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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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A. Stuyvenberg
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001
Phone: 301-415-4006
E-mail: als3@nrc.gov

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

1	$PM_{2.5}$	particulate matter 2.5 micrometers or less in diameter
2	PM_{10}	particulate matter 10 micrometers or less in diameter
3	PNHP	Pennsylvania Natural Heritage Program
4	PPL	PPL Susquehanna, LLC and Pennsylvania Power & Light Company
5	PRA	Probabilistic Risk Assessment
6	PSA	Probabilistic Safety Assessment
7	PSD	Prevention of Significant Deterioration
8	PSW	plant service water
9	PURTA	Pennsylvania Utility Realty Tax Act
10		
11	RAB	reactor auxiliary building
12	RAI	request for additional information
13	RCRA	Resource Conservation and Recovery Act
14	REMP	Radiological Environmental Monitoring Program
15	ROI	region of influence
16	ROW	right-of-way
17	Riverlands	Riverlands Recreation Area
18		
19	s	second(s)
20	SAMA	severe accident mitigation alternative
21	SAR	Safety Analysis Report
22	SBO	station blackout
23	SCR	selective catalytic reduction
24	SEIS	Supplemental Environmental Impact Statement
25	SER	Safety Evaluation Report
26	SHPO	State Historic Preservation Office
27	SLC	Safety Light Corporation
28	SNP	Safety Net Program
29	SO_2	sulfur dioxide
30	SO_x	sulfur oxides
31	sq ft	square foot/feet
32	SR	State Route
33	SRAFRC	Susquehanna River Anadromous Fish Restoration Committee
34	SRBC	Susquehanna River Basin Commission
35	SSES	Susquehanna Steam Electric Station, Units 1 and 2
36	Stat.	*Statutes at Large*
37		
38	TWh	terawatt hour(s)
39		
40	UFSAR	Updated Final Safety Analysis Report
41	U.S.	United States

1	USACE	U.S. Army Corps of Engineers
2	USC	*United States Code*
3	USCB	U.S. Census Bureau
4	USDA	U.S. Department of Agriculture
5	USGS	U.S. Geological Survey
6	USP	U.S. Penitentiary
7		
8	VOC	volatile organic compound
9		
10	yr	year(s)
11		
12	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

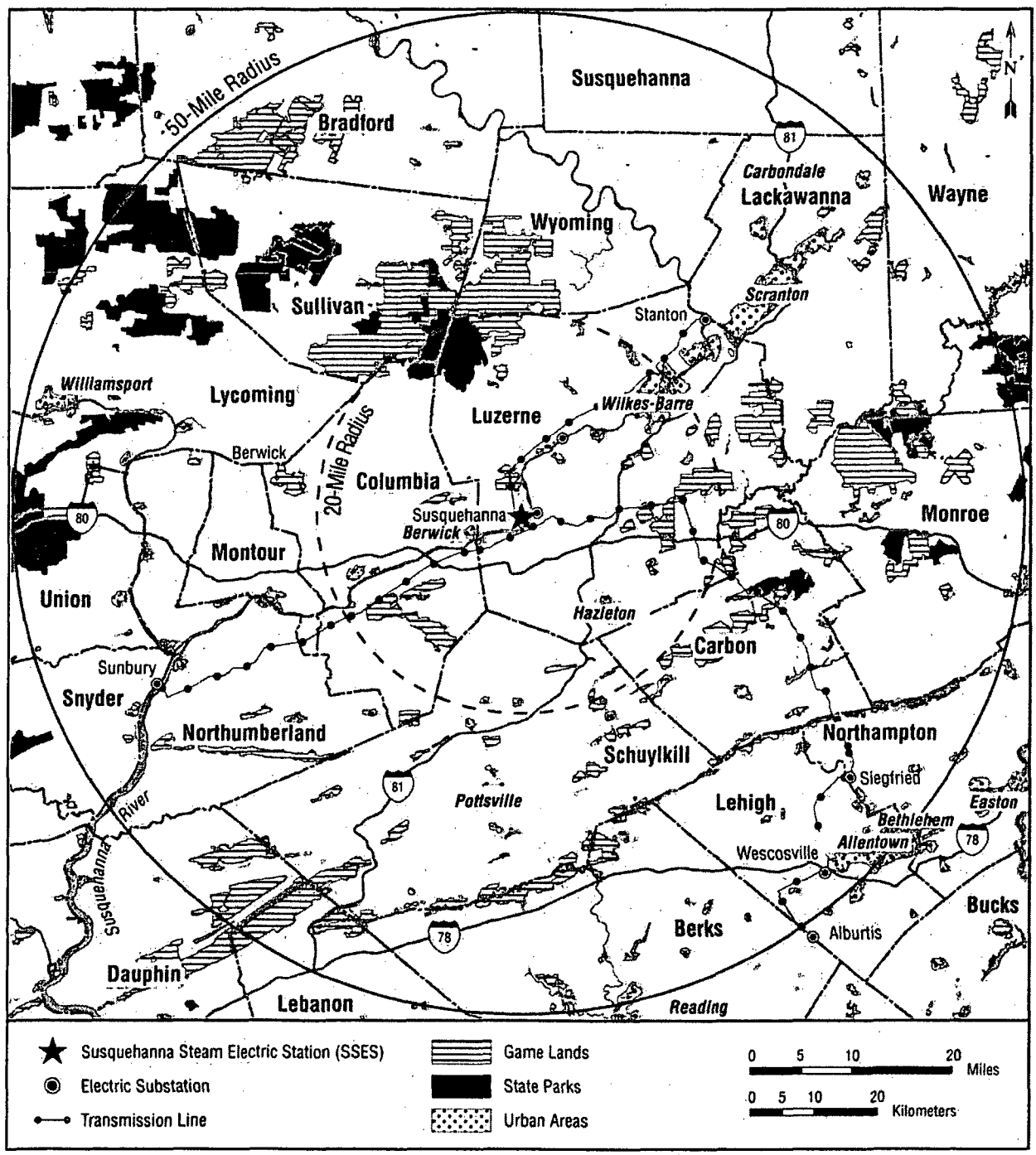

Figure 2-1. Location of Susquehanna Steam Electric Station, 50-mi (80-km) Region (Source: PPL 2006a)

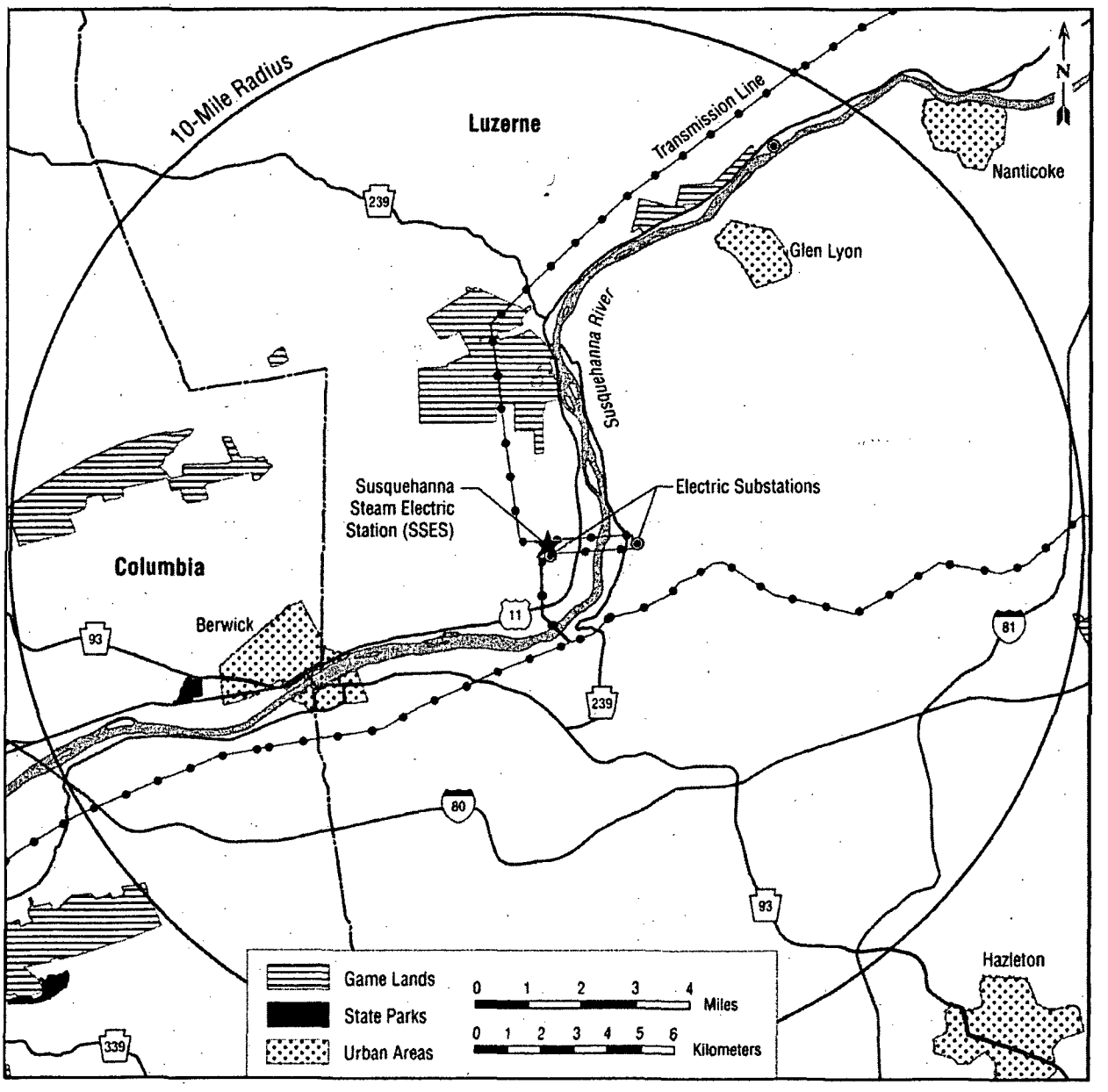

Figure 2-2. Susquehanna Steam Electric Station, 10-mi (16-km) Region (Source: PPL 2006a)

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,

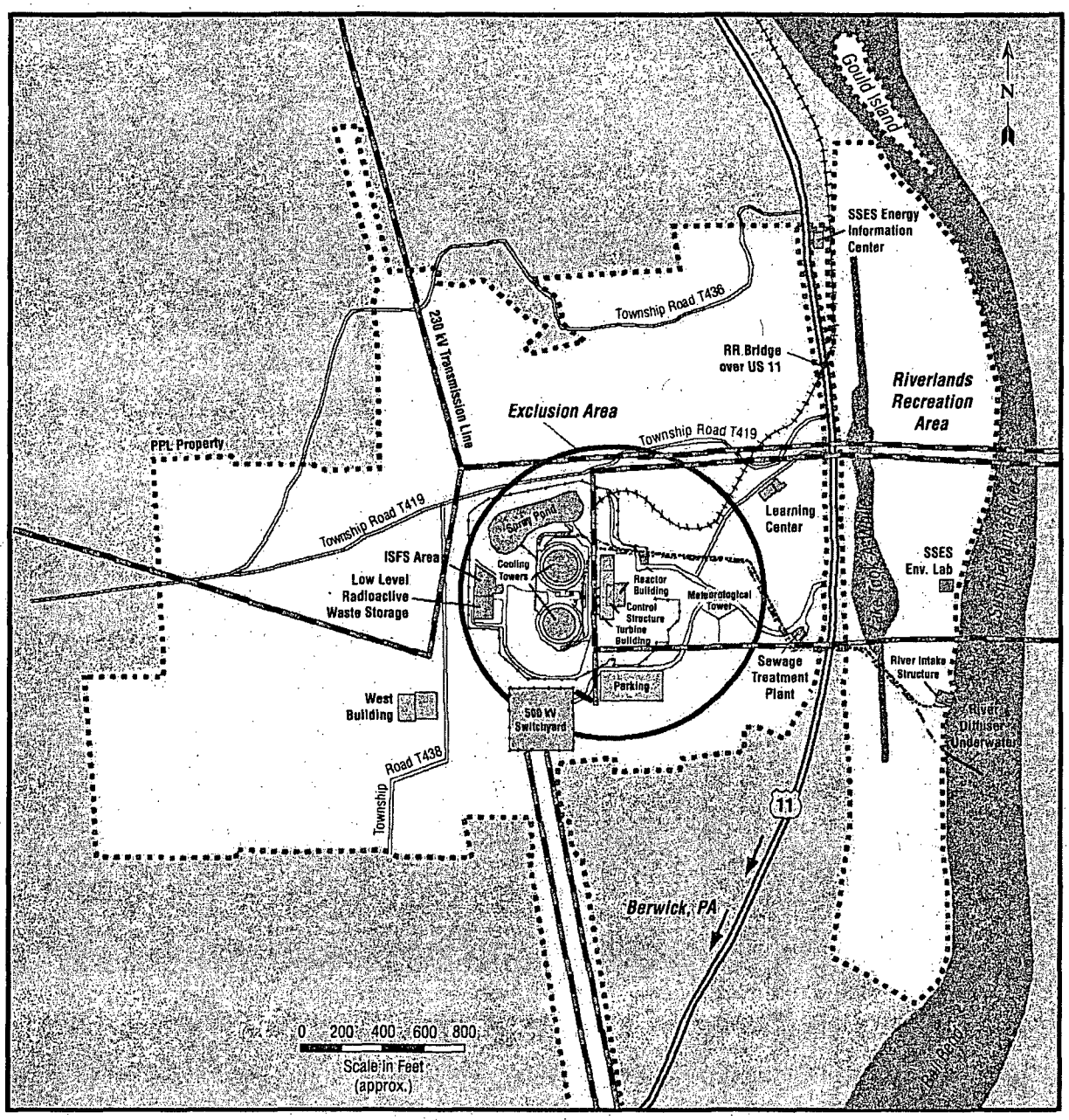

Figure 2-3. Susquehanna Steam Electric Station Site Layout (Source: PPL 2006a)

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):

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

- Susquehanna Riverlands. 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.

- Lake Took-A-While. 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.

- Wetlands Nature Area. 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

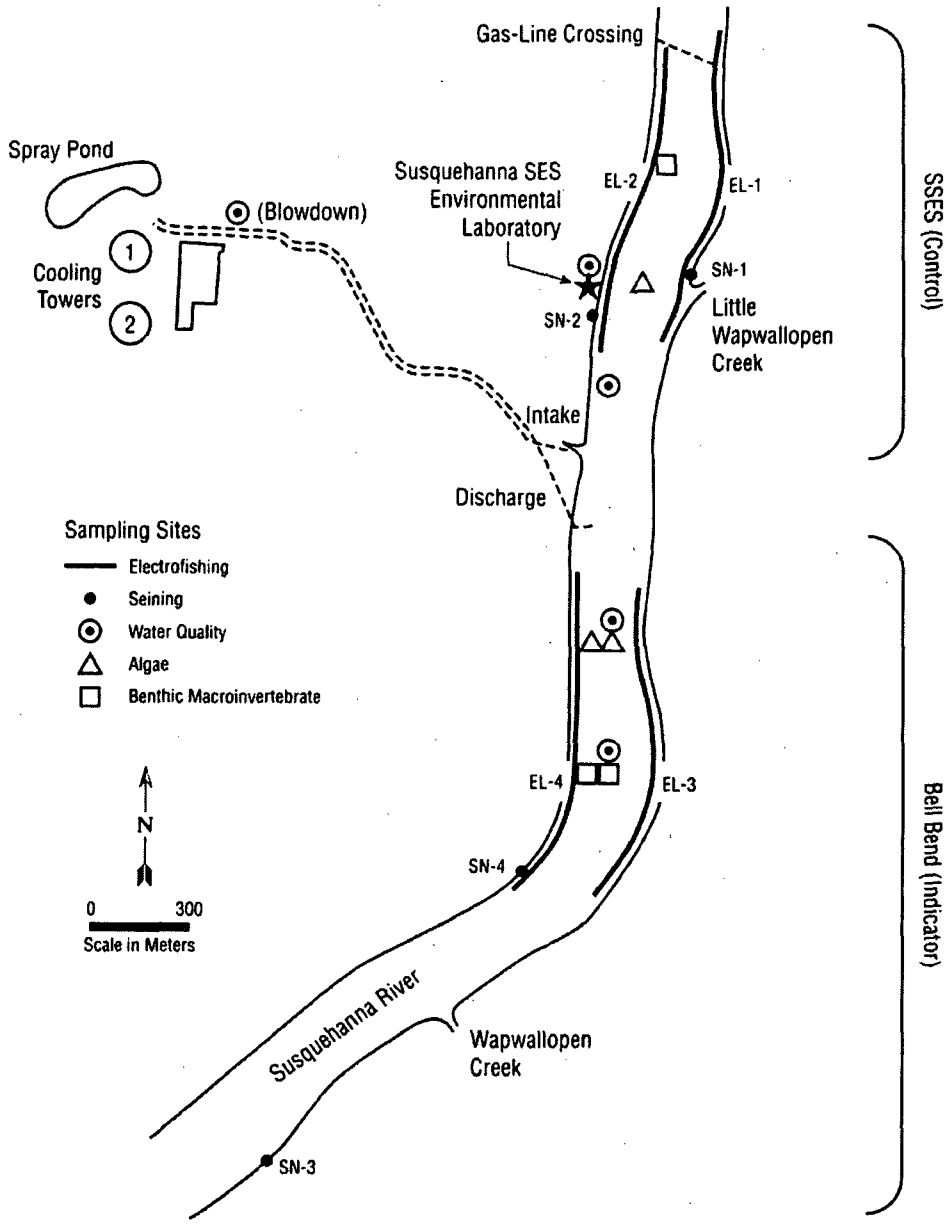

Figure 2-4. Sampling Sites for Water Quality, Algae, Benthic Macroinvertebrates, Electrofishing (EL), and Seining (SN) at SSES and Bell Bend on the Susquehanna River. Sampling for Benthic Macroinvertebrates and Algae Ceased in 1994. (Sources: Adapted from Ecology III 1995, 2005)

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

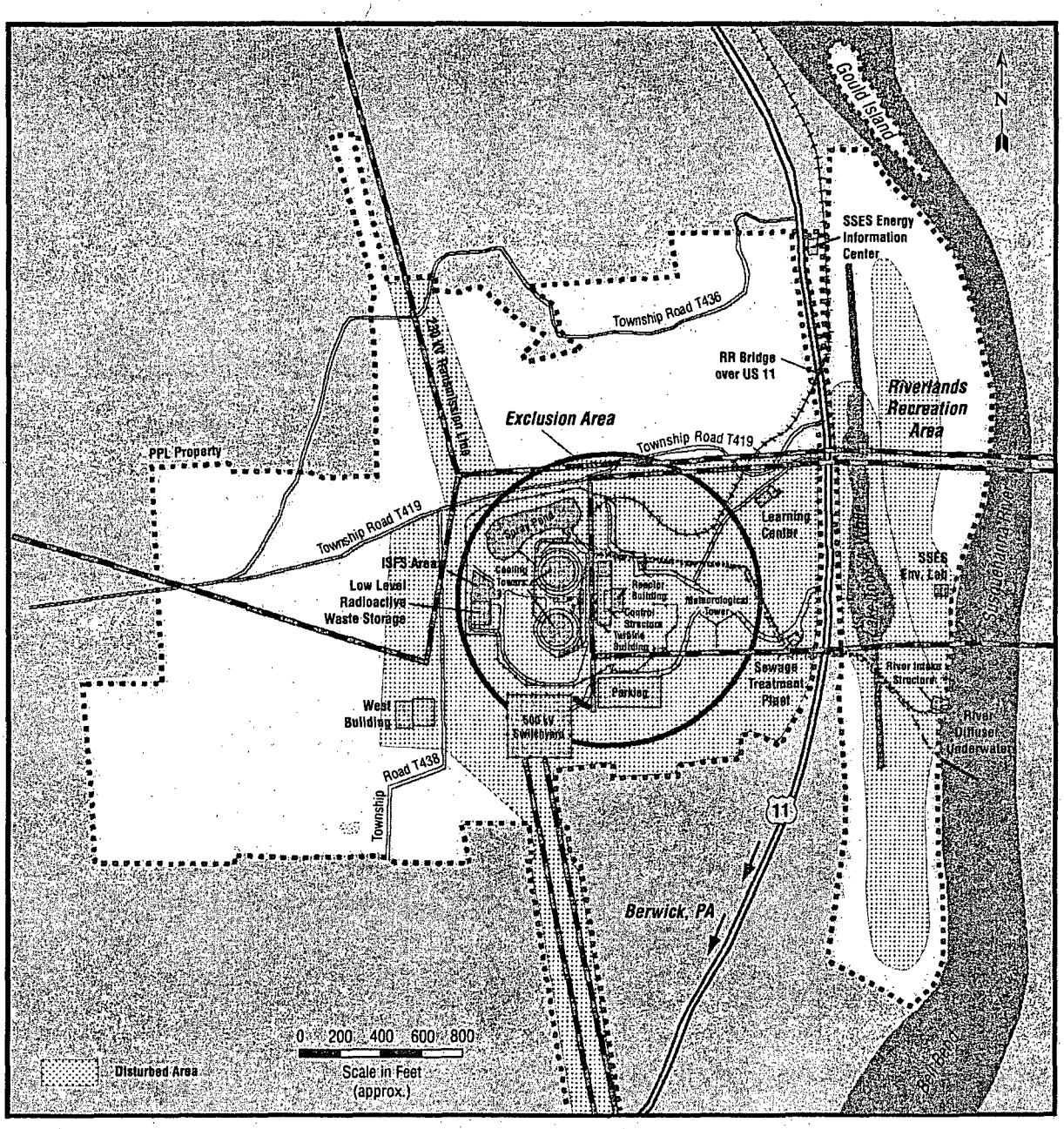

Figure 2-5. Disturbed Areas on the SSES Site (Source: Adapted from PPL 2006a)

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

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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)
Papalpema 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 1.23×10^{-2} mrad (1.23×10^{-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 2.48×10^{-3} mrad (2.48×10^{-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 4.93×10^{-1} mrem (4.93×10^{-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 5.27×10^{-1} mrem (5.27×10^{-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 5.27×10^{-1} mrem (5.27×10^{-3} mSv) to 5.94×10^{-1} mrem (5.94×10^{-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

Year	Luzerne County		Columbia County	
	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."

42 USC 11001, et seq. *United States Code*, Title 42, *The Public Health and Welfare*, Section 11001, et seq., "Emergency Planning and Community Right-to-Know Act," Section 11022, "Emergency and Hazardous Chemical Inventory Forms."

Audubon Pennsylvania and Pennsylvania Department of Conservation and Natural Resources (Audubon Pennsylvania and PDCNR). 2004. "Susquehanna River Birding and Wildlife Trail." Available URL: http://web1.audubon.org/trailMaps/ (Accessed on March 2, 2007). ADAMS No. ML080850123.

Berwick Historical Society. 2007. "A Short Canal History." Available URL: http://www.berwickhistoricalsociety.org/events.html (Accessed October 31, 2007). ADAMS No. ML080850099.

Blasko, J. 2001. "Myotis leibii." Animal Diversity Web. Available URL: http://animaldiversity.ummz.umich.edu/site/accounts/information/Myotis_leibii.html (Accessed February 26, 2007). ADAMS No. ML080280220.

Bright, E., and M.F. O'Brien. 1999. "Notes on *Nannothemis bella* in Michigan." Available URL: http://insects.ummz.lsa.umich.edu/michodo/test/Nannoth.htm (Accessed on December 28, 2006). ADAMS No. ML080280433.

Bugwood Network, University of Georgia, Georgia Forestry Commission, and USDA Forest Service. 2004. "Variable Climbing Caterpillar (*Xestia elimata*)." Available URL: http://www.forestpests.org/caterpillars/variableclimbingcat.cfm (Accessed March 6, 2007). ADAMS No. ML080280434.

Columbia County. 1993. *Comprehensive Plan, Phase I Background Studies*. Columbia County, Pennsylvania. Nassaux-Hemsley, Incorporated, Chambersburg, Pennsylvania. (August 3, 1993). ADAMS No. ML080220501.

Commonwealth Associates, Inc. (CAI). 1981. *Archaeological Investigations at the Susquehanna Steam Electric Station. The Susquehanna SES Floodplain. Management Summary*. R-2282B. Pennsylvania Power & Light Company. (March 26, 1981). ADAMS No. ML080140321.

Dewey, T., and M. Potter. 2002. "Falco peregrinus." Animal Diversity Web. Available URL: http://animaldiversity.ummz.umich.edu/site/accounts/information/Falco_peregrinus.html (Accessed February 26, 2007). ADAMS No. ML080280222.

Doan, N. 1999. "Asio flammeus." Animal Diversity Web. Available URL: http://animaldiversity.ummz.umich.edu/site/accounts/information/Asio_flammeus.html (Accessed February 26, 2007). ADAMS No. ML080280224.

Ecology III, Inc. (Ecology III). 1987. *Ecological Studies of the Susquehanna River in the Vicinity of the Susquehanna Steam Electric Station, 1986 Annual Report*. Prepared for Pennsylvania Power & Light Company. Berwick, Pennsylvania. (November 1987). ADAMS No. ML071800081.

Ecology III, Inc. (Ecology III). 1991. Letter from Ecology III, Inc. to U.S. Fish and Wildlife Service. Subject: Its 1991 Monitoring Program for Impinged Juvenile American Shad at the Susquehanna River Water Intake. (September 1991). ADAMS No. ML071800156 (Attachment 10).

Ecology III, Inc. (Ecology III). 1995. *Environmental Studies in the Vicinity of the Susquehanna Steam Electric Station, 1994 Annual Report*. Berwick, Pennsylvania. (June 1995). ADAMS No. ML071800080.

Ecology III, Inc. (Ecology III). 2003. *Environmental Studies in the Vicinity of the Susquehanna Steam Electric Station, 2002, Water Quality and Fishes.* Berwick, Pennsylvania. (August 2003). ADAMS No. ML071040042.

Ecology III, Inc. (Ecology III). 2007a. *Environmental Studies in the Vicinity of the Susquehanna Steam Electric Station, 2005, Water Quality and Fishes.* Berwick, Pennsylvania. (February 2007). ADAMS No. ML071800077.

Ecology III, Inc. (Ecology III). 2007b. *Environmental Studies in the Vicinity of the Susquehanna Steam Electric Station, 2006, Water Quality and Fishes.* Berwick, Pennsylvania. (July 2007). ADAMS No. ML072200111.

Fields, J.S. 2005. E-mail from J.S. Fields, PPL, to Gary Gunter, Tetra Tech NUS. Subject: "Update Water Well Data." (July 14, 2005), in Chapter 2 references of PPL 2006a (below)..

Fields, J. 2007. E-mail from J. Fields, PPL Suquehanna, LLC, Allentown, Pennsylvania, to A. Mullins, U.S. Nuclear Regulatory Commission, Rockville, Maryland. Subject: "Application to Susq. River Basin Commission (SRBC)." (January 8, 2007). ADAMS No. ML070320756.

Harding, J. 2002. "Clemmys muhlenbergii." Animal Diversity Web. Available URL: http://animaldiversity.ummz.umich.edu/site/accounts/information/Clemmys_muhlenbergii.html (Accessed February 27, 2007). ADAMS No. ML080280460.

Harris, M. 1999. "Botaurus lentiginosus." Animal Diversity Web. Available URL: http://animaldiversity.ummz.umich.edu/site/accounts/information/Botaurus_lentiginosus.html (Accessed February 26, 2007). ADAMS No. ML080280467.

Harris, M. 2002. "Haliaeetus leucocephalus." Animal Diversity Web. Available URL: http://animaldiversity.ummz.umich.edu/site/accounts/information/Haliaeetus_leucocephalus.html (Accessed February 26, 2007). ADAMS No. ML080280477.

Hoffman, J.L.R. 2006. *Susquehanna Large River Assessment Project.* Publication No. 245. Susquehanna River Basin Commission, Harrisburg, Pennsylvania. (August 2006). ADAMS No. ML080180398.

Ichthyological Associates, Inc. 1983. Letter from Ichthyological Associates, Inc. to U.S. Fish and Wildlife Service. Subject: 1983 Monitoring Program for Impinged Juvenile American Shad at the Susquehanna River Water Intake. (November 1983). ADAMS No. ML071800156 (Attachment 9).

Ichthyological Associates, Inc. 1985. *Ecological Studies of the Susquehanna River in the Vicinity of the Susquehanna Steam Electric Station, 1984 Annual Report.* Prepared for Pennsylvania Power & Light Company, Berwick, Pennsylvania. (May 1985). ADAMS No. ML071800290.

Jones, J. 2002. "Ardea alba." Animal Diversity Web. Available URL http://animaldiversity.ummz.umich.edu/site/accounts/information/Ardea_alba.html (Accessed February 26, 2007). ADAMS No. ML080280483.

Kent, B.C., I.F. Smith III, and C. McCann. 1971. *Foundations of Pennsylvania Prehistory.* Anthropological Series of the Pennsylvania Historical and Museum Commission, No. 1.

King's College. 2002. "MaP Center. National Land Cover Classification. Luzerne County." The Pennsylvania Marketing and Planning Center. Available URL: http://www.mapcenter.org/region/nlcd-table.html (Accessed December 20, 2004). ADAMS No. ML080230256, page 12.

Kirschbaum, K., and P. Watkins. 2000. "Pandion haliaetus." Animal Diversity Web. Available URL: http://animaldiversity.ummz.umich.edu/site/accounts/information/Pandion_haliaetus.html (Accessed February 26, 2007). ADAMS No. ML080280488.

Lackawanna/Luzerne Counties. 2003. *Long Range Transportation Plan for the Lackawanna-Luzerne Transportation Study Area (2003-2025).* ORA Job No. 2000186. Orth-Rodgers & Associates, Inc., Philadelphia, Pennsylvania. Wilkes University, Center for Geographic Information Systems. (May 2003). ADAMS No. ML080230335.

Luzerne County Business. 2006. "Major Industries/Employers." Available URL: http://www.luzernecounty.org/business/economic_development_today/major_industries/employers (Accessed April 18, 2007). ADAMS No. ML080180387.

Mangan, B.P. 2002. "Range Expansion of the Asiatic Clam, Corbicula fluminea, into the North Branch of the Susquehanna River." *Journal of the Pennsylvania Academy of Science* 76(1):40–42. ADAMS No. ML071800156 (Attachment 19).

Meiser & Earl, Inc. 2000. *Hydrogeologic Feasibility Analysis for Backup Water Supply, Susquehanna Steam Electric Station.* State College, Pennsylvania. ADAMS No. ML071800077, page 37.

Montana State University Big Sky Institute and the National Biological Information Infrastructure Mountain Prairie Information Node (MSU and NBII). 2007a. "Species Detail: Aphrodite Fritillary." Available URL: http://www.butterfliesandmoths.org/species?l=1676 (Accessed March 2, 2007). ADAMS No. ML080280210.

Montana State University Big Sky Institute and the National Biological Information Infrastructure Mountain Prairie Information Node (MSU and NBII). 2007b. "Species Detail: Baltimore." Available URL: http://www.butterfliesandmoths.org/species?l=1753 (Accessed March 2, 2007). ADAMS No. ML080280214.

Montana State University Big Sky Institute and the National Biological Information Infrastructure Mountain Prairie Information Node (MSU and NBII). 2007c. "Species Detail: Long Dash." Available URL: http://www.butterfliesandmoths.org/species?l=2097 (Accessed March 2, 2007). ADAMS No. ML080280200.

Montana State University Big Sky Institute and the National Biological Information Infrastructure Mountain Prairie Information Node (MSU and NBII). 2007d. "Species Detail: Mulberry Wing." Available URL: http://www.butterfliesandmoths.org/species?l=2113 (Accessed March 2, 2007). ADAMS No. ML080850122.

Montana State University Big Sky Institute and the National Biological Information Infrastructure Mountain Prairie Information Node (MSU and NBII). 2007e. "Species Detail: Northern Pearly Eye." Available URL: http://www.butterfliesandmoths.org/species?l=1838 (Accessed March 2, 2007). ADAMS No. ML080280197.

Montana State University Big Sky Institute and the National Biological Information Infrastructure Mountain Prairie Information Node (MSU and NBII). 2007f. "Species Detail: Pine-devil." Available URL: http://www.butterfliesandmoths.org/species?l=3336 (Accessed March 2, 2007). ADAMS No. ML080280196.

National Center for Education Statistics (NCES). 2007. "College Navigator." U.S. Department of Education. Available URL: http://nces.ed.gov/collegenavigator (Accessed June 2007).

National Climatic Data Center (NCDC). 2007. Tornado Activities in Luzerne County, PA. National Oceanic and Atmospheric Administration, Washington, D.C. Available URL: http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~storms (Accessed June 2007). ADAMS No. ML080230560.

National Weather Service (NWS). 2007a. "Climate of Pennsylvania." National Oceanic and Atmospheric Administration, National Climatic Data Center, Ashville, NC. ADAMS No. ML080840166.

National Weather Service (NWS). 2007b. "Avoca (Scranton/Wilkes-Barre, PA) Seasonal Records, 1955-Present." National Oceanic and Atmospheric Administration, Eastern Region Headquarters. Available URL: http://www.erh.noaa.gov/bgm/climate/avp/avpsea.html (Accessed June 2007). ADAMS No. ML080230262.

National Weather Service (NWS). 2007c. "Climatological Narrative for Wilkes-Barre/Scranton, Pennsylvania." Oceanic and Atmospheric Administration, Eastern Region Headquarters. Available URL: http://www.erh.noaa.gov/bgm/climate/avp/avpclim.txt (Accessed June 2007). ADAMS No. ML080230264.

Nature Conservancy. 2006. "A Natural Areas Inventory, Luzerne County, Pennsylvania." Nature Conservancy, Pennsylvania Science Office. Available URL: http://www.naturalheritage.state.pa.us/CNAI_PDFs/Luzerne%20County%20NAI%202006%20WEB.pdf. (Accessed December 26, 2006).

Nature Conservancy. 2004. "Columbia County Natural Areas Inventory 2004." Nature Conservancy, Pennsylvania Science Office. Available URL: http://www.naturalheritage.state.pa.us/Eastern_PDF_Updates/Columbia%20Co%20NAI%202004.pdf (Accessed December 28, 2006).

NatureServe. 2006a. "Comprehensive Report Species Bartramia longicauda." Available URL: http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Bartramia+longicauda (Accessed March 2, 2007). ADAMS No. ML080280195.

NatureServe. 2006b. "Comprehensive Report Species Cistothorus platensis." Available URL: http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Cistothorus+platensis (Accessed March 2, 2007). ADAMS No. ML080280194.

NatureServe. 2006c. "Comprehensive Report Species Neotoma magister." Available URL: http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Neotoma+magister (Accessed March 7, 2007). ADAMS No. ML080280178.

Newell, T. 1999. "Myotis sodalis." Animal Diversity Web. Available URL: http://animaldiversity.ummz.umich.edu/site/accounts/information/Myotis_sodalis.html (Accessed February 26, 2007). ADAMS No. ML080280216.

Null, S. 1999. "Chlidonias niger." Animal Diversity Web. Available URL: http://animaldiversity.ummz.umich.edu/site/accounts/information/Chlidonias_niger.html (Accessed February 26, 2007). ADAMS No. ML080280215.

Ottawa Forests and Greenspace Advisory Committee (OFGAC). 2007. "Native Trees and Shrubs Database: Hairy Honeysuckle *Lonicera hirsute*." Available URL: http://www.ofnc.ca/ofgac/displaytreeen.php?id=189 (Accessed February 26, 2007). ADAMS No. ML080280422.

Pennsylvania Department of Conservation and Natural Resources (PDCNR). 2006. "Glacial Geology in Pennsylvania." Available URL: http://www.dcnr.state.pa.us/topogeo/field/glacial.aspx (Accessed February 26, 2007). ADAMS No. ML080850485.

Pennsylvania Department of Conservation and Natural Resources (PDCNR). 2007. Letter from R. Bowen, Pennsylvania Department of Conservation and Natural Resources, Harrisburg, Pennsylvania, to A. Mullins, U.S. Nuclear Regulatory Commission, Rockville, Maryland. Subject: "Pennsylvania Natural Diversity Inventory Review, PDNI Number 19031." ADAMS No. ML070190672.

Pennsylvania Department of Education (PDE). 2001. *Public, Private and Nonpublic Schools Enrollments 2000-01.* Compiled by J.R. Bobek and R.A. Hruska, Educational Statistics Associates. (June 2001). ADAMS No. ML080180338.

Pennsylvania Department of Education (PDE). 2004. "Map of Pennsylvania School Districts and Intermediate Unit 16." Available URL: http://www.dot.state.pa.us/Internet/Bureaus/pdPlanRes.nsf/infoBPR_Education_PA_Intermediate_unit (Accessed April 2007). ADAMS No. ML010180328.

Pennsylvania Department of Education (PDE). 2005. "Public Schools Enrollments, Public Enrollment by County, School, and Grade 2005-2006." Available URL: http://www.pde.state.pa.us/k12statistics/lib/k12statistics/0506PubEnrCtySchGrar2.xls (Accessed April 2007). ADAMS No. ML080180338.

Pennsylvania Department of Education (PDE). 2006. *Public, Private and Nonpublic Schools Enrollments 2005-06.* Compiled by J.R. Bobek and R.A. Hruska, Educational Statistics Associates. (December 2006). ADAMS No. ML080180343.

Pennsylvania Department of Environmental Protection (PDEP). 2003. "State Only Operating Permit for Synthetic Minor Facility." State Only Permit No:40-00027. (November 19, 2003.) ADAMS No. ML071800156, p. 63.

Pennsylvania Department of Environmental Protection (PDEP). 2004. "Survey Information. Water Supply Data for Luzerne and Columbia Counties." Available URL: http://www.drinkingwater.state.pa.us/dwrs/HTM/DEP_frm.html (Accessed November 9, 2004). ADAMS No. ML080180382.

Pennsylvania Department of Environmental Protection (PDEP). 2005a. *Authorization to Discharge Under the National Pollutant Discharge Elimination System Requirements for Industrial Wastewater Facilities NPDES Permit No: PA-0047325.* Wilkes-Barre, Pennsylvania. ADAMS No. ML072390080.

Pennsylvania Department of Environmental Protection (PDEP). 2005b. News Release: "Standards Set for Cleanup, Reuse of Hazleton Mine Reclamation Project." Available URL: http:// www.ahs.dep.state.pa.us/newsreleases/default.asp?ID=3740&varQueryType=Detail (Accessed April 18, 2006). ADAMS No. ML080230317.

Pennsylvania Department of Environmental Protection (PDEP). 2005c. *Environmental Radiation in Pennsylvania 2001-2002 Annual Report.* Pennsylvania Bureau of Radiation Protection, Wilkes-Barre, Pennsylvania. ADAMS No. ML080230289.

Pennsylvania Department of Environmental Protection (PDEP). 2006. "Commonwealth of Pennsylvania Fish Consumption Advisory – 2007." Available URL: http://www.depweb.state.pa.us/watersupply/lib/watersupply/fishadvisory07-tbl.pdf (Accessed August 9, 2007). ADAMS No. ML080230304.

Pennsylvania Department of Environmental Protection (PDEP). 2007a. "Black Fly Suppression Program." Available URL: http://www.depweb.state.pa.us/blackfly/cwp/view.asp?a=3&Q=505536 (Accessed July 12, 2007). ADAMS No. ML080230310.

Pennsylvania Department of Transportation (PDOT). 2004. "Traffic Volume Maps. Luzerne and Columbia Counties, 2002." Pennsylvania Department of Transportation, Bureau of Planning and Research, Transportation Planning Division. Available URL: http://www.dot.state.pa.us/ (Accessed August 24, 2004). ADAMS No. ML080230314.

Pennsylvania Fish and Boat Commission. 2007. "Pennsylvania Species by Watershed." Available URL: http://www.fish.state.pa.us/pafish/fishhtms/chap2.htm (Accessed August 8, 2007). ADAMS No. ML080280426.

Pennsylvania Game Commission. 2003. "Least Bittern." Available URL: http://www.pgc.state.pa.us/pgc/cwp/view.asp?a=486&q=152631 (Accessed August 29, 2007). ADAMS No. ML080280416.

Pennsylvania Game Commission. 2005. "10.4 WAP-Priority Mammals." Available URL: http://www.pgc.state.pa.us/pgc/cwp/view.asp?a=496&q=164531 (Accessed March 6, 2007). ADAMS No. ML080280502.

Pennsylvania Historical and Museum Commission (PHMC). Undated-a. "Pennsylvania State History." Available URL: http://www.phmc.state.pa.us/bah/pahist/overview.asp?secid=31 (Accessed November 19, 2007). ADAMS No. ML080220443.

Pennsylvania Historical and Museum Commission (PHMC). Undated-b. "Pennsylvania Counties: Luzerne County." Pennsylvania State Archives. Available URL: http://www.phmc.state.pa.us./bah/dam/counties/county.asp?secid=31 (Accessed November 19, 2007). ADAMS No. ML080230300.

Pennsylvania Natural Heritage Program (PNHP). 2007a. "Natural Community Types." Available URL: http://www.naturalheritage.state.pa.us/community.aspx (Accessed February 26, 2007). ADAMS No. ML080280419.

Pennsylvania Natural Heritage Program (PNHP). 2007b. "Plant Species List." Available URL: http://www.naturalheritage.state.pa.us/PlantsPage.aspx (Accessed March 6, 2007). ADAMS No. ML080280417.

Pennsylvania State Climatologist. Undated. "State Data." Office of the State Climatologist, Department of Meteorology, College of Earth and Mineral Sciences, Pennsylvania State University, State College, Pennsylvania. Available URL: http://www.ems.psu.edu/PA_Climatologist/State/ (Accessed October 2, 2007). ADAMS No. ML080220517

PPL Electric Utilities Corporation. 2007. "Specifications for Initial Clearing and Control Maintenance of Vegetation on or Adjacent to Electric Line Right-of-Way through Use of Herbicides, Mechanical, and Handclearing Techniques." PPL Electric Utilities Corporation, Allentown, Pennsylvania. ADAMS No. ML071800079.

PPL Susquehanna, LLC (PPL). 1999. *NPDES Renewal Permit Application*. Permit No. PA-0047325. Berwick, Pennsylvania.

PPL Susquehanna, LLC (PPL). 2001. *Susquehanna Steam Electric Station Units 1 and 2 Radioactive Effluent Release Report, 2000 Annual Report*. Berwick, Pennsylvania. ADAMS No. ML011230368.

PPL Susquehanna, LLC (PPL). 2002. *Susquehanna Steam Electric Station Units 1 and 2 Radioactive Effluent Release Report, 2001 Annual Report*. Berwick, Pennsylvania. ADAMS Nos. ML021290310 and ML021290495.

PPL Susquehanna, LLC (PPL). 2003. *Susquehanna Steam Electric Station Units 1 and 2 Radioactive Effluent Release Report, 2002 Annual Report.* Berwick, Pennsylvania. ADAMS Nos. ML031250172 and ML031250206.

PPL Susquehanna, LLC (PPL). 2004a. *Susquehanna Steam Electric Station Units 1 and 2 Radioactive Effluent Release Report, 2003 Annual Report.* Berwick, Pennsylvania. ADAMS Nos. ML041280097 and ML041320403.

PPL Corporation (PPL). 2004b. "Susquehanna Riverlands." Available URL: http://www.pplweb.com/community/enviro_preserves/susq_index.htm (Accessed August 18, 2004). ADAMS No. ML080220456.

PPL Susquehanna, LLC (PPL). 2005a. *Susquehanna Steam Electric Station Units 1 and 2 Radioactive Effluent Release Report, 2004 Annual Report.* Berwick, Pennsylvania. ADAMS Nos. ML051220543 and ML051220606.

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

PPL Susquehanna, LLC (PPL). 2006b. *Susquehanna Steam Electric Station Proposed License Amendment Numbers 285 for Unit 1 Operating License No. NPF-14 and 253 for Unit 2 Operating License No. NPF-22 Constant Power Uprate PLA-6076, Attachment 3, Supplemental Environmental Report.* Allentown, Pennsylvania. ADAMS No. ML062900161.

PPL Susquehanna, LLC (PPL). 2006c. *Susquehanna Steam Electric Station Units 1 and 2 Radioactive Effluent Release Report, 2005 Annual Report.* Berwick, Pennsylvania. ADAMS Nos. ML061210159 and ML061210162.

PPL Susquehanna, LLC (PPL). 2006d. "Calculation EC-PUPC-20605, Revision 1, Condenser & Circulating Water System, EPU Evaluation and Task Report." Berwick, Pennsylvania. ADAMS No. ML071800154.

PPL Susquehanna, LLC (PPL). 2007a. *Susquehanna Steam Electric Station Units 1 and 2 Radioactive Effluent Release Report, 2006 Annual Report.* Berwick, Pennsylvania. ADAMS Nos. ML071290153 and ML071290156.

PPL Susquehanna, LLC (PPL). 2007b. *Susquehanna Steam Electric Station Units 1 and 2 Annual Radiological Environmental Operating Report, 2006 Annual Report.* Berwick, Pennsylvania. ADAMS No. ML071410206.

PPL Susquehanna, LLC (PPL). 2007c. "Susquehanna Steam Electric Station Offsite Dose Calculation Manual (ODCM)," included as Appendix A in *Susquehanna Steam Electric Station Units 1 and 2 Radioactive Effluent Release Report, 2006 Annual Report*. Berwick, Pennsylvania. ADAMS No. ML071290156.

PPL Susquehanna, LLC (PPL). 2007d. Site Audit Personal Interview with Curt Saxton, SSES staff. Berwick, Pennsylvania.

PPL Susquehanna, LLC (PPL). 2007e. *Susquehanna Steam Electric Station Application for Renewed Operating Licenses Numbers NPF-14 and NPF-22 Environmental Audit Document Requests Supplemental Information, PLA-6219*. Berwick, Pennsylvania. (June 20, 2007). ADAMS No. ML071800072.

PPL Susquehanna, LLC (PPL). 2007f. *Susquehanna Steam Electric Station Application for Renewed Operating Licenses Number NPF-14 and NPF-22 Requests for Additional Information – License Renewal Application (LRA) Environmental Site Audit Followup*. Berwick, Pennsylvania. (August 1, 2007). ADAMS No. ML072220245.

PPL Susquehanna, LLC (PPL). 2007g. *Susquehanna Steam Electric Station Final Safety Analysis Report*, Revision 62, Berwick, Pennsylvania. (March 2007). ADAMS No. ML073450541.

PPL Susquehanna, LLC (PPL). 2007h. *Susquehanna Steam Electric Station 2006 Meteorological Summary Report R-1710010-701*. Prepared by ABS Consulting. (May 2007). ADAMS No. ML071800173.

PPL Susquehanna, LLC (PPL). 2007i. *Susquehanna Steam Electric Station Application for Renewed Operating Licenses Numbers NPF-14 and NPF-22 Responses to Environmental Audit Questions, PLA-6218*. Berwick, Pennsylvania. (June 20, 2007). ADAMS No. ML071790414.

PPL Susquehanna, LLC (PPL). 2007j. *Susquehanna Steam Electric Station Response to March 9, 2007 NPDES Violation PLA-6180*. Berwick, Pennsylvania. (April 5, 2007). ADAMS No. ML071080247.

Reese, M. 2007. "Leonard's Skipper." Available URL: http://www.wisconsinbutterflies.org/butterflies/species/230 (Accessed February 26, 2007). ADAMS No. ML080280437.

Susquehanna River Anadromous Fish Restoration Committee (SRAFRC). 1992. Letter from Susquehanna River Anadromous Fish Restoration Committee to PPL. (September 1992). ADAMS No. ML071800156 (Attachment 11).

Susquehanna River Anadromous Fish Restoration Committee (SRAFRC). 1993. Letter from Susquehanna River Anadromous Fish Restoration Committee to PPL. (August 1993). ADAMS No. ML071800156 (Attachment 12).

Susquehanna River Anadromous Fish Restoration Committee (SRAFRC). 1994. Letter from Susquehanna River Anadromous Fish Restoration Committee to PPL. (September 1994). ADAMS No. ML071800156 (Attachment 13).

Susquehanna River Basin Commission (SRBC). 2006. "Susquehanna River Basin Commission Information Sheet." Available URL: http://www.srbc.net/docs/Susq%20River%20Basin%20General%20(11_06).PDF (Accessed July 9, 2007). ADAMS No. ML080180391.

Susquehanna River Basin Commission (SRBC). 2007a. Modified Approval for Water Use at PPL Susquehanna, LLC Steam Electric Station. Docket No. 19950301-1. Approval date: March 9, 1995; modification date: September 12, 2007. ADAMS No. ML073090043.

Susquehanna River Basin Commission (SRBC). 2007b. "Middle Susquehanna Subbasin." Available URL: http://www.srbc.net/middlsus.htm (Accessed July 10, 2007). ADAMS No. ML080230333.

University of Connecticut (Cooperative Extension Forestry). 2001. "Keeping Invasive Plants Out of Forest Fragments." Available URL: http://www.canr.uconn.edu/ces/forest/invasives.htm (Accessed March 6, 2007). ADAMS No. ML080280428.

University of Pennsylvania. 2002. "Poisonous Plants: Fly Poison." Available URL: http://cal.vet.upenn.edu/poison/plants/ppfly.htm (Accessed March 6, 2007). ADAMS No. ML080280438.

U.S Atomic Energy Commission (AEC). 1973. *Final Environmental Statement Related to the 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. Army Corps of Engineers (USACE). 2006. Letter to Jerrold McCormick, PPL, from Irwin Garskof, Chief, Pennsylvania Section, Baltimore District, U.S. Army Corps of Engineers, Baltimore, Maryland, plus attached Pennsylvania State Programmatic General Permit – 3. (September 13, 2006). ADAMS No. ML071800156 (Attachment 6).

U.S. Census Bureau (USCB). 2000a. "Pennsylvania Quickfacts: Luzerne County." Available URL: http://quickfacts.census.gov/ (Accessed July 22, 2004). ADAMS No. ML080220445.

U.S. Census Bureau (USCB). 2000b. "Pennsylvania Quickfacts: Columbia County." Available URL: http://quickfacts.census.gov/ (Accessed July 22, 2004). ADAMS No. ML080220446.

U.S. Census Bureau (USCB). 2007. "American FactFinder." Available URL: http://factfinder.census.gov/ (Accessed April 2007).

U.S. Department of Agriculture (USDA). 2004. *2002 Census of Agriculture*. Available URL: http://www.nass.usda.gov/census/census02/volume1/pa/index2.htm (Accessed April 27, 2007). ADAMS No. ML080180357.

U.S. Department of Agriculture/Natural Resources Conservation Service (USDA/NRCS). 2007. The PLANTS Database. Available URL: http://plants.usda.gov (Accessed February 27, 2007). ADAMS No. ML080280439.

U.S. Environmental Protection Agency (EPA). 2000. "Brownfields Cleanup and Redevelopment." Brownfields Cleanup Revolving Loan Fund Pilot Fact Sheet. Luzerne County, Pennsylvania. Available URL: http://www.epa.gov/brownfields/htmldoc/rluzerne.htm (Accessed March 31, 2005). ADAMS No. ML080230332.

U.S. Environmental Protection Agency (EPA). 2004. U.S. Environmental Protection Agency Local Drinking Water Information – Pennsylvania Drinking Water. "List of Water Systems in Safe Drinking Water Information System Database for Luzerne and Columbia Counties." Available URL: http://oaspub.epa.gov/enviro/sdw_form.create_page?state_abbr=PA (Accessed July 27, 2007). ADAMS No. ML080230324.

U.S. Environmental Protection Agency (EPA). 2006. "Biological Indicators of Watershed Health." Available URL: http://www.epa/gov/bioindicators/html/brsig.html (Accessed July 11, 2007). ADAMS No. ML080280435.

U.S. Fish and Wildlife Service (FWS). 1983. "Recovery Plan for the Indiana Bat." Available URL: http://ecos.fws.gov/docs/recovery_plans/2005/051215.pdf (Accessed December 29, 2006). ADAMS No. ML070110342.

U.S. Fish and Wildlife Service (FWS). 2006a. "Species Profile: Indiana Bat (*Myotis sodalis*)." Available URL: http://ecos.fws.gov/speciesProfile/SpeciesReport.do?spcode=A000 (Accessed December 29, 2006). ADAMS No. ML070120336.

U.S. Fish and Wildlife Service (FWS). 2006b. "Wetlands Digital Data." Available URL: http://wetlandsfws.er.usgs.gov/NWI/index.html (Accessed March 6, 2007). ADAMS No. ML080850125.

U.S. Fish and Wildlife Service (FWS). 2007a. Letter from D. Densmore, U.S. Fish and Wildlife Service, to R. Franovich, U.S. Nuclear Regulatory Commission. "RE: USFWS Project #2007-1111." (October 11, 2007). ADAMS No. ML073110515.

U.S. Fish and Wildlife Service (FWS). 2007b. "Endangered and Threatened Wildlife and Plants; Removing the Bald Eagle in the Lower 48 States from the List of Endangered and Threatened Wildlife, Part III, ACTION: Final Rule." 50 CFR Part 17, RIN 1018-AF21. *Federal Register*, Vol. 72, p. 37346. (July 9, 2007).

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. Office of Nuclear Reactor Regulation, Washington, D.C. (June 1981). ADAMS No. ML080150291.

U.S. Nuclear Regulatory Commission (NRC). 2007. *PPL Susquehanna, LLC, Susquehanna Steam Electric Station, Units 1 and 2; Final Environmental Assessment and Finding of No Significant Impact Related to the Proposed License Amendment To Increase the Maximum Reactor Power Level.* U.S. Nuclear Regulatory Commission. Docket Nos. 50–387 and 50–388; Correction. *Federal Register*, Vol. 72, No. 241, pp. 71450–71461. (December 17, 2007). ADAMS No. ML073390306.

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.

Weed, C.S., and W. Wenstrom, eds. 1992a. *Cultural Resources Investigations of 36LU90 (Jacob's Site) and 36LU105 (Gould Island Site), Luzerne County, Pennsylvania.* Prepared by Emanco Inc. for Transcontinental Gas Pipeline Corporation. Report of Archaeological Investigations No. 27. Vol. I. (April 1992). ADAMS No. ML080850144.

Weed, C.S., and W. Wenstrom, eds. 1992b. *Cultural Resources Investigations of 36LU90 (Jacob's Site) and 36LU105 (Gould Island Site), Luzerne County, Pennsylvania.* Prepared by Emanco Inc. for Transcontinental Gas Pipeline Corporation. Report of Archaeological Investigations No. 27. Vol. II. (April 1992). ADAMS No. ML080870278.

Wood, E.W., and J.D. Barnes. 1995. *Sound Level Measurements Near Susquehanna Steam Electric Station Site 1995, Operation Noise Progress Report.* Acentech, Inc., Cambridge, Massachusetts. (September 1995). ADAMS No. ML071800075

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.