plant or an alternative is left up to the appropriate State, utility, and/or Federal entities.*

The NRC staff notes that Diablo Canyon Units 1 and 2 are currently still in operation, as are San Onofre Units 2 and 3. In California, the Santa Susana SRE (Sodium Reactor

Experimental), Vallecitos Nuclear Power Plant, Humboldt Bay Nuclear Power Plant, Rancho Seco Nuclear Power Plant, and San Onofre Unit 1 are no longer operating.

Comment: I'm saying that because Pennsylvania is primarily a coal and nuclear state. And I think we made a mistake before when we became so dependent on two sources of energy. So my plea is that we rationally evaluate relicensing and then think how we're going to meet future energy demand as we move forward. (MC-2-1)

Response: *Decisions about energy policy and energy planning, including choosing an energy generation mix (sometimes referred to as a generation "portfolio"), fall under the authority of the utility and State and Federal (non-NRC) decisionmakers. These entities may also decide which energy generation options to implement in order to meet future energy demand. The NRC does not have the authority or jurisdiction in energy policy and planning, or in deciding whether to implement particular energy generation options. The NRC makes its decision whether or not to renew a license based on safety and environmental considerations. The final decision on whether or not to continue operating the nuclear plant will be made by the utility and State and Federal (non-NRC) decisionmakers.*

A.5. Comments Concerning High-Level Radioactive Waste

Comment: Does everyone realize that our new plants are also becoming high level waste sites? Everyone's life is at stake here. Do what's right. Shut them down. (MC-1-4, D-1-4)

Comment: The Susquehanna nuclear power plant produces approximately 30 metric tons of high-level radioactive waste per year per reactor. The nuclear garbage has no forwarding address. In reality, the SSES is a *de facto* high-level radioactive waste site on the Susquehanna River. There is no solution in sight for disposal of highly radioactive "spent" fuel rods, although the National Academy of Sciences and other technical experts argue that moving all radioactive waste into hardened, dry storage would reduce the risks associated with current high-density cooling ponds at each plant. Susquehanna is one of 21 nuclear power plants where used reactor fuel pools have reached capacity. (D-2-3)

Response: *The comments relate to Category 1 uranium fuel cycle and waste management issues. The environmental impacts of the uranium fuel cycle, including the onsite storage and disposal of spent nuclear fuel, will be addressed in Chapter 6 of the SEIS.*

Appendix B

Contributors to the Supplement

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The overall responsibility for the preparation of this supplement was assigned to the U.S. Nuclear Regulatory Commission (NRC), Office of Nuclear Reactor Regulation. The supplement was prepared by members of the Office of Nuclear Reactor Regulation with assistance from other NRC organizations, Argonne National Laboratory, and Information Systems Laboratories, Inc.

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(a) Argonne National Laboratory is operated for the U.S. Department of Energy by UChicago Argonne, LLC.
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Appendix C

Chronology of NRC Staff Environmental Review Correspondence Related to the PPL Susquehanna, LLC Application for License Renewal of Susquehanna Steam Electric Station, Units 1 and 2

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Chronology of NRC Staff Environmental Review Correspondence Related to the PPL Susquehanna, LLC Application for License Renewal of Susquehanna Steam Electric Station, Units 1 and 2

This appendix contains a chronological listing of correspondence between the U.S. Nuclear Regulatory Commission (NRC) and PPL Susquehanna, LLC (PPL) and other correspondence related to the NRC staff's environmental review, under Title 10, Part 51, of the *Code of Federal Regulations* (10 CFR Part 51), of PPL's application for renewal of the Susquehanna Steam Electric Station, Units 1 and 2 (SSES) operating licenses. All documents, with the exception of those containing proprietary information, have been placed in the Commission's Public Document Room, at One White Flint North, 11555 Rockville Pike (first floor), Rockville, Maryland, and are available electronically from the Public Electronic Reading Room found on the Internet at the following Web address: http://www.nrc.gov/reading-rm.html. From this site, the public can gain access to the NRC's Agencywide Document Access and Management System (ADAMS), which provides text and image files of NRC's public documents in the Publicly Available Records System (PARS) component of ADAMS. The ADAMS accession numbers for each document are included below.

August 2, 2006	Letter from PPL to NRC, "Pre-application Activities Regarding License Application Review Schedule for Susquehanna Steam Electric Station, Units 1 and 2" (ADAMS No. ML062140549).
September 13, 2006	Letter from PPL to NRC forwarding the application for renewal of operating licenses for SSES, Units 1 and 2, requesting an extension of operating licenses for an additional 20 years (ADAMS No. ML062601570).
September 26, 2006	Letter to PPL from NRC, "Receipt and Availability of the License Renewal Application for the Susquehanna Steam Electric Station" (ADAMS No. ML062690158).

October 2, 2006	*Federal Register* notice, "PPL Susquehanna, LLC; Notice of Receipt and Availability of Application for Renewal of Susquehanna Steam Electric Station, Units 1 and 2, Facility Operating License Nos. NPF-14 and NPF-22 for an Additional 20-Year Period" (71 FR 58014).
October 24, 2006	Letter from NRC to Mr. Clifford Farides, Executive Director, Mill Memorial Public Library, regarding maintenance of reference material for SSES license renewal at the Mill Memorial Public Library (ADAMS No. ML0629600791).
October 26, 2006	Letter from NRC to PPL, "Determination of Acceptability and Sufficiency for Docketing, Proposed Review Schedule, and Opportunity for a Hearing Regarding the Application from PPL Susquehanna, LLC., for Renewal of the Operating Licenses for the Susquehanna Steam Electric Station, Units 1 and 2 (ADAMS No. ML062930293).
October 26, 2006	Letter from NRC to Ms. Alice Zaikoski, Co-Director Berwick Public Library, regarding maintenance of reference material for SSES license renewal at the Berwick Public Library (ADAMS No. ML062960060).
November 1, 2006	Letter to Ms. Susan Zacher, Historic Structures Section Chief, State Historic Preservation Office, inviting participation in scoping process related to NRC's environmental review of the license renewal application for Susquehanna Steam Electric Station, Units 1 and 2 (SHPO No. 05-1588-079-A) (ADAMS No. ML062960009).
November 2, 2006	Letter from PPL to NRC, "Susquehanna Steam Electric Station Acceptability and Sufficiency for Docketing – Application for Renewed Operating Licenses Numbers NPF-14 and NPF-22" (ADAMS No. ML063130413).
November 2, 2006	Notice of public meeting to discuss environmental scoping process for the Susquehanna Steam Electric Station, Units 1 and 2, license renewal application review (ADAMS No. ML062990010).

November 2, 2006	*Federal Register* notice, "Notice of Acceptance for Docketing of the Application, Notice of Opportunity for Hearing and Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process for Facility Operating License Nos. NPF-14 and NPF-22 for an Additional 20-Year Period" (71 FR 64566).
November 13, 2006	Letter to Mr. Don Klima, Director, Advisory Council on Historic Preservation, regarding Susquehanna Steam Electric Station, Units 1 and 2, license renewal review (ADAMS No. ML062980237).
November 13, 2006	Letter to Ms. Julie McMonagle, Director, Pennsylvania Environmental Council, Northeast Regional Office, regarding Susquehanna Steam Electric Station, Units 1 and 2 license renewal review (ADAMS No. ML062980195).
November 14, 2006	Letter to The Honorable Mark Hartle, Chief, Aquatic Resources Section, Pennsylvania Fish and Boat Commission, regarding Susquehanna Steam Electric Station, Units 1 and 2 license renewal review (ADAMS No. ML062990018).
November 14, 2006	Letter to Mr. Clint Halftown, Heron Clan Representative, inviting participation in scoping process related to NRC's environmental review of the license renewal application for Susquehanna Steam Electric Station, Units 1 and 2 (ADAMS No. ML063030091).
November 14, 2006	Letter to Mr. Raymond Cline, Chairman, Delaware Trust Board, inviting participation in scoping process related to NRC's environmental review of the license renewal application for Susquehanna Steam Electric Station, Units 1 and 2 (ADAMS No. ML063030370).
November 14, 2006	Letter to Mr. Gerald Danforth, Chairman, Oneida Nation of Wisconsin, inviting participation in scoping process related to NRC's environmental review of the license renewal application for Susquehanna Steam Electric Station, Units 1 and 2 (ADAMS No. ML063050363).

November 14, 2006	Letter to The Honorable Charles D. Enyart, Chief, East Shawnee Tribe of Oklahoma, inviting participation in scoping process related to NRC's environmental review of the license renewal application for Susquehanna Steam Electric Station, Units 1 and 2 (ADAMS No. ML063050355).
November 14, 2006	Letter to The Honorable Raymond Halbritter, Nation Representative, Oneida Indian Nation, inviting participation in scoping process related to NRC's environmental review of the license renewal application for Susquehanna Steam Electric Station, Units 1 and 2 (ADAMS No. ML063030437).
November 14, 2006	Letter to The Honorable Leo R. Henry, Clerk, Chief, Tuscarora Nation, inviting participation in scoping process related to NRC's environmental review of the license renewal application for Susquehanna Steam Electric Station, Units 1 and 2 (ADAMS No. ML063040107).
November 14, 2006	Letter to Ms. Rebecca Hawkins, Tribal Historic Preservation Officer, Shawnee Tribe, inviting participation in scoping process related to NRC's environmental review of the license renewal application for Susquehanna Steam Electric Station, Units 1 and 2 (ADAMS No. ML063050595).
November 14, 2006	Letter to Mr. Tony Gonyea, Faithkeeper, Onondaga Nation, inviting participation in scoping process related to NRC's environmental review of the license renewal application for Susquehanna Steam Electric Station, Units 1 and 2 (ADAMS No. ML063050590).
November 14, 2006	Letter to Mr. Barry Snyder, Sr., President, Seneca Nation of Indians, inviting participation in scoping process related to NRC's environmental review of the license renewal application for Susquehanna Steam Electric Station, Units 1 and 2 (ADAMS No. ML063040153).
November 14, 2006	Letter to Ms. Karen Kaniatobe, Tribal Historic Preservation Officer, Absentee-Shawnee Tribe of Oklahoma, inviting participation in scoping process related to NRC's environmental review of the license renewal application for Susquehanna Steam Electric Station, Units 1 and 2 (ADAMS No. ML063050370).

November 14, 2006	Letter to The Honorable James Ransom, Chief, St. Regis Band of Mohawk Indians, inviting participation in scoping process related to NRC's environmental review of the license renewal application for Susquehanna Steam Electric Station, Units 1 and 2 (ADAMS No. ML063040006).
November 14, 2006	Letter to The Honorable Paul Spicer, Chief, Seneca-Cayuga Tribe of Oklahoma, inviting participation in scoping process related to NRC's environmental review of the license renewal application for Susquehanna Steam Electric Station, Units 1 and 2 (ADAMS No. ML063040032).
November 14, 2006	Letter to The Honorable Irving Powless, Jr., Chief, Onondaga Indian Nation, inviting participation in scoping process related to NRC's environmental review of the license renewal application for Susquehanna Steam Electric Station, Units 1 and 2 (ADAMS No. ML063040171).
November 14, 2006	Letter to Mr. Robert Chicks, Tribal Chairman, Stockbridge-Munsee Band of the Mohican Nation of Wisconsin, inviting participation in scoping process related to NRC's environmental review of the license renewal application for Susquehanna Steam Electric Station, Units 1 and 2 (ADAMS No. ML063050608).
November 15, 2006	Letter to The Honorable Roger Hill, Chief, Tonawanda Band of Seneca, inviting participation in scoping process related to NRC's environmental review of the license renewal application for Susquehanna Steam Electric Station, Units 1 and 2 (ADAMS No. ML063040075).
November 15, 2006	Letter to Ms. Tamara Francis, National American Graves Protection and Repatriation Act, Director, Delaware Nation of Western Oklahoma, inviting participation in scoping process related to NRC's environmental review of the license renewal application for Susquehanna Steam Electric Station, Units 1 and 2 (ADAMS No. ML063030206).

November 15, 2006	Letter to Jennifer Kagel, Fishery Biologist, U.S. Fish and Wildlife Service (FWS), inviting participation in scoping process related to NRC's environmental review of the license renewal application for Susquehanna Steam Electric Station, Units 1 and 2 (ADAMS No. ML062990053).
November 17, 2006	Letter to Ms. Chris Firestone, Native Plant Program Manager, Pennsylvania Department of Conservation and Natural Resources, regarding Susquehanna Steam Electric Station, Units 1 and 2 license renewal review (ADAMS No. ML062990170).
November 20, 2006	Letter from Douglas McLearen, Chief, Division of Archaeology and Protection, Pennsylvania Bureau for Historic Preservation, to NRC, "Regarding ER 05-1558-079-C NRC: Susquehanna Steam Electric Station License Renewal Salem Township, Luzerne County: Area of Potential Effect" (ER 05-1558-079-C) (ADAMS No. ML063470607).
November 27, 2006	Letter from Greg Bunker, Environmental Manager, Stockbridge-Munsee Band of Mohican Indians, regarding request for comments concerning the SSES license renewal review (ADAMS No. ML070240192).
December 7, 2006	Letter from Anthony Wonderley, Historian, Oneida Indian Nation, regarding request for comments concerning the SSES license renewal review (ADAMS No. ML070240190).
December 15, 2006	Letter from Pao-Tsin Kuo, NRC, to Britt T. McKinney, PPL, "Correction to the Notice of the Public Comment Period on the Environmental Scope of the Plant-Specific Supplement to the Generic Environmental Impact Statement Regarding License Renewal for Susquehanna, Units 1 and 2" (ADAMS No. ML063100474).
December 20, 2006	Letter from Mark Rubin, NRC Branch Chief, to Rani Franovich, NRC Branch Chief, "Request for Additional Information to Support the Staff's Severe Accident Mitigation Alternative Review for Susquehanna Steam Electric Station, Units 1 and 2" (ADAMS No. ML063600388).

December 21, 2006	Letter from David Densmore, Field Supervisor, FWS, forwarding a list of protected species which are under evaluation for Susquehanna Steam Electric Station, Units 1 and 2 license renewal (ADAMS No. ML070040431).
December 29, 2006	Issuance of "Summary of Public Environmental Scoping Meetings Related to the Review of the Susquehanna Steam Electric Station, Units 1 and 2 License Renewal Application" (ADAMS No. ML063470573).
January 8, 2007	Letter from Rebecca Bowen, Environmental Review Specialist, Pennsylvania Department of Conservation and Natural Resources, forwarding a list of protected species which are under evaluation for Susquehanna Steam Electric Station, Units 1 and 2 license renewal (ADAMS No. ML070190672).
January 16, 2007	Letter to PPL from NRC, "Request for Additional Information Related to the Staff's Review of Severe Accident Mitigation Alternatives for SSES" (ADAMS No. ML070030463).
March 1, 2007	Letter from David Densmore, Field Supervisor, FWS, regarding USFWS Project #2007-1111 (ADAMS No. ML070720347).
March 2, 2007	Letter to PPL from NRC, "Summary of Telephone Conference Call Held on February 12, 2007, Between the U.S. Nuclear Regulatory Commission and PPL Susquehanna, LLC, Concerning Requests for Additional Information Pertaining to the Susquehanna Steam Electric Station, Units 1 and 2" (ADAMS No. ML070580092).
April 16, 2007	Issuance of "Environmental Scoping Summary Report Associated with the NRC Staff's Review of the Application by PPL Susquehanna, LLC for Renewal of the Operating Licenses for Susquehanna Steam Electric Station, Units 1 and 2" (ADAMS No. ML070740684).
June 9, 2007	Letter to David Densmore, Field Supervisor, FWS, "Regarding USFWS Project #2007-1111 Regarding Protected Species in the Vicinity of the Susquehanna Steam Electric Station, Units 1 and 2, and Associated Transmission Line Corridor" (ADAMS No. ML071300230).

June 14, 2007	Letter from PPL to NRC, "Susquehanna Steam Electric Station Application for Renewed Operating Licenses Numbers NPF-14 and NPF-22 Environmental Audit Document Requests Other Reference Information" (ADAMS No. ML071800156).
June 15, 2007	Letter from PPL to NRC, "Susquehanna Steam Electric Station, Application for Renewed Operating Licenses, Responses to Environmental Audit Questions" (ADAMS No. ML071790414).
June 20, 2007	Letter from PPL to NRC, "Susquehanna, Units 1 and 2 – Application for Renewed Operating Licenses Number NPF-14 and NPF-22, Environmental Audit Document Requests Supplemental Information PLA-6219" (ADAMS No. ML071800072).
July 13, 2007	Letter to PPL from NRC, "Request for Additional Information Regarding the Review of the License Renewal Application for Susquehanna Steam Electric Station Units 1 and 2" (ADAMS No. ML071800479).
August 1, 2007	Letter from PPL to NRC, "Susquehanna, Units 1 and 2, Response to Request for Additional Information – License Renewal Application Environmental Site Audit Followup" (ADAMS No. ML072220245).
October 11, 2007	Letter from David Densmore, Field Supervisor, FWS, "Re: USFWS Project #2007-1111" (ADAMS No. ML073110515).
April 4, 2008	Summary of Site Audit Related to the Review of the License Renewal Application for Susquehanna Steam Electric Station (ADAMS No. ML073480447).

Appendix D

Organizations Contacted

Appendix D

Organizations Contacted

During the course of the U.S. Nuclear Regulatory Commission staff's independent review of environmental impacts from operations during the renewal term, the following Federal, State, regional, local, and Native American Tribal agencies were contacted:

Absentee-Shawnee Tribe of Oklahoma, Shawnee, Oklahoma

Advisory Council on Historic Preservation, Washington, D.C.

Borough of Berwick, Berwick, Pennsylvania

Cayuga Nation, Versailles, New York

Chamber of Commerce, Berwick, Pennsylvania

Delaware Nation of Oklahoma, Anadarko, Oklahoma

Delaware Trust Board, Bartlesville, Oklahoma

East Shawnee Tribe of Oklahoma, Seneca, Missouri

Luzerne Township, Pennsylvania

Oneida Indian Nation, Verona, New York

Oneida Nation of Wisconsin, Oneida, Wisconsin

Onondaga Nation, Nedrow, New York

Pennsylvania Department of Conservation and Natural Resources, Harrisburg, Pennsylvania

Pennsylvania Department of Environmental Protection, Harrisburg, Pennsylvania

Pennsylvania Department of Environmental Protection, Northeast Region, Wilkes-Barre, Pennsylvania

Pennsylvania Department of Environmental Protection, Bureau of Radiation Protection, Harrisburg and Wilkes-Barre, Pennsylvania

Pennsylvania Environmental Council, Northeast Regional Office, Luzerne, Pennsylvania

Pennsylvania Fish and Boat Commission, Bellefonte, Pennsylvania

Pennsylvania Historical and Museum Commission, Harrisburg, Pennsylvania

Seneca-Cayuga Tribe of Oklahoma, Miami, Oklahoma

Seneca Nation of Indians, Irving, New York

Shawnee Tribe, Miami, Oklahoma

St. Regis Band of Mohawk Indians, Akwesasne, New York

Stockbridge-Munsee Band of the Mohican Nation of Wisconsin, Bowler, Wisconsin

Susquehanna River Basin Commission, Harrisburg, Pennsylvania

Tonawanda Band of Seneca, Basom, New York

Town Supervisor, Berwick, Pennsylvania

Tuscarora Nation, Lewistown, New York

U.S. Fish and Wildlife Service, State College, Pennsylvania

Appendix E

PPL Susquehanna, LLC
Compliance Status and Consultation Correspondence

Appendix E

PPL Susquehanna, LLC
Compliance Status and Consultation Correspondence

Consultation correspondence related to the evaluation of the application for renewal of the operating licenses for Susquehanna Steam Electric Station (SSES) is identified in Table E-1. Copies of the correspondence are included at the end of this appendix.

The licenses, permits, consultations, and other approvals obtained from Federal, State, regional, and local authorities for SSES are listed in Table E-2.

Table E-1. Consultation Correspondence

Source	Recipient	Date of Letter
U.S. Nuclear Regulatory Commission (R. Franovich)	State Historical Preservation Office (S. Zacher)	November 1, 2006
U.S. Nuclear Regulatory Commission (R. Franovich)	Pennsylvania Environmental Council, Northeast Regional Office (J. McMonagle)	November 13, 2006
U.S. Nuclear Regulatory Commission (R. Franovich)	Advisory Council on Historic Preservation (D. Klima)	November 13, 2006
U.S. Nuclear Regulatory Commission (R. Franovich)	Pennsylvania Fish and Boat Commission (M. Hartle)	November 14, 2006
U.S. Nuclear Regulatory Commission (R. Franovich)	Cayuga Nation (C. Halftown)	November 14, 2006[a]
U.S. Nuclear Regulatory Commission (R. Franovich)	U.S. Fish and Wildlife Service (J. Kagel)	November 15, 2006
U.S. Nuclear Regulatory Commission (R. Franovich)	Pennsylvania Department of Conservation and Natural Resources (C. Firestone)	November 17, 2006
State Historical Preservation Office (D. McLearen)	U.S. Nuclear Regulatory Commission (R. Franovich)	November 20, 2006
Stockbridge-Munsee Community (G. Bunker)	U.S. Nuclear Regulatory Commission (R. Franovich)	November 27, 2006

Table E-1. (contd)

Source	Recipient	Date of Letter
Oneida Indian Nation (A. Wonderley)	U.S. Nuclear Regulatory Commission (R. Franovich)	December 7, 2006
U.S. Fish and Wildlife Service (D. Densmore)	U.S. Nuclear Regulatory Commission (R. Franovich)	December 21, 2006
Pennsylvania Department of Conservation and Natural Resources (R. Bowen)	U.S. Nuclear Regulatory Commission (A. Mullins)	January 8, 2007
U.S. Fish and Wildlife Service (D. Densmore)	U.S. Nuclear Regulatory Commission (R. Franovich)	March 1, 2007
U.S. Nuclear Regulatory Commission (R. Franovich)	U.S. Fish and Wildlife Service (D. Densmore)	June 9, 2007
U.S. Fish and Wildlife Service (D. Densmore)	U.S. Nuclear Regulatory Commission (R. Franovich)	October 11, 2007

(a) Similar letters were sent to fifteen other Native American Tribes listed in Appendix C.

Table E-2. Federal, State, Local, and Regional Licenses, Permits, Consultations, and Other Approvals for Susquehanna Steam Electric Station

Agency	Authority	Description	Number	Issue Date	Expiration Date	Remarks
NRC	10 CFR Part 50	Operating license, Susquehanna Steam Electric Station, Unit 1	NPF-022	07/17/82	07/17/22	Authorizes operation of the SSES Unit 1.
NRC	10 CFR Part 50	Operating license, Susquehanna Steam Electric Station, Unit 2	NPF-014	03/23/84	03/23/24	Authorizes operation of the SSES Unit 2.
NRC	Atomic Energy Act (42 USC 2011 et seq.)	License renewal	NA	NA	NA	Environmental Report submitted in support of license renewal application.
EPA	40 CFR Part 68	Risk Management Program	EPA Facility ID # 1000 0004 9128	06/15/04	06/30/09	Hydrogen Tank Farm.
FWS	Section 7 of the Endangered Species Act (16 USC 1536)	Consultation	NA	NA	NA	Requires a Federal agency to consult with the FWS regarding whether a proposed action will affect endangered or threatened species.
Pennsylvania Historical and Museum Commission	Section 106 of the National Historic Preservation Act	Consultation	NA	NA	NA	The National Historic Preservation Act requires Federal agencies to take into account the effect of any undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the *National Register of Historic Places*.
PDEP	Clean Water Act (33 USC 1251 et seq.); PA Title 25, Chapter 92	NPDES permit	PA-0047325	09/01/05	08/31/10[a]	Industrial wastewater discharges to Susquehanna River.

Table E-2. (contd)

Agency	Authority	Description	Number	Issue Date	Expiration Date	Remarks
PDEP	Pennsylvania Public Laws 834, 204, 851, 1987, etc.	Water Obstruction & Encroachment Permit Joint Permit	PASPGP-2 E40-195	02/15/06	06/30/06	Same as COE permit.
PDEP	Pennsylvania Public Laws 834, 204, 851, 1987, etc.	Water Obstruction & Encroachment Permit Joint Permit	E40-192	08/31/88	12/31/90	Boat Ramp Env. Lab; can perform routine maintenance.
PDEP	Title 25, Chapter 105, Dam Safety and Waterway Management	Water Obstruction & Encroachment Permit Joint Permit	PASPGP-2 E40-609 APS No. 457878	12/19/02	12/19/05	Work in wetlands.
PDEP	Clean Air Act (42 USC 7401 et seq.); PA Title 25, Chapter 127, Construction, Modification, Reactivation and Operation of Sources	Operating permit	40-00027	11/24/03	11/24/08	All air emission sources at SSES.
PDEP	Clean Water Act (33 USC 1251 et seq.); Clean Air Act (42 USC 7401 et seq.); Resource Conservation and Recovery Act (42 USC 6901 et seq.); PA Title 245, Administration of the Storage Tank and Spill Prevention Program	Registration or certificate	40-10748-008A	04/04/07	04/04/08	Used diesel oil tank "A."
PDEP	Same	Registration or certificate	40-10748-011A	04/04/07	04/04/08	Unit 1 condensate demineralizer sulfuric acid storage tank.
PDEP	Same	Registration or certificate	40-10748-012A	04/04/07	04/04/08	Unit 1 condensate demineralizer sodium hydroxide storage tank.
PDEP	Same	Registration or certificate	40-10748-020A	04/04/07	04/04/08	Raw water treatment alum storage tank.
PDEP	Same	Registration or certificate	40-10748-025A	04/04/07	04/04/08	Sodium bisulfite.

Table E-2. (contd)

Agency	Authority	Description	Number	Issue Date	Expiration Date	Remarks
PDEP	Same	Registration or certificate	40-10748-023A	04/04/07	04/04/08	Sodium hypochlorite.
PDEP	Same	Registration or certificate	40-10748-024A	04/04/07	04/04/08	Sodium hypochlorite.
PDEP	Same	Registration or certificate	40-10748-026A	04/04/07	04/04/08	Raw water treatment sodium hypochlorite storage tank.
PDEP	Same	Registration or certificate	40-10748-016	04/04/07	04/04/08	Unit 1 batch lube oil tank.
PDEP	Same	Registration or certificate	40-10748-017	04/04/07	04/04/08	Unit 2 batch lube oil tank.
PDEP	Same	Registration or certificate	40-10748-018	04/04/07	04/04/08	Fuel farm gasoline tank.
PDEP	Same	Registration or certificate	40-10748-019	04/04/07	04/04/08	Fuel farm diesel fuel tank.
PDEP	PA Title 25, Chapter 109, Safe Drinking Water	Public Water Supply Brief Description Form	ID 2400994 Site Well System (Wells TW1 & TW2)	02/17/89	NA	Well registration continues indefinitely unless there are upgrades.
PDEP	PA Title 25, Chapter 109, Safe Drinking Water	Public Water Supply Brief Description Form	ID 2400995 Riverlands Recreation Area	12/04/85	NA	Well registration continues indefinitely unless there are upgrades.
PDEP	PA Title 25, Chapter 109, Safe Drinking Water	Public Water Supply Brief Description Form	ID 2400999 Energy Information Center	12/04/85	NA	Well registration continues indefinitely unless there are upgrades.
PDEP	PA Title 25, Chapter 109, Safe Drinking Water	Public Water Supply Brief Description Form	ID 2400938 West Building (formerly Emergency Operations Facility)	12/04/85	NA	Well registration continues indefinitely unless there are upgrades.

Table E-2. (contd)

Agency	Authority	Description	Number	Issue Date	Expiration Date	Remarks
PDEP	Section 3010 of Resource Conservation and Recovery Act	Acknowledgement of notification of hazardous waste activity	PAD000765883	08/09/00	NA	Hazardous waste.
PDEP	Clean Water Act, Section 401 (33 USC 1341)	Certification	NA	NA	NA	State issuance of NPDES permit constitutes 401 certification.
PFBC	Chapter 29 of the Fish and Boat Code, Act 1980-175 amended	Scientific Collecting Permit	008 Type III (R) 007 Type III (R)	04/25/07 04/20/07	12/31/07	Collect fish, epilithic algae, zooplankton, macroinvertebrate, amphibians, reptiles.
SRBC	Regulation 18 CFR Part 803 for consumptive use	Approval for consumptive use water	Application 19950301	03/09/95	NA	Low-flow augmentation.
USACE	Section 10 of River and Harbor Act of 1899 (33 USC 403)	Water and Obstruction & Encroachment Permit Joint Permit	CENAB-OP-RPA 06-10107-P12	10/06/06	10/06/09	Maintenance dredging in front of the river intake structure and cleaning the cooling tower blowdown discharge diffuser pipe.
USACE	Section 10 of River and Harbor Act of 1899 (33 USC 403)	Water and Obstruction & Encroachment Permit Joint Permit	CENAB-OP-RR 87-1767-4	08/31/88	12/31/90	Boat Ramp Env. Lab; can perform routine maintenance.
USACE	Section 10 of River and Harbor Act of 1899 (33 USC 403)	Water and Obstruction & Encroachment Permit Joint Permit	PASPGP-2 E40-609 APS No. 457878	12/19/02	12/19/05	Work in wetlands.
DOT	49 USC 5108	Registration	0615065500290Q	06/15/06	06/30/09	Hazardous materials shipments.
CVDEM	Title 44, Code of Virginia, Chapter 3.3, Section 44-146.30	Application for Registration to Transport Hazardous Radioactive Materials	PS-S-013109	01/30/07	01/31/09	Transportation of radioactive waste into the Commonwealth of Virginia.
SCDHEC	Act No. 429 of 1980, South Carolina Radioactive Waste Transportation and Disposal Act	South Carolina Radioactive Waste Transport Permit	0162-37-07-X	11/13/06	12/31/07	Transportation of radioactive waste into the State of South Carolina.

TDEC	Tennessee Department of Environment and Conservation Regulations	Tennessee Radioactive Waste-License-for-Delivery	T-PA001-L08	01/01/08	12/31/08	Shipment of radioactive material into Tennessee to a disposal/processing facility.

Table E-2. (contd)

(a) Application pending.

CFR	=	*Code of Federal Regulations*
CVDEM	=	Code of Virginia, Department of Emergency Management
DOT	=	U.S. Department of Transportation
FWS	=	U.S. Fish and Wildlife Service
NA	=	not applicable
NOAA	=	National Oceanic and Atmospheric Administration
NPDES	=	National Pollutant Discharge Elimination System
NRC	=	U.S. Nuclear Regulatory Commission
PDEP	=	Pennsylvania Department of Environmental Protection
PFBC	=	Pennsylvania Fish and Boat Commission
RCRA	=	Resource Conservation and Recovery Act
SCDHEC	=	South Carolina Department of Health and Environmental Control
SSES	=	Susquehanna Steam Electric Station
SRBC	=	Susquehanna River Basin Commission
TDEC	=	Tennessee Department of Environment and Conservation
USACE	=	U.S. Army Corps of Engineers
USC	=	*United States Code*

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 1, 2006

Susan M. Zacher, Historic Structures Section Chief
Pennsylvania Historical & Museum Commission
Bureau for Historic Preservation
Commonwealth Keystone Building, 2nd Floor
400 North Street
Harrisburg, PA 17120-0093

SUBJECT: SUSQUEHANNA STEAM ELECTRIC STATION LICENSE RENEWAL APPLICATION REVIEW (SHPO NO. 05-1588-079-A)

Dear Ms. Zacher:

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing an application to renew the operating licenses for Susquehanna Steam Electric Station (SSES), Units 1 and 2, which is located on the western bank of the Susquehanna River, five miles northeast of Berwick, (Latitude N41°05'27", Longitude W76°08'45"), in Salem Township, Luzerne County, Pennsylvania. SSES is operated by PPL Susquehanna, LLC (PPL). The application for renewal was submitted by PPL in a letter dated September 13, 2006, pursuant to Title 10 of the *Code of Federal Regulations* Part 54 (10 CFR Part 54).

The NRC has established that, as part of the staff's review of any nuclear power plant license renewal action, a site-specific Supplemental Environmental Impact Statement (SEIS) to its "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," NUREG-1437, will be prepared under the provisions of 10 CFR Part 51, the NRC regulation that implements the National Environmental Policy Act of 1969 (NEPA). In accordance with 36 CFR 800.8(c), the SEIS will include analyses of potential impacts to historic and cultural resources.

In the context of the National Historic Preservation Act of 1966, as amended, the NRC staff has determined that the area of potential effect (APE) for a license renewal action is the area at the power plant site and its immediate environs that may be impacted by post-license renewal land-disturbing operations or projected refurbishment activities associated with the proposed action. The APE may extend beyond the immediate environs in those instances where post-license renewal land-disturbing operations or projected refurbishment activities specifically related to license renewal may potentially have an effect on known or proposed historic sites. This determination is made irrespective of ownership or control of the lands of interest.

On November 15, 2006, the NRC will conduct two public NEPA meetings at 1:30 p.m. and 7:00 p.m. at the Eagles Building, 107 South Market Street, Berwick, Pennsylvania 18603. On May 07, 2007, the NRC plans to conduct a site audit at the SSES facility. You and your staff are invited to attend both the public meetings and the site audit. Your office will receive a copy of the draft SEIS along with a request for comments. The staff expects to publish the draft SEIS in December 2007.

S. Zacher -2-

If you have any questions or require additional information, please contact Ms. Alicia Mullins, Environmental Project Manager, by phone at 301-415-1224 or by e-mail at axm7@nrc.gov.

Sincerely,

Rani Franovich

Rani Franovich, Branch Chief
Environmental Branch B
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket Nos. 50-387 and 50-388

Enclosures:
1. 50-Mile-Vicinity Map
2. Site Area Map

cc w/encls: See next page

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 13, 2006

Julie A. McMonagle, Director
Pennsylvania Environmental Council
Northeast Regional Office
175 Main Street
Luzerne, PA 18709

SUBJECT: SUSQUEHANNA STEAM ELECTRIC STATION LICENSE RENEWAL APPLICATION REVIEW

Dear Ms. McMonagle:

The U.S. Nuclear Regulatory Commission (NRC) is reviewing an application submitted by PPL Susquehanna, LLC (PPL), for renewal of the operating licenses for Susquehanna Steam Electric Station (SSES), Units 1 and 2. SSES is located along the Susquehanna River, approximately five miles northeast of Berwick, Pennsylvania. As part of the review of the license renewal application (LRA), the NRC is preparing a Supplemental Environmental Impact Statement (SEIS) under the provisions of Title 10 of the *Code of Federal Regulations* Part 51 (10 CFR Part 51), the NRC regulations that implement the National Environmental Policy Act (NEPA) of 1969. The SEIS includes an analysis of pertinent environmental issues, including endangered or threatened species and impacts to fish and wildlife. This letter is being submitted under the provisions of the Endangered Species Act of 1973, as amended, and the Fish and Wildlife Coordination Act of 1934, as amended.

PPL is requesting the renewal of its operating licenses for Units 1 and 2 for a period of 20 years beyond the expiration of the current license term, extending unit operation until July 2042 and March 2044, respectively. The proposed action would include the use and continued maintenance of existing plant facilities and transmission lines; PPL does not plan to construct or alter any facilities associated with the plant to support license renewal.

In total, PPL owns 2,355 acres of land on both sides of the Susquehanna River. In general, this land is characterized by open deciduous woodlands interspersed with grasslands and orchards. Approximately 487 acres are used for power generation, and the remainder of the land is primarily river floodplain forest, upland forest, and marshes. PPL maintains a 401-acre nature preserve, the Susquehanna Riverlands, located between SSES and the river; US Route 11 separates these areas. East of the Susquehanna River are 717 acres of mostly undeveloped land, which includes natural, recreational, and wildlife areas. Additionally, PPL owns Gould Island, a 65-acre island just up the Susquehanna River.

SSES uses a closed-cycle heat dissipation system to remove waste heat from the circulating water system. The circulating water and the service water systems draw water from, and discharge to, the Susquehanna River. The river intake structure is located on the western bank of the river and consists of two water entrance chambers with one-inch, on-center vertical bar screens and 3/8-inch mesh traveling screens. A low-pressure screen-wash system periodically operates to release aquatic organisms and debris impinged on the traveling screens to the

-2-

trash rack. Cooling tower blowdown, spray pond overflow, and other permitted effluents are discharged to the Susquehanna River through a buried pipe leading to a submerged discharge structure/diffuser, approximately 600 feet downstream of the river intake structure. The diffuser pipe is 200 feet long, with the last 120 feet containing 72 four-inch portals that direct the discharge upwards at a 45 degree angle then going downstream. Warm circulating water from the cooling towers can be diverted to the river intake structure to prevent icing; this usually occurs from November through March.

For the specific purpose of connecting SSES to the regional transmission system, there is a total of approximately 150 miles of transmission line corridors that occupy approximately 3,341 acres of land. These transmission line corridors are being evaluated as part of the environmental review process. The corridors pass through land that is primarily agricultural and forest land with low population densities. Two 500-kilovolt (kV) lines and one 230-kV transmission line connect SSES to the electric grid, with approximately 2.3 miles of short ties in the immediate plant vicinity to connect SSES to the 230-kV system. The 230-kV Stanton-Susquehanna #2 transmission line corridor runs northeast from the plant for approximately 30 miles and ranges from 100 to 400 feet wide. The Susquehanna-Wescosville-Alburtis 500-kV transmission line corridor ranges from 100 to 350 feet wide and runs generally southeast from the plant for approximately 76 miles. The Sunbury-Susquehanna #2 500-kV line is approximately 325 feet wide and runs 44 miles west-southwest from the plant. Pennsylvania counties crossed by the transmission line corridors include Luzerne (the location of SSES), Carbon, Columbia, Lehigh, Northampton, Northumberland, Montour, and Snyder. PPL plans to maintain these transmission lines and the associated corridors, which are integral to the larger transmission system, indefinitely. Except for the short 230-kV transmission lines, the lines will remain a permanent part of the transmission system even after SSES is decommissioned.

We plan to hold two public NEPA scoping meetings at 1:30 p.m. and 7:00 p.m. on November 15, 2006, at the Eagles Building, 107 South Market Street, Berwick, Pennsylvania 18603. You and your staff are invited to attend the public meetings. Your office will receive a copy of the draft SEIS along with a request for comments. The anticipated publication date for the draft SEIS is December 2007.

-3-

If you have any questions concerning the NRC staff review of this LRA, please contact Ms. Alicia Mullins, Project Manager at 301-415-1224 or by e-mail at axm7@nrc.gov.

Sincerely,

Rani Franovich

Rani Franovich, Branch Chief
Environmental Branch B
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket Nos. 50-387 and 50-388

cc: See next page

November 13, 2006

Mr. Don L. Klima, Director
Advisory Council on Historic Preservation
Office of Federal Agency Programs
1100 Pennsylvania Ave, NW, Suite 803
Washington, DC 20004

SUBJECT: SUSQUEHANNA STEAM ELECTRIC STATION LICENSE RENEWAL APPLICATION REVIEW

Dear Mr. Klima:

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing an application to renew the operating licenses for Susquehanna Steam Electric Station (SSES), Units 1 and 2, which are located on the western bank of the Susquehanna River, approximately five miles northeast of Berwick, in Salem Township, Luzerne County, Pennsylvania. SSES is operated by Susquehanna PPL, LLC (PPL). The application for renewal was submitted by PPL in a letter dated September 13, 2006, pursuant to Title 10 of the *Code of Federal Regulations* Part 54 (10 CFR Part 54).

The NRC has established that, as part of the staff's review of any nuclear power plant license renewal action, a site-specific Supplemental Environmental Impact Statement (SEIS) to its "Generic Environmental Impact Statement for License Renewal of Nuclear Plants," NUREG-1437, will be prepared under the provisions of 10 CFR Part 51, the NRC regulation that implements the National Environmental Policy Act of 1969 (NEPA). In accordance with 36 CFR 800.8(c), the SEIS will include analyses of potential impacts to historic and cultural resources.

On November 15, 2006, the NRC will conduct two public meetings at the Eagles Building, 107 South Market Street, Berwick, Pennsylvania 18603. The purpose of these meetings is to solicit comments on the scope of the staff's environmental review. You and your staff are invited to attend the public meetings. Your office will receive a copy of the draft SEIS along with a request for comments. The staff expects to publish the draft SEIS in December 2007.

If you have any questions or require additional information, please contact the Environmental Project Manager, Ms. Alicia Mullins, at 301-415-1224 or by e-mail at axm7@nrc.gov.

Sincerely,

/RA/

Rani Franovich, Branch Chief
Environmental Branch B
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket Nos. 50-387 and 50-388

cc: See next page

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 14, 2006

Mark Hartle, Chief, Aquatic Resources Section
Pennsylvania Fish & Boat Commission
Environmental Services
450 Robinson Lane
Bellefonte, PA 16823-9620

SUBJECT: SUSQUEHANNA STEAM ELECTRIC STATION LICENSE RENEWAL APPLICATION REVIEW

Dear Mr. Hartle:

The U.S. Nuclear Regulatory Commission (NRC) is reviewing an application submitted by PPL Susquehanna, LLC (PPL), for the renewal of the operating licenses for Susquehanna Steam Electric Station (SSES), Units 1 and 2. SSES is located along the Susquehanna River approximately five miles northeast of Berwick, Pennsylvania. As part of the review of the license renewal application (LRA), the NRC is preparing a Supplemental Environmental Impact Statement (SEIS) under the provisions of Title 10 of the *Code of Federal Regulations* Part 51 (10 CFR Part 51), the NRC regulations that implement the National Environmental Policy Act (NEPA) of 1969.

PPL is requesting the renewal of its operating licenses for Units 1 and 2 for a period of 20 years beyond the expiration of the current license term, renewing the licenses until July 2042 and March 2044, respectively. The proposed action would include the use and continued maintenance of existing plant facilities and transmission lines; PPL does not plan to construct or alter any facilities associated with the plant during the period of extended operation.

The NRC staff plans to hold two identical public NEPA scoping meetings on November 15, 2006, at the Eagles Building, located at 107 South Market Street in Berwick, Pennsylvania. The first meeting will convene at 1:30 p.m., and will continue until 4:30 p.m., as necessary. The second meeting will convene at 7:00 p.m., and will continue until 10:00 p.m., as necessary. From May 7-11, 2007, the NRC plans to conduct a site audit. You and your staff are invited to attend both the site audit and the public meetings. Your office will receive a copy of the draft SEIS along with a request for comments. The anticipated publication date for the draft SEIS is December 2007.

M. Hartle -2-

If you have any questions concerning the NRC staff review of this LRA, please contact Ms. Alicia Mullins, Project Manager at 301-415-1224 or via e-mail at axm7@nrc.gov.

Sincerely,

for

Rani Franovich, Branch Chief
Environmental Branch B
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket Nos. 50-387 and 50-388

cc: See next page

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 14, 2006

The Honorable Clint Halftown
Heron Clan Representative
Cayuga Nation
P.O. Box 11
Versailles, NY 14168

SUBJECT: REQUEST FOR COMMENTS CONCERNING THE SUSQUEHANNA STEAM ELECTRIC STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION REVIEW

Dear Mr. Halftown:

The U.S. Nuclear Regulatory Commission (NRC) is seeking input for its environmental review of an application from PPL Susquehanna, LLC (PPL), for the renewal of the operating licenses for the Susquehanna Steam Electric Station (SSES), Units 1 and 2, located along the Susquehanna River approximately five miles northeast of Berwick, Pennsylvania. SSES is in close proximity to lands that may be of interest to the Cayuga Nation. As described below, the NRC's process includes an opportunity for public and inter-governmental participation in the environmental review. We want to ensure that you are aware of our efforts and, pursuant to Title 10 of the *Code of Federal Regulations* 51.28(b) [10 CFR 51.28(b)], the NRC invites the Cayuga Nation to provide input to the scoping process relating to the NRC's environmental review of the application. In addition, as outlined in 36 CFR 800.8(c), the NRC plans to coordinate compliance with Section 106 of the National Historic Preservation Act of 1966, through the requirements of the National Environmental Policy Act of 1969.

Under NRC regulations, the original operating license for a nuclear power plant is issued for up to 40 years. The license may be renewed for up to an additional 20 years if NRC requirements are met. The current operating licenses for SSES, Units 1 and 2, will expire on July 17, 2022, and March 23, 2024, respectively. PPL submitted its application for renewal of the SSES operating licenses in a letter dated September 13, 2006.

The NRC is gathering information for a SSES site-specific supplement to its "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (GEIS), NUREG-1437. The GEIS is a programmatic environmental impact statement; it documents the NRC staff's assessment of environmental impacts that would be associated with license renewal at nuclear power plant site. The supplement to the GEIS will contain the results of the review of the environmental impacts on the area surrounding the SSES site that are related to terrestrial ecology, aquatic ecology, hydrology, cultural resources, and socioeconomic issues (among others), and will contain a recommendation regarding the environmental acceptability of the license renewal action. Enclosed for your information is a map showing the location of the SSES site.

C. Halftown -2-

To accommodate interested members of the public, the NRC will hold two identical public scoping meetings for the SSES license renewal supplement to the GEIS on November 15, 2006, at the Eagles Building, 107 South Market Street, Berwick, Pennsylvania. The first meeting will convene at 1:30 p.m. and will continue until 4:30 p.m., as necessary. The second meeting will convene at 7:00 p.m. and will continue until 10:00 p.m., as necessary. Additionally, the NRC staff will host informal discussions one hour before the start of each session. To be considered, comments must be provided either at the transcribed public meetings or in writing. No formal comments on the proposed scope of the supplement to the GEIS will be accepted during informal discussions.

The license renewal application (LRA) and the GEIS are publicly available at the NRC Public Document Room (PDR), located at One White Flint North, 11555 Rockville Pike, Rockville, Maryland, 20852, or from the NRC's Agencywide Documents Access and Management System (ADAMS). The ADAMS Public Electronic Reading Room is accessible at http://www.nrc.gov/reading-rm/adams/web-based.html. The accession number for the LRA is ML062620157. Persons who do not have access to ADAMS, or who encounter problems in accessing the documents located in ADAMS, should contact the NRC's PDR reference staff by telephone at 1-800-397-4209, or 301-415-4737, or via e-mail at pdr@nrc.gov.

The SSES LRA is also available on the internet at http://www.nrc.gov/reactors/operating/licensing/renewal/applications/susquehanna.html. In addition, the following public libraries have agreed to make the LRA available for public inspection: Berwick Public Library, 205 Chestnut Street, Berwick, Pennsylvania, 18603, and the Mill Memorial Library, 495 E. Main Street, Nanticoke, Pennsylvania, 18634.

Please submit any comments the Cayuga Nation may have to offer on the scope of the environmental review by January 2, 2007. Written comments should be submitted by mail to the Chief, Rules and Directives Branch, Division of Administrative Services, Mail Stop T-6D59, U.S. Nuclear Regulatory Commission, Washington D.C., 20555-0001. Electronic comments may be submitted to the NRC by e-mail at SusquehannaEIS@nrc.gov. At the conclusion of the scoping process, the NRC staff will prepare a summary of the significant issues identified and the conclusions reached, and mail a copy to you.

The staff expects to publish the draft supplement to the GEIS in December 2007. The NRC will hold another set of public meetings in the site vicinity to solicit comments on the draft. A copy of the draft supplemental environmental impact statement (SEIS) will be sent to you for your

C. Halftown -3-

review and comment. After consideration of public comments received on the draft, the NRC will prepare a final SEIS. The issuance of a final SEIS for SSES is planned for August 2008. If you need additional information regarding the environmental review process, please contact Ms. Alicia Mullins, Environmental Project Manager, at 301-415-1224 or via e-mail at axm7@nrc.gov.

Sincerely,

for

Rani L. Franovich, Branch Chief
Environmental Branch B
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket Nos. 50-387 and 50-388

Enclosure:
SSES Location Map

cc w/encl: See next page

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 15, 2006

Jennifer Kagel, Fishery Biologist
Pennsylvania Field Office
U.S. Fish & Wildlife Service
315 South Allen Street, Suite 322
State College, PA 16801-4850

SUBJECT: REQUEST FOR LIST OF PROTECTED SPECIES WITHIN THE AREA UNDER EVALUATION FOR THE SUSQUEHANNA STEAM ELECTRIC STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION REVIEW

Dear Ms. Kagel:

The U.S. Nuclear Regulatory Commission (NRC) is reviewing an application submitted by PPL Susquehanna, LLC (PPL) for the renewal of the operating licenses for Susquehanna Steam Electric Station (SSES), Units 1 and 2. SSES is located along the Susquehanna River approximately five miles northeast of Berwick, Pennsylvania at Latitude N41°05'27", Longitude W76°08'45". As part of the review of the license renewal application (LRA), the NRC is preparing a Supplemental Environmental Impact Statement (SEIS) under the provisions of Title 10 of the *Code of Federal Regulations* Part 51 (10 CFR Part 51), the NRC regulations that implement the National Environmental Policy Act (NEPA) of 1969. The SEIS includes an analysis of pertinent environmental issues, including endangered or threatened species and impacts to fish and wildlife. This letter is being submitted under the provisions of the Endangered Species Act of 1973, as amended, and the Fish and Wildlife Coordination Act of 1934, as amended.

PPL is requesting the renewal of its operating licenses for Units 1 and 2 for a period of 20 years beyond the expiration of the current license term, extending the operating licenses until July 2042, and March 2044, respectively. The proposed action would include the use and continued maintenance of existing plant facilities and transmission lines. PPL does not plan to construct or alter any facilities associated with the plant to support the renewed licensing period.

In total, PPL owns 2,355 acres of land on both sides of the Susquehanna River. In general, this land is characterized by open deciduous woodlands interspersed with grasslands and orchards. Approximately 487 acres are used for power generation, and the remainder of the land is primarily river floodplain forest, upland forest, and marshes. PPL maintains a 401-acre nature preserve, the Susquehanna Riverlands, located between SSES and the river; US Route 11 separates these areas. East of the Susquehanna River are 717 acres of mostly undeveloped land, which includes natural, recreational, and wildlife areas. Additionally, PPL owns Gould Island, a 65-acre island just up the Susquehanna River.

SSES uses a closed-cycle heat dissipation system to remove waste heat from the Circulating Water System. The Circulating Water and the Service Water Systems draw water from, and discharge to, the Susquehanna River. The River Intake Structure is located on the western

J. Kagel -2-

bank of the river, and consists of two water entrance chambers with one-inch, on-center vertical bar screens and 3/8-inch mesh traveling screens. A low pressure screen-wash system periodically operates to release aquatic organisms and debris impinged on the traveling screens to the trash rack. Cooling Tower blowdown, spray pond overflow, and other permitted effluents are discharged to the Susquehanna River through a buried pipe leading to a submerged discharge structure/diffuser, approximately 600 feet downstream of the River Intake Structure. The diffuser pipe is 200 feet long, with the last 120 feet containing 72 four-inch portals that direct the discharge upwards at a 45 degree angle then going downstream. Warm circulating water from the Cooling Towers can be diverted to the River Intake Structure to prevent icing, this usually occurs from November through March.

For the specific purpose of connecting SSES to the regional transmission system, there is a total of approximately 150 miles of transmission line corridors that occupy approximately 3,341 acres of land. These transmission line corridors are being evaluated as part of the SEIS process. The corridors pass through land that is primarily agricultural and forest land with low population densities. Two 500-kilovolt (kV) lines and one 230-kV line connect SSES to the electric grid, with approximately 2.3 miles of short ties in the immediate plant vicinity to connect SSES to the 230-kV system. The 230-kV Stanton-Susquehanna #2 transmission line corridor runs northeast from the plant for approximately 30 miles, and ranges from 100-400 feet wide. The Susquehanna-Wescosville-Alburtis 500-kV transmission line corridor ranges from 100 to 350 feet wide and runs generally southeast from the plant for approximately 76 miles; the Sunbury-Susquehanna #2 500-kV transmission line corridor is approximately 325 feet wide and runs 44 miles west-southwest from the plant. Pennsylvania counties crossed by the transmission line corridors include Luzerne (the location of SSES), Carbon, Columbia, Lehigh, Northampton, Northumberland, Montour, and Snyder. PPL plans to maintain these transmission lines, which are integral to the larger transmission system, indefinitely. Except for the short 230-kV transmission lines, the lines will remain a permanent part of the transmission system even after SSES is decommissioned.

To support the SEIS preparation process and to ensure compliance with Section 7 of the Endangered Species Act, the NRC requests information on Federally listed, proposed, and candidate species and critical habitat that may be in the vicinity of SSES and its associated transmission line rights-of-way. In addition, please provide any information you consider appropriate under the provisions of the Fish and Wildlife Coordination Act.

We plan to hold two public NEPA scoping meetings at 1:30 p.m., and 7:00 p.m., on November 15, 2006, at the Eagles Building, located at 107 South Market Street in Berwick, Pennsylvania, 18603. Also the week May 7, 2007, the NRC plans to conduct a site audit at the SSES facility. You and your staff are invited to attend both the public meetings and the site audit. Your office will receive a copy of the draft SEIS along with a request for comments. The anticipated publication date for the draft SEIS is December 2007.

J. Kagel -3-

If you have any questions concerning the NRC staff review of this LRA, please contact Ms. Alicia Mullins, Project Manager at 301-415-1224 or by e-mail at axm7@nrc.gov.

Sincerely,

for

Rani Franovich, Branch Chief
Environmental Branch B
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket Nos. 50-387 and 50-388

Enclosures:
1. 50-Mile-Vicinity Map
2. Site Area Map

cc w/encls: See next page

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 17, 2006

Ms. Chris Firestone, Native Plant Program
Manager
Pennsylvania Department of Conservation and
Natural Resources
Bureau of Forestry
Forest Advisory Services
P.O. Box 8552
Harrisburg, PA 17105-1673

SUBJECT: REQUEST FOR LIST OF STATE PROTECTED SPECIES WITHIN THE AREA UNDER EVALUATION FOR THE SUSQUEHANNA STEAM ELECTRIC STATION, UNITS 1 AND 2, LICENSE RENEWAL APPLICATION REVIEW

Dear Ms. Firestone:

The U.S. Nuclear Regulatory Commission (NRC) is reviewing an application submitted by PPL Susquehanna, LLC (PPL), for the renewal of the operating licenses for Susquehanna Steam Electric Station (SSES), Units 1 and 2. The coordinates of SSES are Latitude N41°05'27", Longitude W76°08'45"; it is located along the Susquehanna River approximately five miles northeast of Berwick, Pennsylvania. As part of the review of the license renewal application (LRA), the NRC is preparing a Supplemental Environmental Impact Statement (SEIS) under the provisions of Title 10 of the *Code of Federal Regulations* Part 51 (10 CFR Part 51), the NRC's regulation that implements the National Environmental Policy Act (NEPA) of 1969. The SEIS includes an analysis of pertinent environmental issues, including endangered or threatened species and impacts to fish and wildlife.

PPL is requesting the renewal of its operating licenses for Units 1 and 2 for a period of 20 years beyond the expiration of the current license term, extending unit operation until July 2042 and March 2044, respectively. The proposed action would include the use and continued maintenance of existing plant facilities and transmission lines. PPL does not plan to construct or alter any facilities associated with the plant to support the renewed licensing period.

In total, PPL owns 2,355 acres of land on both sides of the Susquehanna River. In general, this land is characterized by open deciduous woodlands interspersed with grasslands and orchards. Approximately 487 acres are used for power generation, and the remainder of the land is primarily river floodplain forest, upland forest, and marshes. PPL maintains a 401-acre nature preserve, the Susquehanna Riverlands, located between SSES and the river; US Route 11 separates these areas. East of the Susquehanna River are 717 acres of mostly undeveloped land, which includes natural, recreational, and wildlife areas. Additionally, PPL owns Gould Island, a 65-acre island just up the Susquehanna River.

-2-

SSES uses a closed-cycle heat dissipation system to remove waste heat from the circulating water system. The circulating water and the service water systems draw water from, and discharge to, the Susquehanna River.

The river intake structure is located on the western bank of the river and consists of two water entrance chambers with one-inch, on-center vertical bar screens and 3/8-inch mesh traveling screens. A low-pressure screen-wash system periodically operates to release aquatic organisms and debris impinged on the traveling screens to the trash rack. Cooling tower blowdown, spray pond overflow, and other permitted effluents are discharged to the Susquehanna River through a buried pipe leading to a submerged discharge structure/diffuser, approximately 600 feet downstream of the river intake structure. The diffuser pipe is 200 feet long, with the last 120 feet containing 72 four-inch portals that direct the discharge upwards at a 45 degree angle then going downstream. Warm circulating water from the cooling towers can be diverted to the river intake structure to prevent icing; this usually occurs from November through March.

For the specific purpose of connecting SSES to the regional transmission system, there is a total of approximately 150 miles of transmission line corridors that occupy approximately 3,341 acres of land. These transmission line corridors are being evaluated as part of the environmental review process. The corridors pass through land that is primarily agricultural and forest land with low population densities. Two 500-kilovolt (kV) lines and one 230-kV transmission line connect SSES to the electric grid, with approximately 2.3 miles of short ties in the immediate plant vicinity to connect SSES to the 230-kV system. The 230-kV Stanton-Susquehanna #2 transmission line corridor runs northeast from the plant for approximately 30 miles and ranges from 100 to 400 feet wide. The Susquehanna-Wescosville-Alburtis 500-kV transmission line corridor ranges from 100 to 350 feet wide and runs generally southeast from the plant for approximately 76 miles. The Sunbury-Susquehanna #2 500-kV line is approximately 325 feet wide and runs 44 miles west-southwest from the plant. Pennsylvania counties crossed by the transmission line corridors include Luzerne (the location of SSES), Carbon, Columbia, Lehigh, Northampton, Northumberland, Montour, and Snyder. PPL plans to maintain these transmission lines, which are integral to the larger transmission system, indefinitely. Except for the short 230-kV transmission lines, the lines will remain a permanent part of the transmission system even after SSES is decommissioned.

To support the environmental review process, the NRC requests information on state listed, proposed, and candidate species and critical habitat that may be in the vicinity of SSES and its associated transmission line right-of-way. In addition, please provide any information you consider appropriate that might help the NRC to evaluate impacts that extended operation of SSES for up to an additional 20 years under the terms of a license renewal might impose on state listed species.

During the week of May 7, 2007, we plan to conduct a site audit at the SSES facility. You and your staff are invited to attend the site audit. Your office will receive a copy of the draft SEIS along with a request for comments. The anticipated publication date for the draft SEIS is December 2007.

-3-

If you have any questions concerning the NRC staff review of this LRA, please contact Ms. Alicia Mullins, Project Manager at 301-415-1224 or by e-mail at axm7@nrc.gov.

Sincerely,

Rani Franovich

Rani Franovich, Branch Chief
Environmental Branch B
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket Nos. 50-387 and 50-388

Enclosures:
1. 50-Mile-Vicinity Map
2. Site Area Map

cc w/encls: See next page

Commonwealth of Pennsylvania
Pennsylvania Historical and Museum Commission
Bureau for Historic Preservation
Commonwealth Keystone Building, 2nd Floor
400 North Street
Harrisburg, PA 17120-0093

November 20, 2006

Rani Franovich, Branch Chief
Environmental Branch B, Div. of License Renewal
Office of Nuclear Reactor Regulation
Nuclear Regulatory Commission
Washington, DC 20555-0001

TO EXPEDITE REVIEW USE
BHP REFERENCE NUMBER

Re: ER 05-1588-079-C
NRC: Susquehanna Steam Electric Station License Renewal
Salem Township, Luzerne County: Area of Potential Effect

Dear Ms. Franovich:

The Bureau for Historic Preservation (the State Historic Preservation Office) has reviewed the above named project in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended in 1980 and 1992, and the regulations (36 CFR Part 800) of the Advisory Council on Historic Preservation as revised in 1999. These requirements include consideration of the project's potential effect upon both historic and archaeological resources.

We disagree with the Area of Potential Effect selected for this project. We recommend the use of the boundaries of this facility as the Area of Potential Effect, since license renewal could trigger actions within the entire facility.

If you need further information regarding archaeological survey please contact Steven McDougal at (717) 772-0923. If you need further information concerning historic structures please consult Susan Zacher at (717) 783-9920.

Sincerely,

Susan M. Zacher for
Douglas C. McLearen, Chief
Division of Archaeology &
Protection

DCM/smz

Stockbridge-Munsee
Band of Mohican Indians
ENVIRONMENTAL OFFICE
P.O. Box 70, Bowler, WI 54416
715-793-~~4262~~ 4363 ~~gbunker@frontiernet.net~~ greg.bunker@mohican-nsn.gov.

Rani Franovich, Branch Chief
Environmental Branch B
Division of License Renewal
Office of Nuclear Reactor Regulation

November 27, 2006.

Dear Rani Franovich;

Enclosed are twelve "Request for Comment" packets I received in three different envelopes in today's mail. I kept the one addressed to our tribal president, Robert Chicks. I sent six of these same packets back to you in today's outgoing mail. I have also enclosed two other announcements I received concerning the license renewal application review.

Thus far I have received 21 notifications concerning this project, addressed to 21 different persons, only one of which is affiliated with this Tribe. I hope I will not be receiving the rest of the four page list of addresses for the "cc" of this letter.

Hopefully you can find and corrected the glitch in the mailing of this material. At this Tribe we do like getting announcements on actions within former lands, however Sherry White is the main contact for our Historic 106 program, and I am the contact for environmental issues.

Thank you for addressing this issue;

Greg Bunker

Greg Bunker
Environmental Manager
Stockbridge-Munsee Community
P.O. Box 70
Bowler, WI. 54416

ONEIDA INDIAN NATION

ONEIDA NATION HOMELANDS

December 7, 2006

Rani L. Franovich, Branch Chief
Environmental Branch B
Division of License Renewal
Office of Nuclear Reactor Regulation
United States Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Dear Branch Chief Franovich,

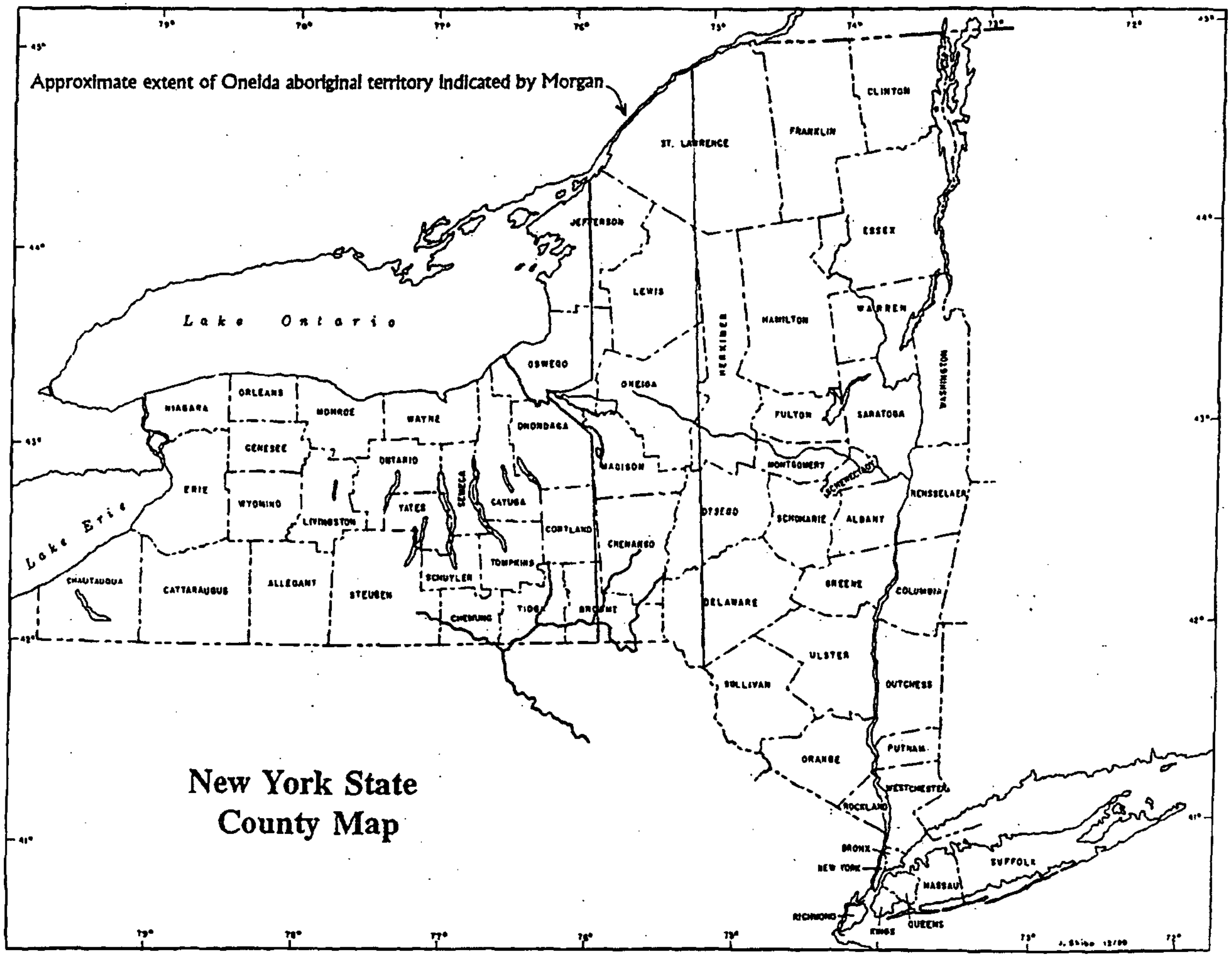
Thank you for soliciting Oneida input into the process of environmental review necessary to relicensing the Susquehanna Steam Electric Station in Berwick, PA (letters of Nov. 11 and 17 and copies of many similar letters to others). Lying outside Oneida aboriginal territory (attached map), the location is beyond our purview.

Sincerely,

Anthony Wonderley
Historian
Legal Department
1256 Union St. PO Box 662
Oneida, NY 13421-0662

cc: Brian Patterson, Jesse Bergevin (OIN)

221 Union Street
PO Box 662 • Oneida, NY 13421-0662
(315) 829-8461 • Fax (315) 829-8473



Approximate extent of Oneida aboriginal territory indicated by Morgan
Lake Ontario
Lake Erie
NIAGARA
ORLEANS
MONROE
WAYNE
GENESEE
ERIE
WYOMING
LIVINGSTON
ONTARIO
YATES
SENECA
CAYUGA
ONONDAGA
OSWEGO
JEFFERSON
LEWIS
ST. LAWRENCE
FRANKLIN
CLINTON
ESSEX
HAMILTON
HERKIMER
ONEIDA
MADISON
CORTLAND
CHENANGO
TOMPKINS
SCHUYLER
CHEMUNG
TIOGA
BROOME
STEUBEN
ALLEGANY
CATTARAUGUS
CHAUTAUQUA
OTSEGO
DELAWARE
SCHOHARIE
ALBANY
GREENE
COLUMBIA
RENSSELAER
SARATOGA
WASHINGTON
WARREN
FULTON
MONTGOMERY
SCHENECTADY
ULSTER
SULLIVAN
DUTCHESS
ORANGE
PUTNAM
WESTCHESTER
ROCKLAND
BRONX
NEW YORK
RICHMOND
KINGS
QUEENS
NASSAU
SUFFOLK
New York State
County Map

Alicia – For your action/Records. Rani R.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pennsylvania Field Office
315 South Allen Street, Suite 322
State College, Pennsylvania 16801-4850

December 21, 2006

Ms. Rani Franovich, Branch Chief
Nuclear Regulatory Commission
(ATTN: Alicia Mullins)
Washington, D.C. 20555-0001

Dear Ms. Franovich:

This responds to your letter dated November 15, 2006, requesting information on fish and wildlife resources within the area affected by the Susquehanna Steam Electric Station located near Berwick, in Luzerne County, Pennsylvania. PPL Susquehanna, LLC, is requesting the renewal of its operating license for a period of 20 years beyond the expiration of the current license term. This proposed action includes the continued operation and maintenance of existing plant facilities and transmission lines. The following comments are provided pursuant to the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) to ensure the protection of federally endangered and threatened species, and the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 *et seq.*) to ensure protection of other fish and wildlife resources.

Federally Listed and Proposed Species

The proposed project is located within the range of the Indiana bat (*Myotis sodalis*), a species that is federally listed as endangered. Due to the proximity of the project area to a known Indiana bat hibernaculum, removal of trees and forested areas within the project area could result in the direct take of roosting Indiana bats, which could be injured or killed when trees are cut. Studies have found that forested areas located within five miles of hibernacula provide important foraging and roosting habitat for Indiana bats, especially during the fall and spring, when bats are building up their fat reserves prior to and after hibernation. Additionally, female maternity colonies and individual male bats may be found in the vicinity of hibernacula throughout the summer months. If any tree-cutting activities are proposed in the future, or the proposed scope of the project changes, further consultation with this office will be necessary.

Aquatic Resources

The National Wetland Inventory maps indicate that wetlands occur within the boundaries of the project. Although NWI maps were prepared using aerial photography, and are therefore not always completely accurate, the Soil Survey for Luzerne County also indicates that wetlands are likely to occur there. Holly silt loam (hydric); Pope and Linden soils (hydric inclusions); Oquaga and Lordstown Channery silt loam (hydric inclusions) and Braceveille gravelly loam (hydric inclusions) occur within this area. These soil types are typically found in depressions, pot holes, and bottomlands, and may indicate the presence of wetlands on the site. Any final determination of whether wetlands are present on the proposed project site should include a site visit by a qualified individual trained in wetland identification. Furthermore, the proposed project area includes perennial streams. We recommend that the applicant avoid, and minimize any unavoidable impacts to aquatic resources.

Work in streams and wetlands requires permits from the Pennsylvania Department of Environmental Protection and/or the Army Corps of Engineers. We suggest that the applicant contact the DEP and the Corps for information on permit requirements should any new construction occur in wetland areas. By copy of this letter, we are informing these agencies of the project. Please be advised that the Service generally recommends that the Corps and DEP not grant permits to destroy streams and wetlands. If any construction is proposed in the future, or the proposed scope of the project changes, further consultation with this office may be necessary.

Other Concerns

We understand that the Nuclear Regulatory Commission is in the process of preparing a Supplemental Environmental Impact Statement which will analyze environmental issues associated with this project. We recommend that, at a minimum, the document address: the effects of thermal releases, fish impingement and entrainment (including the use of appropriate draw rates and mesh size), transmission line management and routing (including right-of way contaminant and wildlife management, erosion control, forest fragmentation, and right-of-way maintenance), cumulative impacts (to avian, terrestrial, and aquatic resources), avian strikes (on transmission lines and cooling towers, as has been the case in the past), and raptor electrocution.

If you have any questions regarding this response, please contact Jennifer Kagel of my staff at 814-234-4090.

Sincerely,

David Densmore
Supervisor

2

Pennsylvania Department of Conservation and Natural Resources

Bureau of Forestry January 8, 2007

Ms. Alicia Mullins
Environmental Branch B
Division of License Renewal
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Pennsylvania Natural Diversity Inventory Review, PNDI Number 19031
Susquehanna Steam Electric Station Units 1 & 2 License Renewal
Salem Twp.; Luzerne County

Dear Ms. Mullins,

This responds to your request for information on species of special concern within the area under evaluation for this project. We screened this project for potential impacts to species and resources of special concern under the Department of Conservation and Natural Resources' responsibility, which includes plants, natural communities, terrestrial invertebrates and geologic features only.

PNDI records indicate that species and communities of special concern under DCNR's jurisdiction are known to occur in the vicinity of the above-mentioned project. **Please see the attached list for species found in the project area. If any earth disturbance is planned or more detailed project information becomes available, please submit this project to our office for further review of potential impacts to the attached species list.**

Scientific Name	Common Name	Global Rank	State Rank
Enodia anthedon	**Northern Peary-eye**	G5 (secure)	S3S4 (vulnerable to apparently secure)
Polites mystic	**Long Dash**	G5 (secure)	S3 (vulnerable)
Poanes massasoit	**Mulberry Wing**	G4 (apparently secure)	S3 (vulnerable)
Speyeria aphrodite	**Aphrodite Fritillary**	G5 (secure)	S3S4 (vulnerable to apparently secure)
Euphydryas phaeton	**Baltimore Checkerspot**	G4 (apparently secure)	S3S4 (vulnerable to apparently secure)

These species are utilizing the area east of the plant, near Rt. 11, although they may be found elsewhere onsite as well. If you are inclined to enhance habitat for these species, the following plants are preferred hosts: willows, poplars, milkweed, mountain laurel, bluegrasses, upright sedge, flower nectar, violets, and turtlehead.

Stewardship Partnership Service

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This response represents the most up-to-date summary of the PNDI data files and is good for one (1) year from the date of this letter. An absence of recorded information does not necessarily imply actual conditions on-site. A field survey of any site may reveal previously unreported populations. Should project plans change or additional information on listed or proposed species become available, this determination may be reconsidered.

This finding applies to impacts to plants, natural communities, terrestrial invertebrates and geologic features only. To complete your review of state and federally-listed species of special concern, please be sure the U.S. Fish and Wildlife Service, the PA Game Commission and the Fish and Boat Commission has been contacted regarding this project either directly or by performing a search with the online PNDI ER Tool found at www.naturalheritage.state.pa.us.

Rebecca H. Bowen

____________________ Rebecca H. Bowen, Environmental Review Specialist, PNHP

DCNR/BOF/PNDI, PO Box 8552, Harrisburg, PA 17105 ~ Ph: 717-772-0258 ~ F: 717-772-0271 ~ c-rbowen@state.pa.us

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pennsylvania Field Office
315 South Allen Street, Suite 322
State College, Pennsylvania 16801-4850

March 1, 2007

Ms. Rani Franovich, Branch Chief
Nuclear Regulatory Commission
Washington, D.C. 20555-0001

RE: USFWS Project #2007-1111

Dear Ms. Franovich:

This responds to your letter of November 15, 2007, requesting information about federally listed and proposed endangered and threatened species within the area affected by the Susquehanna Steam Electric Station license renewal project located in Luzerne County, Pennsylvania. The proposed project is located within the range of the Indiana bat (*Myotis sodalis*), a species that is federally listed as endangered. The following comments are provided pursuant to the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) to ensure the protection of endangered and threatened species.

Based on a telephone conversation with Nathan Goodman on February 20, 2007, we have been advised that the only disturbance to the site would be routine vegetation maintenance underneath existing transmission lines. Therefore, based on this information and anticipated effects on forest habitat, we have determined that the proposed project will not have a significant adverse effect on overall habitat quality for the Indiana bat, and the project is not likely to adversely affect this species.

This determination is valid for two years from the date of this letter. If the proposed project has not been fully implemented prior to this, an additional review by this office is recommended. Should project plans change, or if additional information on listed or proposed species becomes available, this determination may be reconsidered.

This response relates only to endangered and threatened species under our jurisdiction, based on an office review of the proposed project's location. No field inspection of the project area has been conducted by this office. Consequently, this letter is not to be construed as addressing other Service concerns under the Fish and Wildlife Coordination Act or other authorities.

To avoid potential delays in reviewing your project, please use the above-referenced USFWS project tracking number in any future correspondence regarding this project.

If you have any questions regarding this matter, please contact Pam Shellenberger of my staff at 814-234-4090.

Sincerely,

David Densmore
Supervisor

June 9, 2007

David Densmore, Supervisor
(ATTN: Pamela Shellenberger)
United States Department of the Interior
Fish and Wildlife Service
Pennsylvania Field Office
315 South Allen Street, Suite 322
State College, PA 16801-4850

SUBJECT: U.S. FISH AND WILDLIFE SERVICE PROJECT 2007-1111 REGARDING PROTECTED SPECIES IN THE VICINITY OF THE SUSQUEHANNA STEAM ELECTRIC STATION, UNITS 1 AND 2, AND ASSOCIATED TRANSMISSION LINE CORRIDOR

Dear Mr. Densmore,

This letter is intended to serve as a record of the discussions between the U.S. Nuclear Regulatory Commission (NRC) staff and Ms. Pamela Shellenberger of the U.S. Fish and Wildlife Service (FWS) on March 28, 2007. In addition, this letter is intended to allow FWS to respond with an updated version of their March 1, 2007, determination regarding endangered species in the vicinity of Susquehanna Steam Electric Station (SSES), thus concluding NRC's informal Section 7 conference with FWS relating both to SSES license renewal and extended power uprate (EPU) reviews.

As noted in the March 28, 2007, discussion, PPL Susquehanna, LLC, (PPL) has applied for an EPU for Units 1 and 2. NRC's review of PPL's EPU application began after NRC's initial license renewal consultation letter to FWS, dated November 15, 2006. If approved, the EPU will allow SSES to increase maximum thermal power at both SSES Units 1 and 2 from 3489 megawatts thermal (MWt) to 3953 MWt - or by approximately 14 percent. NRC staff, in the March 28, 2007, discussion, requested that FWS issue a revised determination addressing both EPU and license renewal. This will not only assist staff in developing a supplemental environmental impact statement for license renewal, but will also assist NRC staff in preparing an environmental assessment for the EPU. Should NRC staff find that EPU will have significant impacts on the human environment, we will develop an environmental impact statement for the EPU.

Also during the March 28, 2007, call to FWS, NRC staff noted that PPL's March 24, 2005, letter to FWS is a more reliable characterization of PPL's maintenance activities than the NRC staff's assertion FWS referenced in the March 1, 2007, determination. According to PPL's letter, any maintenance activities necessary to support license renewal would be limited to previously disturbed areas, and no additional land disturbance is anticipated for license renewal.

Finally, as discussed in the March 28, 2007, call, NRC staff requested that FWS issue a determination without a set duration, as it is possible that NRC's staff review of license renewal and EPU may take longer than the two-year limit invoked in the March 1, 2007, letter. In return, NRC staff will promptly notify FWS in the unlikely event that either EPU or license renewal reviews change in scope.

D. Densmore -2-

NRC staff greatly appreciates your time and attention in providing an updated version of your previous determination based on the requested EPU. If you have any questions concerning this matter, please contact Drew Stuyvenberg, License Renewal Environmental Project Manager at 301-415-4006 or by e-mail at als3@nrc.gov.

Sincerely,

/RA/
Rani Franovich, Branch Chief
Environmental Branch B
Division of License Renewal
Office of Nuclear Reactor Regulation

Docket No. 50-387

cc: See next page

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pennsylvania Field Office
315 South Allen Street, Suite 322
State College, Pennsylvania 16801-4850

October 11, 2007

Rani Franovich, Branch Chief
Nuclear Regulatory Commission
Washington, D.C. 20555-0001

RE: USFWS Project #2007-1111

Dear Ms. Franovich:

This responds to your email of August 22, 2007, requesting information about federally listed and proposed endangered and threatened species within the area affected by the Susquehanna Steam Electric Station license renewal and extended power uprate project, located in Luzerne County, Pennsylvania. The proposed project is located within the range of the Indiana bat (*Myotis sodalis*), a species that is federally listed as endangered. The following comments are provided pursuant to the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) to ensure the protection of endangered and threatened species.

Based on a telephone conversation with Nathan Goodman on February 20, 2007, we have been advised that the only disturbance to the site will be routine vegetation maintenance underneath existing transmission lines. Therefore, based on this information and anticipated effects on forest habitat, we have determined that the proposed project will not have a significant adverse effect on overall habitat quality for the Indiana bat, and the project is not likely to adversely affect this species.

This determination is valid for two years from the date of this letter. If the proposed project has not been fully implemented prior to this, an additional review by this office is recommended. Should project plans change, or if additional information on listed or proposed species becomes available, this determination may be reconsidered.

This response relates only to endangered and threatened species under our jurisdiction, based on an office review of the proposed project's location. No field inspection of the project area has been conducted by this office. Consequently, this letter is not to be construed as addressing other Service concerns under the Fish and Wildlife Coordination Act or other authorities.

To avoid potential delays in reviewing your project, please use the above-referenced USFWS project tracking number in any future correspondence regarding this project.

If you have any questions regarding this matter, please contact Bonnie Dershem of my staff at 814-234-4090.

Sincerely,

David Densmore
Supervisor

Appendix F

GEIS Environmental Issues Not Applicable to Susquehanna Steam Electric Station, Units 1 and 2

Appendix F

GEIS Environmental Issues Not Applicable to Susquehanna Steam Electric Station, Units 1 and 2

Table F-1 lists those environmental issues identified in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (NRC 1996, 1999)[(a)] and Title 10, Part 51, of the *Code of Federal Regulations* (10 CFR Part 51), Subpart A, Appendix B, Table B-1, that are not applicable to Susquehanna Steam Electric Station, Units 1 and 2 (SSES) because of plant or site characteristics.

Table F-1. GEIS Environmental Issues Not Applicable to SSES

ISSUE–10 CFR Part 51, Subpart A, Appendix B, Table B-1	Category	GEIS Sections	Comment
SURFACE WATER QUALITY, HYDROLOGY, AND USE (FOR ALL PLANTS)			
Altered salinity gradients	1	4.2.1.2.2; 4.4.2.2	SSES is located on a freshwater river.
Altered thermal stratification of lakes	1	4.2.1.2.2; 4.4.2.2	SSES does not use surface water from lakes.
Water-use conflicts (plants with once-through cooling systems)	1	4.2.1.3	SSES does not use a once-through cooling system.
AQUATIC ECOLOGY (FOR PLANTS WITH ONCE-THROUGH AND COOLING POND HEAT DISSIPATION SYSTEMS)			
Entrainment of fish and shellfish in early life stages	2	4.2.2.1.2; 4.4.3	SSES does not have a once-through cooling system or a cooling pond.
Impingement of fish and shellfish	2	4.2.2.1.3; 4.4.3	SSES does not have a once-through cooling system or a cooling pond.
Heat shock	2	4.2.2.1.4; 4.4.3	SSES does not use a once-through cooling system or a cooling pond.

(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 F-1. (contd)

ISSUE–10 CFR Part 51, Subpart A, Appendix B, Table B-1	Category	GEIS Sections	Comment
GROUNDWATER USE AND QUALITY			
Groundwater-use conflicts (potable and service water, and dewatering; plants that use >100 gpm)	2	4.8.1.1; 4.8.2.1	SSES uses <100 gpm of groundwater.
Groundwater-use conflicts (Ranney wells)	2	4.8.1.4	SSES does not have or use Ranney wells.
Groundwater-quality degradation (Ranney wells)	1	4.8.2.2	SSES does not have or use Ranney wells.
Groundwater-quality degradation (saltwater intrusion)	1	4.8.2.1	SSES is located on a freshwater river.
Groundwater-quality degradation (cooling ponds in salt marshes)	1	4.8.3	SSES is located on a freshwater river.
Groundwater-quality degradation (cooling ponds at inland sites)	2	4.8.3	SSES is located on a freshwater river and does not use a cooling pond.
TERRESTRIAL RESOURCES			
Cooling pond impacts on terrestrial resources	1	4.4.4	SSES does not use a cooling pond.

F.1 References

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

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.

Appendix G

U.S. Nuclear Regulatory Commission Staff Evaluation of Severe Accident Mitigation Alternatives (SAMAs) for Susquehanna Steam Electric Station Units 1 and 2 in Support of License Renewal Application Review

Appendix G

U.S. Nuclear Regulatory Commission Staff Evaluation of Severe Accident Mitigation Alternatives (SAMAs) for Susquehanna Steam Electric Station Units 1 and 2 in Support of License Renewal Application Review

G.1 Introduction

PPL Susquehanna, LLC (PPL) submitted an assessment of severe accident mitigation alternatives (SAMAs) for Susquehanna Steam Electric Station (SSES) as part of the environmental report (ER) (PPL 2006). This assessment was based on the most recent SSES probabilistic risk assessment (PRA) available at that time, a plant-specific offsite consequence analysis performed using the MELCOR Accident Consequence Code System 2 (MACCS2) computer code, and insights from the SSES individual plant examination (IPE) (PPL 1991) and the IPE of external events (IPEEE) (PPL 1994). In identifying and evaluating potential SAMAs, PPL considered SAMAs that addressed the major contributors to core damage frequency (CDF) and population dose at SSES, as well as SAMA candidates for other operating plants which have submitted license renewal applications. PPL identified 15 potential SAMA candidates. This list was reduced to 11 unique SAMAs by eliminating SAMAs that were determined to provide no measurable benefit or have estimated costs that would exceed the dollar value associated with completely eliminating all severe accident risk at SSES. PPL assessed the costs and benefits associated with each of the potential SAMAs and concluded in the ER that several of the candidate SAMAs evaluated are potentially cost-beneficial.

Based on a review of the SAMA assessment, the U.S. Nuclear Regulatory Commission (NRC) issued a request for additional information (RAI) to PPL by letter dated January 16, 2007 (NRC 2007a). Key questions concerned: PRA revisions since the IPE and major changes implemented in each version; the current Level 2 PRA model and the approach used to assign source term and release characteristics for each release category; uncertainties in the fire analysis results and their impact in the SAMA identification process; the potential for additional SAMAs specific to fire events; and further information on the costs and benefits of several specific candidate SAMAs and low cost alternatives. SSES submitted additional information by letters dated April 12, 2007 (PPL 2007a) and July 3, 2007 (PPL 2007b). In response to the RAIs, SSES provided: a summary of the major changes made in each PRA revision since the IPE; a description of the Level 2 model and the process for assigning severe accident source terms; a discussion of the technical issue causing the increase in fire CDF mentioned in the

NRC staff's review of the IPE and its applicability to the other fire zones in the fire CDF; a discussion of the potential for SAMAs to address the unique cause of a fire; and additional information regarding several specific SAMAs. PPL's responses addressed the NRC staff's concerns.

An assessment of SAMAs for SSES is presented below.

ENCLOSURE

G.2 Estimate of Risk for Susquehanna Steam Electric Station

PPL's estimates of offsite risk at the SSES are summarized in Section G.2.1. The summary is followed by the NRC staff's review of PPL's risk estimates in Section G.2.2.

G.2.1 PPL's Risk Estimates

Two distinct analyses are combined to form the basis for the risk estimates used in the SAMA analysis: (1) the SSES Level 1 and 2 PRA model, which is an updated version of the IPE (PPL 1991), and (2) a supplemental analysis of offsite consequences and economic impacts (essentially a Level 3 PRA model) developed specifically for the SAMA analysis. The SAMA analysis is based on the most recent SSES Level 1 and 2 PRA models available at the time of the ER, referred to as the Feb06preEPU and Feb06EPU models. These two models reflect the plant's configuration before and after, respectively, the implementation of the extended power uprate (EPU). The SSES SAMA analysis contained in the ER uses both models in a parallel evaluation to document how the proposed EPU could impact the results. For purposes of its SAMA evaluation, the NRC staff relied on results from the post-EPU model since this model generally provides CDF, population dose, and SAMA benefit estimates that bound those from the pre-EPU model. The scope of the SSES PRA does not include external events.

The baseline CDF for the purpose of the SAMA evaluation is approximately 1.97×10^{-6} per year for Unit 1 and 1.94×10^{-6} per year for Unit 2 following implementation of the EPU. The CDF is based on the risk assessment for internally-initiated events. PPL did not include the contribution from external events within the SSES risk estimates; however, it did account for the potential risk reduction benefits associated with external events by doubling the estimated benefits for internal events. This is discussed further in Sections G.2.2 and G.6.2.

The breakdown of CDF by initiating event is provided in Table G-1. The results shown are for Unit 1, but are also representative of those for Unit 2. As shown in this table, events initiated by loss of offsite power are the dominant contributors to CDF. As reported by PPL in their responses to NRC questions (PPL 2007a), station blackout (SBO) sequences contribute

3.2×10^{-7} per year and 2.3×10^{-7} per year (17 percent and 13 percent of the total internal events CDF) for Units 1 and 2, respectively. Anticipated transient without scram (ATWS) sequences contribute 9.5×10^{-8} per year and 9.7×10^{-8} per year to CDF (about 5 percent of the total internal events CDF) for Units 1 and 2, respectively.

The current SSES PRA consists of a fully integrated set of Level 1 and Level 2 event trees and is an extension of prior models which focused on large early release (LERF) and non-LERF end states. The extended model includes additional system-based and phenomenological top events. The sequence end points of this extended model are assigned to one of 12 release categories based on timing and expected magnitude of release. The release category definitions are provided in Tables E.2-1 and E.2-2 of the ER, and the frequency of each release category is given in Table E.2-3. The frequency of each release category was obtained by summing the frequency of the individual accident progression endpoints binned into the release category.

The release characteristics (release fractions, timing, etc.) for each release category are based on the results of an accident progression analysis for a representative sequence for that category using Version 4.05 of the Modular Accident Analysis Program (MAAP) computer code. The MAAP case was selected primarily so that the timing and magnitude of release would agree with that for the release category. The release fractions and times for each release category are provided in Table E.2-4 of the ER.

Table G-1. SSES Core Damage Frequency

Initiating Event	CDF (Per Year)	Percent Contribution to CDF
Loss of offsite power	1.4×10^{-6}	72
Trip w/o MSIV closure	1.8×10^{-7}	9
Interfacing system LOCA	1.1×10^{-7}	6
Loss of DC power bus	8.8×10^{-8}	4
Small LOCA	4.9×10^{-8}	3
MSIV Closure	4.4×10^{-8}	2
Manual shutdown	1.8×10^{-8}	1
Medium LOCA	1.6×10^{-8}	1
Internal flooding	1.5×10^{-8}	1
Excessive rupture	1.0×10^{-8}	1
Others	1.8×10^{-8}	1
Total CDF	$\mathbf{2.0 \times 10^{-6}}$	**100**

The offsite consequences and economic impact analyses use the MACCS2 code to determine the offsite risk impacts on the surrounding environment and public. Inputs for these analyses include plant-specific and site-specific input values for core radionuclide inventory, source term and release characteristics, site meteorological data, projected population distribution (within an 80-kilometer [50-mile] radius) for the year 2044, emergency response evacuation modeling, and economic data. The core radionuclide inventory is derived from an Oak Ridge Isotope Generator (ORIGEN) 2.1 using best estimate, end of cycle values for the SSES core. The magnitude of the onsite impacts (in terms of clean-up and decontamination costs and occupational dose) is based on information provided in NUREG/BR -0184 (NRC 1997b).

In the ER, PPL estimated the dose to the population within 80 kilometers (50 miles) of the SSES site to be approximately 0.0190 person-sievert (SV) (1.90 person-rem) per year for both units. The breakdown of the total population dose by containment release mode is summarized in Table G-2. The results shown are for Unit 1, but are also representative of those for Unit 2. Containment failures within the intermediate time frame (greater than 6 hours but less than 24 hours following accident initiation) dominate the population dose risk at SSES.

Table G-2. Breakdown of Population Dose by Timing of Containment Release

Timing of Containment Release	Population Dose (Person-Rem Per Year)[(a)]	% Contribution[(b)]
Early Containment Failure	0.52	27
Intermediate Containment Failure	1.20	63
Late Containment Failure	0.18	9
Intact Containment	negligible	negligible
Total CDF	**1.90**	**100**

(a) One person-Rem = 0.01 person-Sv.
(b) Does not total 100 percent due to round off.

G.2.2 Review of PPL's Risk Estimates

PPL's determination of offsite risk at SSES is based on the following three major elements of analysis:

- The Level 1 and 2 risk models that form the bases for the 1991 IPE submittal (PPL 1991), and the external event analyses of the 1994 IPEEE submittal (PPL 1994),

- The major modifications to the IPE model that have been incorporated in the SSES Feb06EPU model, and

- The MACCS2 analyses performed to translate fission product source terms and release frequencies from the Level 2 PRA model into offsite consequence measures.

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

The NRC staff's review of the SSES IPE is described in NRC reports dated October 27, 1997 (NRC 1997a), and August 11, 1998 (NRC 1998). Based on a review of the IPE submittals, the NRC staff concluded that the IPE submittal met the intent of Generic Letter (GL) 88-20; that is, the licensee's IPE process is capable of identifying the most likely severe accidents and severe accident vulnerabilities. The IPE did not identify any severe accident vulnerabilities associated with either core damage or poor containment performance.

Although no vulnerabilities were identified in the IPE, several plant improvements were identified and considered for implementation at the plant. These improvements have been either implemented at the site, or addressed by an alternate SAMA in the current evaluation (PPL 2006).

There have been eight revisions to the original IPE model since the 1991 IPE submittal. The February 2006 PRA model used for the SAMA analysis is considered to be the current model. (A subsequent revision was made in August 2006 that resulted in a minor reduction in CDF, but the SAMA analysis was not revised to reflect the August 2006 revision.) A comparison of internal events CDF between the 1998 IPE revision and the current PRA model indicates an increase of approximately a factor of 3 for both Units 1 and 2. A description of those changes that resulted in the greatest impact on the internal events CDF was provided in response to a staff request for additional information (PPL 2007a), and is summarized in Table G-3.

The CDF value from the revised IPE (1998) submittal (5.6×10^{-7} per year) is well below the average of the CDF values reported in the IPEs for BWR 3/4 plants. Figure 11.2 of NUREG-1560 shows that the IPE-based total internal events CDF for BWR 3/4 plants ranges from 1×10^{-7} per year (the original SSES IPE value) to 8×10^{-5} per year, with an average CDF for the group of 2×10^{-5} per year (NRC 1997c). It is recognized that other plants have updated the values for CDF subsequent to the IPE submittals to reflect modeling and hardware changes. The current internal events CDF results for SSES remain lower than that for other plants of similar vintage and characteristics.

Table G-3. SSES PRA Historical Summary

PRA Version	Summary of Changes from Prior Model	CDF (per year)
Original IPE (1991)	Original IPE submittal (PPL 1991)	8×10^{-8}
Revised IPE (1998)	Revised in response to NRC initial SER (NRC 1997a) on original IPE - Revised treatment of common cause failure - Revised human reliability analysis - Revised plant specific data analysis	5.6×10^{-7}
Modified IPE (1/2002)	Included enhancements implemented as a result of the IPE	3.7×10^{-7}
Modified IPE (8/2002)	- Corrected treatment of offsite power recovery - Eliminated credit for manual rod insertion on LOOP - Eliminated credit for manual HPCI suction transfer	5.3×10^{-7}
Revised IPE (10/2002)	- Assumed all containment failures or venting leads to core damage - Eliminated credit for high-pressure make-up using CRD pumps - Eliminated credit for late injection following containment failure - Eliminated credit for RWCU blowdown as a heat removal method	2.3×10^{-5}
012903 (1/2003)	- Added credit for 'E' EDG as backup for the Blue Max portable generator to supply power to the 125 VDC battery chargers - Limited changes to event trees based on analyses using the BWR SAR code - Change core damage success criteria to be <1800°F peak clad temperature - Added LOOP initiating event fault tree - Added credit for late injection following containment failure or venting from systems outside the reactor building	2.5×10^{-6}
SSESCertR20 (10/2003)	- Updated event trees to be consistent with current EOPs - Added event trees for inadvertent opening of a relief valve (IORV) and interfacing system LOCA - Extended sequence progression to more realistically model radiological releases when containment fails prior to the occurrence of core damage - Changed number of ADS SRVs required for medium LOCA depressurization success	3.2×10^{-6}
Feb05 (2/2005)	- Updated model in response to significant peer review Level B facts and observations (No Level A-level F&Os received) - Added flooding initiators - Created a single model including both units - Eliminated credit for operator recovery actions in the reactor building following core damage	3.0×10^{-6} (Unit 1) 2.8×10^{-6} (Unit 2)

Table G-3. (contd)

PRA Version	Summary of Changes from Prior Model	CDF (per year)
Feb06EPU (2/2006)	- Created a separate two-unit model for post-EPU conditions - Completely revised event trees with success criteria based on MAAP4 calculations - Added complete Level 2 model (twelve specific release categories) - Revised LOOP frequency based on INEEL/EXT-0402326 - Used industry standard core damage criteria for ATWS stability events - Modified large and medium LOCA success criteria to one loop of CS and one division of ADS (3 valves)	2.0×10^{-6} (Unit 1) 1.9×10^{-6} (Unit 2)

The NRC staff considered the peer reviews performed for the SSES PRA, and the potential impact of the review findings on the SAMA evaluation. In the ER, PPL described the peer review by the Boiling Water Reactors Owner's Group (BWROG) of the SSESCertR20 PRA Model conducted in October 2003. The BWROG review concluded that all of the PRA technical elements were sufficient to support applications involving risk ranking and that with the exception of the Containment Performance and the Maintenance & Update elements, all of the PRA technical elements were sufficient to support applications involving risk significance determinations supported by deterministic analysis. The ER lists all significant Facts and Observations (F&Os) and their applicable status in ER Section E.2.3.1. It should be noted that the containment performance assessment (Level 2 PRA) has been completely revised and extended subsequent to the BWROG review. The ER also states that for the Maintenance & Update element, a PRA maintenance and update procedure was issued, which defines the process used by PPL to develop, control, and update the Susquehanna PRA.

The ER states that the peer review identified no Level A F&Os (important and necessary to address before the next regular PRA update), and that the Level B F&Os (important and necessary to address but disposition may be deferred until the next PRA update) determined to be the most significant in their effect on the PRA results were resolved as part of the Feb05 PRA model revision. The remainder of the Level B F&Os were scheduled to be resolved prior to the next scheduled model periodic update (i.e., the Feb06 model).

The ER describes a self-assessment of the Feb05 model performed by PPL using the guidance included in RG1.200. This review indicated that some of the remaining open Level B F&Os must be addressed to support the EPU implementation. ER Table E.2-5 tabulates 19 open items and indicates their disposition for the FEB06 PRA model. These F&Os were either resolved by incorporating changes in the current PRA models or judged not to have a significant impact on the EPU application. In response to an RAI, PPL clarified that the self-assessment was performed to support the SAMA assessment as well as the EPU and that remaining open items were judged not to significantly impact the SAMA assessment (PPL 2007a).

Given that the SSES internal events PRA model has been peer-reviewed and the peer review findings were either addressed or judged to have no adverse impact on the SAMA evaluation, and that PPL has satisfactorily addressed NRC staff questions regarding the PRA, the NRC staff concludes that the internal events Level 1 PRA model is of sufficient quality to support the SAMA evaluation.

As indicated above, the current SSES PRA does not include external events. In the absence of such an analysis, PPL used the SSES IPEEE to identify the highest risk accident sequences and the potential means of reducing the risk posed by those sequences, as discussed below.

The SSES IPEEE was submitted in June 1994 (PPL 1994), in response to Supplement 4 of Generic Letter 88-20 (NRC 1991a). This submittal included a seismic margin analysis, a fire PRA, and a screening analysis for other external events. While no fundamental weaknesses or vulnerabilities to severe accident risk in regard to the external events were identified, several opportunities for seismic and fire risk reduction were identified as discussed below. In a letter dated April 27, 1999, the NRC staff concluded that the submittal met the intent of Supplement 4 to Generic Letter 88-20, and that the licensee's IPEEE process is capable of identifying the most likely severe accidents and severe accident vulnerabilities (NRC 1999).

The SSES IPEEE used a focused scope Electric Power Research Institute (EPRI) seismic margins analysis. This method is qualitative and does not provide numerical estimates of the CDF contributions from seismic initiators (EPRI 1991). For this assessment, a detailed walkdown was performed in which components were screened using an overall high confidence of low probability of failure (HCLPF) capacity of 0.3g, the review level earthquake (RLE) value for the plant, and the screening level that would be used for a focused-scope plant. All components either met the 0.3g HCLPF capacity, or, for the four items with lower HCLPF values, would have low risk significance and would not warrant further enhancement as discussed in Section G.3.2.

The SSES IPEEE fire analysis employed a fire probabilistic risk analysis following the general approach of the PRA Procedures Guide, NUREG/CR-2300 (NRC 1983). The methodology consists of four parts: fire hazard analysis, fire propagation analysis, plant and system analysis and release frequency analysis. The hazard analysis is primarily a screening to eliminate fire zones which are considered to be risk-insignificant and determining the frequency of fires in remaining zones. The fire propagation analysis is the determination of the impacts a fire has on cables and equipment in the fire zone. The system analysis is the determination of the consequences of the damaged cables or equipment on the ability to reach safe shutdown. The release frequency analysis uses the above information to determine the CDF. The last two steps utilized the models and data from the SSES IPE to assess the failure frequency of the remaining success path.

In the original IPEEE submittal (PPL 1994) the fire CDF was reported to be 1×10^{-9} per cycle (taken to be a refueling cycle of 12 to 18 months). This was subsequently revised to 4.5×10^{-8} per cycle in response to an NRC audit of the IPEEE (PPL 1998). The dominant fire areas and their contributions to the fire CDF are listed in Table G-4.

Table G-4. Fire Areas and Their Contribution to Fire CDF

Fire Area	Area Description	CDF(a)
1-2B	Reactor Building Access Corridor El. 670'	2.1×10^{-9}
0-28B-II	Battery Charger Area	1.3×10^{-9}
0-27C	Upper Cable Spreading Room	3.5×10^{-10}
0-25E	Lower Cable Spreading Room	3.3×10^{-9}
15 zones	Various	3.3×10^{-8}
0-26H	Main Control Room	5.1×10^{-9}
Total Fire CDF		4.5×10^{-8}

(a) The CDF calculated in the revised fire IPEEE was only 4.52×10^{-8} per cycle, which corresponds to a CDF of about 3.62×10^{-8} per reactor year given an 18 month fuel cycle with 15 months of on-line operation. Although the reported CDFs were calculated per cycle, it is reasonable and somewhat conservative to report fire CDFs on a per year basis.

In the ER, PPL states that the use of the fire PRA results as a reflection of CDF may be inappropriate and that while the fire PRA is generally self-consistent within its calculational framework, the fire PRA does not compare well with internal events PRAs because of limitations on the state of technology for fire PRA, lack of an update program, and some divergences from what were typical fire modeling techniques.

Even after revising the fire risk results in response to the NRC audit, the NRC in the IPEEE SER found that the fire CDF may be too low by as much as three orders of magnitude (NRC 1999). The NRC staff requested PPL to address the impact of this issue on the assumption that the fire CDF is approximately equal to the internal events CDF. In response, PPL noted that a three order of magnitude increase from the originally reported value of 1.0×10^{-9} per cycle is fairly consistent with the assumption in the SAMA analysis that the fire CDF is about equal to the internal events CDF of 2.0×10^{-6} per year. In addition, PPL reported the results of a new fire analysis which utilized a current cable and raceway database and the current Level 1 internal events PRA model (PPL 2007b). The analysis is stated to utilize conservative assumptions (e.g. all cables in the zone are damaged due to a large fire, BOP systems are assumed to be unavailable, and in the most vulnerable fire zones, off-site power is failed. The result of this new analysis indicates a fire CDF of 9.2×10^{-7} per year with credit for automatic and manual fire suppression, 2.7×10^{-6} per year with only credit for manual suppression, and 2.7×10^{-5} per year with no credit for either automatic or manual suppression. PPL concludes and the NRC staff concurs that these results support the assumption of the SAMA analysis that the fire CDF is approximately equal to that for internal events.

The IPEEE analysis of high winds, floods, and other external events followed the screening and evaluation approaches specified in Supplement 4 of FL 88-20 (NRC 1991a) and did not identify any significant sequences or vulnerabilities (PPL 1994). Based on this result, PPL concluded that these other external hazards would not be expected to impact the conclusions of the SAMA analysis and did not consider them further. It is noted that the risks from deliberate aircraft impacts were explicitly excluded since this was being considered in other forums along with other sources of sabotage.

Based on the aforementioned results, PPL assumed that the external events CDF is approximately equal to the internal events CDF. Accordingly, the total CDF from internal and external events would be approximately 2 times the internal events CDF. In the SAMA analysis submitted in the ER, PPL doubled the benefit that was derived from the internal events model to account for the combined contribution from internal and external events. The exception to this is SAMA 9 – develop procedures and install pre-staged cables to bypass failed DC bus in order to power critical loads. In the ER, PPL explained that a separate contribution is included in the benefit assessment for SAMA 9 to specifically address the fire contributions from a fire zone (Fire Zone 0-28B-II) where fire damage could render critical DC equipment inoperable. The NRC staff agrees with the licensee's overall conclusion concerning the multiplier used to represent the impact of external events and concludes that the licensee's use of a multiplier of 2 to account for external events is reasonable for the purposes of the SAMA evaluation.

The NRC staff reviewed the general process used by PPL to translate the results of the Level 1 PRA into containment releases, as well as the results of the Level 2 analysis, as described in the ER and in response to NRC staff requests for additional information. The SSES PRA consists of a fully integrated set of Level 1 and Level 2 event trees and is an extension of prior models which focused on large early release (LERF) and non-LERF end states. The current model and these prior models are not upgrades of the IPE but are completely new models. The extended portions of the model include additional system-based and phenomenological top events.

Approximately 25 event trees are used to model the full spectrum of initiating events from sequence initiation to containment response to atmospheric release characterization. Each event tree end state was referenced to a MAAP case by utilizing a strategy that considered availability of containment, location of containment failure, availability of the suppression pool, status of containment sprays, and accident sequence timing. The sequence end points are then assigned to one of 12 release categories based on timing and magnitude of release. The release category definitions are provided in Tables E.2-1 and E.2-2 of the ER, and the frequency of each release category is given in Table E.2-3.

The release characteristics (release fractions, timing, etc.) for each release category are based on the results of a representative MAAP4.05 analysis for that category. The MAAP case was selected primarily so that the timing and magnitude of release would agree with that for the release category. The release fractions and times for each release category are provided in Table E.2-4 of the ER.

The NRC staff's review of the IPE concluded that, while the intent of GL 88-20 was met, several weaknesses remained in the licensee's back-end (Level 2) analysis. In Section E.2.3.2 of the ER, PPL describes how each of these weaknesses has been addressed and corresponding changes had been made in the SSESCertR20 PRA model reviewed by the BWROG in 2003. Despite these changes, the results of the BWROG peer review provided in Section E.2.3.3 of the ER indicate that the containment performance PRA element (which addresses only LERF considerations) was given only a summary grade of 2 indicating that it is supportive of risk-ranking applications but not fully supportive of absolute risk determinations. In response to an RAI, PPL indicated that the five F&Os related to the Level 2 PRA were addressed in the expanded Level 2 analysis performed for the license renewal and EPU applications (PPL 2007a). PPL also indicated that the current Level 2 analysis had the benefit of input and/or review by recognized industry consultants (PPL 2007a and 2007b). Based on the NRC staff's review of the Level 2 methodology, the fact that the Level 2 model was reviewed in more detail as part of the BWROG peer review and the PPL self-assessment and resulting comments addressed in the expanded Level 2 model used in the SAMA analysis, and the responses to the RAIs concerning the analysis and review process, the NRC staff concludes that the Level 2 PRA provides an acceptable basis for evaluating the benefits associated with various SAMAs.

As indicated in the ER and clarifying RAI responses, the reactor core radionuclide inventory used in the consequence analysis was derived from a 2004 plant-specific ORIGEN 2.1 calculation and corresponds to best estimate, end-of-cycle values for a 24-month fuel cycle and the licensed thermal power of 3489 MWth (PPL 2006 and 2007a). In response to a staff question, PPL indicated that for the post-EPU analysis, these results were linearly scaled to 4031 MWth (post-EPU licensed power plus 2 percent). All releases were modeled as occurring at 60 meters (197 feet) (top of the reactor building) with an assumed thermal content of 1×10^7 watts. PPL assessed the impact of alternative assumptions (i.e., ground level releases and thermal content same as ambient) in sensitivity analyses. The results of these analyses showed that the elevated release and higher thermal content were slightly conservative.

The NRC staff reviewed the process used by SSES to extend the containment performance (Level 2) portion of the PRA to an assessment of offsite consequences (essentially a Level 3 PRA). This included consideration of the source terms used to characterize fission product releases for the applicable containment release categories and the major input assumptions used in the offsite consequence analyses. The MACCS2 code was utilized to estimate offsite consequences. Plant-specific input to the code includes the source terms for each release category and the reactor core radionuclide inventory (both discussed above), site-specific meteorological data, projected population distribution within an 80-kilometer (50-mile) radius for the year 2044, emergency evacuation modeling, and economic data. This information is provided in Attachment E of the ER.

PPL used site-specific meteorological data for the 2001 calendar year as input to the MACCS2 code. The data were collected from the onsite meteorological tower. Data from 2002 and 2003 was also considered, but the 2001 data was chosen because it was the most complete and because results of a MACCS2 sensitivity case comparing the use of 2002 and 2003 data indicated that the 2001 data produced slightly more conservative results (i.e., about a 8 to 9 percent increase in offsite economic cost risk). There were two gaps of missing data. One gap of less than six consecutive hours was filled by interpolation between data points. The other gap of 52 hours was filled using data from the previous or following hours or days. The NRC staff notes that previous SAMA analysis results have shown little sensitivity to year-to-year differences in meteorological data and concludes that the use of the 2001 meteorological data in the SAMA analysis is reasonable.

The population distribution the licensee used as input to the MACCS2 analysis was estimated for the year 2044, using SECPOP2000 (NRC 2003), U.S. Census block-group level population data (USCB 2000a) and population growth rate estimates (USCB 2000b). The 1990 and 2000 county-level census data were used to estimate the annual population growth rate for each of the 50-mile radius rings (USCB 2000b). PPL states that the annual population growth estimate for each ring was applied uniformly to all sectors in the ring to calculate the year 2044 population distribution. A population sensitivity case was performed assuming a 30 percent uniform increase in population for all sectors within the 50-mile (80-km) radius. The result was a 27 percent increase in population dose risk and in offsite economic cost risk. The NRC staff considers the methods and assumptions for estimating population reasonable and acceptable for purposes of the SAMA evaluation.

The emergency evacuation model assumed a single evacuation zone extending out 16 kilometers (10 miles) from the plant. It was assumed that 95 percent of the population would move at an average speed of approximately 0.97 meters per second (2.2 mph) with a delayed start time of 60 minutes (PPL 2006). This assumption is conservative relative to the NUREG-1150 study (NRC 1990), which assumed evacuation of 99.5 percent of the population within the emergency planning zone. A sensitivity analysis was performed in which the evacuation speed was decreased by 50 percent. The result was an 11 percent increase in the total population dose. A second sensitivity analysis was performed in which the start time of evacuation was delayed from 60 minutes to 90 minutes. The result was a 2 percent increase in the total population dose. The NRC staff concludes that the evacuation assumptions and analysis are reasonable and acceptable for the purposes of the SAMA evaluation.

Much of the site-specific economic data was provided from SECPOP2000 (NRC 2003) by specifying the data for each of the counties surrounding the plant to a distance of 50 miles (80 km). SECPOP2000 utilizes economic data from the 1997 Census of Agriculture (USDA 1998). In addition, generic economic data that applied to the region as a whole were revised from the MACCS2 sample problem input when better information was available. This data was adjusted to the year 2000 using the consumer price index. These revised parameters included the value of farm and non-farm wealth.

Subsequent to the ER, several input/output problems related to use of the SECPOP2000 code were identified. PPL performed a re-analysis of the benefit estimates using corrected input/output, and found that the net values calculated for each of the SAMA candidates would be slightly reduced (PPL 2007c). Thus, the overall results of the SAMA assessment were not affected. This is discussed further in Section G.6.1.

The NRC staff concludes that the methodology used by PPL to estimate the offsite consequences for SSES provides an acceptable basis from which to proceed with an assessment of risk reduction potential for candidate SAMAs. Accordingly, the NRC staff based its assessment of offsite risk on the CDF and offsite doses reported by PPL.

G.3 Potential Plant Improvements

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

G.3.1 Process for Identifying Potential Plant Improvements

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

- Review of the most significant basic events from the current plant-specific PRA,

- Review of potential plant improvements identified in the SSES IPE, and IPEEE,

- Review of dominant fire areas from the Fire PRA and SAMAs that could potentially reduce the associated fire risk,

- Review of Phase II SAMAs from license renewal applications for other U.S. nuclear sites, and

- Review of other industry documentation discussing potential plant improvements.

Based on this process, an initial set of 15 potential SAMA candidates (14 SAMA candidates with one containing two options), referred to as Phase I SAMAs, was identified. In Phase I of the evaluation, PPL performed a qualitative screening of the initial list of SAMAs and eliminated SAMAs from further consideration using the following criteria:

- The SAMA was determined to provide no measurable benefit, or

- The SAMA has estimated costs that would exceed the dollar value associated with completely eliminating all severe accident risk at SSES.

Based on this screening, four SAMAs were eliminated, leaving 11 unique SAMAs for further evaluation. The remaining SAMAs, referred to as Phase II SAMAs, are listed in Table E.6-1 of the ER (PPL 2006). In Phase II, a detailed evaluation was performed for each of the 11 remaining SAMA candidates, as discussed in Sections G.4 and G.6 below. To account for the potential impact of external events, the estimated benefits based on internal events were multiplied by a factor of 2.0 (with the exception of SAMA 9 for which the benefits from fire events were separately assessed).

G.3.2 Review of PPL's Process

PPL's efforts to identify potential SAMAs focused primarily on areas associated with internal initiating events, but also included explicit consideration of potential SAMAs for fire and seismic events. The initial list of SAMAs generally addressed the accident sequences considered to be important to CDF from functional, initiating event, and risk reduction worth perspectives at SSES, and included selected SAMAs from prior SAMA analyses for other plants.

PPL provided a tabular listing of the PRA basic events sorted according to their risk reduction worth (RRW) (PPL 2006). SAMAs impacting these basic events would have the greatest potential for reducing risk. PPL used a RRW cutoff of 1.02, which corresponds to about a two-percent change in CDF given 100-percent reliability of the SAMA. This equates to a benefit of approximately $21,000 (for Units 1 and 2 combined, after the benefits have been multiplied to account for external events, and assuming post-EPU conditions). PPL also provided and reviewed the LERF-based RRW events down to an RRW of 1.02. PPL correlated the basic events with highest risk importance in the Level 1 and 2 PRA with the SAMAs evaluated in Phase I or Phase II, and showed that, with a few exceptions, all of the significant basic events are addressed by one or more SAMAs (PPL 2006). Of the basic events of high risk importance that are not addressed by SAMAs, each is closely tied to other basic events that had been addressed by one or more SAMAs.

For a number of the Phase II SAMAs listed in the ER, the information provided did not sufficiently describe the proposed modification. Therefore, the NRC staff asked the licensee to provide more detailed descriptions of the modifications for several of the Phase II SAMA candidates (NRC 2007a). In response to the RAI, PPL provided the requested information (PPL 2007a).

The NRC staff questioned PPL about lower cost alternatives to some of the SAMAs evaluated (NRC 2007a), including:

- Developing guidance/procedures for local, manual control of reactor core isolation cooling following loss of DC power, and

- Developing procedures to control containment venting to avoid adverse impacts on emergency core cooling system.

In response to the RAIs, PPL addressed the suggested lower cost alternatives (PPL 2007a). This is discussed further in Section G.6.2.

Although the IPE did not identify any vulnerabilities, nine potential enhancements to the plant, procedures, and training at SSES were identified as part of the IPE process. The nine enhancements include:

- Revise the control strategy for high pressure coolant injection (HPCI) suction transfer, and raise the HPCI / Reactor Core Isolation Cooling (RCIC) back-pressure trip setpoints in order to ensure timely availability and alignment of HPCI and RCIC for high pressure injection,

- Provide guidance for aligning the Control Rod Drive system for reactor vessel high pressure makeup,

- Revise guidance regarding primary containment control; e.g., use of Reactor Water Cleanup (RWCU) for heat removal, water mass addition to the suppression pool as a means of slowing containment pressurization, redefinition of the Heat Capacity

Temperature Limit (HCTL), and priority on core integrity protection rather than containment integrity,

- Revise guidance regarding reactor pressure vessel (RPV) flooding actions to allow adequate core cooling to be verified even when reactor water level instrumentation is not available,

- Revise guidance regarding reactor scram recovery actions to ensure that plant cool down does not occur unless the reactor is shutdown with control rods,

- Provide guidance to vent primary containment when fission products have not been released from the core and specific plant conditions exist,

- Revise the control logic which would allow immediate operator control of low pressure coolant injection (LPCI) and Core Spray injection and install a bypass switch on the Low Pressure Permissive,

- Provide an alternate, independent power supply for the Condensate Transfer Pumps, and

- Revise guidance regarding reactor vessel level control to allow safety relief valves (SRVs) to cycle automatically rather than to be manually operated.

PPL noted that the first six of these enhancements have been implemented. The seventh enhancement, to revise the LPCI and Core Spray injection control logic and install a bypass switch on the Low Pressure Permissive, was only implemented for Core Spray. With regard to the LPCI modification, PPL indicated that the current SSES PRA shows that these control logic issues are no longer an important issue and no further review is required (PPL 2006). The eighth enhancement, to provide alternate power to the condensate transfer pumps, was not implemented but was determined to be adequately addressed through the installation of a head tank. The ninth enhancement, to revise guidance regarding reactor vessel level control to allow SRVs to cycle automatically rather than be manually operated, was not implemented based on a determination that it is not required for safe operation of the plant. The NRC staff requested that PPL provide a further description of the disposition of this enhancement. In response, PPL stated that the RPV pressure control procedures in place at SSES are in conformance with current BWROG guidance and are considered safer than those recommended in the IPE (which were based on an earlier version of the BWROG Emergency Procedure Guidelines) since they will avoid undesirable cycling of the safety relief valves (PPL 2007a).

Based on this information, the NRC staff concludes that the set of SAMAs evaluated in the ER address the major contributors to internal event CDF.

PPL did not identify SSES-specific candidate SAMAs for seismic events. In the SSES IPEEE, there were five seismic-related potential plant enhancements. Four of these were implemented and the fifth was made irrelevant through the removal of seismically-sensitive equipment. Recommended plant improvements included miscellaneous equipment issues associated with housekeeping and general work practices. Housekeeping items included office furniture which could interact with safety related equipment, transient items in close proximity to safety-related equipment, and equipment with missing or loose screws or broken latches. These housekeeping improvements have been implemented. General work practices required improvements to housekeeping procedures and training on seismic issues. The ER notes that these general work practices enhancements have been implemented. PPL also discovered that breaker lifting devices (trolleys) were stored on top of electrical panels, CRTs in the control room were not adequately anchored, and a number of adjacent plant control and instrumentation panels could interact but were not fastened together. These last three items were corrected at the time of the IPEEE. The staff's review of IPEEE found these resolutions acceptable (NRC 1999). In the IPEEE, all high confidence low probability of failure (HCLPF) values were greater than the 0.3 g review level earthquake except for the following, which had HCLPF values as indicated below:

- The HPCI pump discharge valve with a HCLPF value of 0.21 g,
- The residual heat removal (RHR) suppression pool cooling return valve with a HCLPF of 0.21 g,
- The E diesel generator automatic transfer switch with a HCLPF of 0.25 g, and
- The motor control center for a number of RHR and RHRSW valves with a HCLPF of 0.26 g.

The ER discusses each of these seismic issues and concludes that for each of the four items with HCLPF values less than 0.3 g, other components would have to fail and/or human recovery actions are possible and therefore no additional SAMAs to address these outliers are necessary. The staff agrees that given the low likelihood of seismic damage combined with the probability of additional failures that must occur for core damage, it is unlikely that cost effective SAMAs would exist for these outliers.

In the SSES IPEEE, three opportunities for improvement related to seismic-fire interactions were identified. The first improvement is related to drip shields for electrical panels. The ER states that this improvement was not implemented because a redundant power source was found to be available if the impacted panels fail due to spray. The second improvement required the addition of a second restraining ring on H_2/O_2 bottles where they are only attached by a single ring. According to the ER, this improvement was not implemented because the subject bottles were spares and were removed. The third improvement required the revision of "Natural Phenomena" procedures to discuss the potential impact a large seismic event could have on the fire protection system. This enhancement has been implemented according to the ER.

Based on the licensee's efforts to identify and address seismic outliers and the expected cost associated with further seismic risk analysis and potential plant modifications, the NRC staff concludes that the opportunity for seismic-related SAMAs has been adequately explored and that it is unlikely that there are any cost-beneficial, seismic-related SAMA candidates.

The SSES IPEEE did not identify any changes required for conformance with the design basis related to fire events. However, several opportunities for improvement were identified and several plant modifications were put in place as a result of PPL's Appendix R compliance effort. These modifications include a curb installed on the floor of the control structure chiller bays which limits lube oil and fire suppression water spread, and a heat shield in the control structure which separates division I and II control structure HVAC electrical switchgear. Procedural improvements which have been completed include a modification which allows for the opening of drains in the cable spreading rooms for removal of fire suppression water, and procedural enhancements for housekeeping.

In addition, the licensee further considered potential SAMAs for fire, and identified two opportunities for additional reduction of fire risk, specifically, SAMA 1 – install diesel-driven high pressure injection pump to provide makeup to the reactor pressure vessel, and SAMA 9 – develop procedures and install pre-staged cables to bypass failed DC bus in order to power critical loads. Although these two SAMAs contribute to the reduction in SSES fire risk, no SAMAs unique to the fire analysis were identified. In response to an RAI on the potential for SAMAs that could reduce the fire initiators, improve fire detection or suppression, or relocate components or cabling, PPL stated that the individual fire zone risks were so low that no SAMAs would be cost effective. They quantitatively demonstrated this in a manner similar to that used for SAMA 9 showing that the maximum averted cost-risk associated with each fire zone would not support changes associated with cable wrapping or re-routing. PPL also stated that no procedure changes have been identified that could measurably reduce the SSES fire CDF, and that all areas included fire detection and most included automatic suppression capabilities. For areas without automatic suppression, they provided a discussion supporting the absence of suppression due to continuous manning or limited combustibles (PPL 2007a). The NRC staff concludes that the opportunity for fire-related SAMAs has been adequately explored and that it is unlikely that there are additional potentially cost-beneficial, fire-related SAMA candidates.

The NRC staff notes that the set of SAMAs submitted is not all inclusive, since additional, possibly even less expensive, design alternatives can always be postulated. However, the NRC 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.

The NRC staff concludes that PPL used a systematic and comprehensive process for identifying potential plant improvements for SSES, and that the set of potential plant improvements identified by PPL is reasonably comprehensive and therefore acceptable. This search included reviewing insights from the plant-specific risk studies and reviewing plant improvements considered in previous SAMA analyses. While explicit treatment of external events in the SAMA identification process was limited, it is recognized that the prior implementation of plant modifications for seismic and fire events and the absence of external event vulnerabilities reasonably justifies examining primarily the internal events risk results for this purpose.

G.4 Risk Reduction Potential of Plant Improvements

PPL evaluated the risk-reduction potential of the 11 remaining SAMAs that were applicable to SSES. The SAMA evaluations were performed using realistic assumptions with some conservatism. On balance, such calculations overestimate the benefit and are conservative.

For most of the SAMAs PPL used model re-quantification to determine the potential benefits. The CDF and population dose reductions were estimated using the Feb06EPU version of the SSES PRA. The changes made to the model to quantify the impact of the SAMAs are detailed in Section E.6 of Attachment E to the ER. Table G-5 lists the assumptions considered to estimate the risk reduction for each of the evaluated SAMAs, 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. The estimated benefits reported in Table G-5 reflect the combined benefit in both internal and external events. The determination of the benefits for the various SAMAs is further discussed in Section G.6.

The NRC staff questioned the assumptions used in evaluating the benefits or risk reduction estimates of certain SAMAs provided in the ER (NRC 2007a). For example, for SAMA 3, modify procedures to stagger RPV depressurization when fire protection system injection is the only available makeup source, the NRC staff requested a description of the failure events that were assumed to be impacted by this enhancement. The licensee provided high level failure events that fail the fire main, the diesel-driven fire pump failure modes, and the flow path failure modes. The NRC staff considers the failure events, as clarified, to be reasonable and acceptable for purposes of the SAMA evaluation.

Table G-5. SAMA Cost/Benefit Screening Analysis for SSES[a]

SAMA	Assumptions	% Risk Reduction[b]		Total Benefit Using 3% Discount Rate ($)[b,c]	Cost ($)[c]
		CDF	Population Dose		
1 - Install diesel driven high pressure injection pump to provide makeup to the reactor pressure vessel (RPV).	Assumed additional failure of new high pressure pump to start or to run required to fail high pressure injection.	61	65	750,000	2,800,000
2a - Install minimal hardware modifications and modify procedures to provide cross-tie capability between 4 kV AC emergency buses.	Assumed 100% reliable cross tie between A and D emergency buses and B and C emergency buses.	56	63	700,000	660,000
2b - Improve cross-tie capability between 4kV AC emergency buses (A-B-C-D)[d]	Same assumptions as for 2a, and in addition, assumed a 100% reliable cross tie between A or D emergency buses to B or C emergency buses.	57	64	700,000	1,400,000
3 - Modify procedures to stagger RPV depressurization when fire protection system injection is the only available makeup source.	Added fire main as alternate late injection source. Modeled fire pump failure, maintenance unavailabilities, operator alignment failures, and active and passive flowpath failures. Failure modes were provided in response to a request for additional information.	21	14	140,000	150,000
5 - Modify portable station diesel generator to automatically align to 125 V DC battery chargers.	Assumed alignment of portable station diesel generator was 100% reliable by setting all independent and dependent human action to false.	25	33	370,000	400,000
6 - Procure an additional portable 480 V AC station diesel generator.	Assumed existing and new additional portable station diesel generator both must fail. Independent failures to start and run included with no common cause failures between the two diesel generators.	18	23	270,000	200,000

Table G-5. (contd)

SAMA	Assumptions	% Risk Reduction[b] CDF	Population Dose	Total Benefit Using 3% Discount Rate ($)[b,c]	Cost ($)[c]
7 - Modify piping to sectionalize the cooling paths so that each emergency service water (ESW) division cools the corresponding residual heat removal (RHR) division.	Revised the RHR pump and room cooling support logic for trains C and D so that they are supplied by the same division as the pump.	11	6	76,000	970,000
8 - Install automatic feedwater runback logic.	Assumed feedwater runback is 100% reliable.	4	0.5	10,000	600,000
9 - Develop procedures and install pre-staged cables to bypass failed DC bus in order to power critical loads.	Assumed that DC bus initiating events, independent failure events and common cause failure events could not occur. Also assumed that the fire risk in zone 0-28B-11, which makes up about 3% of the fire risk based on IPEEE audit results, is eliminated.	7	1	35,000	350,000
10 - Install a pressure control valve between instrument air and containment instrument gas systems to automate the cross-tie and remove human dependence.	Assumed that the crosstie is 100% reliable by setting all independent and dependent human action to false.	6	1	19,000	390,000
12 - Improve existing procedures for containment venting after core damage when containment failure is imminent.	Revised base case to account for venting after core damage at direction of technical support center with a 0.1 failure probability. Risk with SAMA implemented based on venting failure probability of 0.0.	0	~0	~0	50,000
14 - Enhance fire main connection to RHR.	Conservatism in current model inflate the importance of the basic event which was the source of this SAMA. Eliminating these conservatism would reduce RRW below the cost-beneficial cutoff.	NOT ESTIMATED			

(a) SAMAs in bold are potentially cost-beneficial.
(b) Reported values for risk reduction and benefits represent the larger of the Unit 1 and Unit 2 specific values, and are based on post-EPU conditions.
(c) Estimated benefits and costs are provided on a "per site" basis unless otherwise noted.
(d) This SAMA was not in the initial screening, but was added based on consideration of the results of an uncertainty analysis of the internal events CDF described in G.6.2.

PPL doubled the benefit that was derived from the internal events model to account for the combined contribution from internal and external events with the exception of SAMA 9 – develop procedures and install pre-staged cables to bypass failed DC bus in order to power critical loads. The risk reduction for this SAMA was calculated by setting the DC bus failure initiating events, independent failure events, and common cause failure events to zero in the PRA model. A separate contribution was also included to specifically address the fire contributions from a fire zone (Fire Zone 0-28B-II) where fire damage could render critical DC equipment inoperable. This contribution was developed by assuming that all external events risk corresponds to the fire risk and that the risk from Fire Zone 0-28B-II accounts for three percent of the total fire risk. The NRC staff considers the method and assumptions used to determine the risk reduction potential for SAMA 9 to be reasonable and acceptable for purposes of the SAMA evaluation.

The NRC asked the applicant to explain the reasons for the small risk reduction for SAMA 12 – improve existing procedures for containment venting after core damage when containment failure is imminent. PPL responded that procedures exist at SSES to perform containment venting after core damage, but were not credited in the PRA model. A sensitivity analysis was performed to determine the impact of crediting post core damage venting relative to the baseline PRA model. The results of this sensitivity confirm the conclusion of the original SAMA 12 analysis that changes to the SSES guidance on post core damage containment venting would not be cost beneficial.

The NRC requested further information as to why the frequencies of high and moderate releases in the intermediate and late time periods (which include drywell overpressure failures) are not reduced more significantly by SAMA 12. PPL responded that the actual failure mode in the these cases is better characterized as containment over-temperature failure (COTF) rather than over-pressure failure. Containment venting is assumed ineffective in COTF scenarios since the high temperature conditions will lead to separate containment failure modes, and so it is not credited in the event tree sequence model. There are some cases where credit for containment vent in the wetwell results in a source term reduction, but the frequency of these contributors is much lower than the COTF contributions. PPL concluded that the overall impact of providing more credit for containment venting when viable has a relatively small impact in reducing the source terms and associated cost benefits.

The NRC staff has reviewed PPL's bases for calculating the risk reduction for the various plant improvements and concludes that the rationale and assumptions for estimating risk reduction are reasonable and generally conservative (i.e., the estimated risk reduction is higher than what would actually be realized). Accordingly, the NRC staff based its estimates of averted risk for the various SAMAs on PPL's risk reduction estimates.

G.5 Cost Impacts of Candidate Plant Improvements

PPL estimated the costs of implementing the 11 candidate SAMAs through the application of engineering judgment and use of other licensees' estimates for similar improvements. The cost estimates conservatively did not include the cost of replacement power during extended outages required to implement the modifications, nor did they include contingency costs associated with unforeseen implementation obstacles. In response to an RAI, the licensee indicated that the cost estimates provided in the ER also did not account for inflation (PPL 2007a), which is considered another conservatism. All cost estimates were provided on a "per site" basis.

The NRC staff reviewed the bases for the licensee's cost estimates (presented in Section E.6 of Attachment E to the ER). For certain improvements, the NRC staff also compared the cost estimates 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 NRC staff reviewed the costs and found them to be reasonable, and generally consistent with estimates provided in support of other plants' analyses.

The NRC staff concludes that the cost estimates provided by PPL are sufficient and appropriate for use in the SAMA evaluation.

G.6 Cost-Benefit Comparison

PPL's cost-benefit analysis and the NRC staff's review are described in the following sections.

G.6.1 PPL's Evaluation

The methodology used by PPL 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:

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

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. PPL's derivation of each of the associated costs is summarized below.

NUREG/BR-0058 has recently been revised to reflect the agency's policy on discount rates. Revision 4 of NUREG/BR-0058 states that two sets of estimates should be developed: one at 3 percent and one at 7 percent (NRC 2004). PPL provided both sets of estimates (PPL 2006).

Averted Public Exposure (APE) Costs

The APE costs were calculated using the following formula:

APE = Annual reduction in public exposure (Δperson-rem per year)
× monetary equivalent of unit dose ($2000 per person-rem)
× present value conversion factor (15.04 based on a 20-year period with a 3-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, which assumes elimination of all severe accidents due to internal events, PPL calculated an APE of approximately $57,000 for the 20-year license renewal period.

Averted Offsite Property Damage Costs (AOC)

The AOCs were calculated using the following formula:

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

For the purposes of initial screening which assumes all severe accidents due to internal events are eliminated, PPL calculated an annual offsite economic risk of about $11,200 based on the

Level 3 risk analysis. This results in a discounted value of approximately $168,000 for the 20-year license renewal period.

Averted Occupational Exposure (AOE) Costs

The AOE costs were calculated using the following formula:

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

PPL 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 3 percent, and a time period of 20 years to represent the license renewal period. For the purposes of initial screening, which assumes all severe accidents due to internal events are eliminated, PPL calculated an AOE of approximately $1200 for the 20-year license renewal period.

Averted Onsite Costs

Averted onsite costs (AOSC) 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. PPL derived the values for AOSC based on information provided in Section 5.7.6 of NUREG/BR-0184, the regulatory analysis handbook (NRC 1997b).

PPL divided this cost element into two parts – the onsite cleanup and decontamination cost, also commonly referred to as averted cleanup and decontamination costs, and the replacement power cost.

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

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

The total cost of cleanup and decontamination subsequent to a severe accident is estimated in NUREG/BR-0184 to be $\$1.3 \times 10^9$ (discounted over a 10-year cleanup period). This value is integrated over the term of the proposed license extension. For the purposes of initial screening, which assumes all severe accidents due to internal events are eliminated, PPL calculated an ACC of approximately $32,000 for the 20-year license renewal period.

Long-term replacement power costs (RPC) were calculated using the following formula:

RPC = Annual CDF reduction
× present value of replacement power for a single event
× factor to account for remaining service years for which replacement power is required
× reactor power scaling factor

PPL based its calculations on the value of 1304 megawatt electric (MW(e)), which is the current electrical output for SSES. Therefore, PPL applied a power scaling factor of 1304/910 to determine the replacement power costs. For the purposes of initial screening, which assumes all severe accidents due to internal events are eliminated, PPL calculated an RPC of approximately $16,000 for the 20-year license renewal period. For the purposes of initial screening, which assumes all severe accidents are eliminated, PPL calculated the AOSC to be approximately $48,000 for the 20-year license renewal period.

It should be noted that PPL performed the SAMA analysis on a unit-specific basis, and summed the values for each unit to obtain a site value. The averted cost values cited above are based on Unit 1 (post-EPU), but are also representative (within about 2 percent) of the Unit 2 values.

Using the above equations, PPL estimated the total present dollar value equivalent associated with completely eliminating severe accidents due to internal events at SSES to be about $275,000 for a single unit, and $550,000 for the two-unit site. Use of a multiplier of two to account for external events increases the value to $1.1M and represents the dollar value associated with completely eliminating all internal and external event severe accident risk at the SSES site, also referred to as the Modified Maximum Averted Cost Risk (MAACR).

PPL's Results

If the implementation costs for a candidate SAMA exceeded the calculated benefit, the SAMA was considered not to be cost-beneficial. In the baseline analysis contained in the ER (using a 3 percent discount rate), PPL identified two potentially cost-beneficial SAMAs. The potentially cost-beneficial SAMAs are:

- SAMA 2a – Install minimal hardware changes and modify procedures to provide cross-tie capability between the 4 kV AC emergency buses, and

- SAMA 6 – Procure an additional portable 480 V AC station diesel generator to power battery chargers in scenarios where AC power is unavailable.

PPL performed additional analyses to evaluate the impact of parameter choices and uncertainties on the results of the SAMA assessment (PPL 2006). If the benefits are increased by a factor of 2.1 to account for uncertainties, three additional SAMA candidates were determined to be potentially cost-beneficial:

- SAMA 2b - Improve cross-tie capability between 4 kV AC emergency buses, i.e., between A or D emergency buses and B or C emergency buses (a more flexible cross-tie option than SAMA 2a),

- SAMA 3 - Modify procedures to stagger RPV depressurization when fire protection system injection is the only available makeup source, and

- SAMA 5 - Modify portable station diesel generator to automatically align to 125 V DC battery chargers.

Subsequent to the ER, three problems related to use of the SECPOP2000 code were identified. These deal with: (1) a formatting error in the regional economic data block text file generated by SECPOP2000 for input to MACCS2 which results in MACCS2 misreading the data, (2) an error associated with the formatting of the COUNTY97.DAT economic database file used by SECPOP2000 which results in SECPOP2000 processing incorrect economic and land use data, and (3) gaps in the numbered entries in the COUNTY97.DAT economic database file which result in any county beyond county number 955 being handled incorrectly in SECPOP2000. PPL performed a re-analysis of the benefit estimates using corrected input to MACCS2 (PPL 2007c). The correction of the identified problems resulted in a small reduction in the maximum averted cost risk (i.e., about a 5 percent decrease), and a small decrease in both the dose-risk and economic cost risk for each of the release categories considered in the SAMA analysis (also about 5 percent). Therefore, the net values calculated for each of the SAMA candidates would be slightly reduced. Given that the impact is small and would reduce rather than increase the net values of the SAMAs, the Phase II cost benefit calculations were not revised, and the SAMAs identified as cost-beneficial were assumed to retain their classification as cost-beneficial. Thus, the overall results of the SAMA assessment were not affected.

The potentially cost-beneficial SAMAs and PPL's plans for further evaluation of these SAMAs are discussed in more detail in Section G.6.2.

G.6.2 Review of PPL's Cost-Benefit Evaluation

The cost-benefit analysis performed by PPL was based primarily on NUREG/BR-0184 (NRC 1997b) and was implemented consistent with this guidance.

To account for external events, PPL multiplied the internal event benefits by a factor of 2.0 for each SAMA. Given that the CDF from internal fires, and other external events as reported by PPL is less than the CDF for internal events, the NRC staff agrees that the factor of 2.0 multiplier for external events is reasonable.

PPL considered the impact that possible increases in benefits from analysis uncertainties would have on the results of the SAMA assessment. In the ER, PPL presents the results of an uncertainty analysis of the internal events CDF which indicates that the 95th percentile value is a factor of 2.1 times the mean CDF. PPL re-examined the initial set of SAMAs to determine if any additional Phase I SAMAs would be retained for further analysis if the benefits (and Modified Maximum Averted Cost Risk) were increased by a factor of 2.1. Two such Phase I SAMAs were identified: SAMA 2b – improve cross-tie capability between 4 kV AC emergency buses (a more flexible cross-tie option than SAMA 2a), and SAMA 4 – install 100 percent capacity battery chargers to support the full DC load requirements early in LOOP or LOCA sequences. The staff finds the PPL methods and assumptions used for this Phase I sensitivity analysis to be reasonable and acceptable for the purposed of the SAMA evaluation.

PPL also considered the impact on the Phase II screening if the estimated benefits were increased by a factor of 2.1 (in addition to the factor of 2.0 multiplier for external events). The two additional Phase I SAMAs, 2b and 4, discussed above, were included in this Phase II sensitivity review. PPL's Phase II analysis identified three additional SAMAs that are potentially cost-beneficial, i.e., SAMA 2b – improve cross-tie capability between 4 kV AC emergency buses, SAMA 3 – modify procedures to stagger RPV depressurization when fire protection system injection is the only available makeup source, and SAMA 5 – modify portable station diesel generator to automatically align to 125 VDC battery chargers. Although not cost-beneficial in the baseline analysis, PPL included SAMAs 2b, 3, and 5 within the set of potentially cost-beneficial SAMAs that they intend to examine further for implementation.

PPL did not develop a cost-risk analysis for the Phase II SAMA 14 – Enhance fire main connection to RHR. In the ER, PPL noted that no SAMAs are considered to be required to address the importance of this event because:

- The CDF based RRW of the event is below the review cutoff,

- Over 88 percent of the Level 2 contribution from the event is based on long term scenarios. The HEP used to represent the action is based on early injection requirements,

- An easily aligned hard pipe connection already exists that can be used for 88 percent of the cases,

- For the early injection component, the RHRSW alignment is assigned the HEP based on characteristic of the FP system cross-tie requirements, and

- The Level 2 based RRW for the early injection component is only 1.005, and below the cutoff limit of 1.02.

The NRC staff questioned the ability of some of the candidate SAMAs identified in the ER to accomplish their intended objectives (NRC 2007a). In response to the RAIs, PPL addressed each SAMA and provided revised or new evaluations as discussed below.

- SAMA 8 – install automatic feedwater runback logic for ATWS, was identified as a potential SAMA to further reduce the risk contribution from operator failures related to the feedwater runback action to mitigate an ATWS (PPL 2006). Too much feedwater will dilute the boron concentration in the core. Too little water causes the core to become uncovered and results in core damage. The NRC staff noted that the reduction in CDF for this SAMA is mostly in the low/early release category and that a reduction in CDF due to ATWS would typically be expected to impact the high and medium release categories (NRC 2007a). In response, PPL explained that in the SSES Level 2 analysis, when there is a high power discharge rate to the pool (as in the ATWS scenario with failure to control RPV level near the top of active fuel), containment failure is assumed when the suppression pool temperature exceeds 260°F. The dominant contributors to core damage sequences which involve feedwater runback failures do not include failures to depressurize the RPV; and scenarios with successful RPV depressurization are assigned a low/early release category. PPL justified that although other containment failure impacts on accident progression were considered, the majority of the CDF reduction attributed to reduced feedwater runback failures were in the low/early release category (PPL 2007a). The NRC staff concludes that the licensee's rationale for evaluation of this SAMA is reasonable.

- SAMA 12 – improve existing procedures for containment venting after core damage when containment failure is imminent, was identified as a potential SAMA to further reduce the risk contribution from drywell failure and the subsequent "unscrubbed" release of the primary containment contents to the atmosphere. The NRC staff questioned the small risk reduction provided by PPL for this SAMA (NRC 2007a).

In response to a RAI clarification request, PPL stated that procedures to vent containment after core damage already exist at SSES, but were not credited in the PRA model used in the SAMA analysis. As a result, a new baseline case was developed to credit the existing procedures, and the benefits of further procedure improvements were assessed relative to this new baseline case. Even when the assumed failure probability after procedure modifications is set to zero, the risk reduction offered by further procedure improvements is extremely limited and the corresponding risk reduction is small (PPL 2007a). Accordingly, the NRC staff concurs that further procedure improvements would not likely be cost-beneficial.

The NRC staff noted that for certain SAMAs considered in the ER, there may be alternatives that could achieve much of the risk reduction at a lower cost. The NRC staff asked the licensee to evaluate several lower cost alternatives to the SAMA considered in the ER, including SAMAs that had been found to be potentially cost-beneficial at other BWR plants. These alternatives were: (1) developing guidance/procedures for local, manual control of RCIC following loss of DC power, (2) protecting a critical subset of fire cables in key fire zones (in lieu of protecting all cables, as assumed in PPL's search for potential fire SAMAs), and (3) procedures to control containment venting to avoid adverse impacts on ECCS (NRC 2007). PPL provided a further evaluation of these alternatives, as summarized below.

- *Developing guidance/procedures for local, manual control of RCIC following loss of DC power.* In an RAI response (PPL 2007a), PPL indicated that a procedure for manual control of RCIC following loss of DC power already exists at SSES. The procedure requires multiple operators working with flashlights and handheld tachometers to give them an indication of pump speed. This procedure is not practiced because of its undue risk to plant personnel and plant safety. Due to its complexity, the PRA assumed no credit for the use of this procedure. Since the procedure already exists, the SAMA does not need to be identified or explored to determine if it is cost beneficial.

- *Protecting a critical subset of fire cables in key fire zones (in lieu of protecting all cables, as assumed in PPL's search for potential fire SAMAs).* In an RAI response (PPL 2007b), PPL explained that the cost for determining a minimal set of cables to be wrapped was much greater than the highest averted cost risk in the initial RAI response. PPL concluded that there would be no one area that would show a cost-benefit from the performance of their analysis.

- *Procedures to control containment venting to avoid adverse impacts on ECCS.* In an RAI response (PPL 2007a), PPL indicated that SSES does not have a hard pipe containment vent capability. The current venting procedure relieves containment pressure through the existing soft duct work. The strategy includes the pre-alignment of alternate injection systems external to the reactor building since it is likely that the steam environment in the reactor building following containment venting would preclude the use of the ECCS injection systems that reside in the reactor building. As such, a venting strategy that attempts to control containment venting to avoid NPSH impacts on ECCS injection would not be useful as it would not eliminate the subsequent steam environment in the reactor building. Therefore, this alternative was not pursued further.

The staff finds the PPL rationale to be reasonable and acceptable for the purposes of this SAMA evaluation.

The NRC staff also requested PPL to consider the costs and benefits of adding either an active or a passive (no operator action required) hard vent, based on consideration of both internal and external events (NRC 2007b). In response, PPL used cost estimates reported by other plants to show that the costs of implementing an unfiltered hard vent exceeds the Modified Maximum Averted Cost Risk (MMACR), which considers internal and external events, even when the 95th percentile MMACR is used (PPL 2007b).

The NRC staff notes that the five potentially cost-beneficial SAMAs 2a, 2b, 3, 5, and 6 identified in either PPL's baseline analysis or uncertainty analysis are included within the set of SAMAs that PPL will consider for implementation. The NRC staff concludes that with the exception of these potentially cost-beneficial SAMAs, the costs of the SAMAs evaluated would be higher than the associated benefits.

G.7 Conclusions

PPL compiled a list of 15 SAMAs based on a review of: the most significant basic events from the current plant-specific PRA, potential plant improvements identified in the SSES IPE and IPEEE, a review of the dominant fire areas, Phase II SAMAs from license renewal applications for other plants, and review of other industry documentation. An initial screening removed SAMA candidates that (1) were determined to provide no measurable benefit, or (2) had estimated costs that would exceed the dollar value associated with completely eliminating all severe accident risk at SSES. Based on this screening, four SAMAs were eliminated leaving 11 candidate SAMAs for evaluation.

For the remaining SAMA candidates, a more detailed design and cost estimate was developed as shown in Table G-5. The cost-benefit analyses in the original ER showed that two SAMA candidates were potentially cost-beneficial in the baseline analysis (SAMAs 2a and 6). PPL performed additional analyses in the revised assessment to evaluate the impact of parameter choices and uncertainties on the results of the SAMA assessment. As a result, three additional SAMAs (SAMAs 2b, 3, and 5) were identified as potentially cost-beneficial. PPL has indicated that all five potentially cost-beneficial SAMAs (2a, 2b, 3, 5, and 6) will be considered for implementation at SSES.

The NRC staff reviewed the PPL analysis and concludes that the methods used and the implementation of those methods were sound. The treatment of SAMA benefits and costs support the general conclusion that the SAMA evaluations performed by PPL are reasonable and sufficient for the license renewal submittal. Although the treatment of SAMAs for external events was somewhat limited, the likelihood of there being cost-beneficial enhancements in this area was minimized by improvements that have been realized as a result of the IPEEE process, and inclusion of a multiplier to account for external events.

The NRC staff concurs with PPL's identification of areas in which risk can be further reduced in a cost-beneficial manner through the implementation of the identified, potentially cost-beneficial SAMAs. Given the potential for cost-beneficial risk reduction, the NRC staff agrees that further evaluation of these SAMAs by PPL is warranted. However, these SAMAs do not relate to adequately managing the effects of aging during the period of extended operation. Therefore, they need not be implemented as part of license renewal pursuant to Title 10 of the *Code of Federal Regulations*, Part 54.

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11. ABSTRACT *(200 words or less)*

This Supplemental Environmental Impact Statement (SEIS) has been prepared in response to an application submitted to the NRC by PPL Susquehanna, LLC (PPL) to issue renewed operating licenses for Susquehanna Steam Electric Station, Units 1 and 2 (SSES) 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 NRC staff's preliminary recommendation regarding the proposed action.

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

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