U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

NUREG-2179, Vol. 2

Environmental Impact Statement for the Combined License (COL) for the Bell Bend Nuclear Power Plant

Final Report

Chapters 9 to 12
Appendices A to N

U.S. Nuclear Regulatory Commission
Office of New Reactors
Washington, DC 20555-0001

Regulatory Branch
Baltimore District
U.S. Army Corps of Engineers
State College, PA 16801

US Army Corps of Engineers®

AVAILABILITY OF REFERENCE MATERIALS IN NRC PUBLICATIONS

NRC Reference Material

As of November 1999, you may electronically access NUREG-series publications and other NRC records at NRC's Library at www.nrc.gov/reading-rm.html. Publicly released records include, to name a few, NUREG-series publications; *Federal Register* notices; applicant, licensee, and vendor documents and correspondence; NRC correspondence and internal memoranda; bulletins and information notices; inspection and investigative reports; licensee event reports; and Commission papers and their attachments.

NRC publications in the NUREG series, NRC regulations, and Title 10, "Energy," in the *Code of Federal Regulations* may also be purchased from one of these two sources.

1. **The Superintendent of Documents**
   U.S. Government Publishing Office
   Mail Stop IDCC
   Washington, DC 20402-0001
   Internet: bookstore.gpo.gov
   Telephone: (202) 512-1800
   Fax: (202) 512-2104

2. **The National Technical Information Service**
   5301 Shawnee Rd., Alexandria, VA 22312-0002
   www.ntis.gov
   1-800-553-6847 or, locally, (703) 605-6000

A single copy of each NRC draft report for comment is available free, to the extent of supply, upon written request as follows:

Address: **U.S. Nuclear Regulatory Commission**
Office of Administration
Publications Branch
Washington, DC 20555-0001
E-mail: distribution.resource@nrc.gov
Facsimile: (301) 415-2289

Some publications in the NUREG series that are posted at NRC's Web site address www.nrc.gov/reading-rm/doc-collections/nuregs are updated periodically and may differ from the last printed version. Although references to material found on a Web site bear the date the material was accessed, the material available on the date cited may subsequently be removed from the site.

Non-NRC Reference Material

Documents available from public and special technical libraries include all open literature items, such as books, journal articles, transactions, *Federal Register* notices, Federal and State legislation, and congressional reports. Such documents as theses, dissertations, foreign reports and translations, and non-NRC conference proceedings may be purchased from their sponsoring organization.

Copies of industry codes and standards used in a substantive manner in the NRC regulatory process are maintained at—
The NRC Technical Library
Two White Flint North
11545 Rockville Pike
Rockville, MD 20852-2738

These standards are available in the library for reference use by the public. Codes and standards are usually copyrighted and may be purchased from the originating organization or, if they are American National Standards, from—
American National Standards Institute
11 West 42nd Street
New York, NY 10036-8002
www.ansi.org
(212) 642-4900

Legally binding regulatory requirements are stated only in laws; NRC regulations; licenses, including technical specifications; or orders, not in NUREG-series publications. The views expressed in contractorprepared publications in this series are not necessarily those of the NRC.

The NUREG series comprises (1) technical and administrative reports and books prepared by the staff (NUREG–XXXX) or agency contractors (NUREG/CR–XXXX), (2) proceedings of conferences (NUREG/CP–XXXX), (3) reports resulting from international agreements (NUREG/IA–XXXX), (4) brochures (NUREG/BR–XXXX), and (5) compilations of legal decisions and orders of the Commission and Atomic and Safety Licensing Boards and of Directors' decisions under Section 2.206 of NRC's regulations (NUREG–0750).

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

NUREG-2179, Vol. 2

Environmental Impact Statement for the Combined License (COL) for the Bell Bend Nuclear Power Plant

Final Report

Chapters 9 to 12
Appendices A to N

Manuscript Completed: March 2016
Date Published: April 2016

Division of New Reactor Licensing
Office of New Reactors
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Regulatory Division
Baltimore District
U.S. Army Corps of Engineers
State College, PA 16801

US Army Corps of Engineers®

Final Environmental Impact Statement for the Combined License (COL) for the Bell Bend Nuclear Power Plant

Lead Agency:	U.S. Nuclear Regulatory Commission
Cooperating Agency:	U.S. Army Corps of Engineers, Baltimore District
Contact:	Tomeka Terry, Environmental Project Manager Environmental Projects Branch Division of New Reactor Licensing Office of New Reactors U.S. Nuclear Regulatory Commission Washington, DC 20555-0001 Telephone: 301-415-1488 e-mail: Tomeka.Terry@nrc.gov

ABSTRACT

This environmental impact statement (EIS) has been prepared in response to an application submitted on October 10, 2008 to the U.S. Nuclear Regulatory Commission (NRC) by PPL Bell Bend, LLC (PPL) for a combined construction permit and operating license (combined license or COL). PPL notified the NRC of changes in its power generation business by letter dated May 12, 2015 (NRC Accession No. ML15146A095). PPL Bell Bend, LLC was renamed Bell Bend, LLC, and Bell Bend, LLC became a generation affiliate of Talen Energy Corporation (Talen Energy). The transaction became official on June 1, 2015. For purposes of this review, the abbreviation “PPL” will still be used to indicate the applicant. Bell Bend, LLC, under Talen Energy, is the applicant. The proposed actions related to the application are (1) NRC issuance of a COL for a new power reactor unit at the Bell Bend Nuclear Power Plant (BBNPP) site in Luzerne County, Pennsylvania, and (2) U.S. Army Corps of Engineers (USACE) decision to issue, deny, or issue with modifications a Department of the Army (DA) permit to perform certain dredge and fill activities in waters of the United States and to construct structures in navigable waters of the United States related to the project. The NRC, contractors, and USACE make up the review team.

This EIS documents the review team’s analysis, which considers and weighs the environmental impacts of constructing and operating one new nuclear unit at the BBNPP site and at alternative sites, including measures potentially available for reducing or avoiding adverse impacts.

The EIS includes the evaluation of the proposed action’s impacts of construction and operation of BBNPP on waters of the United States pursuant to Section 404 of the Clean Water Act and on navigable waters of the United States pursuant to Section 10 of the Rivers and Harbors Appropriation Act of 1899. The USACE will base its evaluation of PPL’s permit application on the requirements of USACE regulations, the Clean Water Act Section 404(b)(1) Guidelines, and the USACE public interest review process.

After considering the environmental aspects of the proposed action before the NRC, the NRC staff’s recommendation to the Commission is that the COL be issued as proposed. This recommendation is based on (1) the application, including the environmental report (ER), submitted by PPL; (2) consultation with Federal, State, Tribal, and local agencies; (3) the review

team’s independent review; (4) the consideration of public scoping comments; and (5) the assessments summarized in this EIS, including the potential mitigation measures identified in the ER and this EIS.

CONTENTS

FIGURES

TABLES

EXECUTIVE SUMMARY

This environmental impact statement (EIS) presents the results of a U.S. Nuclear Regulatory Commission (NRC) environmental review of an application for a combined construction permit and operating license (combined license or COL) for a new nuclear reactor unit at a proposed Bell Bend Nuclear Power Plant (BBNPP) site in Luzerne County, Pennsylvania. The U.S. Army Corps of Engineers (USACE) participated in the preparation of the EIS as a cooperating agency and as a member of the review team, which consisted of the NRC staff, its contractor staff, and the USACE staff.

Background

On October 10, 2008, PPL Bell Bend, LLC (PPL) submitted an application to the NRC for a combined license or COL for the BBNPP. PPL notified the NRC of changes in its power generation business by letter dated May 12, 2015 (NRC Accession No. ML15146A095). PPL Bell Bend, LLC was renamed Bell Bend, LLC, and Bell Bend, LLC became a generation affiliate of Talen Energy Corporation (Talen Energy). The transaction became official on June 1, 2015. For purposes of this review, the abbreviation "PPL" will still be used to indicate the applicant. Bell Bend, LLC, under Talen Energy, is the applicant.

Upon acceptance of PPL's application, the NRC review team began the environmental review process by publishing a Notice of Intent to prepare an EIS and conduct scoping in the *Federal Register,* on January 6, 2009. On March 30, 2012, PPL submitted a revised environmental report (ER) to provide detailed information regarding the revised site layout developed to avoid wetland impacts by relocating the power-block footprint. On June 15, 2012, following PPL's March 2012 submittal, the NRC published a second Notice of Intent in the *Federal Register* to conduct a supplemental scoping process. As part of the environmental review, the review team did the following:

- conducted public scoping meetings on January 29, 2009 in Berwick, Pennsylvania
- considered comments received during a 30-day supplemental scoping period beginning June 15, 2012, regarding the revised site layout that included a relocated power-block footprint developed to avoid wetland impacts
- conducted site visits to the BBNPP site in April and May 2009, May 2012, and March 2014
- conducted visits to alternative sites in March, April, and May 2009, and June 2010
- reviewed PPL's ER
- consulted with Tribal Nations and other agencies such as the U.S. Fish and Wildlife Service, Advisory Council on Historic Preservation, National Marine Fisheries Service, Pennsylvania Game Commission, Pennsylvania Historical & Museum Commission, Pennsylvania Department of Conservation and Natural Resources, Pennsylvania Fish and Boat Commission, and Pennsylvania Department of Environmental Protection
- conducted the review following guidance set forth in NUREG-1555:
  - "Standard Review Plans for Environmental Reviews for Nuclear Power Plants"
  - "Supplement 1: Operating License Renewal"

- considered public comments received during the 60-day scoping process beginning January 6, 2009
- considered public comments received during the 30-day supplemental scoping period beginning June 15, 2012, regarding the revised site layout that included a relocated power-block footprint developed to avoid wetland impacts
- conducted public meetings on the draft EIS on June 4, 2015, in Bloomsburg, Pennsylvania
- considered comments received during the 75-day comment period for the draft EIS, which began on April 24, 2015.

Proposed Action

PPL initiated the proposed Federal action by submitting an application for BBNPP to the NRC. The NRC's Federal action is issuance of COL for the AREVA U.S. EPR reactor at the BBNPP site near Berwick, Pennsylvania.

The USACE is a cooperating agency in preparation of this EIS. The USACE's Federal action is its decision of whether to issue, deny, or issue with modifications a Department of Army (DA) permit pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899 to authorize certain construction activities potentially affecting waters of the United States.(1)

Purpose and Need for Action

The purpose of the proposed NRC action, issuance of the COL, is to generate 1,600 MW(e) of electricity (baseload power) for sale with commercial operation starting June 2025.

The USACE determines both a basic and overall project purpose. The basic project purpose for the project is to generate electricity for additional baseload capacity. The overall purpose of the project is to provide 1,600 MW(e) of additional nuclear baseload electrical power to the northeast portion of the Pennsylvania, New Jersey, and Maryland Regional Transmission Organization grid.

Affected Environment

The BBNPP site is located near Berwick, Pennsylvania, adjacent to the existing Susquehanna Steam Electric Station Units 1 and 2 (Figure ES-1). The site is approximately 115 mi northwest of Philadelphia, Pennsylvania. Cooling water for the plant would be obtained from the Susquehanna River. The BBNPP would use two natural draft cooling towers to transfer waste heat to the atmosphere. A portion of the water obtained from the Susquehanna River would be returned to the environment via a discharge structure located in the Susquehanna River downstream of the existing Susquehanna Steam Electric Station discharge structure. The remaining portion of the water would be released to the atmosphere via evaporative cooling.

(1) Waters of the United States" is used to include both "waters of the United States" as defined by Title 33 of the *Code of Federal Regulations* (CFR) Part 328 defining the extent of USACE geographic jurisdiction pursuant to Section 404 of the Clean Water Act and "navigable waters of the United States" as defined by 33 CFR Part 329 defining the extent of USACE geographic jurisdiction pursuant to Section 10 of the Rivers and Harbors Act of 1899.

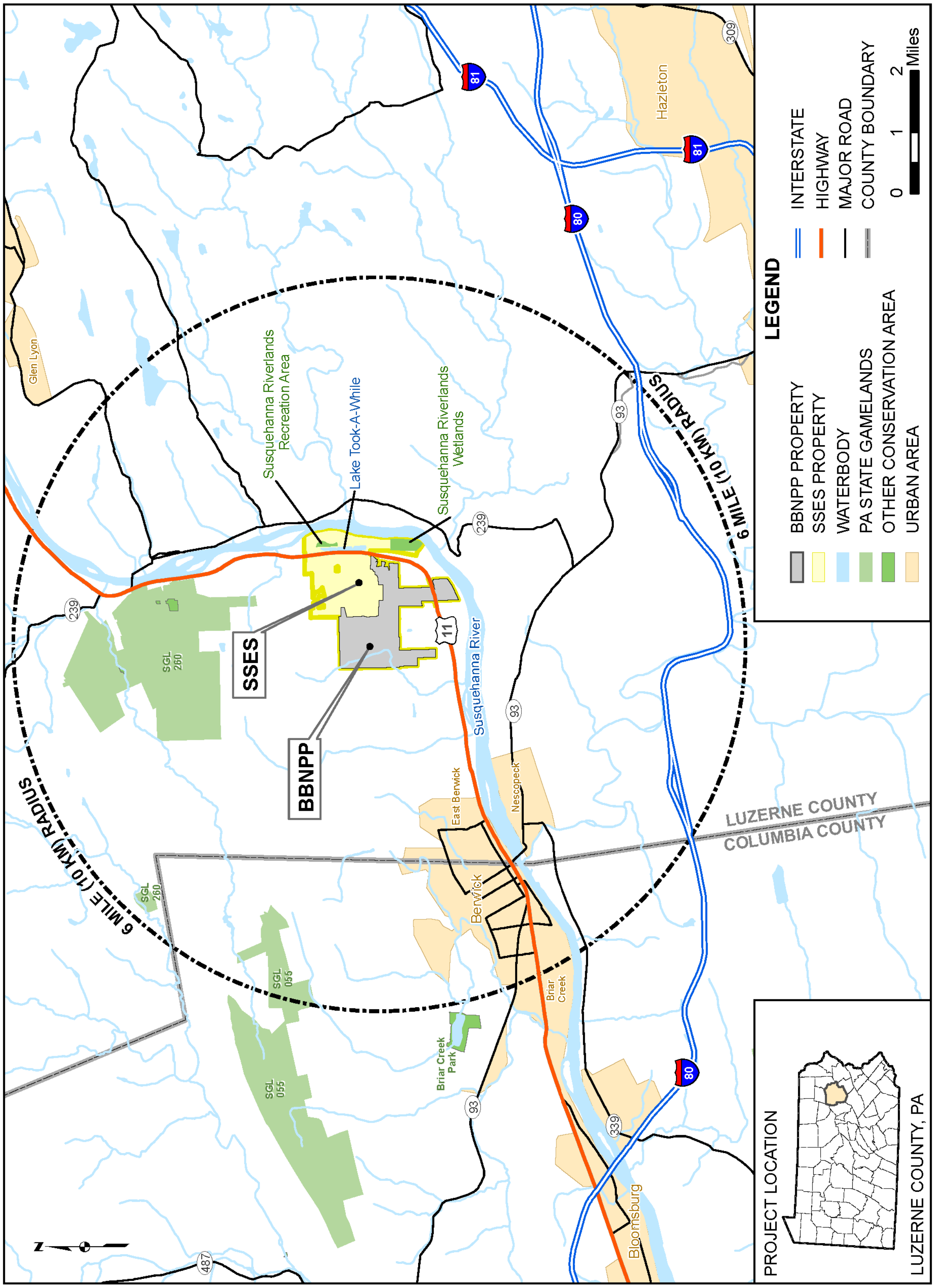

Figure ES-1. The BBNPP Site

During periods of low flow, PPL would rely on water released from Cowanesque Lake, located upstream from the BBNPP site near Tioga, Pennsylvania, to compensate for consumptive-water use. Releases from Cowanesque Lake during these periods would flow from the Cowanesque River into the Tioga River, and then into the Chemung River, which discharges to the North Branch of the Susquehanna River just south of the New York-Pennsylvania border.

Evaluation of Environmental Impacts

This EIS evaluates the potential environmental impacts of the construction and operation of a new nuclear plant related to the following resource areas:

- land use
- air quality
- aquatic ecology
- terrestrial ecology
- surface and groundwater
- waste (radiological and nonradiological)
- human health (radiological and nonradiological)
- socioeconomics
- environmental justice
- cultural resources
- fuel cycle, decommissioning, and transportation.

The impacts are designated as SMALL, MODERATE, or LARGE. The incremental impacts related to the construction and operations activities requiring NRC authorization are described and characterized, as are the cumulative impacts resulting from the proposed action when the effects are added to, or interact with, other past, present, and reasonably foreseeable future effects on the same resources. Table ES-1 summarizes construction and operation impacts. Table ES-2 summarizes the review team's assessment of cumulative impacts. The review team's detailed analysis, which supports the impact assessment of the proposed new units, can be found in Chapters 4, 5, and 7, respectively.

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.

Table ES-1. Environmental Impact Levels of the Proposed BBNPP Unit 1

Resource Category	Preconstruction and Construction	Operation
Land Use	SMALL	SMALL
Water-Related		
Water Use – Surface Water	SMALL	SMALL
Water Use – Groundwater Use	SMALL	SMALL
Water Quality – Surface Water	SMALL	SMALL
Water Quality – Groundwater	SMALL	SMALL

Table ES-1. (contd)

Resource Category	Preconstruction and Construction	Operation
Ecology		
Terrestrial Ecosystems	MODERATE (NRC-authorized construction impact level is small)	SMALL
Aquatic Ecosystems	SMALL	SMALL
Socioeconomic		
Physical Impacts	SMALL	SMALL
Demography	SMALL	SMALL
Economic Impacts on the Community	SMALL to MODERATE (beneficial)	SMALL to MODERATE (beneficial)
Infrastructure and Community Services	SMALL to MODERATE	SMALL
Environmental Justice[(a)]	NONE	NONE
Historic and Cultural Resources	SMALL	SMALL
Air Quality	SMALL	SMALL
Nonradiological Health	SMALL	SMALL
Nonradiological Waste	SMALL	SMALL
Radiological Health	SMALL	SMALL
Postulated Accidents	n/a	SMALL
Fuel Cycle, Transportation, and Decommissioning	n/a	SMALL

(a) A determination of "NONE" for environmental justice analyses does not mean there are no adverse impacts on minority or low-income populations from the proposed project. Instead, an indication of "NONE" means that while there are adverse impacts, those impacts do not affect minority or low-income populations in any disproportionate manner, relative to the general population.

Table ES-2. Cumulative Impacts on Environmental Resources, Including the Impacts of the Proposed BBNPP

Resource Area	Cumulative Impact Level
Land Use	SMALL
Water-Related	
Water Use – Surface Water	MODERATE
Water Use – Groundwater	SMALL
Water Quality – Surface Water	MODERATE
Water Quality – Groundwater	SMALL
Ecology	
Terrestrial Ecosystems	MODERATE
Aquatic Ecosystems	MODERATE to LARGE
Socioeconomic	
Physical impacts	SMALL to MODERATE
Demography	SMALL
Economic impacts on the community	SMALL to MODERATE (beneficial)

Table ES-2. (contd)

Resource Area	Cumulative Impact Level
Infrastructure and community services	SMALL to MODERATE
Environmental Justice[(a)]	NONE
Historic and Cultural Resources	SMALL
Air Quality	SMALL to MODERATE
Nonradiological Health	SMALL
Radiological Health	SMALL
Nonradiological Waste	SMALL
Postulated Accidents	SMALL
Fuel Cycle, Transportation, and Decommissioning	SMALL

(a) Refers to disproportionately high and adverse environmental or health impacts on any identified minority or low-income populations in the region.

Alternatives

The review team considered the environmental impacts associated with alternatives to issuing a COL for a nuclear unit proposed for the BBNPP site. These alternatives included a no-action alternative (i.e., not issuing the COL) and alternative energy sources, siting locations, and system designs.

The no-action alternative would result in the COL not being granted or the USACE not issuing its permit. Upon such a denial, construction and operation of a new unit at the BBNPP site would not occur and the predicted environmental impacts would not take place. If no other facility would be built or strategy implemented to take its place, the benefits of the additional electrical capacity and electricity generation to be provided would also not occur and the need for baseload power would not be met.

Based on the NRC staff's review of energy alternatives, the NRC staff concluded that, from an environmental perspective, none of the viable alternatives is clearly environmentally preferable to building a new baseload nuclear power generation plant at the BBNPP site. The NRC staff eliminated several energy sources (e.g., wind, solar, geothermal, and biomass) from full consideration because they are not currently capable of meeting the need of this project. None of the viable baseload alternatives (natural gas, coal, or a combination of alternatives) was environmentally preferable to the proposed BBNPP unit.

After comparing the cumulative effects of a new nuclear power plant at the proposed site against those at the alternative sites, the NRC staff concluded that none of the alternative sites would be environmentally preferable to the proposed site for building and operating a new nuclear power plant (Table ES-3). The three alternatives sites selected were as follows (Figure ES-2):

- Montour site, Montour County, Pennsylvania
- Humboldt site, Luzerne County, Pennsylvania
- Seedco site, Northumberland County, Pennsylvania.

Table ES-3. Comparison of Cumulative Impacts at the Proposed and Alternative Sites

Resource Area	Bell Bend[b]	Montour[c]	Humboldt[c]	Seedco[c]
Land Use	SMALL	MODERATE	MODERATE	MODERATE
Water Related				
Surface-Water Use	MODERATE	MODERATE	MODERATE	MODERATE
Surface-Water Quality	MODERATE	MODERATE	MODERATE	MODERATE
Groundwater Use	SMALL	SMALL	SMALL	SMALL
Groundwater Quality	SMALL	SMALL	SMALL	SMALL
Ecology				
Terrestrial Ecosystems	MODERATE	MODERATE	MODERATE	MODERATE
Aquatic Ecosystems	MODERATE to LARGE	MODERATE to LARGE	MODERATE to LARGE	MODERATE to LARGE
Socioeconomic[a]				
Physical impacts	SMALL except for MODERATE cumulative impacts from other planned road improvements	SMALL except for MODERATE cumulative impacts from other planned road improvements	SMALL except for MODERATE aesthetic impacts	SMALL except for MODERATE aesthetic impacts
Demography	SMALL	SMALL	SMALL	SMALL
Economic impacts on the community	SMALL and beneficial except for MODERATE and beneficial economic impacts on Columbia County and MODERATE and beneficial tax impacts on Salem Township and the Berwick Area School District	SMALL and beneficial except for MODERATE and beneficial economic impacts on Montour County and LARGE and beneficial tax impacts on Derry Township	SMALL except for MODERATE and beneficial economic impacts on Luzerne County and MODERATE and beneficial tax impacts on Hazle Township	SMALL except for MODERATE and beneficial economic impacts on Northumberland County and LARGE and beneficial tax impacts on Coal Township

Table ES-3. (contd)

Resource Area	Bell Bend[b]	Montour[c]	Humboldt[c]	Seedco[c]
Infrastructure and community services	SMALL except for MODERATE traffic impacts on area highways, MODERATE housing impacts in the Borough of Berwick, and MODERATE student impacts on the Berwick Area School District	SMALL except for MODERATE traffic impacts on area highways	SMALL except for MODERATE traffic impacts on area highways and MODERATE student impacts on the Hazleton Area School District	SMALL except for MODERATE traffic impacts on area highways and MODERATE student impacts on the Shamokin Area School District and the Mount Carmel Area School District
Environmental Justice[d]	NONE	NONE	NONE	NONE
Historic and Cultural Resources	SMALL	MODERATE to LARGE	SMALL	MODERATE to LARGE
Air Quality	SMALL for criteria pollutants to MODERATE for GHG emissions	SMALL for criteria pollutants to MODERATE for GHG emissions	SMALL for criteria pollutants to MODERATE for GHG emissions	SMALL for criteria pollutants to MODERATE for GHG emissions
Nonradiological Health	SMALL	SMALL	SMALL	SMALL
Radiological Health	SMALL	SMALL	SMALL	SMALL
Postulated Accidents	SMALL	SMALL	SMALL	SMALL

(a) Ranges indicate differences in counties.
(b) Cumulative impact determinations taken from Table 7-3 in the EIS.
(c) Cumulative impact determinations taken from Table 9-17 in the EIS.
(d) Refers to disproportionately high and adverse environmental or health impacts on any identified minority or low-income populations in the region.

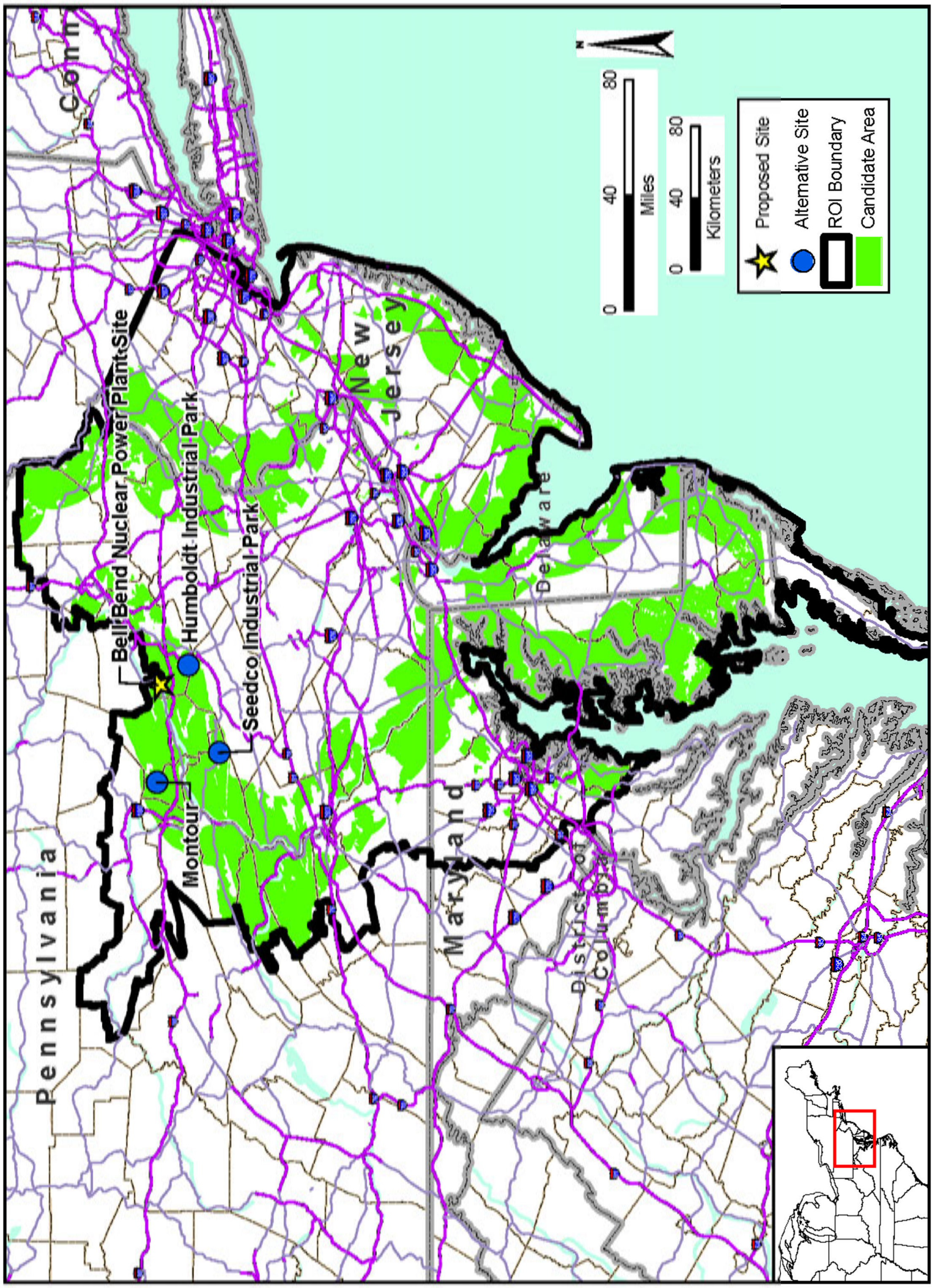

Figure ES-2. Location of Sites Considered as Alternatives to the BBNPP Site

Table ES-3 provides a summary of the cumulative impacts for the proposed and alternative sites. The NRC staff concluded that all of the sites were generally comparable, and it would be difficult to state that one site is preferable to another from an environmental perspective. In such a case, the proposed site prevails because none of the alternatives is clearly environmentally preferable.

Table ES-4 provides a summary of the EIS-derived impacts for a new nuclear power plant in comparison with the energy alternatives. The NRC staff concluded that none of the viable energy alternatives is clearly preferable to construction of a new baseload nuclear power-generating plant located within PPL's Region of Interest.

Table ES-4. Comparison of Environmental Impacts of a New Nuclear Power Plant and Energy Alternatives

Impact Category	Nuclear	Coal[(a)]	Natural Gas[(a)]	Combination of Alternatives[(a)]
Land Use	SMALL	LARGE	SMALL	MODERATE
Air Quality	SMALL for criteria pollutants SMALL incremental contribution to GHG emissions from BBNPP	MODERATE for criteria pollutants and for GHG emissions	SMALL for criteria pollutants MODERATE for GHG emissions	SMALL for criteria pollutants MODERATE for GHG emissions
Water Use and Quality	SMALL	SMALL	SMALL	SMALL
Ecology	MODERATE	SMALL to MODERATE	SMALL	SMALL to MODERATE
Waste Management	SMALL	MODERATE	SMALL	SMALL
Socioeconomics (except Taxes and Economy)	SMALL to MODERATE Adverse	SMALL to MODERATE Adverse	SMALL Adverse	SMALL Adverse
Socioeconomics (Taxes and Economy)	MODERATE Beneficial	MODERATE Beneficial	MODERATE Beneficial	MODERATE Beneficial
Human Health	SMALL	SMALL	SMALL	SMALL
Historic and Cultural Resources	SMALL	SMALL	SMALL	SMALL
Environmental Justice	NONE	NONE	NONE	NONE

(a) Impacts taken from Table 9-4 in the EIS. These conclusions for energy alternatives should be compared to NRC-authorized activities reflected in Chapters 4, 5, and Sections 6.1, and 6.2.

The NRC staff considered various alternative systems designs, including seven alternative heat-dissipation systems and multiple alternative intake, discharge, and water-supply systems. The review team identified no alternatives that were environmentally preferable to the proposed BBNPP systems design.

Benefits and Costs

The review team compiled and compared the pertinent analytical conclusions reached in the EIS. It gathered all of the expected impacts from building and operating the proposed BBNPP and aggregated them into two final categories: (1) expected environmental costs and

(2) expected benefits to be derived from approval of the proposed action. Although the analysis in Section 10.6 is conceptually similar to a purely economic benefit-cost analysis, which determines the net present dollar value of a given project, the intent of the section is to identify potential societal benefits of the proposed activities and compare them to the potential internal (i.e., private) and external (i.e., societal) costs of the proposed activities. In general, the purpose is to inform the COL process by gathering and reviewing information that demonstrates the likelihood that the benefits of the proposed activities outweigh the aggregate costs.

On the basis of the assessments in this EIS, the building and operation of the proposed BBNPP, with mitigation measures identified by the review team, would accrue benefits that most likely would outweigh the economic, environmental, and social costs. For the NRC-proposed action (i.e., NRC-authorized construction and operation), the accrued benefits would also outweigh the costs of preconstruction, construction, and operation of the proposed BBNPP.

Public Involvement

A 60-day scoping period was held from January 6, 2009 through March 9, 2009. On January 22, 2009, the NRC held two public scoping meetings in Berwick, Pennsylvania. In addition, a supplemental scoping period specific to the relocated power-block footprint was held from June 15, 2012 through July 16, 2012. The review team received oral comments during the public meetings and a total of 15 e-mails and 10 letters from both scoping periods on topics such as surface-water hydrology, ecology, socioeconomics, uranium fuel cycle, energy alternatives, and benefit-cost balance.

In addition, during the 75-day comment period on the draft EIS, the review team held public meetings in Bloomsburg, Pennsylvania, on June 4, 2015. Four people provided oral comments at the public meetings and 12 correspondence letters were received during the comment period.

Recommendation

The NRC's recommendation to the Commission related to the environmental aspects of the proposed action is that the COL should be issued.

This recommendation is based on the following:

- the application, including the ER submitted by PPL
- consultation with Federal, State, Tribal, and local agencies
- site audits and alternative site audits
- consideration of public comments received during scoping
- the review team's independent review and assessment summarized in this EIS.

The NRC's determination is independent of the USACE's determination of whether to issue, deny, or issue with modifications the DA permit application for the BBNPP. The USACE will conclude its Clean Water Act Section 404(b)(1) Guidelines and public interest analyses in its Record of Decision.

ABBREVIATIONS AND ACRONYMS

7Q10	7-day average low flow that occurs on average once every 10 years
A.M.	ante meridian
ac	acre(s)
ac-ft	acre-feet
ACHP	Advisory Council on Historic Preservation
ACS	American Community Survey
AEC	U.S. Atomic Energy Commission
ALARA	as low as reasonably achievable
ANS	American Nuclear Society
ANSI	American national Standards Institute
APE	Area of Potential Effect
AREVA	AREVA NP, Inc.
AVP	Wilkes-Barre/Scranton International Airport
BACT	best available control technology (
BAQ	Bureau of Air Quality
BBNPP	Bell Bend Nuclear Power Plant
BBS	(North American) Breeding Bird Survey
BEA	U.S. Bureau of Economic Analysis
BMP	best management practices
°C	degrees Celsius
C-1	Conservation District (zoning designation)
CAES	compressed air energy storage
CCR	coal combustion residuals
CAIR	Clean Air Interstate Rule
CDF	core damage frequency
CED	Commission on Economic Development
CFR	*Code of Federal Regulations*
CGT	combustion gas turbine
Ci	curie(s)
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
COL	combined construction permit and operating license
CORMIX	Cornell Mixing Zone Expert System (modeling software)
cm	centimeter(s)
CRGIS	Cultural Resources Geographic Information System
CUMP	Consumptive-Use Mitigation Plan

CWA	Clean Water Act
CWS	circulating-water system
d	day(s)
dB	decibel(s)
dBA	decibels on the A-weighted scale
DBA	design basis accident
DBH	diameter at breast height
DECOM	(GEIS) Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors
DEIS	draft environmental impact statement
DCD	design control document
DOE	U.S. Department of Energy
DOI	U.S. Department of the Interior
DOT	U.S. Department of Transportation
DRBC	Delaware River Basin Commission
EAB	exclusion area boundary
EDG	emergency diesel generators
EIA	Energy Information Agency
EIS	environmental impact statement
EIT	earned income tax
EJ	environmental justice
EMA	Emergency Management Agency
EMF	electromagnetic fields
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
EPZ	emergency planning zone
ER	environmental report
ESE	east-southeast
ESRP	Environmental Standard Review Plan
ESWEMS	essential service water emergency makeup system
ESWS	essential service water system
FB	future build
FE	Federally endangered
FERC	Federal Energy Regulatory Commission
FNB	future no build
fps	foot(feet) per second
FSAR	Final Safety Analysis Report
ft	foot(feet)
ft/s	foot(feet) per second

FT	Federally threatened
FWS	U.S. Fish and Wildlife Service
FY	fiscal year
µg	microgram(s)
GAI	GAI Consultants, Inc.
GEIS	generic environmental impact statement
GHG	greenhouse gas
gpd	gallons per day
gpm	gallons per minute
GW	gigawatt
HLW	high-level waste
HOP	highway occupation permit
HUD	U.S. Department of Housing and Urban Development
hr	hour(s)
Hz	Hertz
I	(U.S.) Interstate
I-3	Special Industrial District (zoning designation)
IAEA	International Atomic Energy Agency
IBA	Important Bird Area
IBCF	Indiana Bat Conservation Fund
ICPG	(FWS) Interim Conference and Planning Guidance
ICRP	International Commission on Radiological Protection
IGCC	integrated gasification combined-cycle
in.	inch(es)
ISFSI	Independent Spent Fuel Storage Installation
kg/ha/mo	kilograms per hectare per month
Kh	horizontal hydraulic conductivity
KLD	KLD Associates, Inc. or KLD Engineering, P.C.
km	kilometer(s)
kV	kilovolt(s)
L_{90}	sound level exceeded 90 percent of the time (the residual sound level or background level)
L	liter(s)
lb	pound(s)
LEDPA	least environmentally damaging practicable alternative
L_{dn}	day-night average sound level
L_{eq}	equivalent continuous sound level
LLRWHF	Low Level Radioactive Waste Handling Facility

LLW	low-level waste
LOS	level of service
LPZ	low-population zone
LRF	large release frequencies
LST	local services tax
mA	milliampere(s)
MACCS	MELCOR Accident Consequences Code System
mCi	millicurie(s)
MEI	maximally exposed individual
mg	milligram(s)
Mgd	million gallons per day
mi	mile(s)
MMBtu	million British thermal units
MOA	Memorandum of Agreement
mph	mile(s) per hour
mrem	millirem
MSA	Metropolitan Statistical Area
MSES	Montour Steam Electric Station
msl	mean sea level
MT	metric ton(s)
MTU	metric ton(nes) uranium
NAAQS	National Ambient Air Quality Standard
NAVD	North American Vertical Datum
NBSR	North Branch Susquehanna River
NCRP	National Council on Radiation Protection and Measurements
NEPA	National Environmental Policy Act of 1969
NERC	North American Electric Reliability Corporation
NESC	National Electrical Safety Code
NGCC	natural-gas combined-cycle
NHPA	National Historic Preservation Act
NLEB	northern long-eared bat
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NRHP	National Register of Historic Places
NY	New York
NYDEC	New York State Department of Environmental Conservation
NYNHP	New York Natural Heritage Program

O_3	ozone
ODCM	Offsite Dose Calculation Manual
ODNR	Ohio Department of Natural Resources Division of Wildlife
OSHA	Occupational Safety and Health Administration
P.M.	post meridian
PA	Pennsylvania
PADEP	Pennsylvania Department of Environmental Protection
PADLI	Pennsylvania Department of Labor and Industry
PaGWIS	Pennsylvania Groundwater Information System
PAWC	Pennsylvania-American Water Company
Pb	lead
PBAPS	Peach Bottom Atomic Power Station
PCB	polychlorinated biphenyl
PCSM	Post-Construction Stormwater Management
PDCNR	Pennsylvania Department of Conservation and Natural Resources
PennDOT	Pennsylvania Department of Transportation
PE	Proposed Federally endangered
PEM	palustrine forested (wetland)
PFBC	Pennsylvania Fish and Boat Commission
PFO	palustrine forested (wetland)
PGC	Pennsylvania Game Commission
PHMC	Pennsylvania Historical and Museum Commission
PJM	Pennsylvania, New Jersey, Maryland Interconnection, LLC
PM_{10}	particulate matter smaller than 10 micrometers in size
PM	particulate matter
$PM_{2.5}$	particulate matter smaller than 2.5 micrometers in size
PNHP	Pennsylvania Natural Heritage Program
PNNL	Pacific Northwest National Laboratory
PPL	Pennsylvania Power & Light
PPL Bell Bend, LLC	Pennsylvania Power & Light Bell Bend, LLC
PPUC	Pennsylvania Public Utility Commission,
PRA	probabilistic risk assessment
PRT	potential roost tree
PSS	palustrine scrub-shrub (wetland)
RAI	Request(s) for Additional Information
RCRA	Resource, Conservation, and Recovery Act
REMP	radiological environmental monitoring program
RFC	ReliabilityFirst Corporation
RFI	request for information
RG	Regulatory Guide

RHAA	Rivers and Harbors Appropriation Act of 1899
RIMS II	Regional Input-Output Modeling System
ROI	region of interest
ROW	right(s)-of-way
RPS	Renewables Portfolio Standard
RV	recreational vehicle
Ryr	reactor year
μS	microsievert(s)
SACTI	Seasonal and Annual Cooling Tower Impacts
SAMA	severe accident mitigation alternative
SAMDA	severe accident mitigation design alternative
SBO	Station Blackout
SE	State endangered
sec	second(s)
SFY	State fiscal year
SHPO	State Historic Preservation Office (or Officer)
SIP	State Implementation Plan
SO_2	sulfur dioxide
SR	State Route
SRBC	Susquehanna River Basin Commission
SREP	Susquehanna Riverlands Environmental Preserve
SSES	Susquehanna Steam Electric Station
SWPPP	stormwater pollution prevention plan
T	ton(s)
TEDE	total effective dose equivalent
TIS	traffic impact study
TLD	thermoluminescent dosimeter
TMI	Three Mile Island
TRAGIS	Transportation Routing Analysis Geographic Information System
TWh	terawatt-hour(s)
U.S. EPR	U.S. Evolutionary Power Reactor
U.S.C	United States Code
US 11	U.S. Highway 11
USACE	U.S. Army Corps of Engineers
USCB	U.S. Census Bureau
USGS	U.S. Geological Survey
WNS	White-Nose Syndrome
WSW	west-southwest

yd^3	cubic yard(s)
yr	year

9.0 ENVIRONMENTAL IMPACTS OF ALTERNATIVES

This chapter describes alternatives to the proposed U.S. Nuclear Regulatory Commission's (NRC's) action for a combined construction permit and operating license (COL or combined license) and the U.S. Army Corps of Engineers' (USACE's) action for a Department of Army Individual Permit application and discusses the environmental impacts of those alternatives. Section 9.1 discusses the no-action alternative. Section 9.2 addresses alternative energy sources. Section 9.3 reviews PPL Bell Bend, LLC's (PPL's) proposed Bell Bend Nuclear Power Plant (BBNPP) project; its region of interest (ROI), as discussed in its environmental report (ER; (PPL Bell Bend 2013-TN3377); and its site-selection process, and summarizes and compares the environmental impacts for the proposed site and alternative sites. PPL notified the NRC of changes in its power generation business by letter dated May 12, 2015 (PPL Bell Bend 2015-TN4379). PPL Bell Bend, LLC was renamed Bell Bend, LLC, and Bell Bend, LLC became a generation affiliate of Talen Energy Corporation (Talen Energy). The transaction became official on June 1, 2015. For purposes of this review, the abbreviation "PPL" will still be used to indicate the applicant. Bell Bend, LLC, under Talen Energy, is the applicant.

PPL selected the eastern part of the PJM Interconnection, LLC (PJM) classic market area, an ROI that includes eastern parts of Pennsylvania, Virginia, and Maryland and all of Delaware and New Jersey (PPL Bell Bend 2013-TN3377) as shown in Figure 9-1. Section 9.4 examines plant design alternatives, and Section 9.5 presents the USACE's evaluation of onsite alternatives and alternative sites.

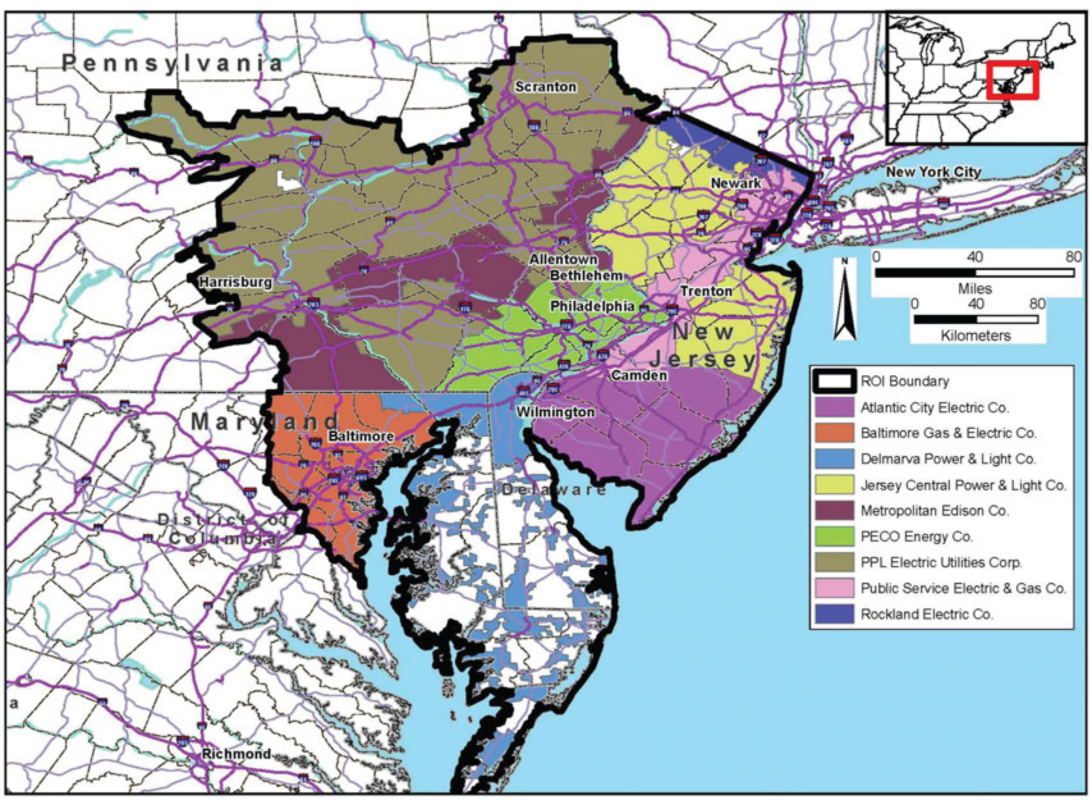

Figure 9-1. Region of Interest (PPL Bell Bend 2013-TN3377)

The need to compare the proposed action with alternatives arises from the requirement in Section 102(2)(c)(iii) of the National Environmental Policy Act of 1969, as amended, (NEPA) (42 U.S.C. § 4321 et seq.-TN661) that environmental impact statements (EISs) include an analysis of alternatives to the proposed action. The NRC implements this comparison through its regulations in Title 10 of the *Code of Federal Regulations* Part 51 (10 CFR Part 51-TN250) and NUREG–1555, *Standard Review Plans for Environmental Reviews for Nuclear Power Plants: Environmental Standard Review Plan* (ESRP) (NRC 2000-TN614). The environmental impacts of the alternatives are evaluated using the NRC's three-level standard of significance—SMALL, MODERATE, or LARGE—that were developed using Council on Environmental Quality guidelines (40 CFR 1508.27 [TN428]) (CEQ 2005-TN1394) and set forth in the footnotes to Table B-1 of 10 CFR Part 51, Subpart A, Appendix B (TN250). The issues evaluated in this chapter are the same as those addressed in the *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, NUREG–1437, Volumes 1, 2, and 3 (GEIS) (NRC 2013-TN2654 and/or NRC 1996-TN288). The NRC issues a site-specific supplemental EIS, adding to determinations already made in NUREG–1437, for each proposed action of license renewal for a nuclear plant. Although NUREG–1437 was developed for license renewal, it provides useful information for this review and is referenced throughout this chapter. Additional guidance on conducting environmental reviews is provided in *Interim Staff Guidance on Environmental Issues Associated with New Reactors* (NRC 2014-TN3767).

As part of the evaluation of the permit application submitted to the USACE, which is subject to Section 404 of the Clean Water Act (33 U.S.C. § 1344 et seq.-TN1019) and Section 10 of the Rivers and Harbors Appropriation Act (33 U.S.C. § 403 et seq.-TN660), the USACE must define the overall project purpose in addition to the basic project purpose. The overall project purpose establishes the scope of the alternatives analysis and is used for evaluating practicable alternatives under the Environmental Protection Agency's (EPA's) Clean Water Act 404(b)(1) Guidelines (40 CFR Part 230 -TN427) (404 Guidelines). In accordance with the 404 Guidelines, the overall project purpose must be specific enough to define the applicant's needs, but not so narrow and restrictive as to preclude a proper evaluation of alternatives. The USACE is responsible for controlling every aspect of the 404 Guidelines analysis. In this regard, defining the overall project purpose is the sole responsibility of the USACE. While generally focusing on the applicant's statement, the USACE will, in all cases, exercise independent judgment in defining the purpose and need for the project from both the applicant's alternatives and the public's perspective (33 CFR Part 325 Appendix B (9)(c)(4) [TN425]).

Section 230.10(a) of the 404 Guidelines requires that "… no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences" (TN427). Section 230.10(a)(2) of the 404 Guidelines states that "… an alternative is practicable if it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of the overall project purposes. If it is otherwise a practicable alternative, an area not presently owned by the applicant that could reasonably be obtained, utilized, expanded, or managed in order to fulfill the basic purpose of the proposed activity may be considered" (TN427). Thus, this analysis is necessary to determine which alternative is the least environmentally damaging practicable alternative (LEDPA) that meets the project purpose and need. The applicant's onsite and offsite

LEDPA analysis is included in Appendix J. The USACE will make its own independent LEDPA determination as part of its permit decision, and that analysis will be included in the Final EIS.

Where the activity associated with a discharge is proposed for a special aquatic site (as defined in 40 CFR Part 230, Subpart E [TN427]), and does not require access or proximity to or siting in these types of areas to fulfill its basic project purpose (i.e., the project is not "water dependent"), practicable alternatives that avoid special aquatic sites are presumed to be available, unless clearly demonstrated otherwise (40 CFR 230.10(a)(3) [TN427]). See Section 1.3.2 for the USACE determination of the basic purpose and overall purpose to be used for the USACE alternatives analysis for this project.

Even if an applicant's preferred alternative is determined to be the LEDPA that meets the project purpose, the USACE must determine whether the LEDPA is contrary to the public interest. The USACE Public Interest Review, described at 33 CFR 320.4 (TN424), directs the USACE to consider several factors in a balancing process. A practicable alternative that is not the LEDPA will not receive a permit, nor will a permit be issued for an activity that is determined to be contrary to the public interest. In considering both the LEDPA and the Public Interest Review, the USACE must consider compliance with other applicable substantive laws such as the Endangered Species Act of 1973, as amended (16 U.S.C. §1531 et seq.-TN1010) and the National Historic Preservation Act of 1966, as amended (NHPA; 54 U.S.C. § 300101 et seq. -TN4157) and consult with other Federal agencies. The USACE also must follow procedural laws (e.g., NEPA [42 U.S.C. § 4321 et seq.-TN661] and other applicable laws described in 33 CFR 320.3 [TN424]).

Because the USACE is a cooperating agency with the NRC in this environmental review and for development of this EIS, both the USACE and the NRC have provided information to the maximum extent practicable in this EIS that the USACE will use in its evaluation of the project, including the evaluation of alternatives. While the USACE concurs as part of the review team with the qualitative designation of impact levels for terrestrial or aquatic resource areas for this EIS, insofar as waters of the United States are concerned, the USACE must conduct a quantitative comparison of impacts on waters of the United States as part of the LEDPA analysis.

The NRC's determination as to whether an alternative site is environmentally preferable to the proposed BBNPP site is independent of the USACE's determination of a LEDPA pursuant to the 404 Guidelines at 40 CFR Part 230 (TN427). The USACE will conclude its analysis of both offsite and onsite alternatives in its Record of Decision.

9.1 No-Action Alternative

For purposes of an application for a COL, the no-action alternative refers to a scenario in which the NRC would deny the COL requested by PPL. Likewise, the USACE could also take no action as a result of the applicant electing to modify the proposal to eliminate work under the jurisdiction of the USACE or by the denial of the permit. Upon such a denial by the NRC, the construction and operation of a new nuclear power plant at the BBNPP site in accordance with 10 CFR Part 52 (TN251) would not occur and the predicted environmental impacts associated with the project would not occur. Preconstruction impacts associated with activities not within the definition of construction in 10 CFR 50.10(a) (TN249) and 51.4 (TN250) may occur. The no-action alternative would result in the proposed facility not being built. If no other power plant were built or electrical power supply strategy implemented to take its place, the benefits of the additional electrical capacity and electricity generation to be provided by the project would not occur. If no additional measures (e.g., conservation, importing power, restarting retired power plants, and/or extending the life of existing power plants) were enacted to realize the amount of electrical capacity that would otherwise be required for power in the ROI, then the need for baseload power, discussed in Chapter 8 of this EIS, would not be met. Therefore, the purpose and need of this proposed project would not be satisfied if the no-action alternative was chosen, and the need for power was not met by other means.

If other generating sources were built either at another site or using a different energy source, the environmental impacts associated with these other sources would eventually occur. As discussed in Chapter 8, there is a demonstrated need for power. This needed power may be provided and supported through a number of alternatives that are discussed in Sections 9.2 and 9.3. Therefore, this no-action section does not include a discussion of other energy alternatives (discussed in Section 9.2) and alternative sites (discussed in Section 9.3) that could meet the need for power.

9.2 Energy Alternatives

The purpose and need for the proposed project identified in Section 1.3.1 of this EIS is to generate1,600 MW(e) of baseload power for use by the applicant and for possible future sale on the wholesale market. This section examines the potential environmental impacts associated with alternatives to construction of a new baseload nuclear generating facility. Section 9.2.1 discusses energy alternatives not requiring new generating capacity. Section 9.2.2 discusses energy alternatives requiring new generating capacity that appear capable of meeting the need for power as a discrete energy source. Other alternatives that have demonstrated commercial acceptance but may be limited in application, total capacity, or technical feasibility when analyzed based on the need to supply reliable, baseload capacity are discussed in Section 9.2.3. A combination of alternatives is discussed in Section 9.2.4. Section 9.2.5 compares the environmental impacts from new nuclear, coal-fired, and natural-gas-fired generating units, as well as a combination of energy sources, at the BBNPP site.

For analysis of energy alternatives, PPL assumed a target installed capacity of 1,600 MW(e) electrical output (PPL Bell Bend 2013-TN3377). The review team (composed of NRC staff, its contractor staff, and USACE staff) also used this level of output in analyzing energy alternatives.

The review team's analysis is based on an in-service date of 2025, which is based on the applicant's response to NRC's request for additional information about the BBNPP schedule (PPL Bell Bend 2014-TN3625). Even if the actual in-service date were to slip by a few years, the review team would not expect such a change to affect the overall conclusions regarding energy alternatives for two reasons. First, the projections by PPL and by the U.S. Department of Energy, Energy Information Administration (DOE/EIA), that have been used by the review team in its analyses do not change appreciably in the later years and are generally consistent with the data used for 2025. Second, the environmental impacts of the feasible alternatives are not likely to change appreciably, and so the conclusions by the review team regarding environmental preferability are unlikely to change.

9.2.1 Alternatives not Requiring New Generating Capacity

Four alternatives to the proposed action that do not require PPL to construct new generating capacity are to

- implement conservation or demand-side management programs
- reactivate retired plants within the power system
- extend the service life of existing plants within the power system
- purchase power from other utilities or power generators.

These four alternatives are discussed in greater detail in the following sections.

9.2.1.1 Energy Efficiency and Demand-Side Management

As noted previously, all of Delaware and New Jersey and parts of Maryland, Virginia, and Pennsylvania are included as the ROI/primary market area for the proposed BBNPP unit (PPL Bell Bend 2013-TN3377). In these states, conservation programs are generally comprehensive and complementary and focus on providing technical and financial assistance to homeowners, businesses, schools, and government organizations. Improved energy efficiency and demand-side management strategies can potentially cost less than construction of new generation and provide a hedge against market, fuel, and environmental risks. The need-for-power discussion in Chapter 8 takes existing conservation and demand-side management programs into account. In Chapter 8, the review team concludes that there is a justified need for power in the BBNPP market area even with the implementation of conservation and demand-side management programs discussed in Section 8.1.2.2.

9.2.1.2 Reactivating Retired Power Plants or Extending Operating Life

Older fossil-fueled plants, which are predominately coal-fired and natural-gas-fired plants, are likely to need refurbishing to extend plant life (the proposed action assumes a minimum operating period of 40 years). Further, meeting current environmental requirements would also be costly. Typically, such plants would be old enough that, as refurbished plants, they would be viewed as new sources, subject to the current-day complement of regulatory controls on air emissions and waste management. In its COL application, PPL identified 59 deactivated generators, including two PPL coal units within the PJM service area (PPL Bell Bend 2013-TN3377). No individual unit would be able to meet the proposed 1,600-MW(e) output of the proposed BBNPP unit and the review team concluded that it would be unlikely that a combination of retired units could be developed to meet this output and successfully meet applicable environmental requirements. Chapter 8 provides further discussion of the market challenges facing existing fossil generation in the PJM territory.

The environmental impacts of any reactivation scenario would be bounded by the impacts associated with coal- and natural-gas-fired alternatives (Section 9.2.2), which the review team concludes are not environmentally preferable to the proposed action (Section 9.2.5). Given both of these refurbishment costs and the environmental impacts of operating such facilities, the review team concludes that reactivating retired generating plants would not be a reasonable alternative to the proposed action—providing new baseload power-generation capacity with a new nuclear power plant.

9.2.1.3 Purchased Power

If power to replace the capacity of the proposed new nuclear power plant were to be purchased from sources within the United States or from a foreign country, the generating technology likely would be one that could provide baseload power (e.g., coal, natural gas, or nuclear, as discussed later in this section), as previously described in the GEIS (NUREG–1437 [NRC 2013-TN2654]). The NUREG–1437 description of the environmental impacts of other technologies is representative of the impacts associated with the construction and operation of a new generating unit at the BBNPP site. Under the purchased power alternative, the environmental impacts of power production would still occur but they would occur elsewhere within the region or nation, or in another country. Also, because of existing constraints on west-to-east power transmission within the PJM service area, any such purchases would likely also require the addition of high-voltage transmission lines (PPL Bell Bend 2013-TN3377). The environmental impacts of coal-fired and natural-gas-fired plants are discussed in Section 9.2.2.

Based on the preceding discussion, the review team concludes that the options of purchasing electric power from other suppliers, reactivating retired power plants, extending the operating life of existing power plants, and conservation and demand-side programs are not reasonable alternatives to providing new baseload power-generation capacity.

9.2.2 Feasible Discrete New Generating Alternatives

Consistent with the NRC’s evaluation of alternatives to operating license renewal for nuclear power plants, a reasonable set of energy alternatives to the construction and operation of a new nuclear power plant for baseload power generation at BBNPP site should be limited to analysis of discrete power-generation sources, or a combination of sources, that are capable of generating baseload power and are developed, proven, and available in the relevant region (NRC 2013-TN2654).

Each year, the DOE’s EIA issues an Annual Energy Outlook. In its updated Annual Energy Outlook 2014, the EIA’s reference case projects that total electric generating capacity additions between 2011 and 2040 will add 351 GW of new generating capacity using the following fuels (in GW and the approximate percentages of the total increase): natural gas(1) (256 GW/73 percent), renewables (84 GW/24 percent), nuclear (11 GW/3 percent), and coal (4 GW/1 percent) (DOE/EIA 2014-TN3585). The EIA also predicts that total coal capacity will decrease by 53.8 GW by 2040 (DOE/EIA 2014-TN3585). The EIA projection includes baseload, intermittent, and peaking units and is based on the assumption that providers of new generating capacity would seek to minimize cost while meeting applicable environmental requirements. The three primary energy sources for generating electric power in the United States are coal, natural gas, and nuclear energy (DOE/EIA 2014-TN3585). Coal-fired plants are the primary source of baseload generation in the United States (DOE/EIA 2014-TN3585). Natural-gas combined-cycle generation plants are often used as intermediate generation sources but are also used as baseload generation sources (SSI 2010-TN1405).

---

(1) Numbers include the projections for “combined cycle,” “combustion turbine/diesel,” and “distributed generation (natural gas).”

The discussions in Sections 9.2.2.1 and 9.2.2.2 are limited to a reasonable range of the individual energy alternatives that appear to be viable for new baseload generation: coal-fired and natural-gas combined-cycle generation. The impacts discussed in these sections are estimates based on current technology.

Section 9.2.3 addresses alternative generation technologies that have demonstrated commercial acceptance but may be limited in application, total capacity, or technical feasibility when based on the need to supply reliable, baseload capacity. Section 9.2.4 discusses a combination of energy sources that could be viable for new baseload generation. Section 9.2.5 compares the viable energy alternatives to the proposed BBNPP unit.

The review team assumed that new generation capacity would be located at the BBNPP site for the coal- and natural-gas-fired alternatives, would use the same type of cooling as the proposed BBNPP unit (i.e., closed-cycle cooling), and no new offsite transmission-line corridors would be needed, which is consistent with the BBNPP COL application.

9.2.2.1 Coal-Fired Power Generation

The environmental impacts from coal-fired generation alternatives were evaluated in the GEIS (NRC 1996-TN288), and Susquehanna Steam Electric Station (SSES) Units 1 and 2 License Renewal Final EIS (NRC 2009-TN1725). It was concluded that construction impacts for a coal-fired generation could be substantial, in part because of the large land area required. Based on NUREG–1437 (NRC 1996-TN288), at least 2,720 ac of land would need to be converted to industrial use on the BBNPP site for the power block, infrastructure and support facilities, coal and limestone storage and handling, reclaimed wastewater line, and landfill disposal of ash and scrubber sludge. This land requirement is approximately three times the land area of the 975 ac BBNPP site and would require expansion into adjacent developed and undeveloped areas. The team's estimates of coal consumption, coal-combustion technology, air emissions, and waste products are based on the EPA's Compilation of Air Pollutant Emission Factors document (EPA AP-42), Section 1.1, Bituminous and Subbituminous Coal Combustion (EPA 2011-TN1088). The plant was assumed to have an operating life of 40 years.

A 1,600-MW(e) coal-fired plant sited at the BBNPP site would consume approximately 4.5 million tons of coal per year (NETL 2010-TN1423). It is assumed that coal and lime (calcium oxide or calcium hydroxide) or limestone (calcium carbonate) for a coal-fired plant would likely be delivered to the BBNPP site by rail. There is direct rail access into the BBNPP site. PPL assumed that the plant would burn bituminous coal (PPL Bell Bend 2013-TN3377). Lime or limestone, used in the scrubbing process for control of sulfur dioxide (SO_2) emissions, would be injected as a slurry into the hot effluent combustion gases to remove entrained SO_2. The lime-based scrubbing solution reacts with SO_2 to form calcium sulfite, which precipitates and is removed from the process as sludge. Approximately 450,000 T/yr of limestone would be needed for flue gas desulfurization (NETL 2010-TN1423). On any given day, up to four train trips may occur on the rail spur as trains come and go. Following combustion, ash for beneficial reuse would likely leave the site by train, as well. Occasional deliveries of lime would also occur by rail (NRC 2009-TN1725).

The review team also considered an integrated gasification combined-cycle (IGCC) coal-fired plant. IGCC is an emerging technology for generating electricity with coal that combines modern coal gasification technology with both gas-turbine and steam-turbine power generation. The technology is cleaner than conventional pulverized coal plants because major pollutants can be removed from the gas stream before combustion. The IGCC alternative also generates less solid waste than the pulverized coal-fired alternative. The largest solid-waste stream produced by IGCC installations is slag—a black, glassy, sand-like material that is potentially a marketable byproduct. The other large-volume byproduct produced by IGCC plants is sulfur, which is extracted during the gasification process and can be marketed rather than placed in a landfill. IGCC units do not produce ash or scrubber wastes.

Although IGCC has the advantages noted above, the review team concludes that, at present, IGCC is not a reasonable alternative to a 1,600-MW(e) nuclear power-generation facility for the following reasons: (1) IGCC plants are more expensive than comparable pulverized coal plants (NETL 2010-TN1423); (2) the system availability of existing IGCC plants has been lower than pulverized coal plants (NETL 2010-TN1423); (3) the existing IGCC plants in the United States have considerably smaller capacity than the assumed 1,600-MW(e) nuclear plant;[(2)] and (4) refined engineering has indicated that non-carbon emissions and plant efficiency would not be significantly better than supercritical steam electric plants (NPCC 2010-TN2107). For these reasons, IGCC plants are not considered further in this EIS.

Air Quality

The impacts on air quality from coal-fired generation would vary considerably from those of nuclear power generation because of emissions of SO_2, nitrogen oxides (NO_x), carbon monoxide (CO), particulate matter (PM), volatile organic compounds, and hazardous air pollutants such as mercury and lead.

The staff estimated air emissions for a coal-fired generation facility based on the emission factors contained in EPA document, AP-42 (EPA 2014-TN4033). The estimates of emissions are based on “as fired” and controlled conditions using both combustion and post-combustion technologies to reduce criteria pollutants. Emissions estimates are not necessarily representative of what would be permitted. Luzerne County is a maintenance area for the 8-hour ozone National Ambient Air Quality Standards (NAAQSs), and the emission estimates presented below exceed the threshold values in 40 CFR 93.153 for NO_x, an ozone precursor. Therefore, a new coal-fired plant having these emissions would qualify as a major source, and a Title V Operating Permit would need to be obtained.

A final air permit for building the coal-fired power plant would likely require the lowest achievable emission rate for ozone precursor emissions (i.e., NO_x), along with offsets and would likely require applicable best available control technologies (BACT) for other pollutants. As did PPL, the NRC staff assumed that a coal-fired generation facility would use bituminous coal fired in a

---

(2) The review team is aware that Duke Energy placed a 618-MW(e) IGCC plant into service in June 2013 (Duke 2013-TN2662) and that Mississippi Power has built an IGCC plant in Kemper County, Mississippi, with an output of 582 MW(e) and a planned commercial operations date in the first half of 2016 (MPC 2015-TN4155).

circulating fluidized bed combustor. The sulfur content of the coal was assumed to be 2 percent by weight. The staff independently calculated air emissions produced by a 1,600-MW(e) coal-fired facility to be as follows:

Air Pollutant Emissions	Tons per Year
Sulfur dioxide (SO_2)	6,906
Nitrogen dioxide (NO_2)	557
Carbon monoxide (CO)	4,010
Particulate matter (PM)	76
PM less than 10 µm (PM_{10})	55
Carbon dioxide equivalent (CO_2e)	12,275,662

The acid rain requirements of the Clean Air Act as amended (42 U.S.C. § 7401 et seq.-TN1141) capped the nation's SO_2 emissions from power plants. PPL would need to obtain sufficient pollution credits either from a set-aside pool or purchases on the open market to cover annual emissions from a coal-fired plant. A new coal-fired generation plant at the BBNPP site would likely need a prevention of significant deterioration (PSD) permit and an operating permit from the State of Pennsylvania. The plant would need to comply with the new source performance standards for such plants in 40 CFR Part 60, Subpart Da (TN1020). The standards establish emission limits for PM and opacity (40 CFR 60.42Da), SO_2 (40 CFR 60.43Da), NO_x (40 CFR 60.44Da), and mercury (40 CFR 60.45Da) (TN1020).

The coal-fired electric utility steam-generating units would be subject to EPA National Emission Standards for Hazardous Air Pollutants because they would qualify as a major source (40 CFR Part 63, Subpart B [TN1403]). The EPA determined that coal-fired and oil-fired electric utility steam-generating units are significant emitters of the following hazardous air pollutants: arsenic, beryllium, cadmium, chromium, dioxins, hydrogen chloride, hydrogen fluoride, lead, manganese, and mercury (65 FR 79825 -TN2536). The EPA concluded that mercury is the hazardous air pollutant of greatest concern and that (1) a link exists between coal combustion and mercury emissions, (2) electric utility steam-generating units are the largest domestic source of mercury emissions, and (3) certain segments of the U.S. population (e.g., the developing fetus and subsistence fish-eating populations) are believed to be at potential risk of adverse health effects resulting from mercury exposures caused by the consumption of contaminated fish (65 FR 79825 -TN2536). On March 28, 2013, the EPA finalized updates to emission standards, including mercury, for power plants under the Mercury and Air Toxics Standards (EPA 2013-TN2537). This rule became effective April 24, 2013 (78 FR 24073 -TN3051). However, the review team recognizes that the environmental impacts of air emissions from the coal-fired plant would be significantly greater than those from BBNPP, even after application of any new mercury emissions standards.

The EPA has various regulatory requirements for visibility protection in 40 CFR Part 51, Subpart P (TN1090), including a specific requirement for review of any new major stationary source in an area designated as being in attainment or unclassified for criteria pollutants under the Clean Air Act (40 CFR 51.307(a) [TN1090]). NAAQSs for criteria pollutants are specified in 40 CFR Part 50 (TN1089). Criteria pollutants under the Clean Air Act are lead, ozone, particulates, CO, NO_2, and SO_2. Ambient air-quality standards for criteria pollutants are in 40 CFR Part 50 (TN1089). As discussed in Section 2.9.2, the BBNPP site is in an area designated as being in attainment or unclassified for all criteria pollutants (40 CFR 81.339 [TN255]), and is considered a maintenance area for the 8-hour ozone NAAQS.

Section 169A of the Clean Air Act (42 U.S.C. § 7491 et seq. -TN4418) and the EPA's regulations (40 CFR Part 81 -TN255) establish a national goal of preventing future and remedying existing impairment of visibility in mandatory Class I Federal areas when impairment occurs because of air pollution resulting from human activities. In addition, EPA regulations provide that for each mandatory Class I Federal area located within a State, the State must establish goals that provide for reasonable progress toward achieving natural visibility conditions. The reasonable progress goals must provide for an improvement in visibility for those days on which visibility is most impaired over the period of the implementation plan and confirm no degradation in visibility for the least visibility-impaired days over the same period (40 CFR 51.308(d)(1) [TN1090]). If a new coal-fired power-generation station were located close to a mandatory Class I area, additional air pollution-control requirements could be imposed. There are no mandatory Class I Federal areas within Pennsylvania and the nearest area is 150 mi from the BBNPP site (PPL Bell Bend 2013-TN3377). Fugitive dust emissions from building activities would be mitigated using best management practices (BMPs). Such emissions would be temporary.

The coal-fired alternative plant would qualify as a major generator of greenhouse gases (GHGs) under the "Tailoring Rule" recently promulgated by the EPA (see 75 FR 31514-TN1404). Beginning January 2, 2011, permits issued to major sources of GHG under the PSD or Title V Federal permit programs must contain provisions requiring the use of BACT to limit the emissions of GHGs if those sources would be subject to PSD or Title V permitting requirements because of their non-GHG pollutant emission potentials and their estimated GHG emissions are at least 75,000 T/yr of CO_2e. Meeting permit limitations for GHG emissions may require installation of carbon capture and sequestration devices on any new coal-fired power plant, which could add substantial power penalties. On October 23, 2015, the EPA published its final rule for new source performance standards to limit CO_2 emissions from new coal-fired power plants (80 FR 64509 -TN4388). However, even with the application of this new standard, emissions from a coal-fired power plant would still be far greater than those from a comparably sized nuclear power plant. The relative efficiency penalty for adding CO_2 capture ranges from 21 to 29 percent on average, meaning that a new coal plant would have to be much larger than 1,600 MW(e) to provide a comparable amount of power to the BBNPP (NETL 2010-TN1423). In addition, once extracted, the CO_2 would have to be piped either to a permanent sequestration site, or for use in enhanced oil recovery. Regardless of end use of the CO_2, the construction of a CO_2 pipeline would have the potential to increase the impacts on, but not limited to, terrestrial and aquatic ecology, socioeconomics, and cultural and historic resources. Because the exact location of such sequestration is beyond the scope of this analysis the magnitude of the impacts could not be quantified by the review team. The review team concludes that the cumulative impacts of construction of both a coal-fired power plant and a CO_2 pipeline could increase the level of impacts. For example, SMALL ecological impacts from a coal plant alone may become MODERATE when combined with those of a CO_2 pipeline.

Historically, CO_2, an unavoidable byproduct of combustion of carbonaceous fuels, has not been regulated as a pollutant. However, regulations are now under development for CO_2 and other GHGs. In response to the Consolidated Appropriations Act, 2008 (Public Law 110-161, 121

Stat. 1844-TN1485), EPA promulgated final mandatory GHG reporting regulations in October 2009 that became effective in December 2009 (74 FR 56260-TN1024). The rules are primarily applicable to large-facility sources of CO_2e (those emitting 25,000 metric tons or more per year). New utility-scale coal-fired power plants would be subject to those regulations.

However, the review team recognizes that the environmental impacts of air emissions from the coal-fired plant would be significantly greater than those from BBNPP, even after application of any new GHG emissions standards.

Pennsylvania is one of 28 states in the eastern half of the United States in which stationary sources of criteria pollutants are subject to revised emission limits for SO_2 and NO_x under the Cross-State Air Pollution Rule (CSAPR). Pennsylvania stationary sources of SO_2 and NO_x would be subject to this rule, as well as complementary regulatory controls developed at the State level. On July 6, 2011, the EPA announced the finalization of the CSAPR, previously referred to as the Transport Rule) (EPA 2011-TN3962) as a response to previous court decisions and as a replacement of the EPA's 2005 Clean Air Interstate Rule. A number of court actions have impacted implementation of CSAPR, including an August 2012 D.C. Circuit decision vacating CSAPR. On April 29, 2014, the U.S. Supreme Court issued an opinion reversing the D.C. Circuit decision, and CSAPR went into effect January 1, 2015. CSAPR took effect starting January 1, 2015, for SO_2 and annual NO_x, and May 1, 2015, for ozone season NO_x (EPA 2015-TN4307). Fossil-fuel power plants in Pennsylvania would be subject to the CSAPR and would be required to reduce emissions of SO_2 and NO_x to help reduce downwind ambient concentrations of fine particulates ($PM_{2.5}$) and ozone. However, the review team recognizes that the environmental impacts of air emissions from the coal-fired plant would be significantly greater than those from BBNPP, even after application of the CSAPR, because the operational emissions from BBNPP would be much less than from a coal-fired plant even with the required reductions under CSAPR.

NUREG–1437 (NRC 2013-TN2654) indicates that air-quality impacts from a coal-fired power plant can be significant. NUREG–1437 also provides estimates of CO_2 and other emissions (NRC 2013-TN2654). Adverse human health effects, such as cancer and emphysema, have been associated with byproducts of coal combustion. Overall, the review team concludes that air-quality impacts from construction and operation of new coal-fired power generation at the BBNPP site, despite the availability of BACT, would be MODERATE.

Waste Management

Coal combustion generates waste in the form of ash, and equipment for controlling air pollution generates additional ash, spent selective catalytic reduction catalyst, and scrubber sludge. The review team estimates that the coal-fired plants would generate approximately 430,000 T/yr of ash (DOE/EIA 2009-TN1415). Significant quantities of the fly ash may be recycled for use in commodity products such as concrete, thus reducing the total landfill volume. PPL estimates that landfill disposal of the ash and scrubber sludge generated by a 1,600-MW(e) coal-fired plant over a 40-year plant life would require approximately 360 ac (PPL Bell Bend 2013-TN3377). The plant would generate approximately 110,000 T/yr of scrubber sludge (NRC 2009-TN1725).

Effective 6 months after publication of the final rule signed by the EPA Administrator on December 19, 2014, coal combustion residuals (CCR) from electric utilities will be regulated as solid waste under Subtitle D of the Resource Conservation and Recovery Act of 1976, as amended (RCRA) (42 U.S.C. § 6901 et seq.-TN1281). The minimum criteria for new CCR units include location restrictions; design and operating criteria; groundwater monitoring and corrective action; closure requirements and post closure care; and requirements for recordkeeping, notification, and Internet posting. Different criteria apply to landfills and surface impoundments. Any existing CCR units that do not meet the location restrictions or cannot meet the structural integrity criteria must close. Any surface impoundment without a liner that exceeds the groundwater protection standard for any constituent must either install a liner or close, with limited exceptions. Inactive CCR surface impoundments that still contain water and CCR must meet the new criteria or be closed and capped (80 FR 21301-TN4230).

Waste impacts on groundwater and surface water could extend beyond the operating life of the plant if leachate and runoff from the waste storage area occurs. Disposal of the waste could noticeably affect land use (because of the acreage needed for waste) and groundwater quality, but with appropriate management and monitoring, it would not destabilize any resources. After closure of the waste site and revegetation, the land could be available for other uses. Construction-related debris would be generated during plant construction activities, and would be disposed of in approved landfills.

For the reasons stated above, the review team concludes that the impacts from waste generated at a coal-fired plant would be MODERATE. The impacts would be clearly noticeable but would not destabilize any important resource.

Human Health

Adverse human health effects such as cancer and emphysema have been associated with the byproducts of coal combustion. Coal-fired power generation introduces worker risks from coal and limestone mining, worker and public risk from coal and lime/limestone transportation, worker and public risk from disposal of coal-combustion waste, and public risk from inhalation of stack emissions. In addition, the discharges of uranium and thorium from coal-fired plants can potentially produce radiological doses in excess of those arising from nuclear power plant operations (Gabbard 1993-TN1144).

Federal (i.e., EPA) and State regulatory agencies base air emission standards and requirements on human health impacts. These agencies also impose site-specific emission limits as needed to protect human health. Given the regulatory oversight exercised by the EPA and State agencies, the review team concludes that the human health impacts from inhaled toxins and criteria pollutants (including particulates and nitrogen oxides) generated from coal-fired generation would be SMALL. Furthermore, similar to the findings of the traffic accident analysis in Chapter 4 for a new nuclear plant, transportation of personnel and construction materials for a new coal-fired plant would result in minor impacts limited mainly to those from traffic associated with the construction workforce traveling to and from the BBNPP site.

Other Impacts

Based on the 1996 version of NUREG–1437 (NRC 1996-TN288), at least 2,720 ac of land would need to be converted to industrial use on and around the BBNPP site for the power block, infrastructure and support facilities, coal and limestone storage and handling, reclaimed wastewater line, and landfill disposal of ash and scrubber sludge. It is assumed that coal mining would occur at an undetermined offsite existing coal mining operation, but land-use changes would also occur if expansion of an existing mine or mines would be required to supply coal for the plant. In the 1996 version of NUREG–1437 (NRC 1996-TN288), the NRC staff estimated that approximately 22,000 ac would be needed for coal mining and waste disposal to support a 1,000-MW(e) coal-fired plant over its operating life (48,000 ac for a 2,200-MW(e) plant) (NRC 1996-TN288). Based on the amount of land affected for the site, mining, and waste disposal, the review team concludes that land-use impacts would be LARGE.

The amount of water used and the impacts on water use and quality from constructing and operating a coal-fired plant at the BBNPP site would be comparable to those associated with a new nuclear plant. The NRC staff assumes that a new facility would use steam cycle electrical generation with closed-cycle cooling (NRC 2009-TN1725). Water consumption due to evaporative cooling would also be comparable to that of a new nuclear power plant. Like a nuclear plant, all withdrawals and discharges would be from and to the Susquehanna River. Water quality would be affected by acids and mercury from air emissions from the coal-fired plant and drift of reclaimed wastewater from the cooling towers. Some of the emissions are regulated to minimize impacts. In NUREG-1437, the NRC staff determined that some erosion and sedimentation would likely occur during construction of new facilities (NRC 2013-TN2654). Coal plants require only relatively shallow excavations and foundations. Constructing the plant with stormwater and sediment discharged to cooling canals would ensure the impacts are minor. These impacts would be similar to those for a new nuclear plant. Overall, the review team concludes that the water-use and water-quality impacts would be SMALL.

The coal-fired power-generation alternative would introduce ecological impacts from construction and incremental impacts from operations. The types of impacts would be similar to those from the proposed action at the BBNPP site. The noticeable impacts would include conversion of wetland type, disturbance and loss of wetland area and function, disturbance and elimination of onsite streams, forest habitat loss and fragmentation, habitat loss for important species, and disruption and conversion of benthic habitats in the Susquehanna River. Similar types of impacts could occur at the sites used for coal and limestone mining but at a larger scale. Stack emissions and ash disposal could also affect aquatic and terrestrial resources, including important species. Because a coal-fired plant on the BBNPP site would require less water for cooling, impingement and entrainment of Susquehanna River biota would be less than at a nuclear plant and therefore SMALL. Overall, the review team concludes that the total aquatic and terrestrial ecological impacts would be MODERATE.

The BBNPP site is bounded by forested land and rolling terrain, which will assist in obscuring construction activities. Some construction activities could be visible from the Susquehanna River, Market Street, Beach Grove Road, and U.S. Highway 11 (US 11), but most of the construction activity would be obscured by the local surroundings. The BBNPP site is already aesthetically altered by the presence of the existing SSES Units 1 and 2 structures. The coal-fired power plant buildings would be up to 200 ft (61 m) tall, and the exhaust stacks could reach 600 ft (183 m) tall. These structures would be visible during daylight hours and also at night because of outside lighting. Current SSES cooling towers are approximately 540 ft (165 m) tall. The visual impact of the plant buildings and stacks could be mitigated through landscaping, planting of native trees and other vegetation, and using a light paint color. With standard mitigation strategies, such as those previously mentioned, aesthetic impacts would be SMALL (PPL Bell Bend 2013-TN3377).

Coal-fired power generation would introduce mechanical sources of noise that would likely be audible offsite. Sources contributing the noise produced by plant operation are classified as continuous or intermittent. Continuous sources include the mechanical equipment associated with normal plant operations. Intermittent sources include the equipment related to coal handling, solid-waste disposal, transportation related to coal and limestone delivery, use of outside loudspeakers, and the commuting of plant employees. The impacts of noise on residents in the vicinity of the facility would be MODERATE.

The analysis of impacts on historic and cultural resources would affect the same resources as the construction and operation of the proposed nuclear plant and would have the same impact as the proposed nuclear plant. Therefore the impact on historic and cultural resources from coal-fired power generation would be SMALL.

Socioeconomic impacts would result from the peak construction workforce of approximately 2,500 and the 640 operations workforce (NRC 2009-TN1725). Overall, the size of the construction workforce would be less than that for the proposed BBNPP, which indicates the impacts from building a coal-fired facility at the BBNPP site would be similar but less than those for the BBNPP as analyzed in Section 4.5.2. The impact of operating a coal-fired plant would be higher than those experienced in operating the BBNPP. Given the magnitude of the estimated population increase, the review team determined the influx of workers required for construction of a coal-fired power-generation plant to be SMALL throughout the 50-mi (80-km) region around the site. Socioeconomics impacts would be small throughout the two-county economic impact area (Columbia and Luzerne Counties) with the following exceptions: there would be MODERATE short-term effects on schools in the Berwick Area School District, there would be moderate housing impacts in Berwick, and there would be MODERATE and intermittent traffic impacts on the US 11 corridor during the peak employment period. Short-term adverse traffic and education effects could be reduced to SMALL through mitigation strategies outlined in Section 4.5.4.1 and once local funding has been adjusted following several years of operation. Tax impacts would be SMALL and beneficial throughout the region, except for the Berwick Area School District where property tax impacts would be MODERATE and beneficial. The economic impacts from salaries, sales, and expenditures would be MODERATE and beneficial in the economic impact area.

As discussed in Section 2.6.2, there are no environmental pathways by which the identified minority or low-income populations within the 50-mi (80 km) radius surrounding the proposed BBNPP site (region) would be likely to suffer disproportionately high and adverse environmental impacts. Furthermore, as discussed in Section 2.6.3, the review team did not identify any evidence of unique characteristics or practices in the minority and low-income populations that may result in different air-quality impacts compared to the general population. Therefore, there would be no disproportionate impacts on minority and low-income populations associated with a coal-fired plant at the BBNPP site.

The review team's characterizations of the construction and operation impacts of coal-fired power generation at the BBNPP site are summarized in Table 9-1.

Table 9-1. Summary of Environmental Impacts of Coal-Fired Power Generation

Impact Category	Impact	Comment
Land Use	LARGE	Uses approximately 2,720 ac for the power block, infrastructure and support facilities, coal and limestone storage and handling, and landfill disposal of ash and scrubber sludge. May require acquisition of some adjoining property. Mining activities would have substantial additional impacts offsite.
Air Quality	MODERATE	Estimated emissions: SO_x – 6906 T/yr NO_x – 557 T/yr PM – 76 T/yr of total suspended particulates; 55 T/yr of PM_{10} CO – 4010 T/yr CO_2 –12.3 million T/yr Small amounts of hazardous air pollutants.
Water Use and Quality	SMALL	Impacts would be comparable to the impacts of a new nuclear power plant located at the BBNPP site.
Ecology	SMALL to MODERATE	Aquatic impacts would be comparable to the impacts of a new nuclear power plant located at the BBNPP site; SMALL. The terrestrial impacts on and around the site would be similar to but somewhat greater than those of the proposed action; MODERATE. Noticeable impacts would include conversion of wetland type, disturbance and loss of wetland area and function, disturbance or elimination of onsite streams, forest habitat loss and fragmentation, habitat loss for important species, and disruption and conversion of benthic habitats in the Susquehanna River. Similar impacts could result from mining activities, ash disposal, and stack emissions.
Waste Management	MODERATE	Approximately 110,000 T/yr of scrubber sludge and 430,000 T/yr of ash would be generated.
Socioeconomics (except Taxes and Economy)	SMALL to MODERATE Adverse	Impacts related to building the facilities would be noticeable. Depending on where the workforce lives, the building-related impacts would be noticeable or minor. Impacts of coal transportation and plant operation would be noticeable and MODERATE. The plant would have SMALL aesthetic impacts. Some offsite noise impacts would occur. Impacts on the Berwick Area School District would be noticeable during the construction phase but could be mitigated through enhanced property tax collections. There would be MODERATE housing impacts in Berwick during the peak construction period. MODERATE and intermittent traffic impacts would be experienced on the US 11 corridor during the peak employment period.
Socioeconomics (Taxes and Economy)	MODERATE Beneficial	Local property tax base would benefit mainly during operation.
Human Health	SMALL	Regulatory controls and oversight are assumed to be protective of human health.
Historic and Cultural Resources	SMALL	Impacts would be comparable to the impacts of a new nuclear power plant located at the BBNPP site.
Environmental Justice	NONE	There are minority and low-income persons in the 50-mi (80-km) region; however, the nearest populations are over 14 mi from the site. Therefore, impacts on such persons would likely be minimal and not disproportionate.

9.2.2.2 Natural-Gas-Fired Power Generation

The NRC staff assumed that a replacement natural-gas-fired plant would use combined-cycle technology, because it provides significant efficiency advantages over combustion turbines or gas-fired boilers. While combined-cycle plants often supply intermediate duty cycles, they are capable of supporting baseload needs (NRC 2009-TN1725).

The environmental impacts from natural-gas-generation alternatives were evaluated in the 1996 version of NUREG-1437 (NRC 1996-TN288) and in the SSES Units 1 and 2 License Renewal Application Final EIS (NRC 2009-TN1725). In that Final EIS, the NRC staff assumed that a replacement natural-gas-fired plant would use combined-cycle technology and have a closed-cycle cooling system (NRC 2009-TN1725). The staff assumed six units with a net capacity of 400 MW(e) per unit, producing a net capacity of 2,400 MW(e). This is larger than what would be needed to replace the 1,600 MW(e) proposed BBNPP; therefore, the impacts from natural-gas-fired units to replace BBNPP would be slightly less than those discussed in the SSES Final EIS.

Air Quality

A gas-fired plant would release a variety of air emissions. Like the coal-fired alternative, a gas-fired plant would emit criteria air pollutants, but generally in smaller quantities (except for NO_x, which requires additional controls to reduce emissions).

The review team assumed the plant design that would minimize air emissions through a combination of combustion technology and post-combustion pollutant removal. Nevertheless, these emissions estimates are not necessarily representative of what would be allowed under applicable regulatory air permits. Luzerne County is in a maintenance area for the 8-hour ozone NAAQS, and the emission estimates listed below exceed the threshold values in 40 CFR 93.153 (TN2495) for NO_x, an ozone precursor. Therefore, a new natural-gas-fired plant having these emissions would qualify as a major source, and a Title V operating permit would need to be obtained. A final air permit would likely require applicable BACT.

The air emissions produced by a 1,600-MW(e) natural-gas-fired facility were estimated by the staff as follows using EPA's AP-42 emission factors (EPA 2011-TN1088). A natural-gas-fired plant equipped with appropriate combustion and post-combustion pollution-control technology would have approximately the following emissions:

Air Pollutant Emissions	Tons per Year
Sulfur dioxide (SO_2)	24
Nitrogen dioxide (NO_2)	392
Carbon monoxide (CO)	66
Particulate matter (PM)	75
PM less than 10 µm (PM_{10})	0
CO_2e	4,706,948

A new gas-fired generating plant located in Luzerne County or other parts of the Scranton-Wilkes-Barre area would need a PSD permit and a Title V operating permit under the Clean Air Act. The plant would need to comply with the new source performance standards for such plants set forth in 40 CFR Part 60, Subpart KKKK (TN1020). The standards (40 CFR Part 60 - TN1020) establish limits for SO_2 and NO_x.

The EPA has various regulatory requirements for visibility protection in 40 CFR Part 51, Subpart P (TN1090), including a specific requirement for review of any new major stationary source in areas designated as being in attainment or unclassified for criteria pollutants under the Clean Air Act (42 U.S.C. § 7401 et seq.-TN1141).

Section 169A of the Clean Air Act (42 U.S.C. § 7491 et seq.-TN4418) establishes a national goal of preventing future impairment of visibility and remedying existing impairment in mandatory Class I Federal areas when impairment is from air pollution caused by human activities. In addition, EPA regulations provide that for each mandatory Class I Federal area located within a State, the State must establish goals that provide for reasonable progress toward achieving natural visibility conditions. The reasonable progress goals must provide for an improvement in visibility for the most impaired days over the period of the implementation plan and verify no degradation in visibility for the least-impaired days over the same period (40 CFR 51.308(d)(1) [TN1090]). If a new natural-gas-fired power plant were located close to a mandatory Class I area, additional air pollution-control requirements could be imposed. There are no mandatory Class I Federal areas in Pennsylvania.

The combustion turbine portion of the combined-cycle plant would be subject to the EPA's National Emission Standards for Hazardous Air Pollutants for Stationary Combustion Turbines (40 CFR Part 63, Subpart YYYY [TN1403]) if the site is a major source of hazardous air pollutants. Major sources have the potential to emit 10 T/yr or more of any single hazardous air pollutant or 25 T/yr or more of any combination of hazardous air pollutants (40 CFR 63.6585(b) [TN1403]). The fugitive dust emissions from construction activities would be mitigated using BMPs; such emissions would be temporary.

Historically, CO_2, an unavoidable byproduct of combustion of carbonaceous fuels, has not been regulated as a pollutant. However, regulations are now under development for CO_2 and other GHGs. In response to the Consolidated Appropriations Act, 2008 (Public Law 110-161, 121 Stat. 1844-TN1485), the EPA promulgated final mandatory GHG reporting regulations in October 2009 that became effective in December 2009 (74 FR 56260-TN1024). The rules are primarily applicable to large-facility sources of CO_2 equivalent (those emitting 25,000 metric tons or more per year). New utility-scale gas-fired power plants would be subject to those regulations.

A new gas-fired generation plant would qualify as a major generator of GHGs under the "Tailoring Rule" recently promulgated by the EPA (75 FR 31514-TN1404). Beginning January 2, 2011, permits issued to major sources of GHGs under the PSD or Title V Federal permit programs must contain provisions requiring the use of BACT to limit the emissions of GHGs if those sources would be subject to PSD or Title V permitting requirements because of their non-GHG pollutant emission potentials and if their estimated GHG emissions are at least 75,000 T/yr of CO_2e. Meeting permit limitations for GHG emissions may require installation of carbon capture and sequestration devices on any new natural-gas-fired power plant, which could reduce power output. On October 23, 2015, the EPA published its final rule for new source performance standards to limit CO_2 emissions from new stationary combustion turbines (e.g., natural-gas combined-cycle technology) (80 FR 64509 -TN4388). However, the staff's emissions estimate of 4.7 million T/yr was already below the new standard and would, therefore, be unchanged under the new rule. Nevertheless, the review team recognizes that the environmental impacts of air emissions from the natural-gas-fired power plant would be significantly greater than those from BBNPP.

The impacts of emissions from a natural-gas-fired power-generation plant would be clearly noticeable, but would not be sufficient to destabilize air resources. Overall, the review team concludes that air-quality impacts resulting from construction and operation of new natural-gas-fired power generation at the BBNPP site would be SMALL to MODERATE.

Waste Management

In NUREG–1437 Supplement 35, the NRC staff concluded that waste generation from natural-gas-fired technology would be minimal (NRC 2009-TN1725). The only significant waste generated at a natural-gas-fired power plant would be spent selective catalytic reduction catalyst, which is used to control NO_x emissions. The spent catalyst would be regenerated or disposed of offsite. Other than spent selective catalytic reduction catalyst, waste generation at an operating natural-gas-fired plant would be largely limited to typical operation and maintenance waste. Construction-related debris would be generated during construction activities. Overall, the review team concludes that waste impacts from natural-gas-fired power generation would be SMALL.

Human Health

Natural-gas-fired power generation introduces public risk from inhalation of gaseous emissions. The risk may be attributable to NO_x emissions that contribute to ozone formation, which, in turn, contributes to health risk. Federal (i.e., EPA) and State regulatory agencies base air emission standards and requirements on human health impacts. These agencies also impose site-specific emission limits as needed to protect human health. Given the regulatory oversight exercised by the EPA and State agencies, the review team concludes that the human health impacts from natural-gas-fired power generation, including traffic accident impacts from the transportation of personnel and construction materials, would be SMALL.

Other Impacts

The staff estimated that construction of a 1,600-MW(e) natural-gas power-generating facility would affect approximately 176 ac (NRC 1996-TN288). PPL estimated that an additional 12 ac (4.9 ha) or 0.02 mi^2 (0.05 km^2) would be affected for a pipeline that would be needed to connect to an existing line (PPL Bell Bend 2013-TN3377). Acreage does not include the gas well field (NRC 2009-TN1725). As a result, land-use impacts would be SMALL during construction and operation of this type of facility.

The amount of water needed for a natural-gas-fired plant would be approximately one-third of the amount needed for a nuclear plant (NREL 2011-TN3850). The impacts on water quality from constructing and operating a natural-gas-fired plant at the BBNPP site would be less than those associated with building a new nuclear power plant. The liquid effluent from the natural-gas-fired alternative would continue to consist mostly of cooling-tower blowdown, with the discharge having a higher temperature and increased concentration of dissolved solids relative to the receiving body of water and intermittent low concentrations of biocides, although the amount discharged would be smaller than the current discharge. The smaller workforce associated with a gas-fired power plant would also create less sanitary waste, which, like that of the BBNPP, would be treated and disposed at the Berwick treatment plant. Process wastewater could also be discharged. All discharges would be regulated through a National Pollutant Discharge Elimination System (NPDES) permit, which would be administered by Pennsylvania's Department of Environmental Protection (PADEP) (NRC 2009-TN1725).

If dry cooling towers were used for the natural-gas-fired plant, impacts on aquatic resources and surface water use could be further reduced because much less water would be withdrawn from the Susquehanna River. Dry cooling technology is discussed in Section 9.4.1.5 of this EIS. Impacts on aquatic resources and surface water use would be less than those with wet cooling towers, which are already characterized as SMALL in Table 9-2.

Some erosion and sedimentation could occur during construction of a natural-gas-fired plant (NRC 1996-TN288), but applicable construction-site regulations and implementation of BMPs would help to reduce these short-lived impacts. The NRC staff characterized water-quality impacts from sedimentation during construction as SMALL in the GEIS (NRC 2009-TN1725).

The BBNPP site is bounded by forested land and rolling terrain, which will assist in obscuring construction activities. Some construction activities could be visible from the Susquehanna River, Market Street, Beach Grove Road, and US 11, but most of the construction activity would be obscured by the local surroundings. The BBNPP site is already aesthetically altered by the presence of the existing SSES Units 1 and 2 structures. The gas-fired units (each approximately 100 ft [30 m] tall), exhaust stacks (each at least 174 ft [53 m] tall), associated emissions, and gas pipeline compressors would be visible during daylight hours from offsite. These structures would not be as tall as the cooling towers (540 ft [165 m]) for SSES Units 1 and 2. Overall, the review team concludes that the aesthetic impacts associated with new natural-gas-fired power generation at the BBNPP site would be SMALL.

Noise would be detectable offsite during construction and operation but noise levels would not be expected to exceed existing SSES plant noise. Therefore, the review team concludes that noise impacts would be SMALL.

At the BBNPP site, a natural-gas-fired plant would occupy a previously disturbed area near the SSES Units 1 and 2 and would thus have less extensive ecological impacts than a new nuclear facility. Most of the impacts could be limited to areas that were previously disturbed during the construction of SSES Units 1 and 2. Although constructing a new underground gas pipeline to the site could result in conversion and fragmentation of forest and wetland habitat and could disturb aquatic habitats, no important ecological attributes would likely be noticeably altered because of the pipeline's relatively small footprint. Impacts on important species would likely be less than the impacts from a new nuclear facility located at the BBNPP site. Also, because a gas-fired plant on the BBNPP site would require less water for cooling, impingement and entrainment of Susquehanna River biota would be less than that at a nuclear plant. Overall, the review team concludes that ecological impacts would be SMALL.

Table 9-2. Summary of Environmental Impacts of Natural-Gas-Fired Power Generation

Impact Category	Impact	Comment
Land Use	SMALL	Approximately 188 ac would be needed for the power block and support systems and connection to a natural-gas pipeline.
Air Quality	SMALL to MODERATE	Estimated emissions: SO_x – 24 T/yr NO_x – 392 T/yr PM – 75 T/yr CO – 66 T/yr CO_2 – 4.7 million T/yr Small amounts of hazardous air pollutants.
Water Use and Quality	SMALL	Impacts would be less than the impacts of a new nuclear power plant located at the BBNPP site.
Ecology	SMALL to MODERATE	Many of the impacts would be limited to areas that were previously disturbed during the construction of SSES Units 1 and 2. However, some forest and wetland areas might have to be cleared or filled. Although constructing a new underground gas pipeline to the site could result in conversion and fragmentation of some forest and wetland habitats and could disturb aquatic habitats, important ecological attributes would likely not be noticeably altered. Impacts on Susquehanna River biota would likely be less than those at a nuclear plant. Impacts on important species would be less than impacts from a new nuclear facility located at the BBNPP site.
Waste Management	SMALL	The only significant waste would be from spent selective catalytic reduction catalyst used for control of NO_x emissions.
Socioeconomics (except Taxes and Economy)	Small Adverse	Construction and operation workforces would be relatively small. Impacts during operation would be minor because of the small workforce involved. The plant would have aesthetic and noise impacts but those impacts would be less than those for coal-fired or nuclear alternatives.
Socioeconomics (Taxes and Economy)	MODERATE Beneficial	Additions to the property tax base, while smaller than for a nuclear or coal-fired plant, would still be noticeable.
Human Health	SMALL	Regulatory controls and oversight are assumed to be protective of human health.
Historic and Cultural Resources	SMALL	Impacts would be comparable to the impacts of a new nuclear power plant located at the BBNPP site.
Environmental Justice	NONE	There are minority and low-income persons in the 50-mi region; however, the nearest populations are over 13 mi from the site. Therefore, impacts on such persons would likely be minimal and not disproportionate.

The analysis of the impacts on historic and cultural resources would affect the same resources as the construction and operation of the proposed nuclear plant and would have the same impact as the proposed nuclear plant. Therefore the impacts on historic and cultural resources from natural-gas generation would be SMALL.

Socioeconomic impacts would result from the peak construction workforce of approximately 1,600 and the 375 operations workforce (NRC 2009-TN1725). Overall, the size of the construction workforce would be less than that for the proposed BBNPP, which indicates the impacts from building a natural-gas-fired facility at the BBNPP site would be similar but less than those for the BBNPP as analyzed in Section 4.5.2. Overall, the review team concludes that these impacts would be SMALL and adverse for land use, demographics, public services, education, traffic, and housing because of the mitigating influence of the site's proximity to the surrounding population area and the relatively small number of workers needed to build the plant in comparison to nuclear and coal-fired alternatives. The operations workforce at a natural-gas-fired plant would be roughly equivalent to that estimated for the BBNPP. Based on the expected valuation of a natural-gas plant, which would be less than for nuclear or coal, the property taxes would be lower for the natural-gas option but still MODERATE and beneficial to the Berwick Area School District. Considering the population and economic condition of the county, the review team concludes that the economic impact would be SMALL.

As discussed in Section 2.6, minority and low-income populations are present in the 50-mi region; however, the nearest populations are located in Hazleton, which is 13 mi from the site. Furthermore, as discussion in Section 2.6.3, the review team did not identify any evidence of unique characteristics or practices in the minority and low-income populations that may result in different air-quality impacts compared to the general population. Therefore, based upon the underlying assumptions of their analysis, the staff concludes that there would be no disproportionate adverse impacts on minority and low-income populations resulting from construction of a natural-gas-fired plant at the BBNPP site.

The construction and operational impacts of natural-gas-fired power generation at the BBNPP site are summarized in Table 9-2.

9.2.3 Other Alternatives

This section discusses other energy alternatives, the review team's conclusions about the feasibility of each alternative, and the review team's bases for those conclusions. A new nuclear power plant at the BBNPP site would be a baseload generation plant. Any feasible alternative to the new unit would need to generate baseload power consistent with the purpose and need for the project. In performing its initial evaluation in the ER, PPL used the findings documented in NUREG-1437 (NRC 1996-TN288). The review team also reviewed the information submitted by PPL, conducted an independent review, and determined that other energy alternatives are not reasonable alternatives to a new nuclear power plant that would provide baseload power.

The review team has not assigned significance levels to the environmental impacts associated with the alternatives discussed in this section because, in general, the generation alternatives would have to be installed at a location other than the BBNPP site. Any attempt to assign significance levels would require the review team's speculation about the unknown site.

9.2.3.1 Oil-Fired Power Generation

The reference case in the EIA Annual Energy Outlook 2014 projects that in the United States electric power production using petroleum will decrease by around 10 percent from 2012 to 2040 (DOE/EIA 2014-TN3585). Oil-fired generation is more expensive than the nuclear, natural-gas-fired, or coal-fired generation options. In addition, future increases in oil prices are expected to make oil-fired generation increasingly more expensive. The high cost of oil has resulted in a decline in its use for electricity generation. In Section 8.3.11 of NUREG–1437, the NRC staff estimated that construction of a 1,000-MW(e) oil-fired plant would require about 120 ac of land (NRC 1996-TN288). Operation of an oil-fired power plant would have environmental impacts that would be similar to those of a comparably sized coal-fired plant (NRC 1996-TN288).

For the preceding economic and environmental reasons, the review team concludes that an oil-fired power plant would not be a reasonable alternative to construction of a 1,600-MW(e) nuclear power-generation facility that would be operated as a baseload plant within PPL's ROI.

9.2.3.2 Wind Power

In general, areas identified by the National Renewable Energy Laboratory as wind resource Class 4 and above are regarded as being potentially economical for wind-energy production with current technology. Class 4 wind resources are defined as having mean wind speeds between 15.7 and 16.8 mph (25.3 to 27.0 kph) at 50-m elevation (NREL 2009-TN1396).

Because the majority of land area throughout the primary market area is characterized as Class 1 with scattered areas of Class 2 and Class 3 sites, and further supported by the fact that as of June 2014 the installed wind-power capacity of the entire ROI (Delaware, New Jersey, Maryland, Virginia, and Pennsylvania) was only 1,471 MW (DOE 2014-TN3716), the staff determined that a land-based wind-power generating facility at the site or within the primary market area/ROI that would match the baseload power of the proposed nuclear power plant would likely not be a viable alternative.

Because the PPL's ROI includes parts of Pennsylvania, New Jersey, Delaware, Virginia, and Maryland, the staff also reviewed the viability of wind power from offshore areas. DOE's Wind Powering America indicates that Pennsylvania has offshore wind resources consistent with utility-scale production in a few areas of the state near Lake Erie that are classified as fair winds (Class 3) at a maximum (DOE 2010-TN1837) as do offshore areas of Delaware DOE 2010-TN1839), New Jersey (DOE 2010-TN1838), Maryland (DOE 2010-TN1841), and Virginia (DOE 2010-TN1840). However, as stated in a joint DOE and U.S. Department of the Interior report, *A National Offshore Wind Strategy Creating an Offshore Wind Energy Industry in the United States* "… key challenges to the development and deployment of offshore wind technology must be overcome, including the relatively high cost of energy, technical challenges surrounding installation and grid interconnection, and the permitting challenges governing deployment in both federal and state waters" (Beaudry-Losique et al. 2011-TN1844). This national strategy for offshore wind resulted from a National Renewable Energy Laboratory-issued analysis in 2010, *Large-Scale Offshore Wind Power in the United States—Assessment of Opportunities and Barriers* (Musial and Ram 2010-TN1843), that also indicated "… the opportunities for offshore wind are abundant, yet the barriers and challenges are also significant. Technological needs are generally focused on making offshore wind technology economically feasible and reliable and expanding the resource area to accommodate more regional diversity for future U.S. offshore projects." When energy policies mature and large-scale offshore wind-energy projects become technically feasible, then wind power can play a significant role in future U.S. energy markets. For perspective, according to the National

Renewable Energy Laboratory in 2010, 49 worldwide offshore wind-energy projects had a total installed capacity of only 2,377 MW (Musial and Ram 2010-TN1843).

The largest operating wind farm in the world—the 9,000-ac Alta Wind Energy Center in California, which has 342 wind turbines of 1.5 to 3 MW capacity each—has a total capacity of 1,020 MW (CEAP 2012-TN2077), and in 2012, financing was obtained for expansion up to 1,320 MW (TGP 2012-TN2117). The second largest wind farm in the United States is the Roscoe Wind Farm situated on 100,000 ac in Texas. The Roscoe Wind Farm has an installed capacity of 781.5 MW and uses 627 wind turbines, each with a capacity between 1.0 and 1.5 MW (Power Technology 2010-TN2112).

A utility-scale, land-based wind-power generation plant in open flat terrain would generally require about 60 ac/MW of installed capacity to prevent interference and shadowing among and between the wind turbine units, although much of this land could be used for other compatible purposes such as farming or ranching (AWEA 2009-TN2075). Wind turbines typically operate at a capacity factor(3) of 25 to 40 percent compared to 90 to 95 percent for a baseload plant such as a nuclear plant (AWEA 2009-TN2074). The capacity factor of the Alta Wind Energy Center is estimated to be 30 percent (CEAP 2012-TN2077). Higher capacity factors for wind turbines are typically associated with wind farms built offshore, where winds are steadier.

With modern wind turbine designs of about 2 MW per turbine, about 2,400 wind turbines would be required to produce the same energy as the BBNPP target of 1,600 MW(e) at a 90 percent capacity factor, assuming a wind-energy capacity factor of 30 percent. The review team estimates that about 288,000 ac (about 450 mi^2) would be required for these 2,400 turbines, assuming 60 ac per installed megawatt.

Offshore wind farms can have higher capacity factors and use larger turbines. For example, the Cape Wind Energy Project will use 130 wind turbines rated at 3.6 MW(e) each for an electrical generation capacity of 468 MW(e). The project is expected to deliver, on average, 1,600 GWh/yr to the grid (including consideration of line losses from the turbines to shore), for an average effective capacity factor of 39 percent (DOI 2009-TN2527). The project will occupy an area of about 25 mi^2 (16,000 ac), or roughly 120 ac per turbine (or about 34 ac per installed megawatt).

Using similar 3.6-MW wind turbine designs, approximately 1,018 wind turbines would be needed to produce the same energy as the BBNPP target of 1,600 MW(e) at a 90 percent capacity factor, assuming a wind-energy capacity factor of 40 percent. The review team estimates that approximately 122,000 ac (about 192 mi^2) would be required for these offshore turbines, assuming 120 ac per turbine.

Wind turbines generally can serve as an intermittent baseload power supply (NPCC 2005-TN1406). Wind power, in conjunction with energy storage mechanisms such as pumped hydroelectric or compressed air energy storage (CAES), or another readily dispatchable power

(3) Capacity factor is a measure of how often an electric generator runs for a specific period of time. It indicates how much electricity a generator actually produces relative to the maximum it could produce at continuous full power operation during the same period.

source, such as hydropower, might serve as a means of providing baseload power. The EIA is not projecting any growth in pumped storage capacity through 2040 (DOE/EIA 2014-TN3585). In addition, the review team concludes in Section 9.2.3.4 that the potential for new hydroelectric development in the ROI is limited. Therefore, the review team concludes that the use of pumped storage in combination with wind turbines to generate 1,600 MW(e) is unlikely.

A CAES plant consists of motor-driven air compressors that use low-cost, off-peak electricity to compress air into a suitable geological repository such as an underground salt cavern, a mine, or a porous rock formation. During periods of high electricity demand, the stored energy is recovered by releasing the compressed air through a combustion turbine to generate electricity (NPCC 2010-TN2107). A few CAES plants are currently in operation. The first CAES plant, a 290-MW plant near Bremen, Germany, began operating in 1978. The second CAES plant, a 110-MW plant located in McIntosh, Alabama, has been operating since 1991. Both facilities use mined salt caverns for compressed air storage (Succar and Williams 2008-TN2122). The largest CAES facility under consideration in the United States is the 2,700-MW Norton Energy Storage facility in Ohio that, if built, would store compressed air in 600 ac of underground limestone mines (FirstEnergy 2009-TN2102; OPSB 2011-TN2111). However, there does not appear to be any timetable for the development of the Norton project at this time.

Alternatively, the power company could install 1,100 2-MW(e) wind turbines to match the planned output of the nuclear power plant and also build and maintain a backup power source (e.g., a natural-gas plant) to provide power when the wind farm is not operating at full capacity. This would involve a smaller commitment of land (about 132,000 ac) for the wind turbines. But it would also involve the cost and impacts of building two power plants: the wind turbines and the natural-gas plant.

The construction and maintenance of land-based, wind-energy facilities alters ecosystem structure through vegetation clearing, forest fragmentation, soil disruption, and the potential for erosion. Wind-energy facilities can also result in avian mortality (AWWI 2014-TN3777). Building and operating offshore wind turbines could affect the marine ecosystem (species and habitat) and avian species. Wind turbines can be highly visible because of their heights and locations (e.g., ridgelines, open plains, and near offshore areas). The aesthetic impacts associated with a large number of wind turbines could be significant. In addition, there could be impacts related to water quality, cultural resources, noise, and socioeconomics (e.g., tourism and property values).

For the preceding reasons, the review team concludes that a wind-energy facility would not currently be a reasonable alternative to construction of a 1,600-MW(e) nuclear power-generation facility that would be operated as a baseload plant within PPL's ROI. The primary reason for this conclusion is the intermittent nature of wind-power generation, which makes it unsuited, by itself, to produce baseload power. However, because it is a proven generating technology available in the ROI, it will be considered by the review team in the combination of energy alternatives in Section 9.2.4.

9.2.3.3 Solar Power

Solar energy depends on the availability and strength of sunlight (strength is measured as kWh/m^2), and solar power is considered an intermittent source of energy. Solar facilities would have equivalent or greater environmental impacts than a new nuclear facility at the BBNPP site. The construction of solar power-generating facilities has the potential for substantial impacts on natural resources (such as wildlife habitat, land use, and aesthetics). As stated in the GEIS, land requirements are approximately 6.2 ac/MW(e) for photovoltaic cells and approximately 3 ac/MW(e) for solar thermal systems (NRC 2013-TN2654). This would require a footprint of approximately 9,920 ac (4,014 ha) for photovoltaic cells and 4,800 ac (1,942 ha) for solar thermal systems to produce a 1,600-MW(e) baseload capacity. Both of these alternatives would increase environmental impacts by constructing on a much larger footprint area. The footprint needed to produce a 1,600-MW(e) baseload capacity solar power facility is much too large to construct at the proposed plant site. In addition, the capacity factor for solar photovoltaic power operation ranges between 0.14 to 0.33. The capacity factor in the ROI would fall somewhere between that of Boston (as high as 24 percent) and Miami (as high as 26 percent) if panels with two-axis tracking are used (Ardani and Margolis 2011-TN2522). Assuming a 0.25 capacity factor, the land-use requirements could be three to four times larger than these estimates.

In the ROI, two types of collectors for solar resources were considered: concentrating collectors and flat-plate collectors. Concentrating collectors are mounted on a tracker, which allows them to face the sun at all times of the day. The DOE’s Office of Energy Efficiency and Renewable Energy rates the solar resources of the States within the ROI as comparable to western States of Washington or Oregon, and not nearly as high as Arizona, California, or Colorado, which are among the best states for solar power generation (DOE/EERE 2014-TN3783).

However, because of the low conversion efficiency and the low availability factor, a means to store large quantities of energy (those discussed in Section 9.2.3.2) for distribution when the plant is producing less than 1,600 MW(e) would be needed. However, the use of these storage mechanisms on this scale in the ROI is unlikely, as discussed in Section 9.2.3.2.

For the reasons discussed above, the review team concludes that solar energy facilities would not currently be a reasonable alternative to construction of a 1,600-MW(e) nuclear power-generation facility that would be operated as a baseload plant within the ROI. However, because it is a proven generating technology available in the ROI, solar generation will be considered by the review team in the combination of energy alternatives in Section 9.2.4.

9.2.3.4 Hydropower

The GEIS (NRC 1996-TN288) estimates use of 1,600 mi^2 (4,144 km^2) of land per 1,000 MW(e) generated by hydropower. Based on this estimate, hydropower would require flooding more than 2,600 mi^2 (6,734 km^2) to produce a baseload capacity of 1,600 MW(e), resulting in a large impact on land use.

In 2006, the DOE published the most recent comprehensive state-by-state study of potential impoundment and diversion hydropower resources in the United States (Hall et al. 2006-TN2092). The 2006 study was a follow-on examination of a 2004 study that evaluated potential water energy resources to identify which of the resources could be feasibly developed. The

2006 study attempted to determine the realistic hydropower potential of the resources by focusing more closely on the low-head resources (i.e., elevation changes of 30 ft or less) and low-power resources. The development model included consideration of working flow restrictions that were equivalent to half the stream flow rate at the site or sufficient flow to produce an average of 30 MW. The study found that a potential total of 1,115 MW (annual average) was feasible in the states of Pennsylvania, New Jersey, Delaware, and Maryland from such water resources. To produce the 1,600 MW(e) of baseload capacity required by the BBNPP, all of these potential hydropower sites and several unidentified additional hydropower generating facilities would need to be developed and in operation.

In addition, environmental considerations associated with hydropower dams include alteration of aquatic habitats above and below the dam, which would affect existing aquatic species, and the constraint the dam puts on migrating fish species in the area. Another consideration is the potential displacement of communities by flooding the new reservoir, or local communities' loss of use of the current river system for recreational activities.

Based on these considerations and the enormous amount of land that would be affected by hydropower, the staff concludes that hydropower is not a feasible alternative to construction of a new 1,600-MW(e) nuclear power-generation facility operated as a baseload plant within PPL's ROI.

As discussed in NUREG-1437 (NRC 2013-TN2654), ocean and tidal technologies are being developed but are in their infancy and have not been used at utility scale. In addition, in the Annual Energy Outlook 2014, DOE/EIA did not include these technologies in its projections (DOE/EIA 2014-TN3585). Therefore the review team concludes that these technologies are not feasible alternatives within the ROI to construction of a new nuclear power-generation facility operated as a baseload plant at the proposed site.

9.2.3.5 Geothermal Energy

Geothermal energy has an average capacity factor of 90 percent and can be used for baseload power where available; however, the development of geothermal generating facilities is only likely to occur in limited geographical areas because of the limited availability of the resource (NRC 2013-TN2654). Geothermal plants are most likely to be sited in the western continental United States, Alaska, and Hawaii, where hydrothermal reservoirs are prevalent (DOE 2008-TN1409). There are no high-temperature geothermal resources that would be suitable for power generation in Pennsylvania, New Jersey, Maryland, or Delaware (NREL 2009-TN3781).

Therefore, the review team concludes that a geothermal energy facility would not be a reasonable alternative to construction and operation of a 1,600-MW(e) nuclear power plant supplying baseload electricity.

9.2.3.6 Wood Waste

A wood-burning facility can provide baseload power and operate with a high annual capacity factor and with thermal efficiency similar to a coal plant (EPA 2007-TN2660; NREL 1993-TN2661). The fuels required are variable and site-specific. A significant impediment to the use of wood waste to generate electricity is the high cost of fuel delivery and high construction cost per megawatt of generating capacity. Estimates in NUREG-1437 suggest that the overall level of construction impacts per megawatt of installed capacity would be approximately the same as that for a coal-fired plant (NRC 2013-TN2654). Similar to coal-fired plants, wood-waste plants require large areas for fuel storage and processing and involve the same type of combustion equipment. In the Annual Energy Outlook 2014 (DOE/EIA 2014-TN3823), DOE/EIA projects that growth in the generating capacity from biomass (which includes wood waste) in the ReliabilityFirst Corporation (RFC) East region between 2011 and 2025 will be about 115 MW(e).

Because of the small projected increase in generating capacity for wood power-generation plants, the review team concludes that wood waste would not be a reasonable alternative to a 1,600-MW(e) nuclear power-generation facility operated as a baseload plant.

9.2.3.7 Municipal Solid Waste

Municipal solid-waste combustors incinerate the waste and use the resultant heat to produce steam, hot water, or electricity. The combustion process reduces the volume of waste and the need for new solid-waste landfills. Municipal waste combustors use three basic types of technologies: mass burn, modular, and refuse-derived fuel (DOE/EIA 2001-TN26). Mass burning technologies are most commonly used in the United States. This group of technologies processes raw municipal solid waste "as is," with little or no sizing, shredding, or separation before combustion. More than one-fifth of the U.S. municipal solid-waste incinerators use refuse-derived fuel. In contrast to mass burning, where the municipal solid waste is introduced "as is" into the combustion chamber, refuse-derived fuel facilities are equipped to recover recyclables (e.g., metals, cans, and glass) followed by shredding the combustible fraction into fluff for incineration (EPA 2009-TN1412).

Municipal solid-waste combustors generate an ash residue that is buried in landfills, as well as SO_2 and NO_x emissions. The ash residue is composed of bottom ash and fly ash. Bottom ash refers to that portion of the unburned waste that falls to the bottom of the grate or furnace. Fly ash represents the small particles that rise from the furnace during the combustion process. Fly ash is generally removed from flue gases using fabric filters and/or scrubbers (EPA 2008-TN1413).

Currently, 84 waste-to-energy plants are operating in the United States (Michaels 2014-TN3849). These plants have a combined generating capacity of approximately 2,770 MW(e), or an average of approximately 33 MW(e) per plant (Michaels 2014-TN3849). Given the small average output of existing plants, the review team concludes that generating electricity from municipal solid waste would not be a reasonable alternative to a 1,600-MW(e) nuclear power-generation facility operated as a baseload plant within PPL's ROI.

9.2.3.8 Other Biomass-Derived Fuels

In addition to wood and municipal solid-waste as fuel, several other biomass-derived fuels are available for fueling electric generators, including burning crops, converting crops to a liquid fuel (such as ethanol), and gasifying crops (including wood waste). The EIA estimates that wind and biomass will be the largest source of renewable electricity generation among the non-hydropower renewable fuels through the year 2040 (DOE/EIA 2014-TN3585).

Co-firing biomass with coal is possible when low-cost biomass resources are available. Co-firing is the most economic option for the near future to introduce new biomass power generation. These projects require small capital investments per unit of power-generation capacity. Co-firing systems range in size from 1 to 30 MW(e) of biopower capacity (DOE 2008-TN1416).

Finally, the DOE/EIA projects limited growth in biomass power in the RFC East region, which includes the PPL service territory. From 2011 to 2025, the review team's analysis is based on an in-service date of 2025 based on PPL's response to the NRC's request for additional information on the BBNPP schedule (PPL Bell Bend 2014-TN3625). Even if the actual in-service date were to slip by a few years, the review team would not expect such a change to affect the overall conclusions regarding energy alternatives for two reasons. First, the projections by PPL and by the DOE/EIA used by the review team in its analyses do not change appreciably in the later years and are generally consistent with the data used for 2025. Second, the environmental impacts of the feasible alternatives are not likely to change appreciably, so the conclusions by the review team regarding environmental preferability are unlikely to change.

DOE/EIA projects biomass capacity (including wood-burning facilities) in the RFC East region will increase by only 115 MW(e) (DOE/EIA 2014-TN3823). The review team concludes that given the relatively small size of biomass generation facilities, biomass-derived fuels do not offer a reasonable alternative to a 1,600-MW(e) nuclear power-generation facility operated as a baseload plant within PPL's ROI.

9.2.3.9 Fuel Cells

Fuel cells work without combustion and its associated environmental side effects. Power is produced electrochemically by passing a hydrogen-rich fuel over an anode, air over a cathode, and then separating the two by an electrolyte. The only byproducts are heat, water, and carbon dioxide. Hydrogen fuel can come from a variety of hydrocarbon resources by subjecting them to steam under pressure. Natural gas is typically used as the source of hydrogen.

Phosphoric acid fuel cells are generally considered first-generation technology. Higher temperature, second-generation fuel cells achieve higher fuel-to-electricity and thermal efficiencies. The higher temperatures contribute to improved efficiencies and give the second-generation fuel cells the capability to generate steam for cogeneration and combined-cycle operations.

During the past three decades, significant efforts have been made to develop more practical and affordable fuel cell designs for stationary power applications, but progress has been slow. The cost of fuel cell power systems must be reduced before they can be competitive with conventional technologies (DOE 2008-TN1417). DOE has an initiative called the Solid State Energy Conversion Alliance with the goal of developing large (i.e., 250 MW or greater) fuel cell power systems, including those based on coal-derived fuels. Another goal of the Solid State Energy Conversion Alliance is to cut costs of electricity generated via fuel cells to $700 per kilowatt (electrical) (DOE 2011-TN2083). However, it is not clear whether DOE will achieve these goals and, if so, when the associated fuel cells might reach commercial operations.

The review team concludes that, at the present time, fuel cells are not economically or technologically competitive with other alternatives for baseload electricity generation. Future gains in cost competitiveness for fuel cells compared to other fuels are speculative.

For the preceding reasons, the review team concludes that a fuel cell energy facility would not currently be a reasonable alternative to construction of a 1,600-MW(e) nuclear power-generation facility operated as a baseload plant within PPL's ROI.

9.2.4 Combination of Alternatives

Individual alternatives to the construction of a new nuclear power plant at the BBNPP site might not be sufficient on their own to generate PPL's target value of 1,600 MW(e) because of the small size of the resource or lack of cost-effective opportunities. Nevertheless, it is conceivable that a combination of alternatives might be cost-effective. There are many possible combinations of alternatives. It would not be reasonable to examine every possible combination of energy alternatives in an EIS. Doing so would be counter to the Council on Environmental Quality's direction that an EIS should be analytic rather than encyclopedic, shall be kept concise, and shall be no longer than absolutely necessary to comply with NEPA (42 U.S.C. § 4321 et seq.-TN661) and Council on Environmental Quality regulations (40 CFR 1502.2(a), (b)[TN2123]). Given that PPL's objective is for a new baseload generation facility, a fossil energy source, most likely coal or natural gas, would need to be a significant contributor to any reasonable alternative energy combination.

In developing a combination of energy alternatives for other combined license applications, the review team has typically relied on data from the power company's integrated resource plan and/or data from the most recent EIA Annual Energy Outlook. However, because of the regulatory structure for power companies within the ROI, and the fact that BBNPP would be a merchant plant, PPL does not publish an integrated resource plan. The review team also found that the Annual Energy Outlook 2014 (DOE/EIA 2014-TN3585) predictions for growth in renewable sources in the RFC East region that includes the ROI are less than the growth that would be necessary to meet the Renewables Portfolio Standard (RPS) for New Jersey (NJBPU 2011-TN2526), which is in the ROI. Compliance with the New Jersey RPS will require greater growth in renewable sources (or considerable compliance payments) beyond the growth predicted by the Annual Energy Outlook. Because of this situation, the review team has relied on the information in the latest annual report for the New Jersey RPS, the New Jersey Energy Master Plan (New Jersey 2011-TN2115), and other public information to develop the combination of energy alternatives.

In Chapter 8, the review team concluded that there is a sufficient need for power by 2025 to justify building and operating one nuclear unit with a total capacity of up to 1,600 MW(e). The review team's conclusion is based on analysis that considered planned new generation sources. Therefore, the combination of alternative energy sources would involve the addition of generating sources beyond those already planned.

The review team considered whether 1,600 MW(e) could be provided by wind and solar, each with a backup power source; a combination of sources including biomass, municipal solid waste, and geothermal; and natural gas. The EIA estimates that through 2040 the combination of wind, solar, and biomass will provide most of the growth in renewable electricity generation in the United States (DOE/EIA 2014-TN3585). Wind or solar energy sources without a backup power source are not considered here for baseload purposes, but that does not preclude their development; in fact, there is great interest in developing such renewable energy resources. The consumption of natural gas by the facility in the combination of alternatives case can be offset by the production of energy from wind and solar resources when available; however, a combination of alternatives would still necessitate the installation of natural-gas power facilities to ensure that power is available as a baseload power source when wind and solar sources cannot meet the demand.

The review team considered a spectrum of energy alternatives that were reasonable for the PPL ROI and, for the purpose of analysis, developed a combination of alternatives case that comprises solar and wind power, biomass (including municipal solid waste and methane from landfills), and natural-gas-fired power generation. Additional savings from energy-efficiency and conservation programs were not included in the combination of energy alternatives because the States within the ROI are already pursuing a very aggressive goal for these programs, which the review team assumes will have already implemented those activities that would be cost-effective.

The review team assessed the environmental impacts of a combination of natural-gas-fired combined-cycle power-generating units with a total capacity of 1,025 MW(e) at the PPL site using closed-cycle cooling and the following additional contributions from within or near the PPL ROI: 400 MW(e) from solar, 650 MW(e) from wind, and 575 MW(e) from biomass sources.(4) These contributions were derived based on the expected percentage contributions to new generation from these resources considering sources such as the Annual Energy Outlook 2014 (DOE/EIA 2014-TN3585), the New Jersey Energy Master Plan (New Jersey 2011-TN2115), and the New Jersey RPS (NJBPU 2011-TN2526). The solar and wind sources would be backed up by natural-gas-powered generation. The review team believes that the preceding contributions are reasonable and representative for the PPL ROI given the publicly available information in the cited Federal and State sources. The contributions of the generating sources used in the combination of energy alternatives reflect the review team analyses in Sections 9.2.2 and 9.2.3.

The capacity factor for solar photovoltaic power operation ranges between of 0.14 to 0.33. The capacity factor in the ROI would fall somewhere between that of Boston (as high as 24 percent) and Miami (as high as 26 percent) if panels with two-axis tracking are used (Ardani and Margolis 2011-TN2522). Assuming a 0.25 capacity factor, the 400 MW(e) from solar energy would generate on average 883 GWh of electricity annually. Land use required for this installed capacity would be approximately 2,500 ac. Additional transmission lines might be needed to connect the locations of the photovoltaic panels to those areas in ROI with the largest load growth rate.

The capacity factor for wind-power generation is within the range of 0.25 to 0.40. The higher the capacity factor, the less area would be needed to support wind turbine facilities. Offshore wind generally provides for the highest capacity factors so the review team assumed

---

(4) Because there is limited landfill gas available, the review team assumes that the biomass is composed of 100 MW(e) of landfill gas (with emissions similar to a natural-gas combined-cycle plant) and 700 MW(e) of a combination of biomass (such as wood waste) and municipal solid waste, with emissions similar to a coal plant. These assumptions were used to estimate the emissions of this portion of the combination of energy alternatives.

development of offshore wind resources. Assuming a 0.40 capacity factor, the 650 MW(e) from wind energy would generate on average 2,270 GWh of electricity annually. An offshore wind farm of this installed capacity would occupy about 35 mi^2 (22,200 ac) based on an extrapolation from the Cape Wind project, a 468-MW(e) project that will occupy about 25 mi^2 (DOI 2009-TN2527). Obtaining offshore wind energy along the New Jersey, Delaware, or Maryland shorelines may require lengthy new transmission lines to deliver the power to those areas with the highest demand for electricity.

For the remainder of the energy sources that make up the combination of alternatives (biomass, municipal solid waste and landfill gas), the review team assumed a capacity factor of 0.85, which is consistent with the fossil energy combustion alternatives discussed in Sections 9.2.3.1 and 9.2.3.2. While land would necessarily be used to host these facilities and, in the cases of biomass and municipal solid waste, additional land would be needed for storage of fuel materials, combustion residue (such as fly ash), and landfills, the review team did not attempt to quantify the additional land used. In addition there could be attendant environmental effects on air, water, ecology, socioeconomics, waste, cultural resources and historical properties, and human health; these were discussed earlier for each of the other power sources.

The review team assumed that the 1,025-MW(e) natural-gas-fired portion of the combination of alternatives would be built at the BBNPP site in a manner similar to the 1,600-MW(e) natural-gas-fired alternative discussed in Section 9.2.2.2. Consequently, the environmental effects for building this portion of the combination of alternatives would be scaled to be about 65 percent of the natural-gas-fired alternative. However, the natural-gas plant would operate at a lower capacity factor than that assumed in Section 9.2.2.2 because it would reduce its output when the wind and solar resources were generating electricity. It would only operate at full capacity when wind and solar generation dropped to zero. Based on the capacity factors of 25 percent and 40 percent assumed for solar and wind, respectively, the natural-gas plant would operate at an average capacity factor of about 58 percent.

Overall, the review team concludes that the impacts on land use would be MODERATE, based on the impacts of the natural-gas plant, the solar facilities, the biomass facilities, and their respective transmission lines. On the same basis, the impacts on terrestrial ecological resources and air quality would be similar to those for the natural-gas plant from Section 9.2.2.2, which were SMALL to MODERATE. The impacts on surface water and groundwater, cultural and historic resources, human health, and waste are also expected to be similar to those for the natural-gas plant, which were SMALL. For aquatic resources, there would be an increase in aquatic effects for construction of offshore wind facilities, assuming that these would have a footprint requiring in-water installation (pile-driving noise and vibration, dewatering, etc.). There may also be additional effects to consider for threatened or endangered species and Essential Fish Habitat. Also, operation may introduce electromagnetic fields that may attract some aquatic species and repel others. As a result, the aquatic impacts would be SMALL to MODERATE. As with the natural-gas plant, the impacts on socioeconomic resources are expected to range from SMALL (adverse) to MODERATE (beneficial). Similar to the situation for a natural-gas-fired plant, there are no environmental pathways by which the identified minority or low-income populations within the region would be likely to suffer disproportionately high and adverse environmental impacts. The review team believes that the preceding contributions are representative of a combination of energy sources that could be considered for comparison with a new nuclear power plant and together form a reasonable combination alternative. A summary of the review team characterization of the environmental impacts associated with the construction and operation of the preceding combination of energy alternatives is shown in Table 9-3.

Table 9-3. Summary of Environmental Impacts of a Combination of Power Sources

Impact Category	Impact	Comment
Land Use	MODERATE	A natural-gas-fired plant would have land-use impacts for the power block, cooling towers and support systems (approximately 176 ac), and for a new connection to an existing natural-gas pipeline (approximately 12 ac).
Air Quality	SMALL to MODERATE	Emissions from the natural-gas-fired plant and the biomass facilities would be approximately: SO_x – 2,497 T/yr NO_x – 451 T/yr PM_{10} – 20 T/yr CO – 1,483 T/yr CO_2 – 7.4 million T/yr. Small amounts of hazardous air pollutants would also be emitted. Biomass emission estimates were assumed to be similar to that of a coal plant.
Water Use and Quality	SMALL	Impacts would be somewhat less than the impacts of a new nuclear power plant located at the BBNPP site.
Ecology	SMALL to MODERATE	Wind-energy facilities could affect aquatic resources and result in bird mortality. Some loss of forest and wetland areas on the site would be necessary.
Waste Management	SMALL	The only significant waste would be from spent selective catalytic reduction catalyst used for control of NO_x emissions and ash from biomass and municipal solid-waste sources.
Socioeconomics (except Taxes and Economy)	SMALL Adverse	Construction and operations workforces would be noticeable but not significant. There would likely not be noticeable adverse impacts on community services or infrastructure due to the relatively small number of in-migrants. Impacts during operation would be minor because of the small workforce involved. The natural-gas-fired, biomass, and wind turbines would have aesthetic impacts, as would the build-out of transmission lines. For the natural-gas-fired plant, noise would be detectable offsite during construction and operation but noise levels would not be expected to exceed existing SSES plant noise.
Socioeconomics (Taxes and Economy)	MODERATE Beneficial	The addition to property tax base, while smaller than for a nuclear or coal-fired plant, would still be noticeable.
Human Health	SMALL	Regulatory controls and oversight would be protective of human health.
Historic and Cultural Resources	SMALL	Regulatory controls and consultation with Federal and State agencies, tribes, and interested parties would identify appropriate measure to identify potential impacts and coordinate appropriate mitigative actions.
Environmental Justice	NONE	There are minority and low-income persons in the 50-mi region; however, the nearest populations are over 13 mi from the site. Therefore, impacts on such persons would likely be minimal and not disproportionate.

9.2.5 Summary Comparison of Alternatives

Table 9-4 contains a summary of the review team's environmental impact characterizations for constructing and operating new nuclear, coal-fired, and natural-gas-fired, combined-cycle generating units at the BBNPP site. The combination of alternatives shown in Table 9-4 assumes siting of natural-gas combined-cycle generating units at the BBNPP site and siting of other generating units within PPL's ROI.

Table 9-4. Summary of Environmental Impacts of Construction and Operation of New Nuclear, Coal-Fired, and Natural-Gas-Fired Generating Units and a Combination of Alternatives

Impact Category	Nuclear	Coal	Natural Gas	Combination of Alternatives
Land Use	SMALL	LARGE	SMALL	MODERATE
Air Quality	SMALL for criteria pollutants SMALL incremental contribution to GHG emissions from BBNPP	MODERATE for criteria pollutants and for GHG emissions	SMALL for criteria pollutants MODERATE for GHG emissions	SMALL for criteria pollutants MODERATE for GHG emissions
Water Use and Quality	SMALL	SMALL	SMALL	SMALL
Ecology	MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE
Waste Management	SMALL	MODERATE	SMALL	SMALL
Socioeconomics (except Taxes and Economy)	SMALL to MODERATE Adverse	SMALL to MODERATE Adverse	SMALL Adverse	SMALL Adverse
Socioeconomics (Taxes and Economy)	MODERATE Beneficial	MODERATE Beneficial	MODERATE Beneficial	MODERATE Beneficial
Human Health	SMALL	SMALL	SMALL	SMALL
Historic and Cultural Resources	SMALL	SMALL	SMALL	SMALL
Environmental Justice	NONE	NONE	NONE	NONE

The review team reviewed the available information about the environmental impacts of power-generation alternatives compared to the construction of a new nuclear power plant at the BBNPP site. Evaluating the alternatives to a nuclear power plant, use of a natural-gas-fired plant would have fewer impacts in some areas. Comparing nuclear and natural gas, the natural gas plant would have fewer impacts on ecology while having greater impacts on air quality. While some socioeconomic impacts are reduced because of the smaller workforce, local positive economic impacts would also be smaller. On balance, the review team concludes that the environmental impacts of these two options would be similar. Based on this review, the review team concludes that, from an environmental perspective, none of the viable energy alternatives is clearly preferable to construction of a new baseload nuclear power-generating plant located within PPL's ROI.

Because of current concerns related to GHG emissions, the review team believes that it is appropriate to specifically discuss the differences among the alternative energy sources regarding CO_2 emissions. CO_2 emissions for the proposed action and energy-generation alternatives are discussed in Sections 5.7.2, 9.2.2.1, 9.2.2.2, and 9.2.4. Table 9-5 summarizes the CO_2 emission estimates for a 40-year period for the alternatives considered by the review team to be viable for baseload power generation. These estimates are limited to the emissions from power generation and do not include CO_2 emissions for workforce transportation, building, fuel cycle, or decommissioning. Among the viable energy-generation alternatives, the CO_2 emissions for nuclear power are a small fraction of the emissions of the other viable energy-generation alternatives. Adding the transportation emissions for the nuclear plant workforce and fuel-cycle emissions would increase the emissions for plant operation over a 40-year period to about 11,000,000 MT CO_2e. This number is still significantly lower than the emissions for the plant operations portion of any of the other reasonable energy-generation alternatives.

Table 9-5. Comparison of Direct Carbon Dioxide Emissions for Energy Alternatives

Generation Type	Years	CO_2 Emission (metric tons)[(a)]
Nuclear Power[(b)]	40	181,000
Coal-Fired Generation[(c)]	40	445,000,000
Natural-Gas-Fired Generation[(d)]	40	171,000,000
Combination of Alternatives[(e)]	40	270,000,000

(a) Nuclear power emissions are in units of metric tons of CO_2e, whereas the other energy alternatives emissions estimates are in units of metric tons of CO_2. If nuclear power emissions were represented in metric tons of CO_2, the value would be slightly less, because the other greenhouse gas emissions would not be included.
(b) From Section 5.7.2.2 for one unit operational emissions, not including CO_2 emissions for workforce transportation.
(c) From Section 9.2.2.1.
(d) From Section 9.2.2.2.
(e) From Section 9.2.4 (assuming only natural-gas power generation has significant CO_2 emissions).

On June 3, 2010, the EPA issued a rule that tailors the applicability criteria. The rule determines which stationary sources and modifications to existing projects become subject to permitting requirements for GHG emissions under the PSD and Title V programs of the Clean Air Act (75 FR 31514 -TN1404). According to the Tailoring Rule, GHG emissions are a regulated New Source Review pollutant under the PSD major source permitting program if the source (1) is otherwise subject to PSD (for another regulated New Source Review pollutant) and (2) has a GHG potential to emit equal to or more than 75,000 T/yr of CO_2e (i.e., “carbon dioxide equivalent” adjusting for different global warming potentials for different GHGs), then the source would be subject to BACT. In addition, on October 23, 2015, the EPA published its final standards to limit CO_2 emissions from new coal and gas-fired power plants (80 FR 64509 - TN4388). The use of BACT has the potential to reduce the amount of GHGs emitted from stationary source facilities. The implementation of this rule could reduce the amount of GHGs from the values indicated in Table 9-5 for coal and natural gas, as well as from other alternative energy sources that would otherwise have appreciable uncontrolled GHG emissions. The GHG emissions from the production of electricity from a nuclear power source are primarily from the fuel cycle and such emissions could be reduced further if the electricity from the assumed fossil-fuel source powering the fuel cycle is subject to BACT controls. GHG emissions from the production of electrical energy by a nuclear power source are orders of magnitude less than those of the reasonable alternative energy sources. Accordingly, the comparative relationship between the energy sources listed in Table 9-5 would not change meaningfully, even if possible reductions of the GHG emissions from the nuclear fuel cycle were ignored, because GHG emissions from the other energy source alternatives would not be sufficiently reduced to make them environmentally preferable to the proposed project.

CO_2 emissions associated with other energy-generation alternatives, such as wind power, solar power, and hydropower, would be associated with workforce transportation, construction, and decommissioning of the facilities. Because these power-generation alternatives do not involve combustion, the review team considers the GHG emissions to be minor and concludes that the GHG emissions would have a minimal cumulative impact. Other energy-generation alternatives involving combustion of oil, wood waste, municipal solid waste, or biomass-derived fuels would produce CO_2 emissions from combustion, as well as from workforce transportation, plant construction, and plant decommissioning. It is likely that the CO_2 emissions from the combustion process for these alternatives would dominate the other CO_2 emissions associated with the generation alternative.

It is also likely that the CO_2 emissions from these alternatives would be of the same order of magnitude as the emissions for the fossil-fuel alternatives considered in Sections 9.2.2.1, 9.2.2.2, and 9.2.4. However, because the review team determined that these alternatives would not meet the need for baseload power generation, their CO_2 emissions were not evaluated quantitatively. Insofar as some of these alternatives, such as biomass, are considered in the combination of alternatives discussed in Section 9.2.4, they would increase the total CO_2 emissions beyond the numbers shown in Table 9-5; however, the review team considers the small fraction contributed by these technologies in comparison to the contributions of the natural-gas component for the combination of alternatives case to have a minimal further cumulative impact that does not warrant a more precise analysis.

As discussed in Chapter 8, the review team has concluded that the need for the additional baseload power generation has been demonstrated. Also, as discussed earlier in this chapter, the review team concludes the viable alternatives to the proposed action would all involve the use of fossil fuels (coal or natural gas). Consequently, the review team concludes that the proposed action results in the lowest level of emissions of GHGs among the viable alternatives.

9.3 Alternative Sites

NRC EISs prepared in conjunction with a COL application are intended to analyze alternatives to the proposed action (10 CFR 51.71(d) [TN250]). The review team uses NRC guidance in Section 9.3 of the ESRP (NRC 2000-TN614) to evaluate the alternative sites and determine if any obviously superior alternative to the proposed site exists. ESRP Section 9.3 regarding the site-selection process calls for the identification of an ROI followed by successive screenings of candidate areas, potential sites, candidate sites, and the proposed site. Section 9.3.1 of this EIS presents a discussion of the applicant's site-selection process, which includes identification of the ROI for possible siting of a new nuclear power plant. This discussion is followed by the review team evaluation of the applicant's site-selection process (Section 9.3.1.3).

This section discusses PPL's process for selecting its proposed and alternative sites, and the review team's evaluation of the process. PPL's site-selection process was based on guidance in the following documents: NRC's ESRP (NRC 2000-TN614), Regulatory Guide 4.2 (NRC 1976-TN89), Regulatory Guide 4.7 (NRC 1998-TN1008), 10 CFR Part 100 (TN282), and the Electric Power Research Institute's Siting Guide (EPRI 2002-TN1799).

In its COL application, PPL proposed the BBNPP site for a new U.S. Evolutionary Power Reactor (U.S. EPR) unit. The decision to select the BBNPP site was based on a special case exception from the systematic site-selection process as identified in the ESRP (NRC 2000-TN614). This exception allows the applicant to conduct the site-selection process among the candidate sites, and then do a comparison of the proposed site with the candidate sites, rather than selecting the proposed site from among the candidate sites based on a site-by-site comparison. The proposed site is adjacent to a currently operating nuclear power plant previously found acceptable on the basis of a NEPA (42 U.S.C. § 4321 et seq.-TN661) review.

This section describes the site-selection process PPL used to identify alternative sites, the review team's evaluation process, the alternative sites selected by PPL, and discusses the environmental impacts of locating a new nuclear generating unit at each alternative site. For the purposes of this evaluation of alternative sites, impacts evaluated include NRC-authorized construction, operation, and other cumulative impacts including preconstruction activities. Sections 9.3.2 through 9.3.4 provide a site-specific description of the environmental impacts at each alternative site based on issues such as land use, air quality, water resources, terrestrial and aquatic ecology, socioeconomics and environmental justice, historic and cultural resources, and transmission-line corridors. Section 9.3.5 contains tables of the review team's characterization of the impacts at the alternative sites and comparison with the proposed site to determine if there are any alternative sites that are environmentally preferable to the proposed site.

9.3.1 Alternative Sites Selection Process

The NRC's site-selection process guidance in the ESRP calls for identification of a ROI—the geographic area considered by an applicant in searching for candidate areas and potential sites for possible siting of a new nuclear power plant (NRC 2000-TN614). Within that ROI, screening criteria are applied to sequentially evaluate candidate areas, potential sites, and candidate sites. This systematic process leads to the selection of a proposed site and alternative sites unless the applicant proposes a site based on the special case identified in ESRP Section 9.3 (NRC 2000-TN614) for proposing to locate a new nuclear facility on the site of an existing nuclear power plant previously found acceptable on the basis of a NEPA (42 U.S.C. § 4321 et seq.-TN661) review. PPL used the ESRP Section 9.3 (NRC 2000-TN614) special case to select the BBNPP site as its proposed site for a new unit.

The review team identified requests for additional information related to PPL's site-selection process and associated results submitted by PPL in the COL application (through Revision 3 of the application). As a result of these information requests, PPL developed a major revision to its site-selection process and documented it in Revision 4 of the ER (PPL Bell Bend 2013-TN3377) and in a separate Alternative Site Evaluation Report Revision 2 (UniStar 2011-TN505).

The process PPL used to select its alternative sites is documented in ER Revision 4 and the Alternative Site Evaluation Report and described in the following sections.

9.3.1.1 Selection of Region of Interest

In its ER, PPL generally defined the geographic scope or primary market area for the BBNPP as the eastern part of the PJM classic market area, encompassing parts of eastern Pennsylvania, Virginia, and Maryland, and all of New Jersey and Delaware (PPL Bell Bend 2013-TN3377). The ROI, shown on Figure 9-1, covers approximately 31,296 mi^2 (81,056 km^2) and encompasses the major population centers of the cities of Wilmington, Delaware; Allentown/Bethlehem/Easton, Pennsylvania; Harrisburg, Pennsylvania; Scranton/Wilkes-Barre, Pennsylvania; Philadelphia, Pennsylvania; Baltimore, Maryland; and Newark, New Jersey (PPL Bell Bend 2013-TN3377). This area is closely approximates the service territories for the electric delivery companies identified and depicted in Figure 9-1. The PJM classic market area is a sub-set of the entire PJM area as defined by the North American Electric Reliability Corporation (NERC) (PPL Bell Bend 2013-TN3377).

As described in ESRP Section 9.3 (NRC 2000-TN614), an ROI is typically selected based on geographic boundaries (e.g., the state in which the proposed site is located) or the relevant service area for the proposed plant. By selecting the eastern part of PJM classic market area, PPL's designated ROI is consistent with expectations for an ROI. The review team concludes that the ROI used in PPL's COL application is reasonable for consideration and analysis of potential sites. The review team also finds that PPL's basis for defining its ROI did not arbitrarily exclude desirable candidate locations.

9.3.1.2 Selection of Candidate Areas

The next step in PPL's site-selection process was to identify suitable candidate areas within the ROI by screening with exclusionary criteria. Candidate Areas refer to one or more areas within the ROI that remain after unsuitable areas have been removed. The staff's review of PPL's exclusionary criteria found them to be consistent with those identified in ESRP Section 9.3 (NRC 2000-TN614) and the Siting Guide (EPRI 2002-TN1799). More specifically, PPL excluded areas from further consideration if they exceeded the following characteristics:

- exhibited a population density of more than 300 persons per square mile
- were located more than 30 mi from 345-kV or higher transmission lines
- were located more than 15 mi from an adequate source of cooling water
- contained land that was dedicated to other uses, such as national and State parks and tribal lands.

The distribution of the exclusionary criteria are shown in summary on Figure 9-2. The candidate areas are all areas that were not eliminated by these criteria. These candidate areas are shown as white areas throughout the states in the ROI.

9.3.1.3 Selection of Potential Sites

PPL considered various brownfield sites, remediation sites, other power facilities, and a greenfield site as possible locations for a new nuclear power plant within the ROI. More than 8,000 sites within the ROI were initially identified for consideration (UniStar 2011-TN505). This initial pool of sites within the ROI was established from the following sources: (1) the DOE/EIA State Energy Profiles for each of the four states in the ROI, (2) state brownfield site databases for the five states in the ROI, and (3) PPL-owned sites provided by PPL (e.g., Martins Creek, New Jersey greenfield site). These sources established the initial pool of over 8,000 sites, of which 356 were located within the candidate areas (PPL Bell Bend 2013-TN3377).

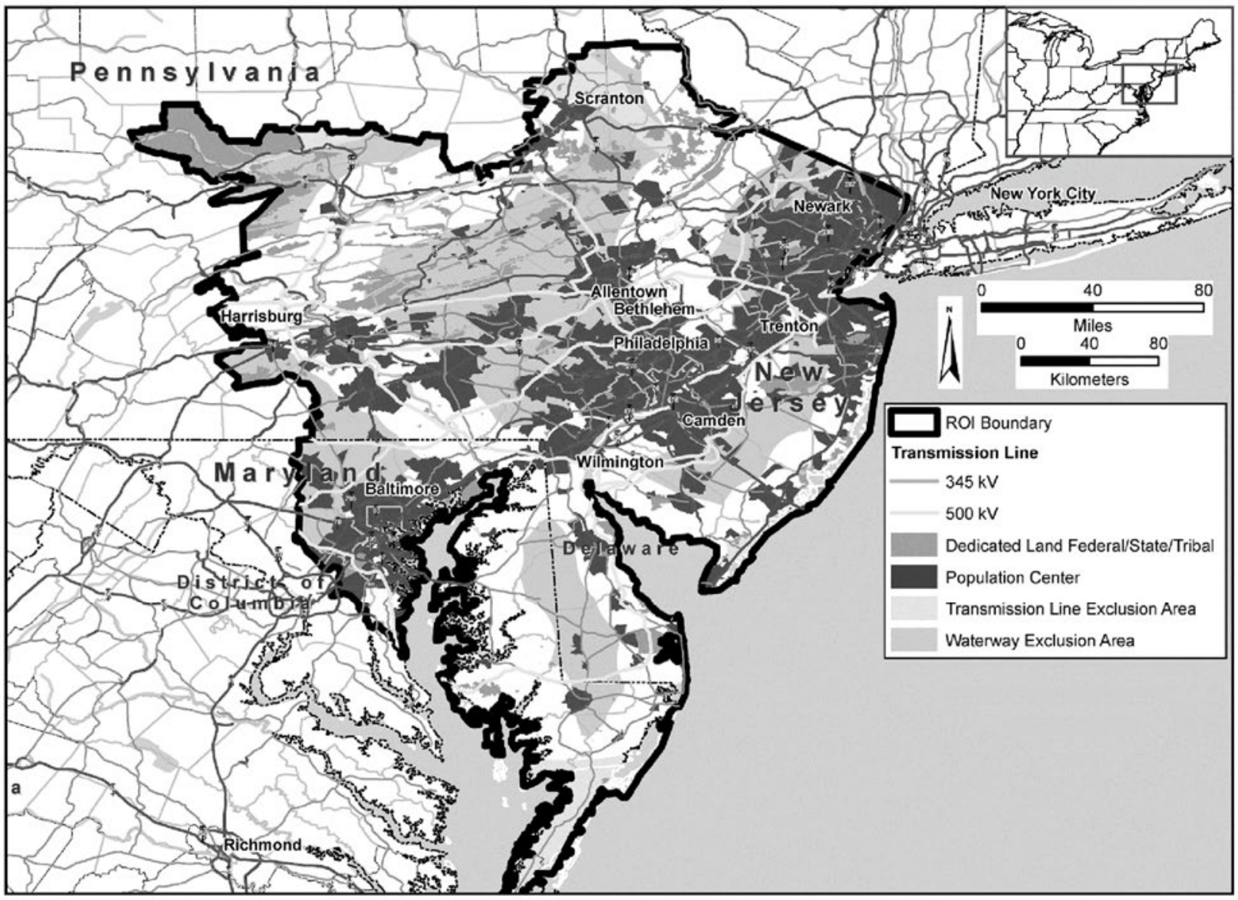

Figure 9-2. Candidate Area Exclusionary Criteria (PPL Bell Bend 2013-TN3377)

Subsequently, PPL eliminated sites that could not provide the requisite 420 ac needed for an U.S. EPR to derive the following list of 14 potential sites:

- Bainbridge, Maryland
- Baltimore/Washington International Airport, Maryland
- Beiler, Maryland Conowingo, Maryland
- Delaware City Plant, Delaware
- Humboldt Industrial Park (Humboldt), Pennsylvania
- Keystone Industrial Port Complex, Pennsylvania

- Martins Creek, New Jersey
- Montour, Pennsylvania
- Peach Bottom, Pennsylvania
- Seedco Industrial Park (Seedco), Pennsylvania
- Sparrows Point, Maryland
- Wallenpaupack, New Jersey
- Indian River, Delaware.

9.3.1.4 Selection of Candidate Sites

To establish the list of candidate sites, PPL next confirmed whether the potential sites were licensable and otherwise viable sites for constructing a new nuclear power station. The staff found that PPL's elimination of the Baltimore/Washington International Airport, Delaware City Plant, Keystone Industrial Port Complex, and Sparrows Point sites due to population density within a 20-mi (32.2-km) radius of the site being in excess of 500 persons per square mile was consistent with NRC's Regulatory Guide 4.7 population criterion.

Upon further review of the Beiler site, PPL determined that a viable water source was beyond the 15-mi (24.1-km) exclusionary criterion after it was determined that the nearest point was too shallow for an inlet structure, and that site was eliminated from further consideration. The review team evaluated this determination and determined that PPL's elimination of the Beiler site was justified. As a result, nine sites remained as candidate sites for the next step in the screening process:

- Bainbridge
- Conowingo
- Humboldt
- Martins Creek
- Montour
- Peach Bottom
- Seedco
- Wallenpaupack
- Indian River.

The locations of the candidate sites are shown in Figure 9-3. The next step of PPL's process was to select alternative sites from its list of nine candidate sites using 16 major criteria categories and 40 sub-criteria and ranking each candidate site against these criteria (UniStar 2011-TN505). Commercial criteria, such as cost-related criteria, were not included in this evaluation. PPL organized a nine-member Delphi panel consisting of personnel from PPL/Bell Bend, AREVA, and CH2M Hill to evaluate the nine sites against the criteria (UniStar 2011-TN505). In its analysis, the Delphi panel used publicly available data, information available through UniStar and PPL/Bell Bend files and personnel, and Google Earth images to evaluate the nine potential sites (UniStar 2011-TN505).

PPL applied weighting factors to each criteria with (1) water resources and population density weighted the highest followed by; (2) wetlands and transmission corridors; (3) terrestrial and aquatic resources and geology/seismology; (4) land use, human health, and postulated accidents; (5) socioeconomics, and transportation access; (6) environmental justice and historic and cultural resources; (7) air quality; and (8) fuel-cycle impacts in the Alternative Site Evaluation Report (UniStar 2011-TN505). This screening process reduced the nine candidate sites to three alternative sites (shown in Figure 9-4):

- Montour
- Humboldt
- Seedco.

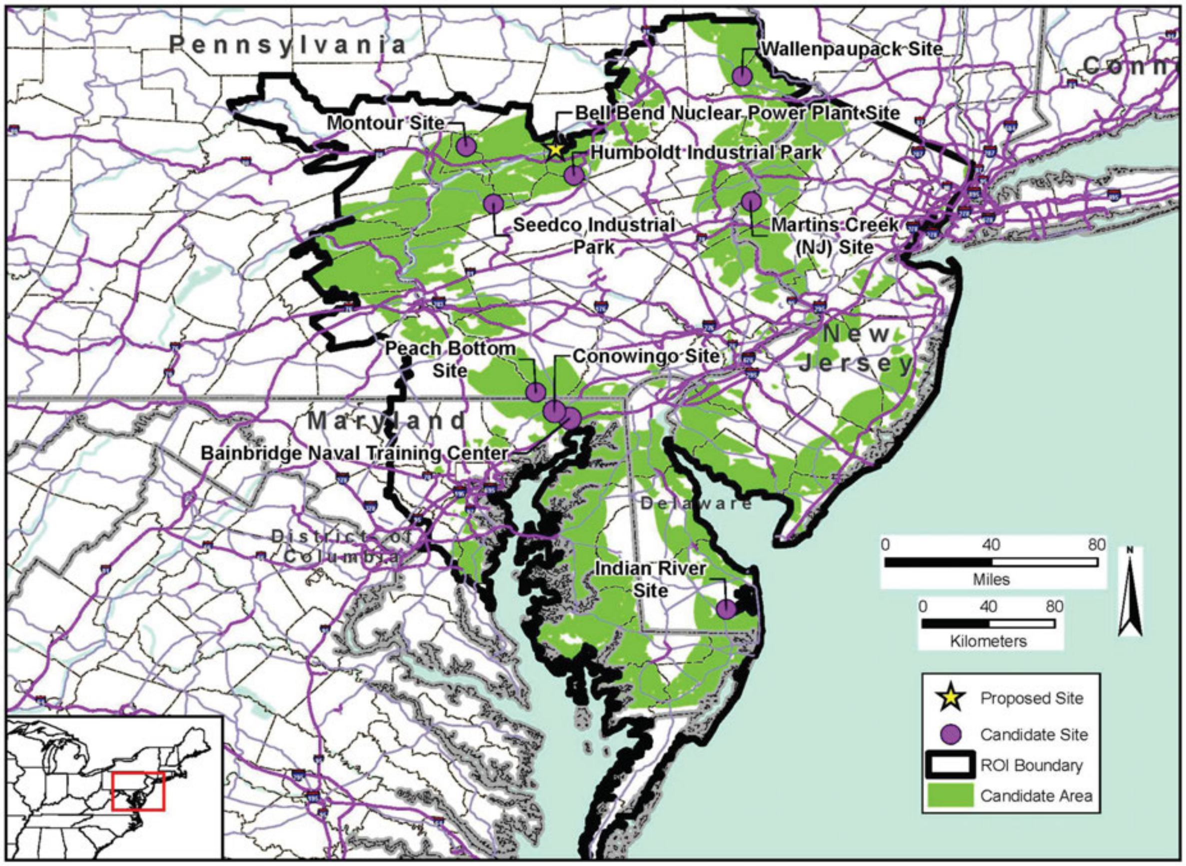

Figure 9-3. Candidate Sites (PPL Bell Bend 2013-TN3377)

Agency reviews of early versions of PPL's screening raised concerns about the screening criteria, site weighting and scoring, and a request to consider at least one site outside of the Susquehanna River Basin. In addition to the NRC, the EPA, the USACE, and the Susquehanna River Basin Commission (SRBC) provided comments on Revision 1 of the Alternative Site Evaluation Report (UniStar 2009-TN506). In response to the challenges provided by these agencies, PPL added several sensitivity analyses to Revision 2 of its Alternative Site Evaluation Report that evaluated the effect on the relative ranking of candidate sites of changes to scoring criteria and weighting (UniStar 2011-TN505).

As a part of the agencies' review, in 2010 the EPA expressed concern about the fact that the three highest scoring Alternative Sites in Revision 1 of the Alternative Site Evaluation Report (UniStar 2009-TN506) were all located within the Susquehanna River Basin along with the proposed site (EPA 2010-TN1797). EPA based its concern on the agency's position that a viable water resource is one that is capable of meeting the needs of a proposed project as well as needs of the watershed, and that by limiting the candidate sites to one watershed, PPL runs the risk of project failure if the watershed needs are not met. The EPA noted the concerns of the SRBC regarding the availability of water from, and the potential adverse impacts on, the Susquehanna River in both the local reach and negative impacts on the river farther downstream. Therefore, it was the EPA's belief that the alternative site-selection process should be revised to avoid the situation where all candidate sites are located in a single watershed.

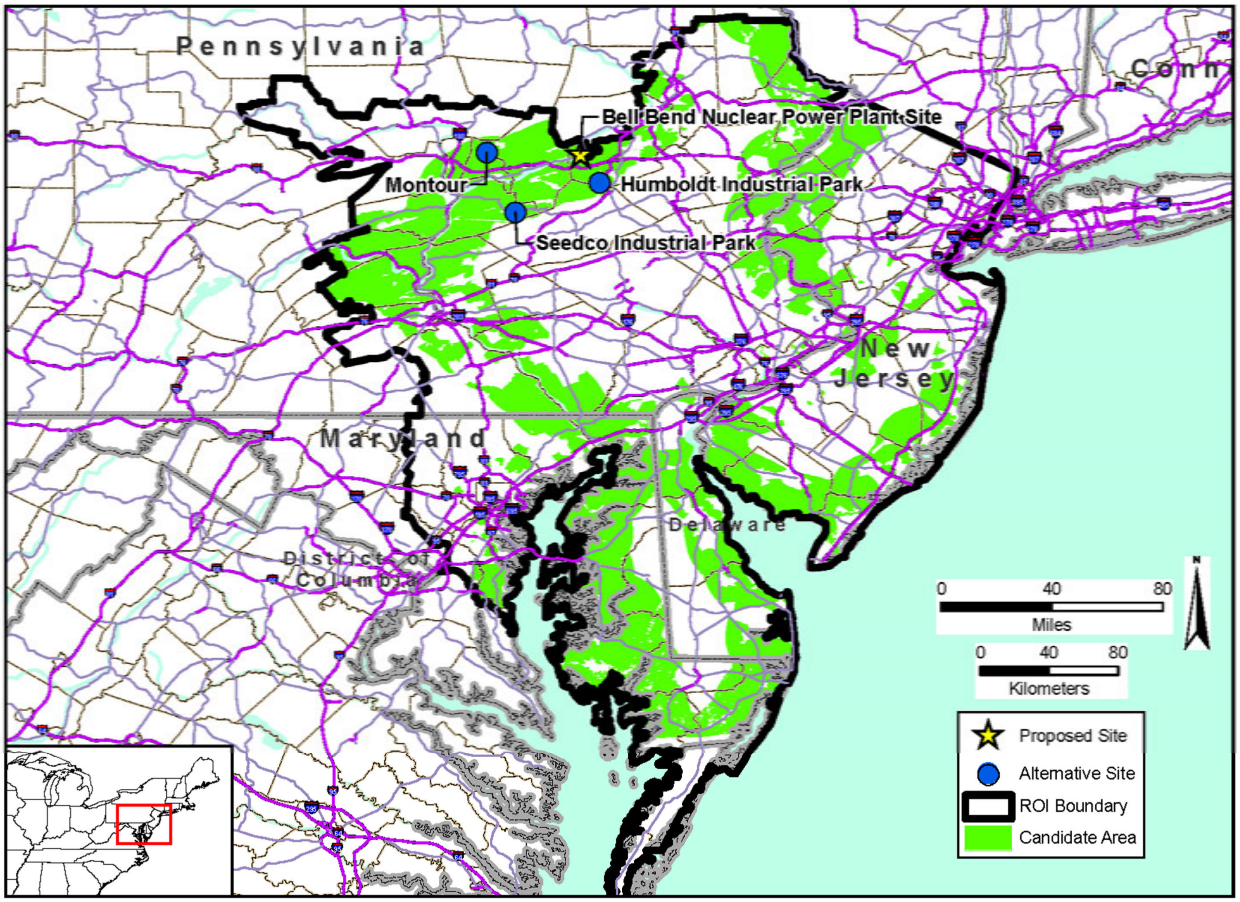

Figure 9-4. Alternative Sites and Proposed Site (PPL Bell Bend 2013-TN3377)

In response to that request, the Martins Creek site, the most favorable non-Susquehanna River Basin alternative site, was added by PPL for consideration as a fourth alternative site in the Federal NEPA (42 U.S.C. § 4321 et seq.-TN661) analyses by the NRC, the USACE, and the EPA (PPL Bell Bend 2013-TN3377). However, as the Martins Creek site was examined in more detail by the review team, it was determined that a nuclear power plant at that site may not be compatible with the restrictions on development imposed by the Highlands Water Protection and Planning Act, N.J.S.A. 13:20-1 et seq. ("Highlands Act") (NJHC 2012-TN1796). More specifically, the State of New Jersey's Highlands Water Protection and Planning Council identified that the Martins Creek site falls within the following Resource Management Plan designated protected areas:

- Conservation Zones − areas with significant agricultural lands interspersed with associated woodlands and environmental features that should be preserved when possible
- Environmentally Constrained Sub-Zones – lands containing significant environmental features within the Conservation Zone that should be preserved and protected from non-agricultural development
- Carbonate Rock Areas – areas that are underlain by carbonate rock, such as limestone and dolomite. Inclusion of lands within a Carbonate Rock Area does not imply the presence of karst features area-wide, but is indicative of the potential for solution of underlying carbonate rock by surface or ground water, over time
- Prime Ground Water Recharge Areas – lands having the highest groundwater recharge rates within each subwatershed
- Wellhead Protection Areas – areas surrounding a public water system well, from which groundwater flows to the well and groundwater contamination
- Riparian Areas – areas adjacent to and hydrologically interconnected with Highlands Open Waters Rivers and Streams
- Agricultural Resource Areas – areas of the most concentrated and contiguous agricultural uses as determined based on the prevalence of active farms, contiguous farming units of 250 ac or more, and the presence of Important Farmland Soils.

In its correspondence to the NRC on November 8, 2012, the Highland Council further clarified that a nuclear facility at the Martins Creek site "… would be inconsistent with the Highlands Regional Master Plan, and that the chances of securing needed approvals would be very limited" (NJHC 2012-TN1795).

For these reasons, the review team determined that it was unlikely the Martins Creek site would be a licensable site for a nuclear power plant and dismissed the site from further evaluation in this EIS. The EPA also concurred with this decision in a conference call with the NRC and the USACE on December 4, 2012 (NRC 2013-TN4042).

After removal of the Martins Creek site, three alternative sites remained (shown in Figure 9-4):

- Montour
- Humboldt
- Seedco.

For the Humboldt site, subsequent to the submittal of the COL application, and detailed evaluation of the site by the review team, the private landowner of the Humboldt Industrial Park continued to develop the site. As part of its development activities, the landowner filed a Department of the Army permit application under Section 404 of the Clean Water Act (33 U.S.C. § 1344 et seq.-TN1019) and Section 10 of the Rivers and Harbors Appropriation Act (33 U.S.C. § 403 et seq.-TN660) related to impacts on jurisdictional wetlands and navigable waters of the United States. Based on this filing, the Department of the Army authorized the industrial park owner to impact approximately 1,200 ft^2 of waters of the United States associated with a road crossing for the future development of a new industrial park. The 420-ac (170-ha) site that the COL applicant evaluated for a U.S. EPR on the Humboldt site is located within the 3,796 ac

(1,536 ha) Humboldt Industrial Park area covered by the permit (PPL Bell Bend 2013-TN3377). In granting the permit under Pennsylvania State Programmatic General Permit-4 (PASPGP-4), among the special conditions the USACE included was the requirement that all remaining waters and/or wetlands within the industrial park would be protected by a conservation easement, and that such easement shall be recorded as a Declaration of Restrictive Covenants for Conservation Easement in the land records of Luzerne County, Pennsylvania (USACE 2012-TN3807; Isett 2003-TN3808). However, if the landowner never performs the work authorized under the PASPGP-4, then the contingent restrictions creating the easement within the industrial park may not be triggered. The applicant may request modification of the existing PASPGP-4 to allow for the removal of the restrictive covenant. Such a request would then require the USACE to review the project under an individual permit process, resulting in further regulatory consideration.

For purposes of this EIS, the existence of the restrictive covenant in PASPGP-4 does not preclude consideration of Humboldt as an alternative site. The Humboldt site is still largely undeveloped, and if the current or a future landowner of the Humboldt site were to submit an application to the USACE to impact additional wetlands on the site, notwithstanding the existence of PASPGP-4, the USACE would consider any such new application.

The review team found that the revised screening criteria and weighting factors applied by PPL were responsive to its comments, consistent with the agencies' regulations and guidance, and were not unreasonable. As a result, the review team determined that PPL's three candidate sites are among the best that could be found within the ROI and are reasonable sites for consideration in this EIS and comparison to PPL's preferred site, the BBNPP site.

9.3.1.5 Review Team Evaluation of PPL's Site Selection

The review team reviewed the siting methodology used by PPL to select its ROI, candidate areas, potential sites, candidate sites, and alternative sites. Based on PPL's description of its process and the review team's evaluation of the criteria used (as addressed in the commentary in the previous section), the review team determined the process used to identify alternative sites was a logical approach consistent with NRC guidance (NRC 2000-TN614) and, therefore, was adequate.

In accordance with ESRP Section 9.3 (NRC 2000-TN614), the review team performed an independent comparison of the proposed and alternative sites. The review team visited each of the alternative sites between March 2009 and June 2012. Following the guidance in ESRP Section 9.3, the review team collected and analyzed reconnaissance-level information for each of the alternative sites. The team then used the information provided in the ER, responses to requests for additional information (RAIs), information from other Federal and State agencies, and information gathered at the visits to each alternative site to evaluate the cumulative impacts of building and operating a new nuclear power plant at those sites. Therefore, the analysis includes the impacts of NRC-authorized construction and operation, as well as impacts from other actions affecting the same resources. Cumulative impacts occur when the effects of an action are added to or interact with other effects in a particular place and within a particular time. As a result, the cumulative impact assessment entails a more extensive and broader review of possible effects of the action beyond the site boundary.

The cumulative analysis for the impacts at the alternative sites was performed in the same manner as discussed in Chapter 7 of this for the proposed site except as specified in ESRP Section 9.3 (NRC 2000-TN614), a reconnaissance-level analysis was conducted for the alternative sites. To inform the cumulative analysis, the review team researched EPA databases for recent EISs within the State, used an EPA database for permits for water discharges in the geographic area to identify water-use projects, and used www.recovery.gov to identify projects in the geographic area funded by the American Recovery and Reinvestment Act of 2009 (Public Law 111-5; 26 U.S.C. § 1-TN1250). The review team developed tables of the major projects near each alternative site that were considered relevant in the cumulative analysis. The review team used the information to perform an independent evaluation of the direct and cumulative impacts of the proposed action at the alternative sites to determine if one or more of the alternative sites were environmentally preferable to the proposed site.

Included in the cumulative analyses are past, present, and reasonably foreseeable future Federal, non-Federal, and private actions that could have meaningful cumulative impacts with the proposed action. For the purposes of this analysis, the past is defined as the time period prior to receipt of the COL application. The present is defined as the time period from the receipt of the COL application until the start of building the BBNPP unit. The future is defined as the time period from the start of building the BBNPP unit through its operation and eventual decommissioning.

Using Chapter 7 as a guide, the specific resources and components that could be affected by the incremental effects of the proposed action and other actions in the same geographic area were identified. The affected environment that is the baseline for the cumulative-impacts analysis is described for each alternative site and includes a qualitative discussion of the general effects of past actions. For each resource area, the geographic area over which past, present, and reasonably foreseeable future actions could reasonably contribute to cumulative impacts is defined and described in later sections. The analysis for each resource area at each alternative site concludes with a cumulative impact finding (SMALL, MODERATE, or LARGE). For those cases in which the level of impact on a resource was greater than SMALL, the review team also discussed whether building and operating a nuclear power plant would be a "significant" contributor to the cumulative impact. In the context of this evaluation, "significant" is defined as a contribution that is important in reaching that impact level determination.

The cumulative impacts are summarized for each resource area in the sections that follow. The level of detail is commensurate with the significance of the impact for each resource area. The findings for each resource area at each alternative site then are compared in a table at the end of Section 9.3 to the cumulative impacts at the proposed site (brought forward from Chapter 7). The results of this comparison are used to determine whether any of the alternative sites are environmentally preferable to the proposed site.

The impacts described in Chapter 6 (e.g., nuclear fuel cycle, decommissioning) would not vary significantly from one site to another. This is true because all of the alternative sites and the proposed site are in low-population areas and the review team assumes the same reactor design (therefore, the same fuel-cycle technology, transportation methods, and decommissioning methods) for all of the sites. As such, these impacts would not differentiate between the sites and would not be useful in the determination of whether an alternative site is environmentally preferable to the proposed site. For this reason, these impacts are not discussed in the evaluation of the alternative sites.

9.3.2 Montour

This section covers the review team's evaluation of the potential environmental impacts of siting a new nuclear unit at the Montour site located in Montour County, Pennsylvania. The following sections describe a cumulative impact assessment conducted for each major resource area. The specific resources and components that could be affected by the incremental effects of the proposed action if it were implemented at the Montour site, and other actions in the same geographic area were considered. This assessment includes the impacts of NRC-authorized construction, operations, and preconstruction activities. Also included in the assessment are other past, present, and reasonably foreseeable Federal, non-Federal, and private actions that could have meaningful cumulative impacts when considered together with a new nuclear plant if such a plant were to be built and operated at the Montour site. Other actions and projects considered in this cumulative analysis are described in Table 9-6.

Table 9-6. Past, Present, and Reasonably Foreseeable Projects and Other Actions Considered in the Montour Site Cumulative Analysis

Project Name	Summary of Project	Location	Status
Energy Projects			
SSES Units 1 and 2	Two 1,140-MW(e) boiling water reactors; Unit 1 was issued an operating license in 1982, Unit 2 was issued an operating license in 1984. Extension of operations of SSES Units 1 and 2 for an additional 20-year period beyond the end of the current license term, or until 2042 and 2044, respectively. Power uprates − currently operating at 3,952 MW(t) and 1,300 MW(e).	26 mi E of the Montour site	Operational (NRC 2014-TN3964). Renewed operating licenses issued November 2009 (NRC 2014-TN3964). Units 1 and 2 approved for combined 48-MW(t) (1.4%) power uprate in 2001 and combined 463-MW(t) (13%) power uprate in 2008 (NRC 2012-TN1538; NRC 2012-TN1900).
Limerick Nuclear Power Plant demonstration project	Project will allow Exelon to put additional water into the Schuylkill River from a reservoir and an abandoned coal mine.	34 mi SE of the Montour site	DRBC approved docket May 8, 2013 (DRBC 2013-TN3345).
Three Mile Island Nuclear Station, Unit 1	One 2,568-MW(t), 786-MW(e) pressurized water reactor; Unit 1 was issued operation license in 1974.	63 mi S of the Montour site	Operational (NRC 2014-TN3964); renewed operating license issued in October 2009 (NRC 2014-TN3964).
Three Mile Island Nuclear Station, Unit 2	Unit 2 is in a non-operating status since the March 1979 accident.	63 mi S of the Montour site	Shut down (NRC 2014-TN3964). Defueling was completed in April 1990. Plant is in a stable condition suitable for long-term management (post-defueling monitored storage) (NRC 2014-TN3285).

Table 9-6. (contd)

Project Name	Summary of Project	Location	Status
Limerick Generating Station, Units 1 and 2	Two 3,514-MW(t), 1,134-MW(e) boiling water reactors; Unit 1 was issued operation license in 1985, Unit 2 was issued operation license in 1989.	81 mi SE of the Montour site	Operational (NRC 2014-TN3964). Renewed operating licenses issued October 2014 (NRC 2014-TN4050). Units 1 and 2 approved for combined 260-MW(t) (17%) power uprate in 2011 (NRC 2012-TN1538). Water withdrawals from the Schuylkill River and Wadesville Mine pool were approved in May 2013 (DRBC 2013-TN3345).
Peach Bottom Atomic Power Station, Units 2 and 3	Two 3,514-MW(t), 1,112-MW(e) boiling water reactors; Unit 2 was issued operation license in 1973, Unit 3 was issued operation license in 1974.	93 mi SE of the Montour site	Operational (NRC 2014-TN3964); renewed operating licenses issued in 2003 (NRC 2014-TN3964).
Peach Bottom Atomic Power Station, Unit 1	200-MW(t), high-temperature, gas-cooled reactor operated from June 1967 to final shutdown on October 31, 1974	93 mi SE of the Montour site	Shut down (NRC 2014-TN3964). All spent fuel has been removed and the spent fuel pool is drained and decontaminated; Unit 1 is in SAFSTOR status (NRC 2014-TN3346).
Montour Power Plant	1,504-MW coal power plant	Adjacent	Operational (Talen 2015-TN4412).
White Deer Energy Project	7-MW tire-derived energy	10 mi W of the Montour site	Application submitted Oct. 2011 to the PADEP (White Deer Energy 2012-TN1188; White Deer Energy 2013-TN4035). Project terminated January 2014 (PADEP 2014-TN4366).
Panda Patriot Power Plant	829-MW natural-gas combined-cycle (NGCC) generating station	11 mi NW of the Montour site	Proposed. Formerly Moxie Patriot Power Plant, was acquired by Panda Power in 2013; projected commercial operations start date 2016 (PPF 2013-TN3374).
Bucknell University Gas Combined Heat and Power Plant	5-MW dual-fuel turbine generator set (natural gas first, oil second); generates thermal energy in heat-recovery steam generators and electricity	13 mi SW of the Montour site	Operational (Bucknell University 2014-TN3737).
Panda Hummel	Converting retired Sunbury coal plant to 3 NGCC generating burners capable of producing 1,064-MW power	18 mi S of the Montour site	Application process begun (PADEP 2015-TN4350); NPDES permit obtained (PADEP 2015-TN4351).

Table 9-6. (contd)

Project Name	Summary of Project	Location	Status
Shamokin Dam Project	4.5-MW hydroelectric power, added to the already existing USACE Shamokin Dam	18 mi SW of the Montour site	Application for preliminary permit submitted August 2011 to Federal Energy Regulatory Commission (FERC) (76 FR 52656-TN1218).
Intelliwatt Renewable Energy	13-MW biomass (wood) energy	22 mi N of the Montour site	Proposed, secured 4.9 million state loan for construction in 2010 (IntelliWatt 2014-TN4037).
Moxie Freedom Project	1,050-MW gas-fired facility with two power blocks, each consisting of a combustion gas turbine (CGT and a steam turbine configured in single shaft alignment, sharing a single common electric generator.	28 mi W of the Montour site	Proposed, air permit obtained (PADEP 2015-TN4392; PennWell 2015-TN4353).
Hunlock Power Station	130-MW NGCC facility	32 mi NE of the Montour site	Operational (EPA 2014-TN3506).
Good Spring	Originally planned to be an IGCC facility, in March 2014 EmberClear announced a partnership with Tyr Energy for the development of two 337-MW NGCC plants	32 mi SE of the Montour site	Proposed, under development (Tyr Energy 2015-TN4361).
Harwood Plant	27–MW oil-fired generation facility	37 mi SE of the Montour site	Operational (PPUC 2015-TN4419).
Jenkins Plant	27.6–MW oil-fired generation facility	47 mi NE of the Montour site	Operational (PPUC 2015-TN4419).
Tenaska Lebanon Valley Generating Station	Up to 950-MW natural-gas facility	48 mi SE of Montour site	Proposed. Construction scheduled in 2015; expected online in 2018 (Tenaska 2014-TN3533).
Blossburg Generating Station	Gas plant	50 mi NW of the Montour site	Operational (EPA 2014-TN3744).
Brunner Island Power Plant	1,411-MW three-unit, coal-fired plant (Talen Energy-owned)	67 mi S of the Montour site	Operational (EPA 2014-TN3531; Talen 2015-TN4413).
Eureka Resources Wastewater-Treatment Facilities	Fracking wastewater treatment	Two sites: 47 mi NE of the Montour site (new construction) and 23 mi NW of the Montour site (operational since 2008)	Construction began in March of 2013 (Eureka Resources 2013-TN2615). Became operational in October 2013 (Williams 2013-TN3613; Eureka 2014-TN3673). Industrial Waste Permit (PA Bulletin 2014-TN3501; Lowenstein 2013-TN3510).

Table 9-6. (contd)

Project Name	Summary of Project	Location	Status
Koppers Susquehanna Waste Plant	The facility's product lines include pressure-creosoted railroad ties, bridge timbers, switch ties, and crossing panels	18 mi SW of the Montour site	Operational (EPA 2014-TN3745).
Viking Energy of Northumberland Waste Plant	18-MW biomass power-generation facility	13 mi SW of the Montour site	Operational (EPA 2014-TN3738; Biomass Magazine 2014-TN3923).
Other fossil-fuel operational energy projects	Numerous operating fossil-fuel power-generating stations such as: Wheelabrator Frackville Energy Coal Plant, Foster Wheeler Mt. Carmel Cogen Coal Plant, Binghamton Energy, Shawville, Paxton Creek, Northeast Natural Gas Portfolio (Hazleton), Saint Nicholas Cogeneration Project, Gilberton Power Co.	Throughout the region	Operational (EPA 2012-TN1193; EPA 2012-TN1192; Red Rock 2012-TN1602; Clearfield 2015-TN4393; Starwood 2015-TN4394; GEO 2014-TN3513; EPA 2014-TN3735; EPA 2014-TN3736).
Wind-energy projects	Various wind-power-generating projects including Locust Ridge Wind Farms	Throughout the region	Operational (Iberdrola Renewables 2012-TN1194).
Solar energy projects	Various solar power-generating projects (e.g., Romark PA Solar, Masser Farms Realty Solar, PA Solar Park, Pocono Raceway Solar Project)	Throughout the region	Operational (EPA 2014-TN3339; Masser 2014-TN3340; CED 2015-TN4355; EDF 2012-TN4356).
Hydropower energy projects	Various hydropower projects including Safe Harbor, Goodyear Lake, York Haven, Muddy Run, Conowingo, Holtwood. Proposed: Francis Walter Hydroelectric Project	Throughout the region	Operational (Enel 2012-TN1603; Olympus 2012-TN1600; Exelon 2012-TN1596; Exelon 2012-TN1595; Talen 2015-TN4414; Safe Harbor 2012-TN1604; USACE 2014-TN3509). Proposed (76 FR 73619-TN3621; FERC 2013-TN3622).
Susquehanna-Roseland 500-kV transmission line and other transmission lines in the region	500-kV power transmission lines	Throughout the region	Operational, May 2015 (PPL 2015-TN4263).
Marcellus gas pipelines	Numerous natural-gas transmission pipelines including Diamond East	Throughout the region	Proposed (Clean Air Council 2015-TN4367).

Table 9-6. (contd)

Project Name	Summary of Project	Location	Status
	Pipeline, PennEast Pipeline, Constitution Pipeline		
Leidy to Long Island Expansion Project	Natural gas transmission pipeline	3.4 mi of pipeline in Lycoming County (Hughesville Loop) and 5.3 mi in Luzerne County (Dorrance Loop); 11.5 mi in Luzerne and Monroe Counties (Franklin Loop)	Construction began in July 2015 (FERC 2015-TN4348).
Sunbury Pipeline	Natural gas transmission pipeline	35-mi long, will originate in Lycoming County and end at Shamokin Dam	Proposed; filed application with FERC in July 2015 (FERC 2015-TN4349).
Atlantic Sunrise Project	Natural-gas transmission pipeline	Throughout the region in Columbia and Luzerne Counties	Includes Central Penn pipeline; FERC process has begun and construction is anticipated for summer 2016 (Williams 2014-TN3614).
Mining Projects			
Spike Island operation	Coal refuse removal	27 mi W of the Montour site	Application pending; water permit pending with SRBC (2012-TN1196).
Various surface and subsurface mining projects	Numerous operating anthracite and stone/quarry mining including Milton Quarry, Knorr, Bear Gap, Harmony Mine	Throughout the region	Operational (EPA 2012-TN1289; EPA 2012-TN1290; EPA 2012-TN1197; EPA 2012-TN1198).
Mt. Pisgah uranium deposit	Uranium mines	46 mi SE of the Montour site	Test mines conducted in the 1950s, never developed commercially (Klemic and Baker 1954-TN1998).
Various Marcellus natural-gas projects	Various natural-gas extraction sites	9+ mi N and NW of the Montour site	Operational and Proposed (SRBC 2015-TN4358; SRBC 2013-TN1999; PDCNR 2012-TN3505).
Various acid mine drainage and abandoned mine remediation	Mine remediation	Throughout the region	Ongoing (PADEP 2014-TN3503; PADEP 2005-TN690; PADEP 2014-TN3504).

Table 9-6. (contd)

Project Name	Summary of Project	Location	Status
Transportation Projects			
Susquehanna River transportation projects	Bridge replacements, road, traffic, and pedestrian projects	Throughout the region	Ongoing (PennDOT 2014-TN4359).
Parks and Aquaculture Facilities			
Milton State Park	Activities include picnicking, boating, fishing, and hiking	12 mi SW of the Montour site	Development unlikely in this park (PDCNR 2012-TN1206).
Ricketts Glen State Park	Activities include picnicking, boating, swimming, camping, fishing, and hiking	23 to 28 mi NW of the Montour site	Development unlikely in this park (PDCNR 2012-TN1199).
Other State Parks	Various operating State parks such as: Sand Bridge State park, R.B. Winter State park, Locust Lake, Nescopeck, Hickory Run, Lehigh Gorge, Sand Bridge, McCalls Dam; Loyalsock Township Riverfront Park	Throughout the region	Development unlikely (PDCNR 2012-TN1287; PDCNR 2012-TN1288; PDCNR 2012-TN1203; PDCNR 2012-TN1200; PDCNR 2012-TN1202; PDCNR 2012-TN1201; PDCNR 2014-TN3520; Van Auken 2012-TN3986).
Other Actions/Projects			
Assorted flood control projects	Construction of levees, floodwalls, closure structures, and interior drainage structures	Throughout the region	Ongoing (PADEP 2013-TN2002).
Sandy-Longs Run	Abandoned mine-drainage watershed and aquatic restoration	Throughout the region	Ongoing (USACE 2012-TN1222).
Adam T. Bower Memorial Dam	Inflatable dam used in summer to make reservoir	17 mi SW of the Montour site	Seasonal (Sunbury 2014-TN3516).
Various wastewater-treatment plant facilities	Sewage treatment	Throughout the region	Operational

Table 9-6. (contd)

Project Name	Summary of Project	Location	Status
Various hospitals and industrial facilities that use radioactive materials	Medical and other industrial isotopes	Throughout the region	Operational
Safety Light Corporation	Manufacturing, former user of radioactive materials	16 mi SE of the Montour site	Superfund site, cleanup of radioactive waste in process (NRC 2012-TN1211).
Procter and Gamble Mehoopany Mill	Paper products and natural-gas power generation for facility use	47 mi NE of the Montour site	Operational (EPA 2012-TN1212).
US Gypsum/Ancillary Improvements	660,000-ft^2 wallboard manufacturing facility. Use synthetic gypsum generated as flue gas desulfurization byproduct at the adjacent Montour plant	Adjacent	Operational (Walbridge 2012-TN1213; EPA 2014-TN3499).
Cherokee Pharmaceutical Plant	Merck-owned steam-generation (natural-gas) facility for pharmaceutical production	8 mi S of the Montour site	Operational (EPA 2012-TN1214).
Great Dane Trailers	Trailer manufacturing	8 mi SE of the Montour site	Operational (Great Dane 2014-TN3514).
Benton Foundry	Iron foundries	21 mi NE of the Montour site	Operational (EPA 2012-TN1215).
Foam Fabricators Inc./Bloomsburg Plant	Polystyrene foam product manufacturing	18 mi SE of the Montour site	Operational (EPA 2012-TN1216).
KYDEX	Unlaminated plastics film and sheet	17 mi SE of the Montour site	Operational (EPA 2012-TN1217).
Jersey Shore Steel Company	Blast furnace/steel works/rolling	34 mi NW of the Montour site	Operational (EPA 2012-TN1291).
Corixa Corporation	Pharmaceutical preparations	70 mi S of the Montour site	Operational (EPA 2012-TN1590).
Seedco Industrial Park	Various industry and energy projects	22 mi SE of the Montour site	Operational and proposed (Jones Lang Laselle 2012-TN1292).
Various other large-scale industrial facilities	Industrial/manufacturing facilities	Throughout the region	Operational (EPA 2012-TN1592; EPA 2012-TN1591; EPA 2012-TN1589; EPA 2012-TN1588; EPA 2012-TN1293; EPA 2012-TN1300).

Table 9-6. (contd)

Project Name	Summary of Project	Location	Status
Misc. golf courses	Golf courses	Throughout the region	Operational
Other manufacturing	Other manufacturing plants	Throughout the region	Operational (EPA 2014-TN3739; EPA 2014-TN3740).
Future urbanization	Construction of housing units and associated commercial buildings; roads, bridges, and rail; construction of water- and/or wastewater-treatment and distribution facilities and associated pipelines, as described in local land-use planning documents	Throughout the region	Construction would occur in the future, as described in State and local land-use planning documents.

The Montour site is a greenfield site located north of the existing Montour coal-fired power plant in Derry Township, approximately 2 mi (3.2 km) northeast of the borough of Washingtonville, Montour County, Pennsylvania. State Route (SR) 54 and SR 254 are located to the west and south, respectively. Figure 9-5 provides a location map showing a 6-mi (9.7-km) radius surrounding the Montour site (PPL Bell Bend 2013-TN3377). The potential transmission- and water-corridor routes for the Montour site are shown in Figure 9-6.

Offsite Areas Affected by PPL's Plan for Consumptive-Use Mitigation and Site-Specific Low-Flow Protection for the Proposed Montour Site

The NRC staff assumed that PPL would apply to the SRBC for a permit to consumptively use 43 cfs (28 Mgd) of water from the West Branch of the Susquehanna River during operations of a nuclear plant at the Montour site. The NRC staff also assumed that the SRBC would impose consumptive-use mitigation and site-specific low-flow protection requirements for a plant at the Montour site that would include compensating releases from upstream sources in an amount equal to the plant's consumptive use, as required for the proposed Bell Bend site.

In its April 17, 2014, response to an RAI, (PPL Bell Bend 2014-TN3652), PPL described its plan for consumptive-use mitigation for a plant at the Montour site. Under this plan, PPL would expand the capacity of its existing Rushton Mine water-treatment facility to provide approximately 14 cfs (9 Mgd) of water for consumptive-use mitigation (PPL Bell Bend 2014-TN3536). Rushton Mine discharges to Moshannon Creek, which is a tributary to the West Branch of the Susquehanna River with a confluence near Karthaus, approximately 20 mi northeast of Rushton Mine and upstream of the Montour site (Figure 9-7). The remainder of the water required for consumptive-use mitigation (approximately 29 cfs [19 Mgd]) would be obtained by developing other mine sources.

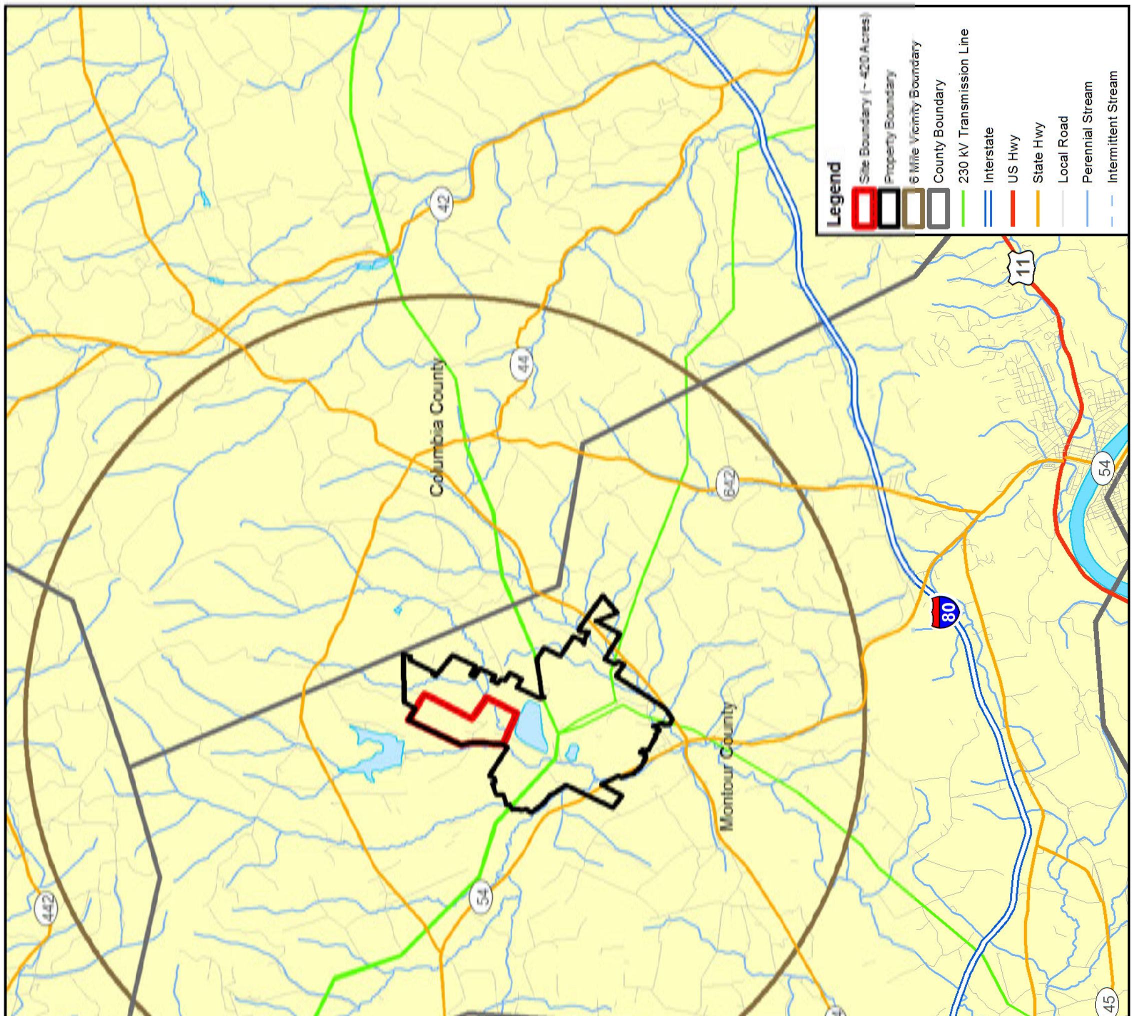

Figure 9-5. The Montour Site Region (PPL Bell Bend 2013-TN3377)

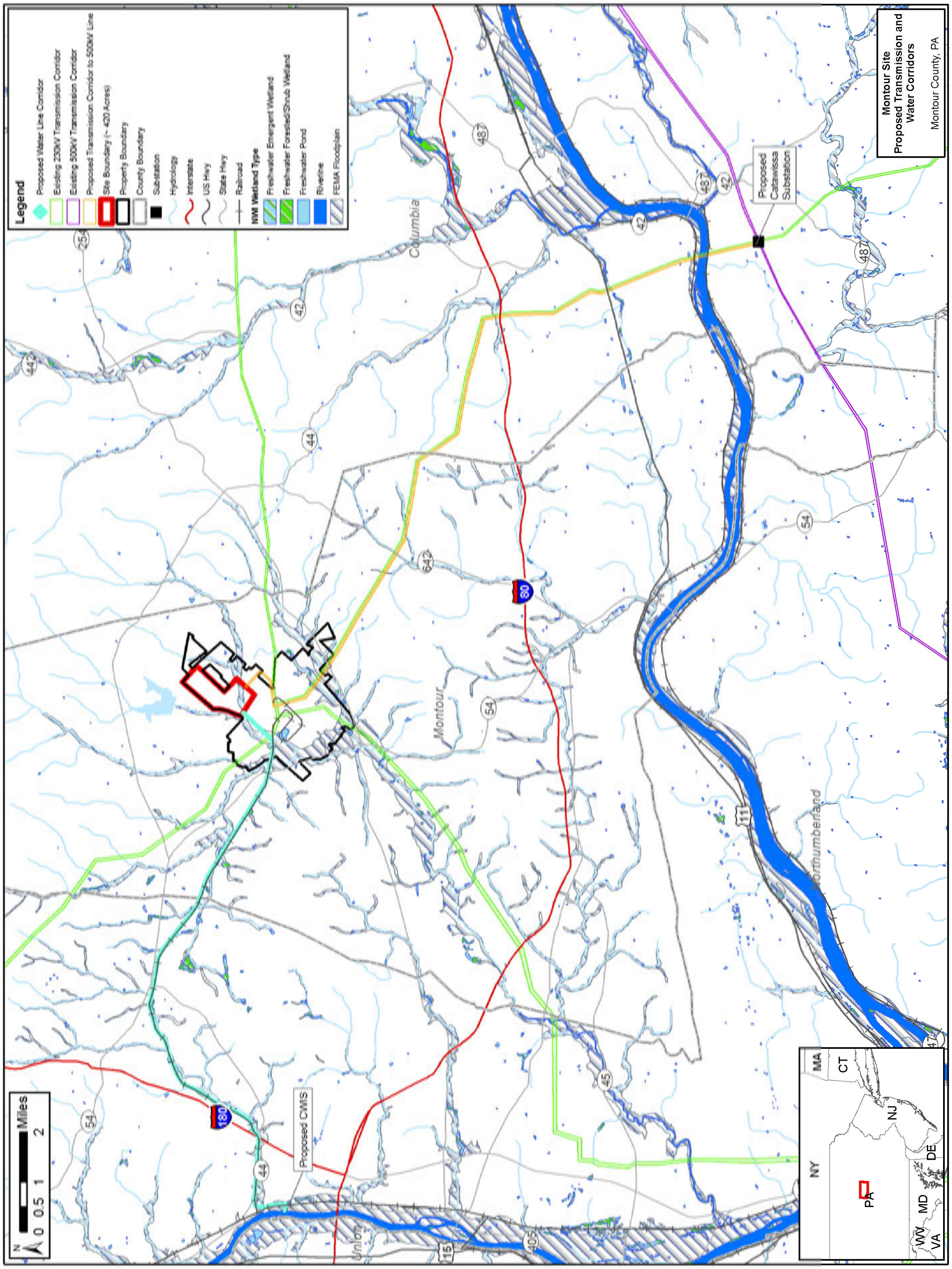

Figure 9-6. The Montour Site Transmission- and Water-Corridor Routes

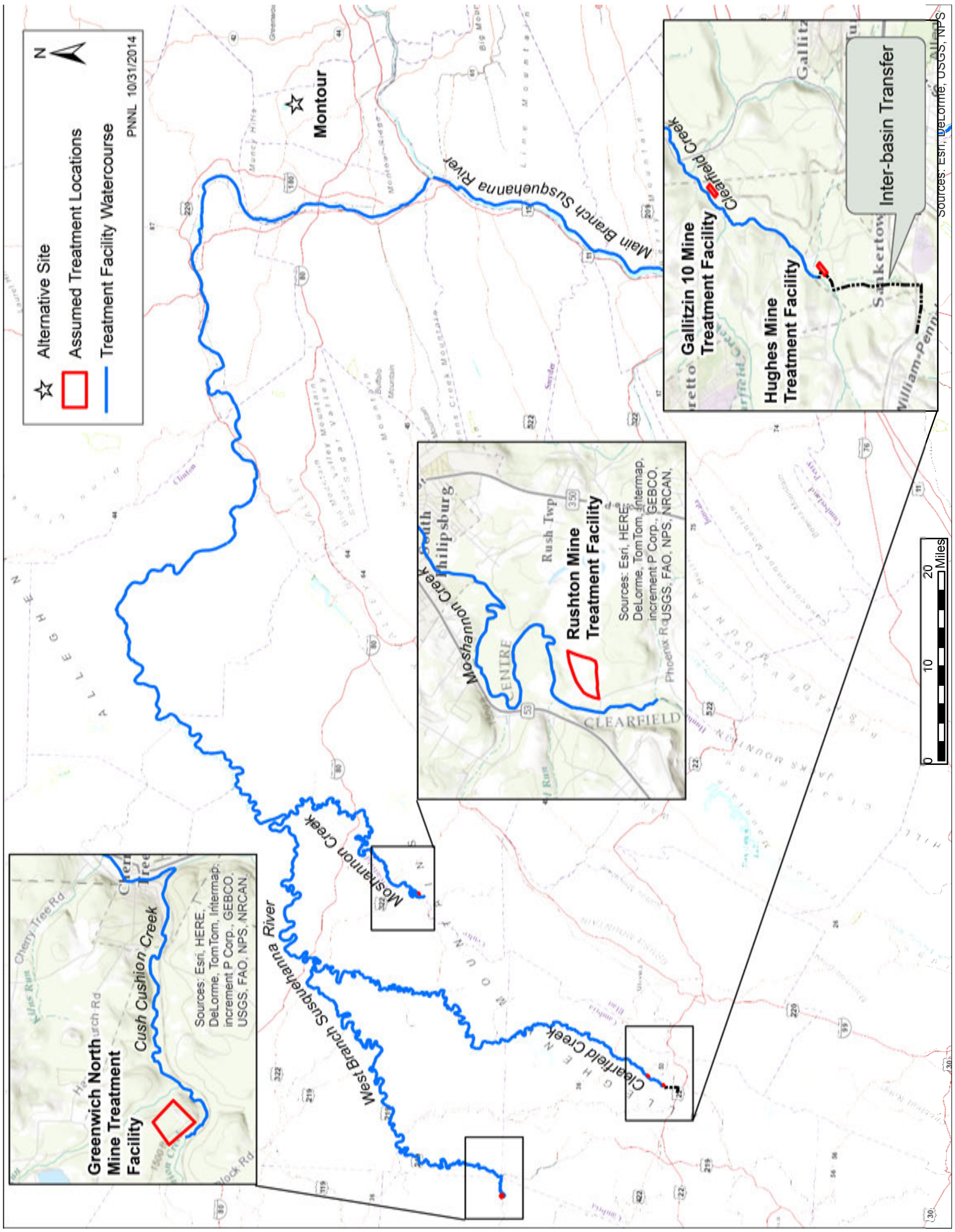

Figure 9-7. Waterbodies and Mines that are Part of PPL's Plan for Consumptive-Use Mitigation and Site-Specific Low-Flow Protection for the Montour Alternative Site

Three potential mines were described by PPL that collectively have a capacity to yield approximately 22 cfs (14 Mgd) for consumptive-use mitigation and site-specific low-flow protection (PPL Bell Bend 2014-TN3652). Locations of these mines are shown in Figure 9-7. The Greenwich North Mine would discharge at a rate of 10 cfs (6.5 Mgd) to Cush Cushion Creek, a tributary of the West Branch of the Susquehanna River with a confluence at Cherry Tree, approximately 30 mi southwest of Rushton Mine. The Gallitzin 10 Mine and the Hughes Mine would discharge to the headwaters of Clearfield Creek at rates of about 5 and 7 cfs (3.0 and 4.6 Mgd), respectively. Clearfield Creek is a tributary of the West Branch of the Susquehanna River with a confluence near Clearfield. The Hughes Mine currently discharges to the headwaters of the Little Conemaugh River, a tributary of the Allegheny River in the Ohio River Basin. Water from the Hughes Mine would be redirected to Clearfield Creek via pipeline. PPL stated that other mines in the vicinity of the Gallitzin 10 Mine could be developed to provide an additional discharge of 9 cfs (5.7 Mgd) to Clearfield Creek (PPL Bell Bend 2014-TN3652).

The location and magnitudes of flow measurements used to trigger consumptive-use mitigation and site-specific low-flow protection for a plant at the Montour site would be determined by the SRBC. The NRC staff assumed that triggering flows selected by the SRBC would result in the need for consumptive-use mitigation and site-specific low-flow protection similar to that for the proposed BBNPP unit.

The plan described by PPL for mitigation of consumptive use by a plant at the Montour site would not alter the existing consumptive-use mitigation releases from Cowanesque Lake.

9.3.2.1 Land Use

The following analysis includes impacts from building and operating a nuclear power plant at the Montour site, along with transmission lines needed to connect the plant to the electrical grid. The analysis also considers other past, present, and reasonably foreseeable future actions that affect land use, including the other Federal and non-Federal projects listed in Table 9-6. For this analysis, the geographic area of interest is considered to be the 25-mi region centered on the Montour site plus any transmission-line and pipeline corridors that extend beyond that range. The review team determined that a 25-mi radius would represent the smallest area that would be directly affected because it includes the primary communities that would be affected by the proposed project if it were located at the Montour site. The geographic area of interest also includes lands bordering or otherwise closely associated with water features (e.g., shorelines, riparian zones, floodplains, and water-based recreation areas) affected by the proposed plan for consumptive-use mitigation and site-specific low-flow protection associated with use of the Montour site.

Site Description

The 420-ac Montour site is located in the northern portion of a larger property owned by PPL in Montour County, Pennsylvania (Figure 9-5). The site is predominantly agricultural land with scattered stands of forest. In general, the topography of the site is level with higher elevations in its northern portions. The total relief across the site is approximately 132 ft. The Montour site is located in a Residential–Agricultural zoning district. Approximately 241 ac (56 percent) of the land within the site area is prime farmland (UniStar 2011-TN505).

The surrounding area has sparse population and is mostly rural, with forests and small farms comprising the dominant land uses. The Montour site is located immediately north of an existing coal-fired power plant, which is owned and operated by PPL and situated within the remainder of the PPL Montour property. The coal-fired power plant has been operating since 1972 and has a 1,550-MW generating capacity (PPL Generation 2014-TN3194). A small residential area (Strawberry Ridge) and a larger community (Washingtonville) are located to the east and southwest of the Montour site, respectively. A complex of greenhouses is located northwest of the site, and a gypsum/wallboard plant is located southeast of the site. SR 54 and SR 254 are located to the west and south of the Montour site, respectively.

PPL owns several parcels in the area including the coal-fired power plant site, the proposed Montour site, and adjoining lands. PPL owns additional property north of the coal-fired power plant site, including the 165-ac Lake Chillisquaque Reservoir that serves as a backup water source to the power plant and the Montour Preserve that surrounds the lake. The preserve offers a variety of educational and recreational opportunities, including hiking, nature observation and photography, birding, boating, and fishing. In addition, hunting occurs nearby (PPL Generation 2014-TN3194).

Building and Operation Impacts

Based on information provided by the applicant and the review team's independent assessment, development of a proposed power plant at the Montour site would convert existing land uses on about 420 ac of the site to utility uses for the nuclear facility and associated structures and infrastructure. Additional areas would be affected by laydown yards, stormwater-retention ponds, and borrow pits both during and after building activities. The proposed new unit at the Montour site would take advantage of existing rail infrastructure serving the coal-fired power plant (UniStar 2011-TN505). Table 9-7 summarizes expected land-use impact parameters for the Montour site, including the construction and operation of new water and transmission lines.

Table 9-7. Land-Use Impact Parameters for the Montour Site

Parameter	Value
Property acreage (ac)	3,796
Site acreage (ac)	420
Estimated onsite land disturbance area (ac)	420
Length of new water pipelines (mi)	12.6
Right-of-way (ROW) clearing for new water pipelines (ac)[(a)]	183
Length of transmission-line corridor (mi)	16.3
ROW clearing for new transmission-line corridor (ac)[(b)]	395

(a) The water line construction ROW is assumed to be 120 ft wide to allow installation of two 60-in. diameter pipes. The ROW width would be reduced to 80 ft at wetland and stream crossings.
(b) A 200-ft-wide cleared ROW is assumed for new transmission-line construction across open land. A 100-ft-wide cleared ROW is assumed in areas where the new line would parallel an adjacent existing transmission line.

Source: Bell Bend Nuclear Power Plant Alternative Site Evaluation v.[2], May 2011 (UniStar 2011-TN505)

Because the project would not be consistent with the existing Residential−Agricultural zoning, that zoning would have to be changed. However, considering the proximity to an existing operating power plant, the potential incompatibility with nearby land uses would be less than suggested by the zoning. The review team is not aware of any other substantial conflicts with any existing land-use plans. Development of the Montour site would result in the loss of approximately 241 ac of prime farmland, which would have at most a minimal effect on agriculture in the geographic area of interest. This is especially true considering the nearby presence of an existing power plant. The review team does not expect the proposed plant to interfere substantially with PPL's ongoing hunting and other conservation efforts on its Montour property.

New water-intake and water-discharge pipelines would need to be constructed to obtain water from the West Branch of the Susquehanna River. PPL's initial conceptual design suggests the new water pipelines would extend west from the western border of the Montour site for approximately 12.6 mi, running parallel to a railroad line for the majority of the distance to the West Branch of the Susquehanna River. The construction ROW for the new water lines would be 120 ft wide to allow installation of two 60-in. diameter pipes. An estimated 183 ac would be cleared within the ROW to install the new water lines. Development of the water lines would require a small amount of riverfront land sufficient for an intake, a major pumping station, and ancillary structures, as well as additional land for the construction of a pipeline large enough to provide approximately 50 Mgd of river water to the site. The new pipeline would cross railroad tracks, a major highway, and several local roads between the river and the site (UniStar 2011-TN505).

Development of a proposed power plant at the Montour site would require construction of one new transmission line between the new plant and the proposed Catawissa substation. One option being considered is to construct a new transmission line of approximately 16.3 mi from the southern boundary of the Montour site to the substation (UniStar 2011-TN505). The total amount of cleared ROW needed is estimated to be approximately 395 ac.

Most of the new and expanded transmission-line ROW would cross low-density rural land that is primarily agricultural and forest land. In addition, the new transmission lines would cross numerous roads and highways. Where a new transmission-line ROW would cross-agricultural land, existing agricultural activities would be allowed to continue, and the effect of these corridors on land usage would be minimal. Because of the steep, dissected landscape with most wetlands limited to riparian settings, the review team expects that transmission towers and other facilities could be built without substantial encroachment into wetlands or floodplains. In some limited areas, expansion of the existing ROW may encroach onto adjacent residential or commercial lands requiring land acquisition and potentially causing conflicts with existing land uses.

Cumulative Impacts

Ongoing urbanization in the geographic area of interest could contribute to additional decreases in open areas, forests, and wetlands and generally result in some increase in residential and industrialized areas. However, if recent trends described for the surrounding area (PDCED 2011-TN2225) continue, the region is likely to experience continued slow rates of development. Future climate change could also result in changes in land use in the geographic area of interest, similar to those described in Section 7.1. Most of the other projects described in Table 9-6 do not suggest a likelihood of substantial changes in general land-use patterns within the geographic area of interest.

If additional transmission lines, pipelines, or other utility lines were built for other energy projects, a cumulative land-use impact could occur from the additional amount of land converted to utility-corridor use within the geographic area of interest. Multiple new utility line corridors could alter the land-use classification acreage proportions within the area. However, the review team expects that the utility lines would be consistent with land-use plans and zoning regulations implemented by the affected counties.

The review team concludes that the cumulative land-use impacts associated with the proposed project at the Montour site, related development of offsite corridors needed for transmission lines and other appurtenant facilities, and other projects in the geographic area of interest would be MODERATE. This conclusion primarily reflects possible land-use conflicts from having to traverse numerous offsite properties to establish new ROWs for transmission lines and water pipelines for a new reactor at the Montour site. Building and operating a new nuclear power plant at the Montour site would be a significant contributor to these impacts.

9.3.2.2 Water Use and Quality

This section describes the review team's assessment of impacts on water use and quality associated with building and operating a nuclear power plant at the Montour alternative site. The assessment considers other past, present, and reasonably foreseeable future actions that affect water use and quality, including the other Federal and non-Federal projects listed in Table 9-6. The Montour site hydrology, water use, and water quality are discussed in Section 9.3.2.2.3 of the ER (PPL Bell Bend 2013-TN3377).

The ROI consists of the Susquehanna River Basin because water would be withdrawn from and wastewater would be discharged to the river if the proposed project were located at the Montour site. Based on PPL's description (PPL Bell Bend 2013-TN3377), the review team estimated that the intake and discharge structures would be located on the West Branch of the Susquehanna River, approximately 15 mi upstream from the confluence with the North Branch of the Susquehanna River) at Sunbury. The U.S. Geological Survey (USGS) gage closest to the intake location for the Montour site, with an extended period of discharge observations, is at Lewisburg (USGS Gage 01553500, the West Branch of the Susquehanna River at Lewisburg). The available discharge record for this gage is from 1939 to the present. Mean annual discharge for the period from 1939 to 2013 is 10,910 cfs, and the P90 flow (the daily flow that is exceeded 90 percent of the time) for the same period is 1,510 cfs (USGS 2014-TN4427). Curwensville Dam, constructed by the U.S. Army Corps of Engineers in 1965 for flood control, is the only major dam in the West Branch Susquehanna sub-basin with significant influence on West Branch of the Susquehanna River flows.

The West Branch of the Susquehanna River at the point of intake and discharge for a plant at the Montour site has a designated protected water use for aquatic life of warm-water fishes and migratory fishes (Pennsylvania Code, Title 25, Chapter 93.9l [PA Code 25-93 -TN611]). Water quality in the West Branch of the Susquehanna River at Lewisburg is monitored by the SRBC as part of its large river biological assessment (Shenk 2011-TN698). Water-quality parameters evaluated by the SRBC include temperature, dissolved oxygen, conductivity, pH, alkalinity, total suspended solids, nitrogen, nitrite, nitrate, turbidity, phosphorous, orthophosphate, total organic carbon, hardness, calcium, magnesium, sodium, chloride, sulfate, iron, manganese, and aluminum. The West Branch of the Susquehanna River was rated as slightly impaired for biological condition at this monitoring location in 2010 (Shenk 2011-TN698). Water quality was monitored in 2002 and 2009 near the intake/discharge location for a plant at the Montour site (SRBC 2014-TN3708). All parameters measured satisfied the water-quality standards in Table 2-6. The lower West Branch of the Susquehanna River is not designated by SRBC as mine-drainage impaired (SRBC 2013-TN2942).

For groundwater, the geographic area of interest is limited to the site and the immediate surroundings because PPL has indicated groundwater would not be used when building or operating the plant (PPL Bell Bend 2013-TN3377). The geologic map of Pennsylvania (Berg et al. 1980-TN3709) indicates that the bedrock at the Montour site is composed of the same formations present at the BBNPP site. The review team assumed that the bedrock aquifer characteristics at the Montour site would be similar to those at the BBNPP site. Surficial deposits in the area of the Montour site are sandy to clayey glacial tills of pre-Illinoisan age (>770,000 years) (Sevon 1989-TN3700; Sevon and Braun 2000-TN3701).

Building Impacts

Because building activities at the Montour site would be similar to those for the BBNPP site, the review team assumed the amount of water needed for building activities at the Montour site would be the same as that required for building activities at the BBNPP site. The Pennsylvania-American Water Company (PAWC) municipal groundwater-supply system at Berwick Water would supply water via a dedicated line for construction and preconstruction (PPL Bell Bend 2013-TN3377). As described in Section 4.2.2, the review team determined that the average work-day water demand for building activities is about 5 percent of the average unused capacity of the PAWC Berwick well system, and the resulting impact on water resources would be minor.

The intake and discharge structures for a plant at the Montour site would be similar in design to those proposed for the BBNPP site (PPL Bell Bend 2013-TN3377). PPL would locate the structures to minimize impacts on wetlands and the Susquehanna River (PPL Bell Bend 2013-TN3377). Building the structures would be subject to the same regulatory and monitoring conditions as described in Section 4.2 at the BBNPP site. Therefore, the review team determined that the effects on river flows and water quality of building the intake and discharge structures would be temporary and limited to a small portion of the river and shoreline.

A plant at the Montour site would require new intake and effluent discharge pipelines to be built from the site approximately 12.5 mi to the Susquehanna River. PPL estimated that 1.3 ac of wetlands and 3,400 ft of streams would be affected by building the 12-mi-long pipelines. The review team assumed that these activities would conform to applicable local and state requirements so that impacts on the affected water resources would be localized and temporary.

Surface-water quality could be affected by stormwater runoff during building of a plant at the Montour site. The Montour site is drained by Chillisquaque Creek, a stream with a designated protected water use for aquatic life of warm-water fishes and migratory fishes (PA Code 25-93 - TN611). Building activities at the site would be required to conform to the conditions of a NPDES permit issued by the PADEP. An erosion and sediment control plan would be required as part of the permit, which would identify BMPs to be used to control the impacts of stormwater runoff. The review team assumed that facilities such as stormwater detention and infiltration ponds would be used to control site runoff and minimize sediment transport offsite. As a result, stormwater runoff is not anticipated to affect water quality of the local waterbodies.

Because the effects from building-related activities for a plant at the Montour site would be minimized using BMPs, would be localized and temporary, and would be controlled under various permits, the review team concludes that the impact from building-related activities on surface-water use and quality would be minor.

Building activities at the Montour site include building a safety-related onsite impoundment to provide water for the ultimate heat sink (PPL Bell Bend 2013-TN3377). This impoundment would be similar in size and construction to the safety-related essential service water emergency makeup system (ESWEMS) pond at the BBNPP site. The review team considered that building the impoundment at the Montour site would involve dewatering of the excavation, similar to that needed at the BBNPP site. Dewatering for the power-block and cooling-tower excavations also would likely be required. The potential effects of the excavation dewatering may include changes in groundwater levels in the surrounding area. Based on the assumed similarity of the bedrock aquifers in the Montour site area to those at the BBNPP site, the review team assumed that the impact of dewatering the excavations would be managed by methods such as grouting and installing low-permeability barriers, similar to that proposed for dewatering at the BBNPP site. Because there would be no groundwater use at the Montour site and the impact of dewatering during building would be controlled and temporary, the review team concludes that building impacts on groundwater resources would be minor.

While building a plant at the Montour site, groundwater quality may be affected by inadvertent spills of chemicals (e.g., petroleum products). The review team assumed that the BMPs PPL would follow for the BBNPP site would be in place during building activities at the Montour site and, therefore, concludes that any spills would be quickly detected and remediated. The review team evaluated the BMPs described in Section 4.2.1.9 of the ER (PPL Bell Bend 2013-TN3377) and the commitments made by PPL in Section 4.2.1.8 of the ER to comply with the applicable hydrological standards and regulations. Because runoff, groundwater, and surface waterbodies would be monitored for contaminants, and any spills related to building activities would be quickly remediated under the BMPs, the review team concludes that the impact on groundwater quality from building a plant at the Montour site would be minor.

Operational Impacts

The review team assumed that water withdrawal, consumptive use, and effluent discharge for operating a plant at the Montour site would be identical to the estimated water flows for operating the proposed BBNPP unit. The average withdrawal from the Susquehanna River to operate a plant at the Montour site would be 25,729 gpm (57.3 cfs), and the average consumptive use would be 17,064 gpm (38.0 cfs). Water-use impacts of operating the proposed BBNPP unit were evaluated using the requested withdrawal and consumptive-use limits in PPL's permit application to the SRBC. These maximum amounts are 65 cfs for withdrawal and 43 cfs for consumptive use. These flow rates are less than 1 percent of the mean annual flow of the West Branch Susquehanna River at Lewisburg. For the 7Q10 flow (i.e., the 7-day average low flow that occurs on average once every 10 years), which is approximately 730 cfs at Lewisburg (Ehlke and Reed 1999-TN3705), consumptive use by a plant at the Montour site would result in about a 6 percent reduction in river flow. Because flow in the West Branch of the Susquehanna River is less than in the North Branch of the Susquehanna River, operating a plant at the Montour site would reduce river flow by a greater fraction than would operating a plant at the BBNPP site. The NRC staff assumed that the SRBC would consider this in determining the consumptive-use mitigation and passby flow requirements for a plant at the Montour site so that the impacts of the consumptive use would be minimized. Based on this assumption, and because operating the plant would reduce West Branch of the Susquehanna River flow by a small fraction under all but very low-flow conditions, the NRC staff determined that the operational impact on surface water of the proposed plant at the Montour site would be minor.

The NRC staff assumed that the requirements for consumptive-use mitigation and site-specific low-flow protection, specified by SRBC for the proposed BBNPP unit and described in Section 2.2.2, would also apply to a plant at the Montour site. PPL's plan for consumptive-use mitigation and site-specific low-flow protection for a plant at the Montour site is described in Section 9.3.2 and would involve the development of four or more mines as upstream water sources to provide the releases that would be require during low-flow conditions (PPL Bell Bend 2014-TN3652). The NRC staff conducted a brief assessment of the impacts of this plan on the affected waterbodies. Impacts on Moshannon Creek would be identical to those from the proposed BBNPP unit, which the NRC staff determined to be minor. The other mine releases would be made near the headwaters of the receiving streams. Because all releases would occur during low-flow conditions, the releases could cause significant changes in stream flow. Because each release is relatively small, they would be expected to result in average flows in the streams, and not expected to result in flooding conditions. Water treatment prior to release would be expected to improve the water quality of the receiving streams.

Consumptive-use mitigation and site-specific low-flow protection releases from the Hughes Mine would involve an out-of-basin transfer that would eliminate the current discharge from the mine into the Little Conemaugh River. Because the mine discharge is currently untreated, PPL stated that the out-of-basin transfer would reduce flow in the Little Conemaugh River, but improve the downstream water quality (PPL Bell Bend 2014-TN3652). The NRC staff assumed that the SRBC would require that impacts on the Little Conemaugh River be minimized as part of approving PPL's plan for consumptive-use mitigation and site-specific low-flow protection.

PPL stated that drawdown in the Gallitzin 10 Mine would be expected to impact 15 private water supply wells (PPL Bell Bend 2014-TN3652). The NRC staff assumed that the SRBC would require that impacts on these users be minimized as part of approving PPL's plan for consumptive-use mitigation and site-specific low-flow protection (e.g., by replacing private wells with a public water supply). Forty private water supply wells were identified near the Hughes Mine, but PPL stated that these wells would not be affected by use of the mine as a source of water for mitigation.

The SRBC has an interest in developing mine pools as sources of water for consumptive-use mitigation (SRBC 2013-TN3568), and would have the authority to require PPL to implement a plan that minimizes impacts. PADEP also would have regulatory authority over discharges to the receiving streams through the NPDES permit. As described above, the NRC staff recognized that PPL's consumptive-use mitigation and site-specific low-flow protection plan for the Montour site could result in a reduction of flows in the Little Conemaugh River and potentially impact private water supply wells. These effects would be noticeable but not destabilizing. However, these effects would be localized and addressed as a condition of the SRBC water withdrawal and consumptive-use permit. Therefore, the NRC staff determined that the effects of consumptive-use mitigation and site-specific low-flow protection on the potentially affected waterbodies would be minor.

As stated above, onsite groundwater would not be used for operating a plant at the Montour site. The review team assumed that the water supply for potable and sanitary uses during operations would be the PAWC well system at Berwick. The review team also assumed that the amount of water required from the PAWC municipal system would be the same as that required for operating the BBNPP. As described in Section 5.2.2, the review team determined that the average water demand during plant operation would be about 5 percent of the average unused capacity of the PAWC Berwick well system, and the resulting impact on water resources would be minor.

During operation of a proposed plant at the Montour site, impacts on surface-water quality could result from stormwater runoff, discharge of sanitary and other wastewater, and discharge of blowdown from the cooling towers into the Susquehanna River. Stormwater runoff and discharges from the site would be regulated under the NPDES permit administered by the PADEP. BMPs for controlling stormwater would be described in a post-construction stormwater management plan. The review team assumed that the concentration of solutes in the liquid effluent and the blowdown discharge rate (19 cfs) would be the same as that for the proposed BBNPP unit. Because the blowdown rate is only 2.6 percent of the estimated 7Q10 flow, constituents in the effluent would be rapidly diluted by the much larger flow in the river. Because flow in the West Branch of the Susquehanna River is less than in the North Branch of the Susquehanna River, the extent of the thermal plume would be somewhat greater than that determined for the discharge from the proposed BBNPP unit. As described in Section 5.2.3, under conservative conditions, the maximum extent of the thermal plume from the proposed BBNPP unit in winter is anticipated to be about 50 ft as determined by the isotherm 2°F above the ambient river temperature. Because stormwater controls would be in place and the blowdown discharge would be regulated under an NPDES permit, the review team concludes that the impacts on surface-water quality from operating a plant at the Montour site would be minor.

During operation of a nuclear plant at the Montour site, impacts on groundwater quality could result from accidental spills. Spills that might affect the quality of groundwater would be prevented and mitigated by using BMPs as described above. Because BMPs would be used to mitigate spills and no intentional discharge to groundwater should occur, the review team concludes that the groundwater-quality impacts from operation of a plant at the Montour site would be minor.

Cumulative Impacts

In addition to water-use and water-quality impacts from building and operating activities, this cumulative analysis consider past, present, and reasonably foreseeable future actions that affect the same water resources. For the cumulative analysis of impacts on surface-water, the geographic area of interest is considered to be the drainage basin of the Susquehanna River upstream and downstream of the Montour site intake and discharge structures. For the cumulative analysis of impacts on groundwater, the following two geographic areas of interest have been identified: (1) the proposed Montour site and the surrounding area that could be affected by dewatering activities during preconstruction and construction, and (2) the area contributing to the PAWC well system that is the source of water for site activities during preconstruction and construction and for potable and sanitary uses during operations.

Cumulative Water-Use Impacts

Based on a review of the history of water-use and water-resources planning in the Susquehanna River Basin, the review team determined that past and present use of the surface waters in the basin has been noticeable, necessitating consideration, development, and implementation of careful planning (SRBC 2013-TN3568). As described in Section 7.2, the SRBC anticipates that population in the basin will increase 4.4 percent between 2010 and 2030, with this growth occurring almost entirely in the Lower Susquehanna sub-basin. Population growth is projected to increase about 1 percent during the same period in the West Branch Susquehanna sub-basin (SRBC 2013-TN3568). Consumptive use in the basin is projected to increase by about 320 Mgd (495 cfs) between 2005 and 2025 (SRBC 2013-TN3568), with 43 Mgd (66 cfs) of this occurring in the West Branch Susquehanna sub-basin (SRBC 2008-TN699).

The review team is aware of the potential climate changes that could affect the water resources available for cooling and the impacts of reactor operations on water resources for other users. Because the Montour site is located near the BBNPP site, the potential changes in climate would be similar (GCRP 2014-TN3472). Therefore the review team concludes that the impact of climate change on water resources would be similar to that for the BBNPP site.

Of the projects listed in Table 9-6, those that were considered for cumulative impacts on the surface-water resource are natural gas extraction, and the continued operation of the Montour Steam Electric Station (MSES) and other power-generation facilities. Other projects listed in Table 9-6 either do not affect the surface-water resource, their surface-water use is insignificant, or the impacts of their surface-water use are reflected in the West Branch of the Susquehanna River discharge record.

Unconventional natural gas extraction is less than 10 percent of current basin-wide consumptive use (excluding public water supply diversions), and is expected to remain a relatively small proportion of total consumptive use in the future. Impacts from gas extraction are of greatest concern in small watersheds where most of the gas development has occurred. Therefore, the review team determined that the cumulative impacts from unconventional gas extractions would be limited.

Consumptive use of 43 cfs for operation of a plant at the Montour site is about 0.4 percent of the mean annual West Branch of the Susquehanna River discharge at Lewisburg of 10,910 cfs. This mean annual discharge is for the period after the construction of Curwensville Dam, and it reflects the cumulative consumptive use of current users in the West Branch Susquehanna sub-basin. Total consumptive use of water in the West Branch Susquehanna sub-basin is anticipated to increase by about 66 cfs between 2005 and 2025 (SRBC 2008-TN699). This amount of consumptive use is less than 1 percent of the mean annual flow at Lewisburg, and would result in minor cumulative impacts at that flow rate. However, during low-flow conditions, cumulative impacts from an additional 66 cfs of consumptive use would be significant without mitigation. Addressing the need for additional consumptive-use mitigation in the basin is a primary concern of the SRBC.

Under PPL's plan for mitigation of consumptive use by a plant at the Montour site, described in Section 9.3.2, mitigation releases would be made from four or more mine pools. These releases would be individually small and distributed in the basin. Therefore, the NRC staff determined that there would be no cumulative impacts associated with the consumptive-use mitigation for a plant at the Montour site.

Because of extensive use of surface water in the Susquehanna River Basin, both in the past and the present, the NRC staff determined that the cumulative impacts on surface-water resources at the Montour site would be MODERATE. However, the NRC staff further concludes that building and operating a new nuclear power plant at the Montour site would not be a significant contributor to these impacts.

As stated above, no onsite groundwater would be used when building or operating a new nuclear plant at the Montour site. Most of the projects in Table 9-6 are more than 10 mi from the Montour site and, thus, would not contribute to a cumulative impact on groundwater supply within the ROI. Water for potable and sanitary uses would be obtained from the PAWC municipal supply at Berwick. The amount required would be less than 11 percent of the available unused capacity of the PAWC system. Because only a small population increase in the West Branch Susquehanna sub-basin is anticipated, the review team determined that the capacity of the PAWC system is unlikely to be exceeded during operation of a plant at the Montour site. No other significant groundwater use was identified in Table 9-6 that would affect the capacity of the PAWC system. Therefore the review team concludes that the cumulative impact on groundwater use at the Montour site would be SMALL.

Cumulative Water-Quality Impacts

As stated in Section 7.2.2.1, the SRBC has implemented careful planning and regulation of water quality in the Susquehanna River Basin. In addition, the PADEP monitors water quality throughout most of the basin and enforces water-quality regulations through the NPDES permitting program. Although there have been improvements in water quality in the basin (e.g., reductions in iron concentrations), water quality remains a priority for the SRBC (SRBC 2013-TN3568). In its review of the SSES license-renewal application, the NRC staff concluded that water quality in the Susquehanna River Basin has been significantly impacted by past activities, and will likely continue to be adversely affected by human activities in the future (NRC 2009-TN1725). The review team concludes that past and present actions in the Susquehanna River Basin have resulted in noticeable impacts on water quality.

The projects listed in Table 9-6 may result in alterations to land surface, surface-water drainage pathways, and waterbodies. These projects would need Federal, State, and local permits that would require implementation of BMPs. Therefore, the impacts on surface-water quality from these projects are not expected to be noticeable. The discharge for a plant at the Montour site would be located near the intake and discharge for the MSES. The MSES discharge rate is less than the discharge rate for a plant at the Montour site. While reviewing the NPDES application for a plant at the Montour site, the PADEP would have the opportunity to consider the interaction of the discharge with the existing MSES discharge, and require discharge rules that would protect the aquatic environment. The review team assumed that the discharge for a plant at the Montour site would be located, designed, and regulated so that significant interaction with the discharge from the MSES would be avoided. Therefore, the review team determined that the cumulative impact of the combined discharges from the MSES and a new plant at the Montour site would be minor.

Because of extensive use of surface water in the Susquehanna River Basin, the review team concludes that the cumulative impact on surface-water quality from past and present actions and building and operating the proposed plant at the Montour site would be MODERATE. However, the review team further concludes that building and operating a new nuclear power plant at the Montour site would not be a significant contributor to the cumulative impact.

Based on the proposed or possible projects listed in Table 9-6, most of which are located more than 10 mi from the Montour site, additional impacts on groundwater quality are expected to be minimal. As discussed previously in this section, BMPs would be implemented to minimize groundwater contamination and quickly remediate any inadvertent spills. Engineering controls would be used to limit the impacts of dewatering activities during building, and no onsite groundwater would be used during building or operation of the plant. Therefore, the review team concludes that the cumulative groundwater-quality impacts of a new plant at the Montour site would be SMALL.

9.3.2.3 Terrestrial and Wetland Resources

The following analysis includes impacts from building and operating the proposed new nuclear plant on terrestrial ecology resources at the Montour site. The analysis also considers past, present, and reasonably foreseeable future actions that affect the terrestrial ecological resources, including other Federal and non-Federal projects and the projects listed in Table 9-6. For the analysis of terrestrial ecological impacts at the Montour site, the geographic area of interest includes the portions of Montour, Northumberland, Snyder, Union, Lycoming, and Columbia Counties that are within a 21-mi radius of the site. The 21-mi geographic area of interest was selected to encompass closely interrelated nearby terrestrial habitats and ensure inclusion of all associated pipelines and transmission lines. The greatest distance to such an offsite facility from the Montour site is to the nearest point of transmission interconnection (14.3 mi) (UniStar 2011-TN505). The land within the 21-mi area lies within the Ridge and Valley ecoregion (Woods et al. 2003-TN1806). The geographic area of interest is expanded to also include the waterbodies affected by consumptive-use mitigation and site-specific low-flow protection releases.

The geographic area of interest encompasses all of the offsite facilities discussed below in the site description section. The geographic area of interest would also encompass the important animal and plant species and communities that could potentially be affected by plant construction and operation. The 21-mi distance was used by the Pennsylvania Department of Conservation and Natural Resources (PDCNR), Pennsylvania Fish and Boat Commission (PFBC), Pennsylvania Game Commission (PGC), and U.S. Fish and Wildlife Service (FWS) for their important species and community of concern occurrence analysis (PNHP 2013-TN3900). The NRC definition of important species is discussed in Section 4.3.1.3.

In accordance with ESRP Section 9.3, the review team relied upon reconnaissance-level information to perform the alternative site evaluation for this EIS (NRC 2000-TN614). Reconnaissance-level information is data readily available from agencies and other public sources (e.g., scientific literature, books, and Internet websites) and information obtained from site visits. To identify terrestrial resources at the Montour site, the review team relied primarily on the following information:

- tours of the Montour site in April 2009 (NRC 2009-TN1889) and June 2010 (NRC 2010-TN1891)
- responses to RAIs provided by PPL that were incorporated into its ER (PPL Bell Bend 2013-TN3377)
- State and Federal information on important species and community occurrences within 21-mi region (PNHP 2013-TN3900)
- correspondence from Federal and State agencies regarding important species and communities (FWS 2013-TN3847; PDCNR 2012-TN3910; PGC 2012-TN3901).

Site Description

The Montour site and offsite facilities are situated within the Ridge and Valley ecoregion (Woods et al. 1999-TN1805; Woods et al. 2003-TN1806). As described in Section 7.3.1, the Ridge and Valley ecoregion is characterized by alternating forested ridges and agricultural valleys. Natural vegetation varies from north to south, and in the north is characterized as mostly Appalachian oak forest dominated by white oak (*Quercus alba*) and red oak (*Q. rubra*) (USGS 2012-TN1800; Woods et al. 1999-TN1805; Woods et al. 2003-TN1806). Three land-cover types dominate the ecoregion: forest (56 percent), agriculture (approximately 30 percent), and developed areas (approximately 9 percent). The greatest recent land-cover change has been the conversion of forest to disturbed lands, followed by disturbed lands reverting back to forest. Forest and disturbed land are both also being converted to developed land (USGS 2012-TN1800). Today, farming is prevalent over much of the landscape and woodland occurs on steeper sites (Woods et al. 1999-TN1805; Woods et al. 2003-TN1806). This has resulted in the overall reduction and fragmentation of forest, resulting in a mosaic of habitat types in various stages of succession, a greater amount of forest-edge habitat, and a lesser amount of forest-interior habitat and forest-interior wildlife (PGC and PFBC 2005-TN3815).

The Montour site is a 420-ac greenfield site that is part of the 3,538-ac PPL Montour property in Montour County. If the Montour site were selected, PPL would build onsite facilities and the following offsite facilities:

- 2.1-mi and 1.8-mi extensions of an existing rail line and roadway (that currently serve the existing coal-fired plant on the PPL Montour property)
- a new 12.3-mi makeup/blowdown water-pipeline corridor to extend west from the site to the West Branch of the Susquehanna River in Northumberland County

- a new 0.7-mi section of transmission line
- a 15.5-mi expansion of an existing 230-kV transmission line.

Both of the transmission lines would serve to connect the site to an existing 500-kV transmission line (PPL Bell Bend 2013-TN3377) located 14.3 mi southeast of the site in Columbia County (PPL Bell Bend 2013-TN3377; UniStar 2011-TN505).

The Montour site is located north of the existing Montour coal-fired power plant. Land use in the area surrounding the Montour site is predominantly rural. A majority of the area surrounding the site is wooded and undeveloped or used for agricultural purposes (PPL Bell Bend 2013-TN3377).

Terrestrial habitat types on the Montour site include approximately 311 ac of cropland and pasture, 99 ac of forest, 2 ac of grassland/herbaceous habitat, and 1 ac of shrub/scrub habitat. In addition, approximately 7 ac are existing developed areas. According to PPL, no wetlands or barrens are located on the Montour site (PPL Bell Bend 2011-TN4010). About 10 percent of the site (42 ac) lies with a 100-year floodplain (PPL Bell Bend 2013-TN3377; UniStar 2011-TN505).

The proposed corridors traverse substantial areas of forest. The water-pipeline corridor traverses approximately 36 ac of forested habitat and 144 ac of non-forested habitat. The transmission-line corridor traverses approximately 40 ac of forested habitat and 354 ac of non-forested habitat (PPL Bell Bend 2011-TN4010).

The offsite facilities needed to support a nuclear plant at the Montour site would traverse small areas of wetlands. No wetlands are known to occur in the proposed locations for the cooling-water intake pump house or railroad spur expansion. Approximately 6.1 ac of wetlands occur at the cooling-water intake, water-pipeline corridor, transmission-line corridor, and access roadways (PPL Bell Bend 2013-TN3377).

The NRC staff visited the Montour site in April 2009 (NRC 2009-TN1889) and June 2010 (NRC 2010-TN1891). Much of the land onsite was under cultivation except for the northwest corner, which consists of forest that resembles a woodlot. Typical tree and shrub species observed in previously disturbed, uncultivated areas included black walnut (*Juglans nigra*), bigtooth aspen (*Populus grandidentata*), black cherry (*Prunus serotina*), autumn olive (*Elaeagnus umbellata*), and stag-horn sumac (*Rhus typhina*). Typical trees of the forest canopy include scarlet oak (*Quercus coccinea*), pin oak (*Q. palustris*), red oak (*Q. rubra*), black oak (*Q. velutina*), and shagbark hickory (*Carya ovata*). Honeysuckle (*Lonicera* spp.) and other invasive species are common in areas with open canopy (NRC 2010-TN1891).

Federally Listed, State-Listed, and State-Ranked Species and Communities

PPL provided no new field survey information for the Montour site and the review team is unaware of any field surveys at this location or at the locations of the offsite facilities. The presence or absence of Federally listed, State-listed, and State-ranked species and communities in the project footprint cannot be ascertained without field surveys.

A query of the Pennsylvania Natural Heritage Program database (PNHP 2013-TN3900) indicates the presence of 1 Federally listed species, 1 proposed Federally listed species, 20 State-listed species, 68 State-ranked species, and 9 State-ranked communities within 21 mi of the Montour site in Montour, Northumberland, Snyder, Union, Lycoming, and Columbia Counties. Table 9-8 lists species habitat affinities.

Of the 77 species documented in Table 9-8, only the Indiana bat (*Myotis sodalis*) is listed as Federally endangered. The northern long-eared bat (*Myotis septentrionalis*) is listed as Federally threatened. A description of the Indiana bat and northern long-eared bat follows. Descriptions of species discussed in correspondence from Federal and State agencies (FWS 2013-TN3847; PDCNR 2012-TN3910; PGC 2012-TN3901), including State-listed and State-ranked species and State-ranked communities, are also provided below.

<u>Indiana Bat (*Myotis sodalis*), Federally Endangered (FE)</u>

The Indiana bat is a small insectivorous bat that is a true hibernator, entering hibernation in the fall and surviving on stored fat until spring. Mating occurs in late August and September during fall swarming, when bats move in and out of winter hibernacula at night and roost individually in surrounding forests during daytime. Hibernation occurs communally in abandoned mines and caves. Reproductive females migrate from hibernacula to summer roosting habitat where they establish maternity colonies. Maternity roosts are found in dead or nearly dead trees, or dead parts of living trees. Males and non-reproductive females are most commonly found in the vicinity of their hibernaculum but may also disperse throughout the summer range and roost individually or in small groups in trees. In summer and fall, Indiana bats primarily use wooded or semi-wooded habitats, usually near water. Foraging often occurs in riparian areas, ponds, and wetlands, but also takes place in upland forests and fields. Flying insects are typical prey of the Indiana bat. Significant threats to the Indiana bat include human-induced disturbance and alterations at hibernation sites, loss of summer roosting habitat, contaminants, and white nose syndrome (see Section 2.4.1.3) (Normandeau 2012-TN1784).

The historical range of the Indiana bat includes much of the eastern United States. The species has disappeared from, or greatly declined in, most of its former range in the northeastern United States (Normandeau 2012-TN1784). Rangewide, the total population of hibernating Indiana bats was estimated to be about 534,239 in 2013 (FWS 2013-TN3848). About 42 percent of the total hibernating population occurs in Indiana, with 0.02 percent (about 120 hibernating bats) estimated to occur in Pennsylvania (FWS 2013-TN3848). The population of hibernating Indiana bats in Pennsylvania has dropped by about 77 percent since 2011 (FWS 2013-TN3848). Indiana bats are known to occur within 21 mi of the Montour site (PNHP 2013-TN3900).

Table 9-8. Federally and State-Listed and State-Ranked Terrestrial Species (Except Birds [see Table 2-17]) and Communities Occurring in Counties within the Geographic Area of Interest (21-mi Radius) around the Montour Site (PFBC 2014-TN4430; PNHP 2013-TN3900) and Their Known or Likely Presence in the Project Area Based on Field Surveys

Scientific Name	Common Name	Federal Status[(a)]	State Status[(a)]	State Rank[(a)]	Potentially Suitable Habitat Onsite	Observed or Likely to Occur Onsite	Habitat
Plants							
Amelanchier bartramiana	oblong-fruited serviceberry		PE	S1	Yes	No	Swamps, sphagnum bogs, and peaty thickets[(b)]
Amelanchier humilis	serviceberry			S1	Yes	No	Dry, open, high ground and bluffs[(b)]
Amelanchier obovalis	coastal juneberry			S1	Yes	No	Peaty barrens, thickets, and roadsides[(b)]
Aplectrum hyemale	puttyroot		PR	S3	Yes	No	Moist woodlands, forested slopes, and stream banks[(c)]
Arabis missouriensis	Missouri rock-cress		PE	S1	Yes	No	Dry slopes[(b)]
Bartonia paniculata	screw-stem			S3	Yes	No	Hummocks in wet woods, wooded bogs, and sphagnous pond margins[(b)]
Bidens discoidea	small beggar-ticks			S3	Yes	No	Bogs, vernal ponds, and swampy ground[(b)]
Carex bicknellii	Bicknell's sedge		PE	S1	Yes	No	Dry woods, thickets, fields, and serpentine barrens[(b)]
Carex disperma	soft-leaved sedge		PR	S3	Yes	No	Swamps, wet thickets, wetlands, and bogs[(c)]
Carex lasiocarpa	slender sedge		PR	S3	Yes	No	Bogs, wetlands, and marshes[(c)]
Carex limosa	mud sedge			S2	Yes	No	Bogs and floating sphagnum moss mats at bog pools[(c)]
Carex longii	Long's sedge			S2S3	Yes	No	Swamps, open thickets, moist meadows, old gravel pits, and swales[(b)]
Carex polymorpha	variable sedge		PE	S2	Yes	No	Openings along woods and road margins[(c)]
Cyperus diandrus	umbrella flatsedge		PE	S2	Yes	No	Shorelines of ponds, lakes, and streams, and in bogs and marshes[(c)]
Dodecatheon radicatum	jeweled shooting-star		PT	S2	No	No	Moist, shaded areas of limestone outcrops and river bluffs[(c)]
Dryopteris clintoniana	Clinton's wood fern			S2	Yes	No	Swampy woodlands[(c)]
Elymus trachycaulus	slender wheatgrass			S3	Yes	No	Sunny, well-drained habitats such as woods borders, rocky banks, grasslands, barrens, thickets, and utility ROW[(c)]
Eurybia radula	rough-leaved aster			S2	Yes	No	Wet woods, swamps, seeps, bogs, along streams[(c)]
Gaultheria hispidula	creeping snowberry		PR	S3	Yes	No	Bogs, peaty wetlands, and swamps[(c)]

Table 9-8. (contd)

Scientific Name	Common Name	Federal Status[a]	State Status[a]	State Rank[a]	Potentially Suitable Habitat Onsite	Observed or Likely to Occur Onsite	Habitat
Helianthemum bicknellii	Bicknell's hoary rockrose		PE	S2	Yes	No	Open rocky places, riverbed scours, exposed banks, slopes, woods, rock outcrops, and serpentine barrens[c]
Juncus filiformis	thread rush		PR	S3	Yes	No	Bogs and sandy shores[b]
Ledum groenlandicum	common Labrador-tea		PR	S3	Yes	No	Bogs and peaty wetlands[c]
Lonicera hirsuta	hairy honeysuckle			S1	Yes	No	Moist woods, swamps, and rocky thickets [b]
Lupinus perennis	lupine		PR	S3	Yes	No	Woods borders, open woods, and clearings[c]
Muhlenbergia uniflora	fall dropseed muhly		PE	S2	Yes	No	Bogs and peaty wetlands[c]
Piptatherum pungens	slender mountain-ricegrass		S2	PE	No	No	Sunny, well-drained, sandy habitats, rocky open woods, bedrock outcrops, heath barrens, balds, and mountain summits[c]
Platanthera blephariglottis	white-fringed orchid			S2S3	Yes	No	Bogs, peaty wetlands, swamps, and floating sphagnum moss mats at bog pools[c]
Platanthera ciliaris	yellow-fringed-orchid			S2	Yes	No	Bogs, moist meadows, and woods[b]
Polemonium vanbruntiae	Jacob's-ladder		PE	S1	Yes	No	Wet soil in woods, thickets, and openings[c]
Polystichum braunii	Braun's holly fern		PE	S1	Yes	No	Cool, rocky slopes, and shaded ravines[b]
Potentilla tridentata	three-toothed cinquefoil		PE	S1	No	No	Rock outcrops at high elevations[c]
Prunus pumila var. susquehanae	Susquehanna sand cherry			S2	No	No	Dry, exposed rock outcrops and mountain tops[b]
Ribes lacustre	swamp currant			S1	Yes	No	Damp soil on rocky slopes and talus, moist to seepy rock outcrops and cliffs, cool woods, and swamps[c]
Rosa virgiana	Virginia rose			S1	Yes	No	Pastures, fields, open woods, thickets, and roadsides[b]
Schoenoplectus subterminalis	water bulrush			S3	Yes	No	Lakes, ponds, and slow-moving streams[c]
Schoenoplectus torreyi	Torrey's bulrush		PE	S1	Yes	No	Shallow water along shorelines of lakes and ponds[b].
Scirpus ancistrochaetus	northeastern bulrush	FE	PE	S3	Yes	No	Edges of seasonal pools, wet depressions, beaver ponds, wetlands, and small ponds[b]
Stellaria borealis	mountain starwort			S1S2	Yes	No	Seeps and spring-fed streamlets in wooded areas[c]
Streptopus amplexifolius	white twisted-stalk		PT	S1	No	No	Cool shaded areas on seepy cliffs and rock outcrops[c]
Utricularia cornuta	horned bladderwort		PT	S2	Yes	No	Shallow water or wet peaty substrate in ponds, bogs, seepages, and along shorelines[c].

Table 9-8. (contd)

Scientific Name	Common Name	Federal Status[a]	State Status[a]	State Rank[a]	Potentially Suitable Habitat Onsite	Observed or Likely to Occur Onsite	Habitat
Utricularia intermedia	flat-leaved bladderwort		PT	S2	Yes	No	Bogs, wetlands, floating bog mat islands, and shorelines[c].
Viola selkirkii	great-spurred violet			S3S4	Yes	No	Cool, moist woods, humus/moss rock outcrops and boulders[c]
Vittaria appalachiana	Appalachian gametophyte fern		PT	S2	No	No	Cool, damp, shaded rock outcrops and cliffs in forested areas[c]
Insects							
Amblyscirtes vialis	common roadside skipper			S2	Yes	No	Riparian forest[d]
Boloria selene myrina	silver bordered fritillary			S3	Yes	Yes[e]	Open, marshy, or boggy areas with violets[d]
Carterocephalus palaemon mandan	Arctic skipper			S2	Yes	No	Glades, roadsides, swampy places, and streamside grassy openings in forests; sometimes bogs or fens[d]
Chlosyne harrisii	Harris' checkerspot			S3	Yes	No	Bogs, fens, wetlands, riparian, grassland/old-field, and ROW[d]
Erynnis persius persius	Persius duskywing			S1	Yes	No	Bogs, fens, shrub/scrub wetland, riparian, and forest [d]
Euphyes conspicua	black dash				Yes	Yes[e]	Open, shrubby or partially wooded (e.g., red maple) bogs and fens, wetlands, and riparian areas[d]
Euphydryas phaeton	Baltimore checkerspot			S3	Yes	Yes[f]	Bogs, fens, wetlands, riparian, grassland/old-field, and woodland[d]
Glena cognataria	blueberry gray			S1	No	No	Heathlands, bogs, and pine barrens[e]
Hemileuca maia	barrens buckmoth			S1S2	No	No	Scrub oak-pine sand barrens and oak woods[g]
Hesperia leonardus	Leonard's skipper			S3	Yes	No	Grassland/old-field, shrubland, and woodland[d]
Itame sp. 1 nr. inextricata	barrens Itame (Cf I. Inextricata)			S1	No	No	Xeric pine-oak scrub[d]
Lethe eurydice	eyed brown			S3	Yes	No	Open sedge meadows and open wetlands[d]
Lycaena epixanthe	bog copper			S2	No	No	Acid bogs and wetlands containing cranberries[c]
Poanes massasoit	mulberry wing			S2	Yes	Yes[f]	Bogs, fens, wetlands, and riparian[d]
Speyeria atlantis	Atlantis fritillary			S3	Yes	No	Bogs, fens, forested wetland, riparian, grassland, and woodland[d]
Sphinx gordius	apple sphinx			S3	Yes	No	Bogs and deciduous forest[g]
Reptiles and Amphibians							
Acres crepitans	northern cricket frog		PE	S1	Yes	Yes[e]	Slow-moving creeks, pools, herbaceous and shrub/scrub wetlands, and bogs and fens in open country[h]

Table 9-8. (contd)

Scientific Name	Common Name	Federal Status[a]	State Status[a]	State Rank[a]	Potentially Suitable Habitat Onsite	Observed or Likely to Occur Onsite	Habitat
Clemmys guttata	spotted turtle			S3	Yes	Yes[i]	Slow-moving creeks, pools, wetlands, bogs, and fens[d]
Crotalus horridus	timber rattlesnake		PC	S3S4	Yes	No	Deciduous forest and rock outcrops[c]
Glyptemys insculpta	wood turtle			S3S4	Yes	Yes[e, i]	Low-gradient creeks, moderate-gradient medium sized rivers, forested wetlands, and herbaceous wetlands[d]
Heterodon platirhinos	eastern hognose snake			S3	Yes	No	Riparian, cropland/hedgerow, grassland/old-field, and woodland[d]
Lithobates pipiens	northern leopard frog			S2S3	Yes	Yes[i]	Springs, slow streams, marshes, bogs, ponds, canals, flood plains, reservoirs, and lakes[d]
Scaphiopus holbrookii	eastern spadefoot		PT	S1			Breeding – temporary pools; non-breeding – sandy, gravelly, or soft, light soils in wooded or unwooded terrain
Terrapene carolina carolina	eastern box turtle			S3S4	Yes	Yes[e, i]	Wide variety of habitats from wooded swamps to dry, grassy fields[j]
Thamnophis sauritus	eastern ribbon snake			S3	Yes	Yes[e]	Slow-moving creeks, pools, wetlands, riparian, and bare rock/scree[d]
Birds							
Podilymbus podiceps	pied-billed grebe			S3B, S4N			Wetlands near open water[b]
Mammals							
Felis rufus	bobcat			S3S4	Yes	Yes[e]	Large forest tracts with thick undergrowth [d]
Glaucomys sabrinus	northern flying squirrel		PE	SU	No	No	Old-growth forests with moist soil[k]
Lontra canadensis	river otter			S3	Yes	Yes[f]	Lowland marshes and swamps interconnected with meandering streams and small lakes[l]
Microtus chrotorrhinus	rock vole			S2	Yes	No	Forested wetland, coniferous/mixed forests, and woodlands[d]
Myotis lucifugus	little bown myotis			S1	Yes	Yes[e]	Hibernation in caves, tunnels, and mines; maternity sites in man-made structures, caves, and hollow trees[d]
Myotis leibii	eastern small-footed myotis		PT	S1B, S1N	Yes	No	Hibernation in caves and mines; maternity sites in forests[d, k]
Myotis septentrionalis	northern long-eared bat	FT		S1	Yes	Yes[e, m]	Hibernation in caves and mines; maternity sites in riparian, conifer/mixed late-successional forest[c, d]
Myotis sodalis	Indiana bat	FE	PE	SUB, S1N	Yes	Yes[n]	Hibernation in caves and mines; maternity sites in trees in upland and wetland forest and buildings[d, k]

Table 9-8. (contd)

Scientific Name	Common Name	Federal Status[a]	State Status[a]	State Rank[a]	Potentially Suitable Habitat Onsite	Observed or Likely to Occur Onsite	Habitat
Neotoma magister	Allegheny woodrat		PT	S3	No	No	Bare rock/talus/scree surrounded by unfragmented hardwood or mixed forest[d, k]
Perimyotis subflavus	tri-colored bat			S1	Yes	Yes[m]	Hibernation in caves and mines; maternity sites in tree foliage in riparian, upland woodland/grassland area[d]
Sorex palustris albibarbis	water shrew			S3	Yes	No	Stream and lake edges and boulders[c]
Communities							
	calcareous opening/cliff			S2	No	No	Calcareous cliffs, outcrops, and rocky slopes with variable vegetation composition[c].
hemlock (*Tsuga canadensis*)	hemlock palustrine forest			S3	No	No	Wetland forests dominated or co-dominated by eastern hemlock[c]
	herbaceous vernal pool			S3S4	Yes	Ye [o]	Seasonally fluctuating water levels and variable herbaceous composition[c]
hemlock (*Tsuga canadensis*)	hemlock - mixed hardwood palustrine forest			S3S4	No	No	Wetland forests dominated by a mixture of conifer and hardwood species[c].
oak (*Quercus* spp.)	dry oak - heath woodland			S3	No	No	Dry sites dominated by various oak species[c]
leatherleaf (*Chamaedaphne calyculata*) – bog rosemary (*Andromeda polifolia*)	leatherleaf – bog rosemary peatland			S2S3	No	No	Bogs dominated by leatherleaf with bog rosemary associated[c]
leatherleaf (*Chamaedaphne calyculata*) cranberry (*Vaccinium oxycoccos and/or macrocarpon*)	leatherleaf – cranberry peatland			S2S3	No	No	Bogs dominated by leatherleaf, cranberry, and sphagnum moss[c]
little bluestem (*Schizachyrium scoparium*) - Pennsylvania sedge (*Carex pensylvanica*)	little bluestem - Pennsylvania sedge opening			S3S4	No	No	Dry acidic sites without invasion of woody plant species[c]
	low heath shrubland			S1	No	No	Sites dominated by huckleberry (*Vaccinium* spp.)[c].
pitch pine (*Pinus rigida*) rhodora (*Rhododendron canadense*) – scrub oak (*Quercus ilicifolia*)	pitch pine – rhodora - scrub oak woodland			S1	No	No	Part of the "Mesic till barrens complex" with pitch pine dominant in the overstory and rhododendron and scrub oak dominant in the understory[c].
pitch pine (*Pinus rigida*) – scrub oak (*Quercus ilicifolia*)	pitch pine – scrub oak woodland			S2S3	No	No	Sites with acidic, dry soils and drought-stressed trees of small stature where pitch pine is dominant and scrub oak is dominant in the understory[c]
red maple (*Acer rubrum*) – black gum (*Nyssa sylvatica*)	red maple – black gum palustrine forest			S3S4	Yes	Yes[p]	Wetland forest dominated by red maple or black gum[c]

Table 9-8. (contd)

Scientific Name	Common Name	Federal Status[(a)]	State Status[(a)]	State Rank[(a)]	Potentially Suitable Habitat Onsite	Observed or Likely to Occur Onsite	Habitat
red spruce (*Picea rubens*)	red spruce – mixed hardwood palustrine forest			S3	No	No	Wetland forests dominated by a mixture of conifer and hardwood species[(c)].
red spruce (*Picea rubens*)	red spruce palustrine forest			S3	No	No	Wetland forests dominated or co-dominated by red spruce[(c)]
scrub oak (*Quercus ilicifolia*)	scrub oak shrubland			S3	No	No	Sites without a tree layer dominated by scrub oak[(c)]
	Talus cave community			S2S4	No	No	None provided[(c)]
Virginia pine (*Pinus virginianus*)	Virginia pine – mixed hardwood shale woodland			S2	No	No	Dry shale slopes with southerly exposure dominated by Virginia pine and various hardwood tree species[(c)]

(a) Federal status FE = Federally endangered, FT = Federally threatened; State status PE = Pennsylvania endangered, PT = Pennsylvania threatened, PC = Pennsylvania candidate, PR = Pennsylvania rare; NatureServe rank S1 = critically imperiled (five or fewer populations, especially vulnerable to extirpation), S2 = imperiled (20 or fewer populations, very vulnerable to extirpation), S3 = vulnerable (80 or fewer occurrences, vulnerable to extirpation), S4 = apparently secure (uncommon but not rare, some cause for long-term concern) (PNHP 2014-TN3975).
(b) Morris Arboretum 2014-TN3858.
(c) PNHP 2015-TN4431.
(d) NatureServe 2015-TN4432.
(e) Normandeau 2011-TN490.
(f) PNHP 2006-TN1570.
(g) Lotts and Naberhaus 2014-TN3857.
(h) NYNHP 2012-TN3909.
(i) PPL 1978-TN4036.
(j) Davidson College 2014-TN3863.
(k) PGC 2013-TN3845.
(l) Hardisky 2013-TN3386.
(m) Normandeau 2014-TN3828.
(n) FWS 2009-TN3868.
(o) PPL Bell Bend 2013-TN3377.
(p) Normandeau 2011-TN489.

Northern Long-Eared Bat (*Myotis septentrionalis*), Federally Threatened (FT)

The northern long-eared bat is a small insectivorous bat that is a true hibernator. It ranges over 39 states in the eastern and north-central United States, and has been considered to be more prevalent in the eastern portion of its range. The species predominantly overwinters in hibernacula that include caves and abandoned mines, but has also been found overwintering in other types of man-made habitat that resemble cave or mine hibernacula (e.g., railroad tunnels, sewers, aqueducts, and wells). The species arrives at hibernacula in August or September, enters hibernation in October and November, and leaves the hibernacula in March or April. A total of 112 of the 780 known hibernacula in the United States are in Pennsylvania. Migration distances between hibernacula and summer roosts are typically 35 to 55 mi (78 FR 61046-TN3207).

Breeding occurs when males swarm hibernacula from late July in northern regions to early October in southern regions. Fertilization of a single egg occurs in the spring following hibernation (78 FR 61046-TN3207). During the summer, the species roosts singly or in colonies underneath tree bark or in cavities or crevices of both live and dead trees (Johnson et al. 2011-TN1852; 78 FR 61046-TN3207), but may also roost in colonies in man-made structures (e.g., buildings, under eaves, and behind shutters). In addition, males and non-reproductive females may roost in caves and mines during summer. Summer roost selection is similar to that of the Indiana bat. Adult females give birth to a single pup in May to early June. Volancy (i.e., flight) occurs in 21 days (78 FR 61046-TN3207).

Most hunting takes place on forested hillsides and ridges above the understory but under the canopy. Therefore, mature forests are an important foraging habitat for the species (78 FR 61046-TN3207; PGC and PFBC 2005-TN3815). The species consumes a variety of night-flying insects (e.g., moths, beetles, flies, etc.) (78 FR 61046-TN3207; NatureServe 2015-TN4432).

The northern long-eared bat is known to occur within 21 mi of the Montour site (PNHP 2013-TN3900).

Eastern Small-Footed Myotis (*Myotis leibii*), State Threatened (PT)

The eastern small-footed myotis is a small, insectivorous bat that hibernates in caves, primarily under large rocks or in crevices and mine shafts in the winter, and roosts in caves (or cracks and crevices in rock walls) and hollow trees (under bark) in the summer. Little is known about the species' reproductive behavior, habitat, or food requirements because very few have been captured during summer mist-netting surveys (PGC 2013-TN3845). The eastern small-footed myotis is known to occur within 21 mi of the Montour site (PNHP 2013-TN3900).

Long-Haired Panic Grass (*Dichanthelium villosissimum* var. *villosissimum*), Currently Tentatively Undetermined, Proposed State Endangered (Proposed PE)

Long-haired panic grass is an herbaceous perennial (Morris Arboretum 2014-TN3858) found in dry woods and serpentine barrens (PDCNR 2012-TN3910). This species was observed along a disturbed field edge near (distance unspecified) the Montour site in 1994 (PDCNR 2012-TN3910).

<u>Short-Leaf Pine (*Pinus echinata*), Proposed Tentatively Undetermined</u>

Short-leaf pine is an evergreen coniferous tree that may grow 80 to 100 ft (PNHP 2015-TN4431) and occurs on wooded slopes and ridges in low-nutrient soil (PDCNR 2012-TN3910). This species was observed 1.5 mi east of Strawberry Ridge in 1956 (PDCNR 2012-TN3910). Strawberry Ridge is located about 1 mi southeast of the Montour site.

<u>Tooth Cup (*Rotala ramosior*), State Rare (SR)</u>

Toothcup is a small annual herb that inhabits exposed shorelines, stream margins, streambed outcrops, and other damp, open places (PNHP 2015-TN4431). This species was observed along a shoreline near (distance unspecified) the Montour site in 2004 (PDCNR 2012-TN3910).

Building Impacts

The entirety of the 420-ac Montour site would be disturbed for construction of a new nuclear plant (PPL Bell Bend 2011-TN4010). Thus, approximately 311 ac of cropland and pasture, 99 ac of forest, 2 ac of grassland/herbaceous habitat, and 1 ac of shrub/scrub habitat would be disturbed (PPL Bell Bend 2011-TN4010). This affected area would also include the 42 ac of floodplain habitat on the site (UniStar 2011-TN505). Based on this information, there would be no impacts on wetlands (PPL Bell Bend 2013-TN3377) or impacts on barrens habitat (PPL Bell Bend 2011-TN4010). However, as noted in the next paragraph, it would be necessary to disturb a forested riparian corridor.

The Montour site is predominantly open land that is crossed by a forested riparian corridor along East Branch Chillisquaque Creek in the southeastern portion of the site. This corridor provides a potential travel corridor for wildlife across the site upstream and downstream along the creek. Site development would remove the wooded riparian corridor within the site boundaries (PPL Bell Bend 2012-TN1173). Removal of the wooded riparian corridor would reduce its utility as a travel corridor for local wildlife, particularly for species disinclined to move such distances in the absence of forest cover (e.g., Indiana bat).

The makeup-water and blowdown pipelines would be collocated with or near an existing water line for most of its length and would thus largely be placed in previously disturbed areas. The majority of the approximately 16.3 mi of transmission line would be routed through agricultural land (PPL Bell Bend 2013-TN3377). Approximately 36 ac of forested habitat and 144 ac of non-forested habitat would be disturbed within the water-pipeline corridor and approximately 40 ac of forested habitat and 354 ac of non-forested habitat would be disturbed within the transmission-line corridor (PPL Bell Bend 2011-TN4010).

There would be no impacts on wetlands from building the cooling-water intake pump house or extending the railroad spur. However, building the cooling-water intake, water-pipeline corridor, transmission-line corridor, and access roadways would affect approximately 6.1 ac of wetlands (PPL Bell Bend 2013-TN3377). Impacts on wildlife at the Montour site would be noticeable, similar to impacts described for the proposed BBNPP site in Section 4.3.1. Wildlife would be affected by forest fragmentation caused by installation of the water-pipeline and transmission-line corridors at the Montour site. Collocating the water pipeline and transmission lines to the extent practicable within or adjacent to existing corridors would reduce the impacts of forest fragmentation (PPL Bell Bend 2013-TN3377).

Species adapted to early successional habitat would be lost from affected upland shrub/scrub habitats within proposed water-pipeline and transmission-line corridors. Such species may disperse into shrub/scrub habitats in adjacent areas and colonize new shrub/scrub habitats created by installation of the water-pipeline and transmission-line corridors. Similarly, species adapted to forest/clearing interface environments within proposed water-pipeline and transmission-line corridors may be lost from the edge habitats destroyed by forest clearing, but may disperse into edge habitats in adjacent areas and colonize new edge habitats created by the installation of water-pipeline and transmission-line corridors. Thus, overall, water-pipeline and transmission-line corridor installation could pose minor adverse effects or could be beneficial for some species that inhabit early successional habitat or use edge environments. However, species dependent on interior forests could only disperse into contiguous forest habitats, which are likely less prevalent in adjacent areas and are not created by installation of these corridors. Thus, forest-interior wildlife may be locally affected to a greater extent than wildlife adapted to early successional or forest-edge habitats.

The PGC (2012-TN3901) indicated that impacts on the Indiana bat, northern long-eared bat, and eastern small-footed myotis would be unlikely. The long-haired panic grass (SE), short-leaf pine (tentatively undetermined), and tooth cup (SR) could potentially be affected by construction, because the species are known to occur near the Montour site, as indicated above.

<u>Consumptive-Use Mitigation and Site-Specific Low-Flow Protection</u>

Pumping facilities, treatment plants, and discharge structures would be built at four former underground coal mines (i.e., Rushton Mine, Greenwich North Mine, Gallitzin 10 Mine, and Hughes Mine) (see Section 9.3.2). Limited areas of less than 50 ac each would likely be disturbed near each mine. At the Greenwich North Mine and Gallitzin 10 Mine mostly reclaimed mine spoils and agricultural lands, respectively, would be disturbed (PPL Bell Bend 2014-TN3652) and impacts on terrestrial resources would likely be minor. Mostly old-field habitat would be disturbed at Rushton Mine where impacts on terrestrial resources would also likely be minor (see description in Section 4.3.1). At the Hughes Mine, an interbasin pipeline (Figure 9-7) would also be constructed to convey water from the mine (which discharges to the Little Conemaugh River in the Ohio River Basin) to Clearfield Creek in the Susquehanna River Basin (see Section 9.3.2). Disturbance for facilities at the Hughes Mine, including the interbasin pipeline, would occur primarily in forested areas (PPL Bell Bend 2014-TN3652). Building these facilities at the Hughes Mine would likely require multiple wetland and stream crossings, fragmentation of forest, and loss of terrestrial habitat. The impacts on terrestrial resources would likely be noticeable.

Operational Impacts

Impacts on terrestrial ecological resources from operation of a new nuclear plant at the Montour site would be minor and similar to those for the proposed BBNPP site as described in Section 5.3.1. There may be minor differences in operational impacts because of factors such as climate, topography, and elevation. The staff's independent review did not identify any information specific to the Montour site that would contradict the conclusions for the BBNPP site in Section 5.3.1.

Consumptive-Use Mitigation and Site-Specific Low-Flow Protection

Streams (i.e., Cush Cushion Creek, Clearfield Creek, and Moshannon Creek) fed by releases from the four abandoned underground coal mines would receive episodic increased discharges necessitated by low flows in the West Branch Susquehanna River at MSES. The impacts of Rushton Mine discharges to wetlands and other riparian habitats and wildlife fringing Moshannon Creek are described in Section 5.3.1. The NRC staff expects that the other two receiving streams and fringing habitats and wildlife below Greenwich North Mine, Gallitzin 10 Mine, and Hughes Mine would be affected in a manner similar to those along Moshannon Creek. The NRC staff expects impacts on terrestrial resources to be minimal.

Cumulative Impacts

Overlaying the historic impacts in the Ridge and Valley ecoregion discussed in the site description above are the current projects listed in Table 9-6. Projects located within the geographic area of interest include the following:

- energy (e.g., PPL Montour Electric Steam Station coal-fired power plant located adjacent to the Montour site, Sunbury Generation, other fossil-fuel plants, and solar energy projects)
- a variety of industry (e.g., US Gypsum located adjacent to the Montour site, Kydex, Foam Fabricators, Safety Light, Cherokee Pharmaceutical Plant, and Great Dane Trailers)
- foundries (e.g., Benton Foundry)
- surface and subsurface mines (e.g., Milton Quarry, and Knorr)
- natural gas production (e.g., Marcellus shale production sites) and gas pipelines
- natural areas (including State game lands and Milton State Park) in Montour, Northumberland, Snyder, Union, Lycoming, and Columbia Counties within a 21-mi radius of the site (PNHP 2014-TN4013).

The development of most of these projects has or is expected to further reduce, fragment, and degrade natural forests and wetland and floodplain habitat and decrease habitat connectivity. Reasonably foreseeable projects within the geographic area of interest that would affect terrestrial resources include the proposed Panda Patriot Power Plant and White Deer recycled tire power plants, and the Atlantic Sunrise pipeline for natural gas. Reasonably foreseeable land conversions within the geographic area of interest that would affect terrestrial resources include the following:

- ongoing conversion of forest to disturbed lands for agriculture and other uses
- succession of open habitats to forest
- continued urbanization, whereby terrestrial habitats are converted to developed land (e.g., commercial and residential buildings, roads, and landfills)

- continued reclamation of abandoned surface mine lands.

The NRC staff is not aware of any other projects that could substantially impact water levels in the streams affected by consumptive-use mitigation and site-specific low-flow protection releases. The review team expects that terrestrial habitats in the geographic area of interest will continue to experience changes related to global climate change. These changes would be similar to those discussed for the BBNPP site in Section 7.3.

Summary

Impacts on terrestrial ecology resources are estimated based on the information provided by PPL and the review team's independent review. Site preparation and development of the Montour site for a new nuclear plant, site preparation and development of the new transmission-line and water-pipeline corridors, and extension of the existing railroad spur and roads would affect approximately 175 ac of forest habitat, approximately 6.1 ac of wetlands, and approximately 42 ac of floodplain habitat. The overall impact of these activities on habitat and wildlife would be noticeable and permanent. There are 77 Federally listed, State-listed, and State-ranked species and communities that potentially occur at the Montour site and associated offsite facilities that may be affected (Table 9-8). There are past, present, and future activities and land-use conversions in the geographic area of interest that have affected and would continue to affect habitat and wildlife in ways similar to site preparation and development for a new nuclear plant and offsite facilities.

The review team concludes that the cumulative impacts from past, present, and reasonably foreseeable future actions, including a new nuclear plant at the Montour site and associated offsite facilities, on baseline conditions for terrestrial ecological resources in the geographic area of interest would be MODERATE. Building and operating a new nuclear plant at the Montour site would be a significant contributor to the MODERATE impact.

9.3.2.4 Aquatic Resources

The following impact analysis includes impacts from building activities and operations on aquatic ecology resources at the Montour site. The analysis also considers cumulative impacts from other past, present, and reasonably foreseeable future actions that could affect aquatic resources, including the other Federal and non-Federal projects listed in Table 9-6. In developing this EIS, the review team relied on reconnaissance-level information to perform the alternative site evaluation in accordance with ESRP 9.3 (NRC 2000-TN614). Reconnaissance-level information is data that are readily available from regulatory and resources agencies (e.g., SRBC, FWS, PADEP, PFBC) and other public sources such as scientific literature, books, and Internet websites. It can also include information obtained through site visits (e.g., PNNL 2009-TN3667; NRC 2010-TN1891; NRC 2012-TN1890; NRC 2014-TN3639) and documents provided by the applicant. The geographic area of interest for the assessment of the potential cumulative aquatic ecosystem impacts of building and operating a new reactor at the Montour site is the same as for the BBNPP site, and includes the North Branch and the West Branch of the Susquehanna River Basin to their confluence and south to Conowingo Dam, as described in Section 7.3.2. As previously discussed in Section 9.3.2, the NRC staff also assumed that the

SRBC would impose consumptive-use mitigation and site-specific low-flow protection requirements for a plant at the Montour site. Those impacts are also discussed below.

Affected Environment – Onsite and Supporting Infrastructure (Pipeline and Transmission-Line Corridors)

The Montour site is north of the existing MSES, a coal-fired two-unit plant that draws cooling water from the West Branch of the Susquehanna River at a location downriver of Watsontown, Northumberland County, Pennsylvania (Figure 9-5). A new nuclear plant on the Montour site would also draw cooling water from the West Branch of the Susquehanna River. The water-intake/discharge pipeline corridor would pass through Montour and Northumberland Counties. The new/widened transmission-line corridor would pass through Montour and Columbia Counties.

The primary aquatic resources that would be affected by a new plant on the Montour site are the West Branch of the Susquehanna River and the East Branch of Chillisquaque Creek (Figure 9-8). There are no onsite ponds that would be affected by the construction and operation of a new plant, and nearby Lake Chillisquaque, a popular recreational fishing area approximately 0.4 mi northwest of the site (PPL Bell Bend 2010-TN3643), would also not be affected.

Figure 9-8. Chillisquaque Creek near the Montour Site.

The West Branch of the Susquehanna River is a part of the larger Susquehanna River Basin, and therefore has a shared history with the North Branch of the Susquehanna River, including historical water-quality degradation from abandoned mine drainage, agricultural and industrial runoff, and effects from installation of dams for flood control (PFBC 2011-TN3834). The West Branch of the Susquehanna River at the potential intake/discharge site has a designated protected water use for migratory and warm-water fishes (PA Code 25-93-TN611), and supports much of the same recreational fishery as described for the North Branch of the Susquehanna River near the Bell Bend site (Section 2.4.2.3).

The East Branch of Chillisquaque Creek and its small tributary to the north cross the proposed Montour site. The East Branch is a tributary of Chillisquaque Creek, which drains about 73 mi^2 in Montour County (HRG 2010-TN633). Approximately two-thirds of the Chillisquaque Creek watershed is impaired, primarily from agricultural activities (HRG 2010-TN633). The designated protected use for Chillisquaque Creek is for warm-water fishes (PA Code 25-93-TN611).

Consumptive-Use Mitigation and Site-Specific Low-Flow Protection Areas

PPL identified a conceptual plan for consumptive-use mitigation and site-specific low-flow protection for the Montour site that would involve water releases from the Rushton Mine into Moshannon Creek, the Greenwich North Mine into Cush Cushion Creek, the Gallitzin 10 Mine into Clearfield Creek, and the Hughes Mine into Clearfield Creek (PPL Bell Bend 2014-TN3652); this plan is described in Section 9.3.2. Additionally, use of the Hughes Mine would involve redirecting and treating existing mine water flow from the Little Conemaugh River (Alleghany River watershed) to Clearfield Creek (Susquehanna River watershed). The primary affected aquatic resources would be the Little Conemaugh River (Cambria County), Clearfield Creek (Cambria and Clearfield Counties), Cush Cushion Creek (Indiana County), and Moshannon Creek (Centre County) (PPL Bell Bend 2014-TN3652).

Recreationally Important Species

The West Branch of the Susquehanna River is a popular recreational fishing area. Species commonly caught include Smallmouth Bass (*Micropterus dolomieu*), Walleye (*Sander vitreus*), and Muskellunge (*Esox masquinongy*). These species are discussed in more detail in Section 2.4.2. Additional recreational species that could occur in the streams on the Montour site and along the pipeline corridor include Bluegill (*Lepomis macrochirus*), Pumpkinseed (*L. gibbosus*), Redbreast Sunfish (*L. auritus*), Rock Bass (*Ambloplites rupestris*), Black Crappie (*Pomoxis nigromaculatus*), White Crappie (*P. annularis*), Yellow Perch (*Perca flavescens*), Largemouth Bass (*M. salmoides*), Channel Catfish (*Ictalurus punctatus*), and Bullhead Catfish (*Ameiurus* spp.) (PPL Bell Bend 2013-TN3377). The PFBC stocked Tiger Muskellunge (Muskellunge *E. masquinongy* × Northern Pike *E. Lucius*) fingerlings and Walleye fingerlings or fry in the West Branch of the Susquehanna River between Loyalsock Creek near Williamsport and the confluence with the North Branch of the Susquehanna River from 1991 to 1995, but has not stocked them since 1995 (PFBC 2012-TN2433; PFBC 2014-TN3468). Trout are not stocked in the Chillisquaque Creek watershed drainage within the proposed water-intake/discharge line corridor (PFBC 2014-TN3471). There are no commercial fisheries or commercial bait operations in the West Branch of the Susquehanna River near the conceptual location of the water-intake/discharge system (PDA Undated-TN688).

All of Cush Cushion Creek, as well as the stretch of Clearfield Creek between Beaverdam Run and Condron, Pennsylvania, are approved trout waters that are open to public fishing and are stocked with Brown Trout (*Salmo trutta*) and Rainbow Trout (*Oncorhynchus mykiss*). Although the protected use designation for the stretch of Moshannon Creek downstream of Osceola Mills to its confluence with the West Branch of the Susquehanna River is for trout-stocking and migratory fish (PA Code 25-93-TN611), the PFBC (2014-TN3471) does not stock the stream.

Species of Historic Interest

American Shad (*Alosa sapidissima*) is a species of considerable historical interest in the Susquehanna River Basin. Shad biology and restoration efforts in the Susquehanna River are discussed in Section 2.4.2.3. American Shad fry have been stocked since 2000 in reaches of the North Branch of the Susquehanna River and Susquehanna River mainstem (PFBC 2014-TN3468). Approximately 1.3 million additional juvenile American Shad were stocked at an unspecified location in the West Branch of the Susquehanna River in 2009 (Hendricks 2009-TN632).

The American Eel (*Anguilla rostrata*) spends most of its life in freshwater areas, but returns to the ocean to spawn. A large commercial eel fishery existed in the Susquehanna River until the early 1900s, when dam construction blocked eel passage (Steiner 2000-TN1918). Efforts are underway to restore eels to the Susquehanna River above the Conowingo Dam (Minkkinen and Park 2011-TN1719). The PFBC has stocked American Eel fingerlings in the North Branch of the Susquehanna River and downriver of the confluence of the North Branch and the West Branch of the Susquehanna River (PFBC 2014-TN3468).

Non-Native and Nuisance Species

The zebra mussel (*Dreissena polymorpha*), the Asian clam (*Corbicula fluminea*), the rusty crayfish (*Orconectes rusticus*), and the Flathead Catfish (*Pylodictis olivaris*) are four non-native nuisance species that have been recorded in sections of the Susquehanna River. Two non-native plant species also occur within the Susquehanna River Basin. Ecology III (2012-TN1645) found Eurasian watermilfoil (*Myriophyllum spicatum*) and curly pondweed (*Potamogeton crispus*) in the North Branch of the Susquehanna River near Bell Bend. Didymo (*Didymosphenia geminata*), a non-native colony-forming, large, single-celled alga, has been documented in the West Branch of the Susquehanna River Basin (SRBC 2013-TN2944). These non-native species and their potential effects on freshwater ecosystems are discussed in more detail in Section 2.4.2.3.

Federally and State-Listed Species

<u>Onsite and Supporting Infrastructure</u>

There are no Federally or State-listed threatened or endangered aquatic animal species near the Montour site in Montour County, in the West Branch of the Susquehanna River near the intake/discharge site in Northumberland County, along the water-intake/discharge pipeline corridor in Montour and Northumberland Counties, or along the new/widened transmission-line corridor route in Montour and Columbia Counties (FWS 2013-TN3847; PPL Bell Bend 2013-

TN3377). There are also no Federally listed aquatic plant species near the Montour site or near supporting infrastructure in the counties described above. However, the northern water plantain (*Alisma triviale*) is a Pennsylvania-endangered species that occurs in Northumberland County (PNHP 2015-TN4411). The northern water plantain grows to a height of approximately 3 ft and lives primarily in shallow water or mud, but may occur in water as deep as 18 in. (PSU 2009-TN696). Although the distribution of the northern water plantain in Northumberland County is not known, appropriate habitat exists along the conceptual water-intake/discharge pipeline route, and potential effects on the species cannot be completely discounted.

<u>Consumptive-Use Mitigation and Site-Specific Low-Flow Protection Areas</u>

There are no Federally listed aquatic species for the four counties (Cambria, Centre, Clearfield, and Indiana) associated with consumptive-use mitigation and site-specific low-flow protection for the Montour site (FWS 2014-TN3967; FWS 2014-TN3996). State-listed species for these same counties were evaluated only for occurrence within one of the aquatic areas included in the proposed consumptive-use mitigation and site-specific low-flow protection plan. Occurrence in a county associated with the consumptive-use mitigation and site-specific low-flow protection plan, but in another watershed, is not included. The aquatic plant, bushy naiad (*Najas gracillima*) is a Pennsylvania threatened species listed for Indiana County that may occur in softwater lakes, ponds, and streams (NatureServe 2013-TN2928). The Redfin Shiner (*Lythrurus umbratilis*), brook floater (*Alasmidonta varicosa*), and clubshell (*Pleurobema clava*) are listed for Indiana County within the West Branch of the Susquehanna River watershed, but are also noted as extirpated or possibly extirpated (NatureServe 2014-TN3995; NatureServe 2014-TN3969; NatureServe 2014-TN3997). Grassy pondweed (*Potamogeton gramineus*) (NatureServe 2014-TN3994), is listed for Centre County, but is also noted as extirpated or possibly extirpated (NatureServe 2014-TN3994).

Building Impacts

The onsite aquatic resources have not been quantitatively characterized; however, there are no ponds on the site, and small stream courses on the site amount to 3,821 linear ft (PPL Bell Bend 2013-TN3377). PPL assumes that building a new plant on the Montour site would affect all 3,821 linear ft of streams on the development site, primarily along the East Branch of Chillisquaque Creek. Table 9-7 summarizes expected land-use impact parameters for the Montour site, including the installation and operation of water-intake and discharge pipelines and a new/widened transmission-line corridor. Section 9.3.2.2 discusses surface-water quality and assumed use of stormwater detention and infiltration ponds as well as conformance with the NPDES permit and required BMPs to control stormwater runoff. The impact on the aquatic biota of the onsite and offsite streams should be minimal.

New cooling-water intake and discharge structures would be required for a new plant at the Montour site, and new water-intake and discharge pipelines would need to be installed between the West Branch of the Susquehanna River and a new plant on the Montour site. Building the water-intake and discharge pipelines along the conceptual route as described in Section 9.3.2.1 may affect about 3,417 linear ft of streams, including the East Branch of Chillisquaque Creek, Chillisquaque Creek, and County Line Branch in Montour County, Beaver Run in Montour and Northumberland Counties, and Warrior Run in Northumberland County (PPL Bell Bend 2013-

TN3377). Extending or improving a railroad spur that exists approximately 1.4 mi southwest of the site would not affect streams, but building new access roads may affect approximately 246 linear ft of streams (PPL Bell Bend 2013-TN3377).

It is assumed that the intake and discharge structure designs would be similar to those at the proposed BBNPP site (Section 3.2.2.2); building impacts would also be similar to those described for the BBNPP site (Section 4.3.2.1). The nature of the river bottom at the potential intake/discharge site is not known. However, there is no information to suggest that the river at the conceptual location of the intake/discharge system is a deep pool, such as that found at the proposed BBNPP site. Installation of the water-intake and discharge structures, as well as associated dredging, would result in some loss of benthic habitat in the West Branch of the Susquehanna River, and temporary degradation of water quality due to localized turbidity and sedimentation effects. Use of cofferdams to facilitate in-water building activities and dredging would minimize the amount and transport of disturbed sediments. Predators that rely on vision to capture prey could be temporarily affected, but most motile aquatic organisms would likely avoid the area of in-water activities. Effects on aquatic biota would be short-term and localized, and would be mitigated through the use of BMPs. Prior to commencement of dredging, sediments within the areas proposed for dredging would be characterized in accordance with Federal and State permitting procedures. PPL anticipates that no construction-related effluents from building the intake and discharge structures would enter aquatic resources; BMPs would be used to minimize runoff (PPL Bell Bend 2012-TN1348).

Approximately 0.7 mi of a new transmission-line corridor would need to be built and 15.5 mi would need to be upgraded for a new nuclear plant on the Montour site (PPL Bell Bend 2013-TN3377). The conceptual transmission-line corridor route to the substation at Catawissa in Columbia County would cross Mahoning Creek, Frozen Run, Montour Run, Mud Creek, Sechler Run, and the North Branch of the Susquehanna River (PPL Bell Bend 2013-TN3377; HRG 2010-TN633). Building or upgrading this transmission-line corridor may affect approximately 2,321 linear ft of streams (PPL Bell Bend 2013-TN3377). The severity of impacts would be minimized by the placement of footings outside of waterbodies, the use of BMPs during building to reduce sedimentation and erosion, and the management of stormwater through NPDES compliance (PPL Bell Bend 2013-TN3377).

The use of the Greenwich, Gallitzin 10, and Hughes mines to supply water for the Montour site consumptive-use mitigation and site-specific low-flow protection would require building new pumping facilities, water-treatment facilities, and the installation of water pipelines and discharge systems. Installation of the discharge systems would have relatively minor impacts on the receiving waters, including increased turbidity and downstream sedimentation. These impacts, with the exception of any habitat loss, are expected to be localized and temporary. Additionally, use of the Hughes Mine would involve the transfer of mine water currently discharged into the Little Conemaugh River in the Allegheny River watershed to Clearfield Creek in the Susquehanna River Basin. The installation of a pipeline to accomplish this transfer likely would not directly affect any aquatic resources. Pennsylvania Mines, LLC would need to expand the current Rushton Mine treatment facilities to be able to meet the consumptive-use mitigation and site-specific low-flow protection demands that would be required during low-flow events. The facility expansion would be on previously disturbed land and would not affect aquatic resources (PPL Bell Bend 2013-TN3541). PPL has determined that the existing

Rushton outlet channel is sufficient to accommodate the potentially increased flows required during low-flow events, and the channel would not need to be expanded (PPL Bell Bend 2014-TN3539).

Building a new nuclear plant on the Montour site, including the water-intake/discharge pipeline corridor, new/widened transmission-line corridor, and access roads, may affect a combined onsite and offsite (excluding consumptive-use mitigation areas) total of about 9,875 linear ft of streams (PPL Bell Bend 2013-TN3377). The areal extent of the aquatic resources that would be affected by the installation of new treatment facilities associated with the use of reclaimed mine water for consumptive-use mitigation has not been determined because the specific locations for the facilities have not been identified (PPL Bell Bend 2014-TN3652).

Operational Impacts

The most likely effects on aquatic populations from the operation of a new nuclear power plant at the Montour site would be the impingement and entrainment of organisms from the West Branch of the Susquehanna River. Assuming that a new reactor at the Montour site would use a closed-cycle cooling system that meets the EPA's Phase I regulations for new facilities (66 FR 65256 -TN243), has a maximum through-screen velocity of 0.5 ft/s, and meets the appropriate EPA intake flow-to-source water volume criterion, adverse impacts at the population level of many West Branch of the Susquehanna River aquatic species from impingement and entrainment would not be anticipated. There are no nearby data that could be used to evaluate the potential entrainment and impingement of river biota by a plant built on the Montour site. However, the cooling system would be the same as that proposed for the BBNPP unit, and fauna in the West Branch of the Susquehanna River is relatively similar to that in the North Branch of the Susquehanna River. Therefore, the impacts from entrainment and impingement on the West Branch of the Susquehanna River aquatic biota are expected to be minor, as assessed for the BBNPP unit (Section 5.3.2). Operational impacts associated with water quality and discharge cannot be determined without additional detailed analysis, but are also expected to be similar to effects described for the BBNPP unit. Maintenance activities onsite and in offsite corridors would follow BMPs required by Federal and State permits to minimize impacts on aquatic resources (PPL Bell Bend 2013-TN3377). Consequently, impacts on aquatic ecology due to operations at the Montour site are expected to be minor. Operational impacts on aquatic biota from the transmission lines would also be minor, assuming that BMPs are used for the maintenance of the transmission-line corridor. The effects of water-intake and discharge system maintenance, as well as stormwater runoff, are expected to be minor.

The inclusion of the Gallitzin 10 and Hughes mines in the consumptive-use mitigation and site-specific low-flow protection plan would require that the mines discharge water into Clearfield Creek all year to reduce abandoned mine discharge effects (PPL Bell Bend 2014-TN3539). These releases would increase baseline flow in the creek by about 12 cfs. This continuous discharge should not adversely affect aquatic biota in the creek, and likely would help improve water quality in the creek.

The NRC staff assumed that the SRBC would impose consumptive-use mitigation and site-specific low-flow protection requirements for a plant at the Montour site, as described in Section 9.3.2, that would include compensating releases from upstream sources in an amount equal to the plant's consumptive use. Such release of water upstream of the Montour intake system would reduce the likelihood that sensitive downstream areas would become dewatered or experience unusually low water levels because of the consumptive-use by the plant. Therefore, the impacts from consumptive use by a Montour-site plant on the West Branch of the Susquehanna River downstream of the plant water-intake system would be negligible.

Cumulative Impacts

In addition to the impacts from construction, preconstruction, and operation, the cumulative analysis also considers other past, present, and reasonably foreseeable future projects that could affect aquatic resources. A new plant built on the Montour site would rely on the West Branch of the Susquehanna River for cooling water, and would involve much of the river basin in a consumptive-use mitigation and site-specific low-flow protection plan. Therefore, the geographic area of interest for the assessment of the potential cumulative aquatic ecosystem impacts of building and operating a new reactor at the Montour site is the North Branch and West Branch of the Susquehanna River Basin to their confluence and south to Conowingo Dam. The Conowingo Dam is in Maryland, approximately 3 mi upriver from Deer Creek, which is the general location of the tidal extent in the river (Normandeau and Gomez and Sullivan 2011-TN3681).

The major actions identified in Table 9-6 that would contribute to the potential cumulative impacts affecting the aquatic resources within the area of interest include historic anthropogenic activities, abandoned mine drainage, operation of the existing PPL Montour Electric Steam Station and other power-generation facilities within the defined geographic area of interest, increased urban/suburban development (creating increased runoff, increased sewage effluent, consumptive-water use), agricultural runoff, Marcellus Shale gas extraction, and climate change. The primary activities associated with the preconstruction, construction, and operation of a new nuclear plant at the Montour site that could interact with these actions include the impingement and entrainment of the West Branch of the Susquehanna River biota, thermal discharges and chemical releases into the river, and the consumptive use of river water. The review team considered these potential sources of impacts in its evaluation of the cumulative aquatic ecosystem impacts as described for the BBNPP site in Section 7.3.2.

Summary

Impacts on aquatic ecology resources are estimated based on the information provided by PPL, SRBC, FWS, the Commonwealth of Pennsylvania, and the review team's independent review. Properly siting the associated transmission line and switchyard, minimizing interactions with waterbodies and watercourses along the utility corridors and access roads, and use of BMPs during water-intake and discharge structure installation, pipeline installation, access roads installation, transmission-line corridor preparation, and tower placement would minimize building and operation impacts and are required by Federal and State permit requirements. As required by law, the SRBC would identify the requirements for consumptive-use mitigation and site-specific low-flow protection to avoid adverse effects from low-flow events (SRBC 2012-TN2453). Thus, building and operational impacts on aquatic resources and Federally and State-listed species should be minor.

The review team concludes that the cumulative impacts on most aquatic resources in the region of building and operating the proposed plant on the Montour site, combined with other past, present, and future activities, would be MODERATE to LARGE, primarily from past actions, such as the building of dams in the watershed, abandoned mine drainage, and urbanization; however, building and operating a new nuclear plant at the Montour site would not be a significant contributor to the cumulative impact.

9.3.2.5 Socioeconomics

For the analysis of socioeconomic impacts at the Montour site, the geographic area of interest is the 50-mi (80-km) region centered on the site with special consideration of Columbia, Luzerne, Lycoming, Montour, and Northumberland Counties. In evaluating the socioeconomic impacts of building and operating a nuclear power plant at the Montour site in Montour County, the review team undertook a reconnaissance-level survey of the site using readily obtainable data from the Internet and published sources.

The Montour site is located in Montour County, and the nearest community is Washingtonville, which is approximately 3 mi to the south. The review team drew upon U.S. Census Bureau (USCB) data, workforce data provided by PPL, and other State and Federal sources to evaluate the impacts of building and operations activities within the 50-mi region, the host county, and any nearby counties with a major population center within a reasonable commuting distance from the site. For the Montour site, this includes Columbia (Bloomsburg and Berwick), Lycoming (Williamsport), Luzerne (Wilkes-Barre and Hazleton), Montour (Danville and Washingtonville), and Northumberland (Sunbury and Milton) Counties.

For the Montour site, the review team employed a gravity model to estimate the distribution of in-migrating workers between cities located in the 50-mi region. The gravity model is a standard economic location model inspired by Newton's law of gravitation to evaluate trade and migration patterns between competing countries, cities, or economies. The simplified model employed for this analysis measured the "gravitational pull" of each community surrounding the Montour site on in-migrants based on the population of the community divided by the square of the distance of that community from the site (Anderson 2010-TN1947). Each community was, in turn, assigned a value based on the aforementioned calculation. These values were used to determine the proportion of the in-migrating population that would reside in each community. The gravity model evaluated all communities located within 10 mi of the Montour site and all communities with populations in excess of 5,000 located within the 50-mi region. The results of the gravity model for the Montour site indicate that 21.7 of the in-migrants would locate in Columbia County, 15.3 percent in Luzerne County, 12.8 percent in Lycoming County, 17.2 percent in Montour County, 23.1 percent in Northumberland County, and 9.8 percent in other counties within the 50-mi region. Communities with the highest concentration of in-migrating workers were Bloomsburg, Williamsport, Danville, and Milton.

Based on the results of the gravity model calculations, the review team identified Columbia, Luzerne, Lycoming, Montour, and Northumberland Counties as the primary economic impact area for the project in Montour County and the basis of expected effects of in-migrating construction and operations workers and their families. Table 9-9 provides socioeconomic data for each county located within the economic impact area.

Table 9-9. Selected Socioeconomic Data for the Montour Site Economic Impact Area

	Columbia	Luzerne	Lycoming	Montour	Northumberland	Data Source
Population						
1980	61,967	343,079	118,416	16,675	100,381	(a)
1990	63,202	328,149	118,710	17,735	96,771	(a)
2000	64,151	319,250	120,044	18,236	94,556	(b)
2010	67,296	320,918	116,111	18,267	94,517	(c)
Vacant Housing Units						
1990	2,120	10,241	4,631	342	3,164	(a)
2000	2,818	13,999	5,461	542	4,329	(b)
2010	3,019	16,816	5,800	572	5,883	(c)
Total Housing Units						
1990	25,598	138,724	49,580	6,885	41,900	(a)
2000	27,733	144,686	52,464	7,627	43,164	(b)
2010	29,498	148,748	52,500	7,965	45,125	(c)
Workforce						
Employed	31,370	147,286	54,610	8,259	42,097	(d)
Construction	1,900	8,148	3,732	455	2,738	(d)
Unemployment Rate	5.8%	7.0%	7.9%	6.2%	7.5%	(d)
Median Household Income	42,788	42,224	42,689	45,255	38,387	(d)
Education						
Total Schools	10 E, 1 E-M, 3 M, 3 E-M-H, 4 M-H, 6 H	37 E, 19 E-M, 6 M, 6 E-M-H, 9 M-H, 10 H	21 E, 0 E-M, 6 M, 0 E-M-H, 3 M-H, 6 H	2 E, 1 E-M, 0 M, 0 E-M-H, 0 M-H, 3 H	12 E, 1 E-M, 5 M, 8 E-M-H, 3 M-H, 6 H	(e)
Student-to-Teacher Ratio	12.6	15.0	13.3	12.8	13.5	(e)

Table 9-9. (contd)

	Columbia	Luzerne	Lycoming	Montour	Northumberland	Data Source
Sheriff and Police						
Law Enforcement Employees	141	640	234	54	194	(f)
Officers	126	572	203	48	179	(f)
Officer per 1,000 people	1.9	1.8	1.7	2.7	2.0	(f)
Emergency Services						
Firefighters	901	2,324	953	168	888	(g)
Firefighters per 1,000 people	13.4	7.2	8.2	9.2	9.4	(g)
Demographics						
White	96.9%	94.0%	94.5%	96.0%	96.8%	(h)
Black	2.0%	3.7%	5.4%	1.7%	3.1%	(h)
Hispanic or Latino Origin	1.9%	5.4%	1.3%	1.5%	2.4%	(h)
Below Poverty Level	13.7%	13.7%	14.4%	11.0%	11.9%	(h)

(a) USCB 1990-TN1869.
(b) USCB 2001-TN1873.
(c) UCSB 2011-TN1874.
(d) USCB 2011-TN1876.
(e) NCES 2013-TN4026.
(f) Pennsylvania State Police 2010-TN1868.
(g) USFA 2013-TN1867.
(h) USCB 2011-TN1875.
E=elementary school; M = middle school; H = high school

Physical Impacts

Many of the physical impacts of building and operation would be similar regardless of the site. Building activities can cause temporary and localized physical impacts (e.g., noise, odor, vehicle exhaust, vibration, shock from blasting [if used], and dust emissions). The use of public roadways, railways, and waterways would be necessary to transport construction materials and equipment. Offsite areas that would support building activities (e.g., borrow pits, quarries, and disposal sites) would be expected to be already permitted and operational.

Potential impacts from station operation include noise, odors, exhausts, thermal emissions, and visual intrusions (the latter are discussed under aesthetics and recreation). A new unit would produce noise from the operation of pumps, cooling towers, transformers, turbines, generators, and switchyard equipment. Traffic at the site also would be a source of noise. Any noise coming from the proposed site would be controlled in accordance with standard noise protection and abatement procedures. This practice also would be expected to apply to all alternative sites, including the Montour site. Good road conditions and appropriate speed limits would minimize the noise level generated by the workforce commuting to the Montour site.

The new unit at the Montour site would have standby diesel generators and auxiliary power systems. Permits obtained for these generators would ensure that air emissions comply with applicable regulations. In addition, the generators would be operated on a limited, short-term basis. During normal plant operation, the new unit would not use a significant quantity of chemicals that could generate odors that exceed odor threshold values. Access roads and appropriate speed limits would minimize the dust generated by the commuting workforce.

The Montour site is adjacent to the PPL MSES, which is an existing coal-fired power plant that includes two cooling towers and three stacks. The plumes from the new unit at the Montour site would be near those from the existing coal-fired plant. The building and operation of transmission lines to support the site also would have an aesthetic impact on the region. The review team concludes that the visual impact associated with site development and operation of one nuclear unit on this site would have a minor impact on the visual aesthetic resources in the area due to the presence of existing plumes from the coal-fired plant. Impacts on aesthetic resources would be minor because these resources are already significantly affected by the presence of the nearby MSES. Based on the information provided by PPL and the review team's independent evaluation, the review team concludes that the aesthetic and recreation impacts of building and operating one nuclear unit at the Montour site would be minor.

Based on the information provided by PPL and the review team's independent evaluation, the review team concludes that the physical impacts of building and operating one nuclear unit on workers and the local public, buildings, roads, and aesthetics near the Montour site would be minor.

Demographic Impacts

The Montour site is located in Montour County, approximately 20 mi (32 km) from Williamsport, Pennsylvania (population 29,381 in 2010) and 3 mi from Washingtonville, Pennsylvania (population 273 in 2010). Bloomsburg (population 14,855 in 2010), Berwick (population 10,477 in 2010), Danville (population 4,699 in 2010), Sunbury (population 9,905 in 2010), and Milton (population 7,042 in 2010) are other nearby communities. Wilkes-Barre, Pennsylvania, with a population of 41,498 in 2010, represents the largest community located within the 50-mi radius of the Montour site. Populations for each county located within the economic impact area are presented in Table 9-9. In 2010, the population within the economic impact area reached 617,109, representing an increase in population of 0.1 percent over 2000 levels (USCB 2011-TN1875). As of 2010, the population density within the economic impact area was 193.4 persons per square mile compared to 283.9 for the Commonwealth of Pennsylvania.

For the proposed BBNPP unit, PPL estimated that the peak number of construction workers would be 3,950, with an additional 363 operations workers onsite during the final phase of construction activities (PPL Bell Bend 2013-TN3377). In the BBNPP ER, PPL indicated that staffing levels at each alternative site would be similar to those estimated for the BBNPP (PPL Bell Bend 2013-TN3377). In 2010, the total construction workforce in the economic impact area was 16,973 (Table 9-9). While the construction workforce in the economic impact area is sufficient to meet the needs of the project, many of these workers are engaged in other activities and will not be available to participate in nuclear power plant construction at the Montour site. Therefore, the review team concludes that resident and commuting workers could meet the majority but not all of the building workforce needs. Thus, the review team has retained the 20 to 35 percent in-migration assumption presented in Sections 4.4.2 and 5.4.2. The review team has also adopted PPL's bounding assumption that 100 percent of the operations workforce would in-migrate into the area. The results of the gravity model calculations indicate that 90.2 percent of those in-migrants would locate in the economic impact area. Based on these assumptions, the review team estimates that 1,040 to 1,574 construction and operations workers would in-migrate into the Montour site economic impact area. Using the Pennsylvania average of 2.47 people per household, workers would bring an additional 1,529 to 2,314 family members with them. Thus, the review team estimates the in-migration in the economic impact area to be 2,569 to 3,889. At this level of in-migration, the economic impact area population would grow by 0.4 to 0.6 percent.

If the facility is constructed and commences operation, the 363-person operational workforce would already be onsite during the period of peak building-related employment and are included in the above analysis, meaning that there would be very little demographic impact during operations in the economic impact area. Based on the information provided by PPL and the review team's independent evaluation, the review team concludes that the demographics impacts of building and operating the nuclear unit at the Montour site would be minor.

Economic Impacts

The principal economic centers in the economic impact area include Back Mountain, Berwick, Bloomsburg, Danville, Hazleton, Kingston, Milton, Mountain Top, Nanticoke, Sunbury, Wilkes-Barre, and Williamsport. The USCB reports that the top five industries in the economic impact area in 2010 were educational, health, and social services (24.8 percent); manufacturing (15.7 percent); retail trade (13.1 percent); arts, entertainment, recreation, accommodation, and food services (7.8 percent); and professional, scientific, management, administrative, and waste-management services (6.5 percent). Together, these five industries accounted for 67.9 percent of the employment in the economic impact area in 2010 (USCB 2011-TN1876).

The review team determined that the impact of jobs associated with building a nuclear power plant on the Montour site would have a noticeable and beneficial impact on total employment in Montour County. The impact of 713 to 1,247 construction-related jobs and 327 operations jobs filled by in-migrating workers, as well as the 992 to 1,381 indirect jobs, would be minor and beneficial in the economic impact area. Note the estimated indirect jobs created as a result of building and operating a nuclear power plant at the Montour site. When a new job is added to an economy, that new (direct) job supports the creation of other (indirect) jobs. Every new direct job in a given area—in this case, a job building the plant at the Montour site—stimulates spending on goods and services. This spending results in the economic need for a fraction of another indirect job, typically in the service industries. The U.S. Department of Commerce Bureau of Economic Analysis (BEA) provided RIMS II regional multipliers for industry employment and earnings in the BBNPP economic impact area. As noted in Section 4.4.2, the employment multiplier for construction jobs in the BBNPP economic impact area is 1.73, meaning that for each construction job created a total of 1.73 jobs (including the direct job) would be supported in the two-county economic impact area. The employment multiplier for operations jobs during the building phase is 2.44 (BEA 2014-TN3624). For comparative purposes, the review team applied these multipliers to the Montour site economic impact area. The BEA employment multiplier is applied only to in-migrating workers because the BEA model assumes the direct employment of workers that already live in the area would have no additional impact on employment.

The review team assumed that tax revenue generated from sales and use taxes associated with construction and operation of a nuclear unit at the Montour site would be similar to those evaluated for the BBNPP site in Sections 4.4.3.3 and 5.4.3.3, with a similarly noticeable and beneficial impact on revenues in the economic impact area. For the BBNPP site, property taxes are estimated by PPL at $2.4 million annually (PPL Bell Bend 2013-TN3377). Adjusting the property tax rate differential between Salem Township (16.544 mills) and Derry Township (14.61 mills) results in an annual property tax assessment of $2.1 million if the nuclear power plant is constructed at the Montour site. Derry Township would receive approximately $63,000 of the annual property tax payments during the operations phase. The review team estimates that the proposed nuclear power plant would generate $3.1 million annually in local earned income taxes throughout the region. It would also generate $129,390 in annual local services tax (LST) revenue for Derry Township during the peak construction period and $10,890 annually during the operations phase (PDCED 2014-TN3915). In 2012, total revenue to Derry Township was $468,892, indicating the addition of the nuclear power plant, and the resulting increase in property and LST tax proceeds, would result in a minimum 27.6 percent increase in revenues during the peak construction period and 15.8 percent growth over current levels during the operations period (PDCED 2012-TN3916).

The new unit would employ an operations workforce of 363 people who would earn $28 million annually (average annual salaries of $77,135) (PPL Bell Bend 2013-TN3377). The building workforce of 3,950 would collectively earn $279 million annually at its peak (average annual salaries of $70,720). The in-migrating building workforce, including operations workers training onsite during the construction period, would earn $75.7 to $113.4 million annually during the peak construction period. As shown in Table 9-9, these salaries far exceed the median household incomes in the economic impact area (USCB 2011-TN1876). The in-migrating building and operations workforce would stimulate the creation of 992 to 1,381 additional indirect jobs within the economic impact area during the peak of employment during the building period. These indirect jobs would generate an additional $17.7 to $24.7 million annually in the economic impact area (average annual salary of $17,870) (PPL Bell Bend 2013-TN3377). In addition, PPL estimates that within the 50-mi region, $260.8 million will be spent on materials, equipment, and outside services during the construction period and $9 million spent annually during operations (PPL Bell Bend 2013-TN3377). The economic multiplier effect of the increased spending by the direct and indirect workforce and the businesses serving PPL directly would increase the economic activity in the region, most noticeably in the communities near the Montour site.

Based on the information provided by PPL, and the review team's own independent evaluation, the review team concludes that the tax and economic impacts of building and operating a new nuclear unit at the Montour site would be similar to those estimated for the BBNPP site; impacts would be noticeable but not destabilizing in Montour County, and minor and beneficial in the economic impact area. Tax impacts on Derry Township would be noticeable and destabilizing.

Transportation Impacts

Primary access to the Montour site is from SR 54 and SR 254, both of which are two-lane highways near the site. Traffic impacts would be felt along SR 54 and SR 254, as well as several other smaller roads surrounding the facility, including SR 1003, SR 1006, SR 1009, McMichael Road, Strawberry Ridge Road, and White Hall Road. Based on the information provided by PPL, a 1.8-mi (2.9-km) access road extending southeast from the southeast border of the site to State Highway 254 would be required, as would a 2.1-mi (3.4-km) rail spur (PPL Bell Bend 2013-TN3377). The review team concludes that the transportation impacts from site development of a plant at the Montour site would be noticeable. The temporary (6-year) impact on transportation near the Montour site would be noticeable during shift changes but could be reduced through a number of mitigation strategies outlined in the BBNPP ER, including scheduling shift changes and deliveries during off-peak hours and improvements to local roads, intersections, and signals (PPL Bell Bend 2013-TN3377). PPL identified a number of mitigation strategies for the BBNPP ER, and the review team assumes that similar mitigation strategies would be identified for the Montour site. Any mitigation strategies must be agreed to by applicable Pennsylvania Department of Transportation (PennDOT) regions prior to PPL submitting final highway occupation permit (HOP) engineering plans for review. Mitigation strategies that are agreed upon with PennDOT in the final approved Transportation Impact Study (TIS) will be required as a condition of issuing an HOP (PPL Bell Bend 2013-TN3377).

In addition to congestion impacts, construction-related traffic will also result in emissions, traffic accidents, injuries, and fatalities. The heavy vehicles that transport construction-related equipment and materials and the automobiles carrying the commuting workforce to the Montour site will emit several pollutants, including CO, CO_2, NO_X, fine PM, volatile organic compounds, and SO_2. Construction-related traffic will also result in an increase in the number of accidents, injuries, and fatalities. The costs associated with these incidents include workers' compensation premiums, lost productivity, environmental remediation, property damage, fines and penalties, insurance premiums, and medical costs. As discussed in Sections 4.4 and 5.4, the review team expects the impacts of BBNPP construction and operation to be minor with respect to emissions and the number of traffic accidents. Impacts at the Montour site would be expected to be similar to those estimated for the BBNPP. Therefore, the socioeconomic impacts of emissions and traffic accidents would also be minor.

Operations impacts would be significantly lower than the building phase impacts of traffic due to the much smaller workforce and because roads would have been improved during site development. During the operations phase, traffic impacts would be minor.

Recreation Impacts

Within the 50-mi region, there are 149 parks, including 62 game lands, 27 State parks and forests, 34 local parks and preserves, and 2 playgrounds (PPL Bell Bend 2013-TN3377). Recreation in the area includes two parks located in Montour County: one local park and a playground (PPL Bell Bend 2013-TN3377). Operations impacts on recreation areas near the Montour site would be minimal. In response to SRBC consumptive-use mitigation and site-specific low-flow protection requirements, there could also be impacts on Cush Cushion Creek, Clearfield Creek, and Little Conemaugh River resulting from discharges at the Greenwich North Mine, Gallitzin 10 Mine, and Hughes Mine, respectively. Water flowing from these mines would be treated, and the increased flow combined with the positive water-quality impacts would be favorable to recreational uses (PPL Bell Bend 2014-TN3652). Based on the information provided by PPL and the review team's independent evaluation, the review team concludes that the recreation impacts of building and operating a nuclear unit at the Montour site would be minor.

Housing Impacts

Within a 50-mi (80-km) radius of the Montour site, there were a total of 130,160 vacant housing units in 2010, with 542 of those located within Montour County (PPL Bell Bend 2013-TN3377). Within the five-county economic impact area, there were 283,836 housing units and 32,090 vacant units in 2010 (USCB 2011-TN2072). The housing figures presented in Table 9-9 do not include recreational vehicle parks, campgrounds, or hotels and, thus, provide a lower bound of what would be available to house workers.

The review team compared the vacant housing units to the number of workforce households projected for the peak workforce years. Using the approach outlined in Section 4.5.2, the review team estimates the number of workforce households at 1,040 to 1,574 during peak workforce years. In the 50-mi radius surrounding the Montour site, 0.8 to 1.2 percent of the year 2010 vacant housing units would be needed to house in-migrating workers. In the economic impact area, 3.2 to 4.9 percent of the vacant housing units would be needed. The review team assumes that current residents who would not require additional housing would fill all the indirect jobs.

The review team expects that the in-migrating workforce could be absorbed into the existing housing stock in the 50-mi (80-km) region around the Montour site and the economic impact area without a noticeable impact. Based on the information provided by PPL and the review team's independent evaluation, the review team concludes that the housing impacts of building and operating a nuclear unit at the Montour site would be minor.

Impacts on Public Services and Education

In-migrating construction workers and plant operations staff would affect local municipal water and wastewater-treatment facilities, and other public services in the region. These impacts would likely be in proportion with the demographic impacts experienced in the region, unless these resources have excess capacity or are particularly strained during construction, which would decrease or increase the impact.

Within the economic impact area, there are 151 community public water systems that have a total design capacity of 145.5 Mgd, average use of 71.4 Mgd, and excess capacity of 74.2 Mgd. Based on assumptions presented in Section 4.4.4.4, water use onsite and offsite by the workforce population during the peak building period would require 334,681 to 518,887 gal/day or 0.2 to 0.4 percent of the design capacity for public water systems in the economic impact area. There are 57 wastewater/sanitary sewer treatment plants in the economic impact area with a collective design flow of 128.8 Mgd. Based on assumptions presented in Section 4.4.4.4, combined onsite and offsite wastewater use are estimated at 545,332 to 743,330 gallons per day or 0.4 to 0.6 percent of the design flow rate in the economic impact area. There are four wastewater/sanitary sewer treatment plants within Montour County with a collective wastewater design flow rate of 3.9 Mgd (PPL Bell Bend 2013-TN3377). The Montour County Comprehensive Plan recognizes constraints associated with existing sewer systems, and to accommodate future population and economic growth, the plan recommends expanding the local Valley Township Wastewater Treatment Plant or a conveyance to the Danville Borough Plant, which currently has the required reserve capacity to meet future demand.

Within the five-county economic impact area, there are 210 fire stations and 5,234 career, volunteer, and paid-per-call firefighters (Table 9-9). Firefighters per 1,000 people within the economic impact area range from a low of 7.2 in Luzerne County to a high of 13.4 in Columbia County. In 2011, the national average rate of firefighters per 1,000 people was 3.5 (Karter and Stein 2012-TN1871). During the period when the peak construction workforce is present, 2,569 to 3,889 people would be expected to move into the economic impact area. To meet the demands placed on the fire protection network, an additional 22 to 33 firefighters would need to be hired or would need to volunteer based on the economic impact area average rate of 8.5 firefighters per 1,000 people. With that noted, the firefighter rates in the economic impact area far exceed the national average.

Within the economic impact area, there are 1,128 law enforcement officers, with officer rates per 1,000 people ranging from a low of 1.7 in Lycoming County to a high of 2.7 per 1,000 people in Montour County (Pennsylvania State Police 2010-TN1868). Five to seven law enforcement officers would need to be hired to maintain the current officer rate in the economic impact area of 1.8 per 1,000 people.

There are 20 hospitals located within the economic impact area. During 2010 to 2011, hospitals within the economic impact area provided 569,223 patient days of care and were operating at 67.6 percent capacity (PADOH 2012-TN2224). Based on the size and availability of medical services in the region, temporary construction workers would not overburden existing medical services. The review team concludes adverse impacts on medical services near the proposed site would be minor and temporary.

In the 2011 to 2012 school year, student enrollment in the economic impact area reached 88,531 (NCES 2013-TN4026). With a population of 617,109, there are 7.0 individuals for every student enrolled in schools within the economic impact area. Applying this ratio, the review team expects a peak building-related increase of approximately 369 to 558 students. Student-to-teacher ratios within the economic impact area range from 12.6 in Columbia County to 15.0 in Luzerne County. As shown in Table 9-9, student-to-teacher ratios in all counties located within the economic impact area, with the exception of Luzerne County, fall below the statewide average of 13.8 (NCES 2013-TN4026). When adding the influx of students generated during plant construction, student-to-teacher ratios increase only slightly in the economic impact area from 14.1 to 14.2. Based on the gravity model calculations, the review team estimates that the student population in Montour County would grow by 63 to 96 students or 3.3 to 5.0 percent. To keep student-to-teacher ratios at current levels, economic impact area schools would need to add 26 to 40 teachers. To maintain student-to-teacher ratios in Montour County, schools would need to add 5 to 7 teachers. With that noted, the in-migrating students would not push student-to-teacher ratios in Montour County above the statewide average of 13.8. Thus, the review team concludes that in-migrating students would have a minor impact on schools throughout the economic impact area and the 50-mi region.

Based on the information provided by PPL and the review team's independent evaluation, the review team concludes that the public service and education impacts of building and operating a new nuclear unit at the Montour site would be minor.

Summary of Project-Related Socioeconomic Impacts

Physical impacts on workers and the general public include impacts on existing buildings, transportation, aesthetics, noise levels, and air quality. Social and economic impacts span issues of demographics, economy, taxes, infrastructure, and community services. On the basis of information provided by PPL and the review team's independent evaluation, the review team concludes that the impacts of building and operating a nuclear unit at the Montour site on socioeconomics would be SMALL and adverse for the 50-mi region. The temporary (6-year) and intermittent building-related impact on transportation near the Montour site would be MODERATE during shift changes but could be reduced through a number of mitigation strategies outlined in the BBNPP ER, including scheduling shift changes and deliveries during off-peak hours and improvements to local roads, intersections, and signals (PPL Bell Bend 2013-TN3377). PPL identified a number of mitigation strategies for the BBNPP ER, and the review team assumes that similar mitigation strategies would be identified for the Montour site. Any mitigation strategies must be agreed to by applicable PennDOT regions prior to PPL submitting final HOP engineering plans for review. Mitigation strategies that are agreed upon with PennDOT in the final approved TIS will be required as a condition of issuing an HOP (PPL Bell Bend 2013-TN3377). During operation, transportation impacts are expected to be SMALL. Economic impacts in Montour County are expected to be MODERATE and beneficial. Economic and tax impacts in the economic impact area are expected to be SMALL and beneficial. Tax impacts on Derry Township are expected to be LARGE and beneficial.

Cumulative Impacts

The review team concludes that the current and reasonably foreseeable projects listed in Table 9-6 with the greatest potential to affect cumulative socioeconomic impacts would be the SSES (located 26 mi east of the Montour site), Montour Power Plant (located adjacent to the Montour site), Panda Patriot natural gas power plant (located 11 mi northwest of the Montour site), Panda Hummel Station (planned to be built 18 mi south of the Montour site), the Moxie Freedom Project (planned to be built 28 mi west of the Montour site), Atlantic Sunrise pipeline (planned to be built in Lycoming, Montour, and Northumberland Counties), the Cherokee Pharmaceutical Plant (located 8 mi south of the Montour site), planned improvements to Federal, State, and county roads and bridges, and other renewable energy projects, fossil-fuel operational energy projects, and natural gas drilling operations throughout the region. The projects with the greatest potential to affect cumulative socioeconomics impacts would be the proposed Panda Patriot power plant, the Atlantic Sunrise pipeline, and planned improvements to Federal, State, and county roads and bridges. Other projects involve continuation of ongoing activities and are expected to result in little or no change in current levels of employment at existing establishments. Any resulting new development is expected to be consistent with controls in existing county comprehensive plans.

The review team determined that the cumulative socioeconomic effects of a nuclear power plant located at the Montour site and other past, present, and reasonably foreseeable projects would be SMALL with some exceptions. The cumulative impacts on transportation near the Montour site would be MODERATE during the 6 years of construction, and traffic during shift changes at the nuclear plant would be a significant contributor to these impacts. PPL identified a number of mitigation strategies in the BBNPP ER, and the review team assumes that similar mitigation strategies would be identified for the Montour site. Any mitigation strategies must be agreed to by applicable PennDOT regions prior to PPL submitting final HOP engineering plans for review. Mitigation strategies that are agreed upon with PennDOT in the final approved TIS will be required as a condition of issuing an HOP (PPL Bell Bend 2013-TN3377). Cumulative physical impacts on roads of planned improvements to Federal, State, and county roads and bridges are expected to be MODERATE. However, the review team concludes that the physical impacts on local road systems from building and operating a nuclear power plant at the Montour site would not be a significant contributor to these impacts. The cumulative economic and tax impacts of a nuclear power plant located at the Montour site would be SMALL and beneficial to the economic impact area. Montour County would be expected to experience MODERATE and beneficial economic impacts, and the nuclear plant would be a significant contributor to these beneficial impacts. Tax impacts on Derry Township are expected to be LARGE and beneficial, and the nuclear plant would be a significant contributor to these beneficial impacts.

9.3.2.6 Environmental Justice

To evaluate the distribution of minority and low-income populations near the Montour site, the review team conducted a demographic analysis of populations within the 50-mi region surrounding the proposed site in accordance with the methodology discussed in Section 2.6.1. The review team identified 968 census block groups within a 50-mi radius of the Montour site, 24 of which were classified as having aggregate minority populations. Of these minority populations, two were identified in Lycoming County and one was located in Northumberland

County. No aggregate minority populations are located in Montour or Columbia Counties. A total of 13 census block groups in the 50-mi region meet at least one of the two significance criteria outlined in Section 2.6 for black populations. One census block group meets the criteria for Asian populations, and 21 meet the criteria for Hispanic ethnicity (USCB 2011-TN2009).[5] Figure 9-9 shows the aggregate minority block groups within the 50-mi region surrounding the Montour site.

Figure 9-10 shows the location of low-income populations within the 50-mi region surrounding the Montour site. The review team identified 56 census block groups with low-income populations of interest. The closest low-income populations of interest are located in Bloomsburg and Milton. Of the 56 census block groups with low-income populations, 4 are located in Columbia County, 11 in Lycoming County, and 5 in Northumberland County. No low-income populations of interest are located in Montour County. The most significant concentration of low-income census blocks (nine census blocks) near the Montour site is in Williamsport, Pennsylvania.

Almost all of the potential physical impacts of building and operation would occur within the vicinity of the Montour site. These physical impacts would not affect any of the populations of interest because they attenuate with distance, topography, and intervening foliage.

The review team also investigated for the presence of unique characteristics of practices in minority or low-income communities that could result in different socioeconomic impacts from building and operations at the Montour site. The review team identified a small number of Amish farms in the area, but did not find any information suggesting that communities with distinctive characteristics were dependent on natural resources that would be adversely affected by a nuclear power plant at the Montour site (PNNL 2009-TN3667). Finally, the review team did not identify any potential pathways by which any building or operations activity could affect any minority and low-income populations within the 50-mi region surrounding the Montour site. Consequently, the review team determined that, for the Montour site, there would be no disproportionate and adverse impacts on minority or low-income populations from building and operating one nuclear unit.

Cumulative Impacts

The cumulative impacts portion of Section 9.3.2.5 details the projects that would contribute to the environmental justice impacts at the Montour site. The review team found no evidence that, in conjunction with a nuclear power plant at the Montour site, the traffic contributions of the SSES, MSES, Panda Patriot Power Plant, Panda Hummel Station, Moxie Freedom Project, Atlantic Sunrise pipeline, Susquehanna River Bridge replacement projects, Cherokee Pharmaceutical Plant, and other renewable energy projects, fossil-fuel operational energy projects, and natural gas drilling operations throughout the region could impose

[5] The U.S. Census Bureau (USCB) data used in this section were obtained from American Community Survey (ACS) results released in 2011. During the preparation of this EIS, the results of the 2012 ACS were released in topical and regional data sets. The review team has examined the latest ACS data, and is not aware of any information that appears to be inconsistent with the earlier information sets and those sets projected from the earlier survey.

disproportionately high and adverse effects on minority or low-income populations. The review team concludes that, in addition to other past, present, and reasonably foreseeable future projects, building, and operating a nuclear unit at the Montour site would not impose disproportionately high and adverse impacts on any minority or low-income populations.

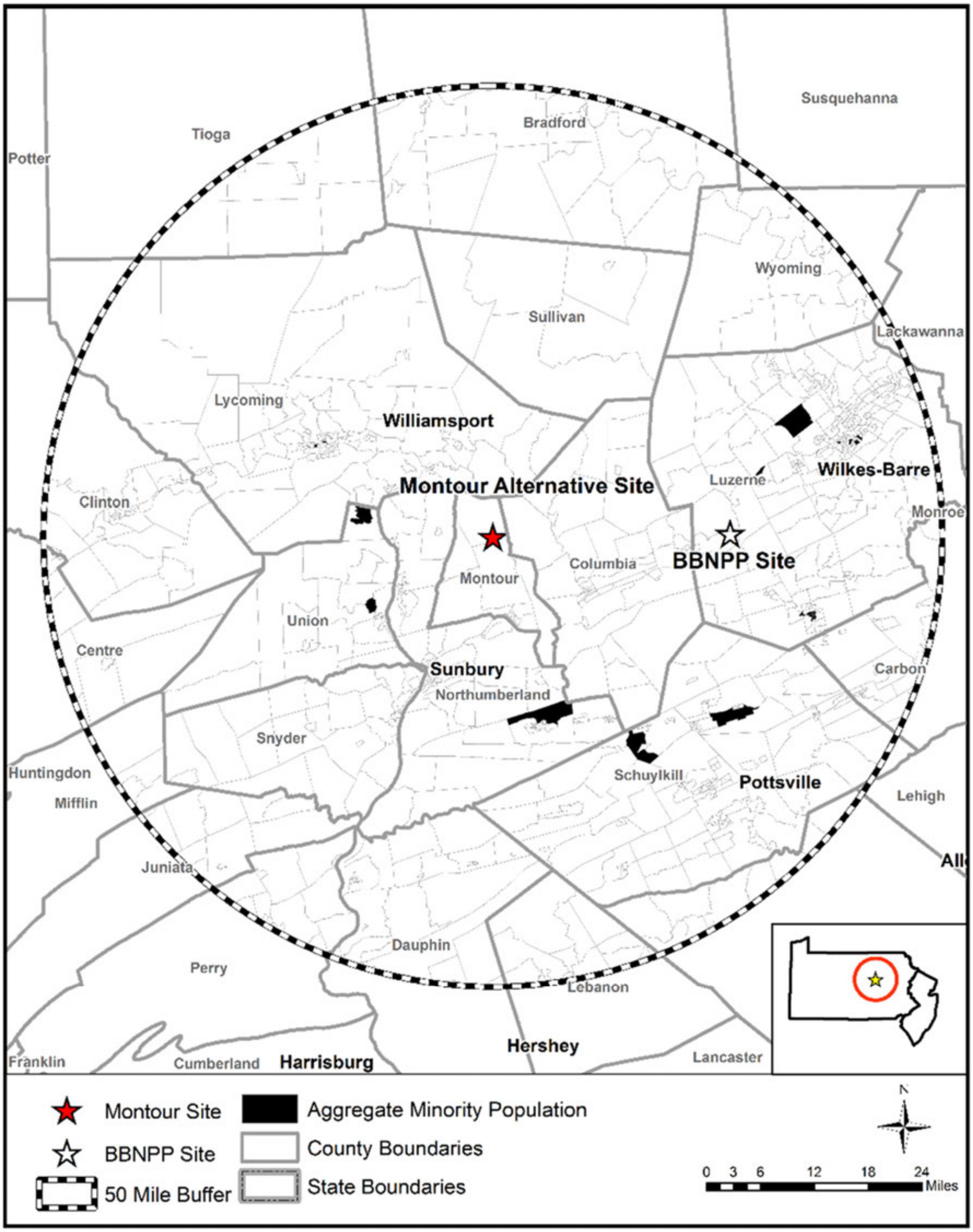

Figure 9-9. Aggregate Minority Block Groups within 50 mi of the Montour Site

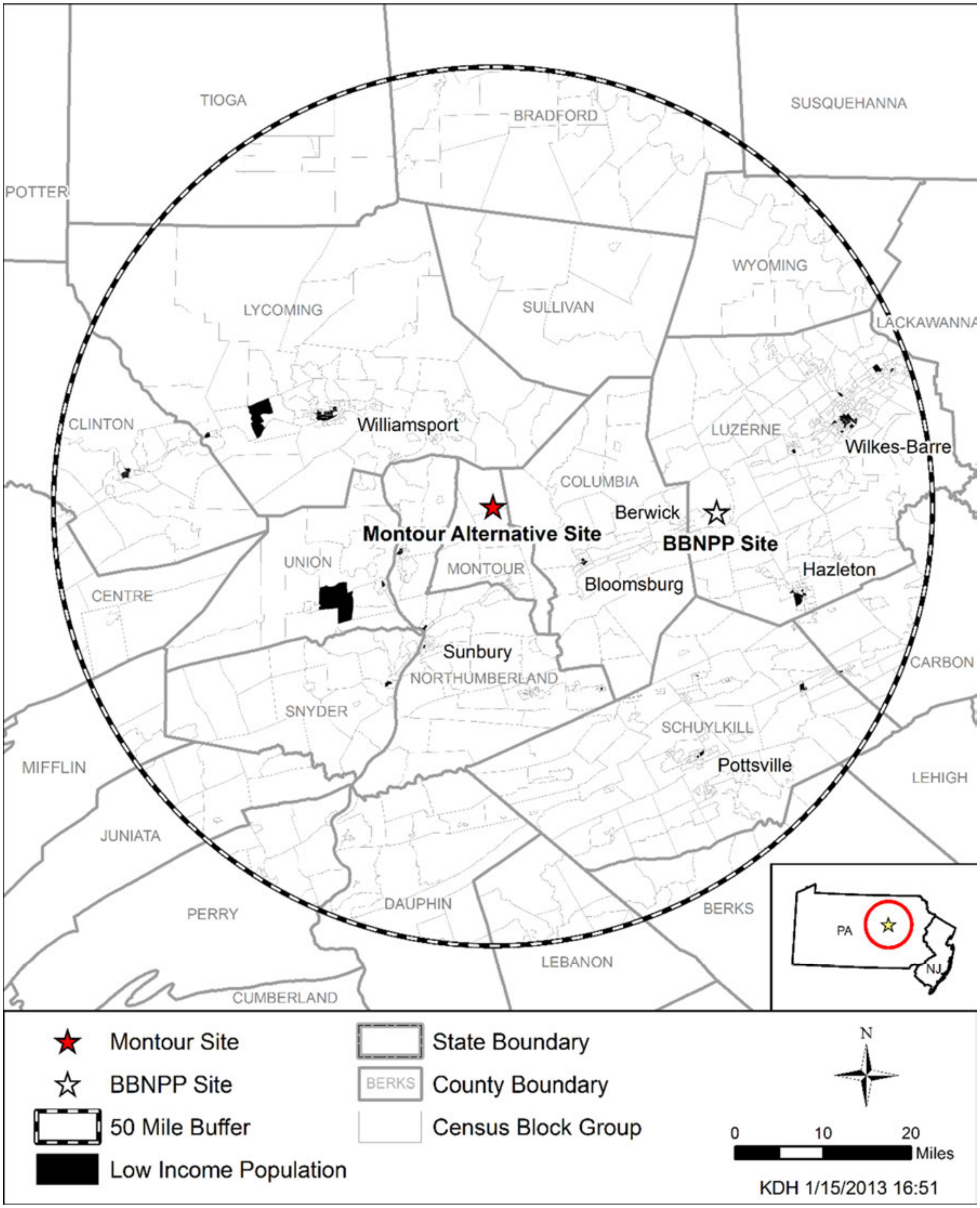

Figure 9-10. Low-Income Block Groups within 50 mi of the Montour Site

9.3.2.7 Historic and Cultural Resources

The following analysis addresses impacts on historic and cultural resources from building and operating one new nuclear generating unit at the Montour site. The analysis also considers other past, present, and reasonably foreseeable future actions that could cause cumulative impacts on historic and cultural resources, including other Federal and non-Federal projects listed in Table 9-6. For the analysis of cultural resources impacts at the Montour site, the geographic area of interest is considered to be the onsite and offsite direct physical and indirect visual areas of potential effect (APEs) associated with the proposed undertaking. This includes direct-physical APEs, defined as the onsite areas directly affected by site development and operation activities as well as offsite areas such as railroad corridors, transmission lines, and new reservoirs. Indirect-visual APEs are also included and defined generally as a 1-mi radius buffer around the proposed direct-physical APEs, which encompasses the approximate maximum distance from which tall structures could be seen.

Reconnaissance activities in a cultural resource review have particular meaning. Typically such activities include preliminary field investigations to confirm the presence or absence of historic properties or cultural resources. However, in developing this EIS, the review team relied upon reconnaissance-level information to perform the alternative site evaluation in accordance with ESRP 9.3 (NRC 2000-TN614). Reconnaissance-level information in this context is data readily available from agencies and other public sources. It can also include information obtained through site visits. To identify historic and cultural resources at the Montour site, the review team relied on the following information:

- the revised BBNPP ER (PPL Bell Bend 2013-TN3377)
- the Pennsylvania Historical and Museum Commission (PHMC) and PennDOT Cultural Resources Geographic Information System (CRGIS)
- the NRC alternative sites visits in April 2009 and June 2010.

Site Description

The Montour site is an industrial site located north of the existing Montour coal-fired power plant in Derry Township, approximately 2 mi (3.2 km) northeast of the borough of Washingtonville, Montour County, Pennsylvania. The Montour project area encompasses rolling farmland that borders Chillisquaque Creek and its tributaries, which drain into the North Branch of the Susquehanna River to the southeast. Obvious disturbances in the project area are limited to paved highways, farm roads, residential structures, and other structures associated with farm activities.

The history of northeastern Pennsylvania spans more than 10,000 years beginning with the earliest Paleondian hunter-gatherers and continuing into the historic period (PHMC 2014). Historic Native American tribes that resided in the region just prior to European colonization include the Susquehannocks, an Iroquoian group that dominated the Lower Susquehanna Valley. By the 1700s disease and warfare caused the Susquehannocks to vanish as a distinct tribe. Other Iroquois tribes also have historic ties to the region, including the Oneida and Mohawk, as well as the Delaware (an Algonkian group). Montour County is the smallest county in Pennsylvania. Established in 1850 from a subdivision of Columbia County, its economy historically focused on agriculture. Early historic settlers used the North Branch of the Susquehanna River as a major transportation route to move cargo into and out of the county. The county remains rural today.

The Montour project area is considered to have a high potential for prehistoric sites due to its proximity to Chillisquaque Creek and its tributaries. Proximity to water is a well-known indicator of prehistoric activity in Pennsylvania. Given the long history of historic settlement in the region, historic archaeological sites and historic structures may also be present. The Montour project area consists of agricultural fields and forest land crisscrossed by paved and unpaved roadways with several residential and agricultural structures. Past actions in the geographic area of interest that have similarly affected historic and cultural resources include rural development and agricultural development and activities associated with these land-disturbing activities such as road development. No current or planned projects were identified in Table 9-6 that may contribute to cumulative impacts on archaeological sites, historic structures, and other cultural resources in the geographic area of interest.

Two APEs for cultural resources were evaluated for the Montour site, including the direct-effects (physical) and indirect-effects (visual) APEs. The direct-effects APE includes the area within the project area that may be affected during preconstruction and/or construction activities. The indirect-effects APE includes the direct-effect APE and a 1-mi buffer around it. No historic properties (e.g., archaeological sites, historic buildings, and/or historic districts) listed in the National Register of Historic Places (NRHP) are recorded within either APE. Seven historic properties listed in the NRHP are located in Montour County. Of these, only one, the Keefer Covered Bridge No. 7, is located within 5 mi (8 km) of the Montour site. The bridge is located 1.7 mi (2.7 km) from the Montour site. It would not be directly affected by physical construction of the plant or by its subsequent operation and lies outside of the indirect-effects APE for cultural resources.

Building and Operation Impacts

While no NRHP-listed archaeological sites or historic structures are located within the direct-effects APE, the absence of such properties has not been confirmed through systematic surveys to identify cultural resources, either through archaeological surveys or historic structures inventories. The potential for archaeological sites within the direct-effects APE is considered high. Pennsylvania archaeological site survey records indicated that more than 40 prehistoric archaeological sites are located within 2 mi of the Montour site. Five archaeological sites (i.e., 36MO32, 36MO31, 36MO65, 36MO30, and 36MO28) are located within the direct-effects APE and may be affected by preconstruction and construction activities. None of these sites are listed on the NRHP; however, they have not been professionally investigated and insufficient data are available to determine their NRHP eligibility. Additional historic structures or districts are likely to be identified as well. One NRHP-eligible historic district, the Exchange Historic District, is located to the northwest within 1.7 mi of the Montour project area. If this historic district is subsequently listed in the NRHP, it may be adversely affected by construction at the Montour site.

To accommodate building a nuclear generating unit on the Montour site, up to 420 ac could be affected through preconstruction and construction activities. In the event that the Montour site were chosen for the proposed project, identification of cultural resources would be accomplished through cultural resource surveys and consultation with the State Historic Preservation Officer (SHPO), Tribes, and interested parties. The results would be used in the site planning process to avoid or mitigate cultural resources impacts. In the event significant cultural resources were identified by these surveys, the review team assumes that PPL would develop protective measures in a manner similar to those for the BBNPP site.

The main source of cooling water for the Montour site would be the West Branch of the Susquehanna River, which lies approximately 10 mi to the west of the project area. To obtain the water from the West Branch of the Susquehanna River, new water-intake and -discharge pipelines would need to be constructed. A conceptual plan for the proposed pipeline would include an 18.3-mi-long, 120-ft-wide right-of-way corridor. Archaeological sites and historic structures may be directly affected by placement of the water pipeline. Construction of the pipeline may have temporary visual impacts on historic structures and historic districts. Aboveground structures such as pumping stations may have permanent visual impacts on historic structures and historic districts. If the Montour site was chosen for the proposed project, the review team assumes that PPL would conduct its water-pipeline-related cultural resource surveys and procedures in a manner similar to that for the BBNPP site described in Section 2.7.

No existing transmission-line corridors connect directly to the Montour site; however, two 500-kV transmission lines and six existing 230-kV transmission lines could be connected to a plant at the site (PPL Bell Bend 2013-TN3377). A new transmission-line corridor would need to be created. Archaeological sites and historic structures may be directly affected by building the transmission lines and aboveground structures (e.g., power lines and support poles), and these new facilities may have permanent visual impacts on historic structures and historic districts. If the Montour site was chosen for the proposed project, the review team assumes that PPL would conduct transmission-line-related cultural resource surveys and establish appropriate procedures to avoid or mitigate impacts on historic properties.

Activities associated with building a nuclear power-generating unit and supporting facilities that can potentially destabilize important attributes of historic and cultural resources include land clearing, excavation, and grading activities. Given the high probability of archaeological sites within the direct-effects APE of the Montour site and the potential for visual impacts on the NRHP-listed Keefer Covered Bridge No. 7 and the NRHP-eligible Exchange Historic District, there may be impacts on cultural resources due to preconstruction and construction activities. Placement of water pipelines and electrical transmission lines may also affect archaeological sites and historic structures. In addition, visual impacts from aboveground structures associated with the water pipeline and transmission lines may result in significant alterations to the visual landscape within the geographic area of interest. The review team assumes that PPL would develop procedures and consult with the SHPO to develop a cultural resource management program to avoid or mitigate adverse impacts on significant archaeological sites, historic structures, and other historic properties during preconstruction and construction activities.

Impacts on historic and cultural resources from operation of a new nuclear generating unit at the Montour site include those associated with the operation of a new unit and maintenance of water pipelines and electrical transmission lines. The review team assumes that the same procedures used by PPL would be used for onsite and offsite maintenance activities.

Consequently, the incremental effects of the maintenance of transmission-line corridors and operation of one new unit and associated impacts on the cultural resources for the direct-effects and indirect-effects APEs could be significant.

Cumulative

The geographic area of interest for cumulative impacts on historic and cultural resources at the Montour site corresponds to the onsite and offsite direct (physical) and indirect (visual) APEs defined for the site. As indicated in Table 9-6, past actions in the geographic area of interest that have similarly affected historic and cultural resources include rural, agricultural, and industrial development and activities associated with these land-disturbing activities (e.g., road development). Past, present, and reasonably foreseeable projects and other actions that may contribute to cumulative impacts on historic and cultural resources in the geographic area of interest are listed in Table 9-6. No other activities listed in Table 9-6 in the geographic area of interest were identified that would significantly affect historic and cultural resources in a manner similar to those associated with the operation of a new nuclear power plant.

Summary

Cultural resources are non-renewable; therefore, the impact of destruction of cultural resources is cumulative. Based on the information provided by the applicant and the review team's independent evaluation, the review team concludes that the cumulative impacts on cultural resources on the Montour site would be MODERATE to LARGE and the impacts from building and operating one new nuclear unit would be a significant contributor to those impacts. This impact level determination reflects the high probability of archaeological sites within the direct-effects APE of the Montour site, and indirect effects from visual impacts that could occur to the NRHP-listed Keefer Covered Bridge No. 7 and Exchange Historic District, both of which are within 1.7 mi of the Montour site. If the Montour site were to be developed, then cultural resource surveys and evaluations would need to be conducted to assess and resolve adverse effects of the undertaking.

9.3.2.8 Air Quality

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that affect air quality, including other Federal and non-Federal projects listed in Table 9-6. The geographic area of interest for the Montour site is Montour County, which is in the Central Pennsylvania Intrastate Air Quality Control Region (AQCR) (40 CFR 81.104 [TN255]).

Emissions related to building and operating a nuclear power plant at the Montour alternative site would be similar to those at the BBNPP site, as described in Chapters 4 and 5. The air-quality attainment status for Montour County, as set forth in 40 CFR Part 81, reflects the effects of past and present emissions from all pollutant sources in the region. Montour County is designated as unclassifiable or in attainment for all criteria pollutants for which NAAQSs have been established (40 CFR 81.339 [TN255]).

Atmospheric emissions related to building and operating a nuclear power plant at the BBNPP site in Luzerne County are described in Chapters 4 and 5. Emissions of criteria pollutants were found to have a SMALL impact on air quality. In Chapter 7, the cumulative impacts of the criteria pollutants at the BBNPP site were evaluated and also determined to be SMALL.

Reflecting on the projects listed in Table 9-6, several energy-related and industrial projects are considered major sources of NAAQS criteria pollutants in Montour County or nearby counties within the AQCR. Any new projects would either have minimal emissions or be subject to permitting by the PADEP. Given that these projects would be subject to permitting requirements to ensure compliance with the NAAQSs, it is unlikely that the air quality in the region would degrade to the extent that the region is in nonattainment of NAAQSs.

The air-quality impact of Montour site development would be local and temporary. The distance from building activities to the site boundary would be sufficient to generally avoid significant air-quality impacts. There are no land uses or projects, including projects listed in Table 9-6, that would have emissions during site development that would, in combination with emissions from the Montour site, result in degradation of air quality in the region.

Emissions from operations at the Montour site would be intermittent. The air-quality impacts of existing major and minor sources are included in the baseline air-quality status. The cumulative impacts from emissions of effluents from the Montour site and projects listed in Table 9-6 would be minor.

The cumulative impacts of GHG emissions related to nuclear power are discussed in Section 7.6. The impacts of the emissions are not sensitive to the location of the source. Consequently, the discussion in Section 7.6 is applicable to a nuclear power plant located at the Montour site. The review team concludes that the national and worldwide cumulative impacts of GHG emissions are noticeable but not destabilizing. The review team further concludes that the cumulative impacts would be noticeable but not destabilizing with or without the GHG emissions of a nuclear power plant at the Montour site.

Cumulative impacts on air-quality resources are estimated based in the information provided by PPL and the review team's independent evaluation. Other past, present, and reasonably foreseeable future activities exist in the geographic areas of interest (local for criteria pollutants and global for GHG emissions) that could affect air-quality resources. The cumulative impacts on criteria pollutants from emissions of effluents from the Montour site, other projects, and existing sources would be minor.

The review team concludes that cumulative impacts from other past, present, and reasonably foreseeable future actions on air-quality resources in the geographic areas of interest would be SMALL for criteria pollutants and MODERATE for GHG emissions. Building and operating a new unit at the Montour site would not be a significant contributor to these air-quality impacts.

9.3.2.9 Nonradiological Health Impacts

The following analysis considers nonradiological health impacts from building and operating a new nuclear unit at the Montour site. Nonradiological health impacts at the Montour site are estimated based on information provided by PPL and the review team's independent evaluation. The analysis also includes past, present, and reasonably foreseeable future actions that could contribute to cumulative nonradiological health impacts on site workers (construction and operations workers) and members of the public, including other Federal and non-Federal projects and the projects listed in Table 9-6 within the geographic area of interest. For the analysis of nonradiological health impacts at the Montour site, the geographic area of interest is the site and the immediate vicinity of the Montour site (~6-mi radius) and the associated transmission-line corridors (~15 mi long). This geographic area of interest is based on the localized nature of nonradiological health impacts and is expected to encompass all nonradiological health impacts.

Building activities with the potential to affect the health of members of the public and construction workers at the Montour site include exposure to dust, vehicle exhaust, and emissions from construction equipment, noise, occupational injuries, and the transport of construction material and personnel to and from the site. The operations-related activities that may affect the health of members of the public and workers include exposure to etiological (disease-causing) agents, noise, electromagnetic fields (EMFs), occupational injuries, and impacts from the transport of workers to and from the site.

Building Impacts

Nonradiological health impacts on construction workers and members of the public from building a new nuclear unit at the Montour site would be similar to those evaluated in Section 4.8 for the BBNPP site. During the site-preparation and building phase, PPL would comply with applicable Federal and State regulations on air quality and noise (PPL Bell Bend 2013-TN3377). The frequency of construction worker accidents is expected to be the same as those estimated for the BBNPP site. The Montour site is located in a rural area, and building impacts would likely be negligible on the surrounding populations, which are classified as medium- and low-population areas. The review team concludes that nonradiological health impacts on construction workers and the public from building a new nuclear unit and associated transmission lines at the Montour site would be minimal.

Operational Impacts

Nonradiological health impacts on occupational health of workers and members of the public would include those associated with the operation of cooling towers and transmission lines as described in Section 5.8. Based on the configuration of the proposed new unit at the Montour site (see Chapter 3 for detailed site layout description), etiological agents would not likely increase the incidence of waterborne diseases in the receiving waters because of the temperature attenuation in the discharge pipe (12.3 mi long) and diffuser and the temperature limitations outlined in the plant's NPDES permit for thermal discharge into the Susquehanna River (PPL Bell Bend 2013-TN3377). Impacts on workers' health from occupational injuries, noise, and EMFs would be similar to those described in Section 5.8 for the BBNPP site. Noise and EMF exposure would be monitored and controlled in accordance with applicable Occupational Safety and Health Administration regulations. Effects of EMFs on human health would be controlled and minimized by conformance with National Electrical Safety Code criteria. Nonradiological impacts of traffic during operations would be less than the impacts during building. The review team concludes that nonradiological health impacts on workers and the public from operating a new nuclear unit and associated transmission lines at the Montour site would be minimal.

Cumulative Impacts

The only past action in the geographic area of interest that has similarly affected nonradiological health of workers and members of the public is the development and operation of the PPL Montour Electric Steam Station coal power plant, located adjacent to the Montour site. No major current projects in the geographic area of interest would have a cumulative impact on nonradiological health in a way that is similar to building and operating a nuclear power plant at the Montour site.

There are no proposed future actions that would affect nonradiological health in a way similar to development at the Montour site. However, future urbanization and transmission-line creation and/or upgrading throughout the region would be expected to occur.

The review team is also aware of the potential climate changes that could affect human health. A recent compilation of the state of the knowledge in this area (GCRP 2014-TN3472) has been considered in the preparation of this EIS. Projected changes in the climate for the region include an increase in average temperature, increased likelihood of drought in summer, more heavy downpours, and an increase in precipitation, especially in the winter and spring, which may alter the presence of microorganisms and parasites. In view of the water source characteristics, the review team did not identify anything that would alter its conclusion regarding the presence of etiological agents or change in the incidence of waterborne diseases.

The review team concludes that the cumulative impacts on nonradiological health from building and operating a new nuclear power plant and associated transmission lines at the Montour site would be minimal.

Summary of Nonradiological Health Impacts at the Montour Site

Impacts on nonradiological health from building and operation of a new unit at the Montour site are estimated based on the information provided by PPL and the review team's independent evaluation. Although some past and future activities in the geographical area of interest could affect nonradiological health in ways similar to the building and operation of a new unit at the Montour site and associated offsite facilities, those impacts would be localized and managed through adherence to existing regulatory requirements. The review team concludes that nonradiological health impacts on construction workers and the public resulting from the building of a new nuclear unit and associated transmission lines at the Montour site would be minimal. The review team expects that the occupational health impacts on the operations employees and the public of a new nuclear unit at the Montour site would be minimal. Finally, the review team concludes that cumulative impacts on nonradiological health from past, present, and future actions in the geographic area of interest would be SMALL.

9.3.2.10 Radiological Impacts of Normal Operations

The following impact analysis includes radiological impacts from building activities and operation of a nuclear unit at the Montour site. The analysis also considers other past, present, and reasonably foreseeable future actions that affect radiological health, including other Federal and non-Federal projects listed in Table 9-6. As described in Section 9.3.2, the Montour site is a greenfield site located north of the existing Montour coal-fired power plant. The geographic area of interest is the area within a 50-mi radius of the Montour site. The only facilities potentially affecting radiological health within this geographic area of interest are the existing SSES Units 1 and 2. In addition, there are likely to be hospitals and industrial facilities that use radioactive materials within 50 mi of the Montour site.

The radiological impacts of building and operating the proposed U.S. EPR reactor at the Montour site include doses from direct radiation and liquid and gaseous radioactive effluents. Releases of radioactive materials and all pathways of exposure would produce low doses to people and biota offsite that would be well below regulatory limits. The impacts are expected to be similar to those estimated for the BBNPP site.

The radiological impacts of SSES Units 1 and 2 include doses from direct radiation and liquid and gaseous radioactive effluents. These pathways result in low doses to people and biota offsite that are well below regulatory limits, as demonstrated by the ongoing radiological environmental monitoring program conducted in the SSES Units 1 and 2 vicinity. The NRC staff concludes that the dose from direct radiation and effluents from hospitals and industrial facilities that use radioactive material would be an insignificant contribution to the cumulative impact around the Montour site. This conclusion is based on the radiological monitoring program conducted for the currently operating nuclear power plant.

Based on the information provided by PPL and the NRC staff's independent analysis, the NRC staff concludes that the cumulative radiological impacts from building and operating the one proposed U.S. EPR unit and other past, present, and reasonably foreseeable projects and actions in the geographic area of interest around the Montour site would be SMALL.

9.3.2.11 Postulated Accidents

The following impact analysis includes radiological impacts from postulated accidents from operations for one nuclear unit at the Montour site. The analysis also considers other past, present, and reasonably foreseeable future actions that affect radiological health from postulated accidents, including other Federal and non-Federal projects and the projects listed in Table 9-6 within the geographic area of interest. As described in Section 9.3.2, the Montour site is a greenfield site; there are no nuclear facilities at the site. The geographic area of interest considers all existing and proposed nuclear power plants that have the potential to increase the probability-weighted consequences (i.e., risks) from a severe accident at any location within 50 mi of the Montour site. Facilities potentially affecting radiological accident risk within this geographic area of interest are SSES Units 1 and 2, Limerick Generating Station Units 1 and 2, Three Mile Island Nuclear Station Unit 1, and Peach Bottom Atomic Power Station Units 2 and 3. Other than the proposed BBNPP unit, no other reactors have been proposed within the geographic area of interest.

As described in Section 5.11.1, the NRC staff has concluded that the environmental consequences of design basis accidents (DBAs) at the BBNPP site would be SMALL for a U.S. EPR reactor. DBAs are addressed specifically to demonstrate that a reactor design is robust enough to meet NRC safety criteria. The U.S. EPR design is independent of site conditions and the meteorology of the Montour site and BBNPP site are similar; therefore, the NRC staff concludes that the environmental consequences of DBAs at the Montour site would be SMALL.

Because the meteorology, population distribution, and land use for the Montour site are expected to be similar to the BBNPP site, risks from a severe accident for a U.S. EPR reactor located at the Montour site are expected to be similar to those analyzed for the BBNPP site. The risks for the BBNPP site are presented in Table 5-20 and Table 5-21, and are well below the median value for current-generation reactors. In addition, as discussed in Section 5.11.2, estimates of average individual early fatality and latent cancer fatality risks are well below the Commission's safety goals (51 FR 30028-TN594). For existing nuclear power plants within the geographic area of interest (i.e., SSES Units 1 and 2, Limerick Generating Station Units 1 and 2, Three Mile Island Nuclear Station Unit 1, and Peach Bottom Atomic Power Station Units 2 and 3); the Commission has determined that the probability-weighted consequences of severe accidents are SMALL (10 CFR Part 51, Appendix B, Table B-1 [TN250]).

Because of the NRC safety review criteria, it is expected that risks for any new reactors at any other locations within the geographic area of interest for the Montour site would be below the risks for current-generation reactors and would meet Commission safety goals. The severe accident risk due to any particular nuclear power plant becomes smaller as the distance from that plant increases. However, the combined risk at any location within 50 mi of Montour site would be bounded by the sum of risks for all these operating nuclear power plants and would still be low.

Although several plants have the potential to be included in the combination, the combined risk would still be low. On this basis, the NRC staff concludes that the cumulative risks of severe accidents at any location within 50 mi of the Montour site would be SMALL.

9.3.3 Humboldt

This section covers the review team's evaluation of the potential environmental impacts of siting a new nuclear unit at the Humboldt site located in Luzerne County, Pennsylvania. The following sections describe a cumulative impact assessment conducted for each major resource area. The specific resources and components that could be affected by the incremental effects of the proposed action if it were implemented at the Humboldt site, and other actions in the same geographic area were considered. This assessment includes the impacts of NRC-authorized construction, operations, and preconstruction activities. Also included in the assessment are other past, present, and reasonably foreseeable Federal, non-Federal, and private actions that could have meaningful cumulative impacts when considered together with a new nuclear plant if such a plant were to be built and operated at the Humboldt site. Other actions and projects considered in this cumulative analysis are described in Table 9-10.

Table 9-10. Past, Present, and Reasonably Foreseeable Projects and Other Actions Considered in the Humboldt Site Cumulative Analysis

Project Name	Summary of Project	Location	Status
Energy Projects			
SSES Units 1 and 2	Two 1,140-MW(e) boiling water reactors, Unit 1 was issued an operating license in 1982, Unit 2 was issued an operating license in 1984. Extension of operations of SSES Units 1 and 2 for an additional 20-year period beyond the end of the current license term, or until 2042 and 2044, respectively. Power uprates - currently operating at 3952 MW(t), 1,300 MW(e)	12 mi NW of the Humboldt site	Operational (NRC 2014-TN3964). Renewed operating licenses issued November 2009 (NRC 2014-TN3964). Units 1 and 2 approved for combined 48 MW(t) (1.4%) power uprate in 2001 and combined 463 MW(t) (13%) power uprate in 2008 (NRC 2012-TN1538; NRC 2012-TN1900).
Limerick Nuclear Power Plant demonstration project	Project will allow Exelon to put additional water into the Schuylkill River from a reservoir and an abandoned coal mine	17 mi SW of the Humboldt site	The Delaware River Basin Commission approved docket May 8, 2013 (DRBC 2013-TN3345).
Limerick Generating Station, Units 1 and 2	Two 3,514-MW(t), 1,134-MW(e) boiling water reactors, Unit 1 was issued operation license in 1985, Unit 2 was issued operation license in 1989	54 mi SE of the Humboldt site	Operational (NRC 2014-TN3964). Currently undergoing license renewal (NRC 2012-TN1181; NRC 2012-TN1180). Units 1 and 2 approved for combined 260-MW(t) (17%) power uprate in 2011 (NRC 2012-TN1538). Water withdrawals from the Schuylkill River and Wadesville Mine pool were approved in May 2013 (DRBC 2013-TN3345).
Three Mile Island Nuclear Station, Unit 2	Unit 2 is in a non-operating status since the March 1979 accident	64 mi SW of the Humboldt site	Shut down (NRC 2014-TN3964). Defueling was completed in April 1990. Plant is in a stable condition suitable for long-term management (post-defueling monitored storage) (NRC 2014-TN3285).

Table 9-10. (contd)

Project Name	Summary of Project	Location	Status
Three Mile Island Nuclear Station, Unit 1	One 2,568-MW(t), 786-MW(e) pressurized water reactor, Unit 1 was issued operation license in 1974	65 mi SW of the Humboldt site	Operational (NRC 2014-TN3964); renewed operating license issued in October 2009 (NRC 2014-TN3964).
Peach Bottom Atomic Power Station, Units 2 and 3	Two 3,514-MW(t), 1,112-MW(e) boiling water reactors; Unit 2 was issued operation license in 1973, Unit 3 was issued operation license in 1974	82 mi S of the Humboldt site	Operational (NRC 2014-TN3964); renewed operating licenses issued in 2003 (NRC 2014-TN3964).
Peach Bottom Atomic Power Station, Unit 1	A 200-MW(t), high-temperature, gas-cooled reactor operated from June 1967 to final shutdown on October 31, 1974	82 mi S of the Humboldt site	Shut down (NRC 2014-TN3964). All spent fuel has been removed and the spent fuel pool is drained and decontaminated; Unit 1 is in SAFSTOR status (NRC 2014-TN3346).
Harwood Plant	27–MW oil-fired generation facility	3 mi NE of the Humboldt site	Operational (PPUC 2015-TN4419).
Moxie Freedom Project	1,050-MW gas-fired facility with two power blocks, each consisting of a combustion gas turbine (CGT and a steam turbine configured in single shaft alignment, sharing a single common electric generator	14 mi NW of the Humboldt site	Proposed, air permit obtained (PADEP 2015-TN4392; PennWell 2015-TN4353).
Fishbach Plant	28–MW oil-fired generation facility	19 mi SW of the Humboldt site	Operational (PPUC 2015-TN4419).
Jenkins Plant	27.6–MW oil-fired generation facility	27 mi NE of the Humboldt site	Operational (PPUC 2015-TN4419).
Intelliwatt Renewable Energy	13-MW biomass (wood) energy	25 mi SW of the Humboldt site	Proposed, secured 4.9 million state loan for construction in 2010 (IntelliWatt 2014-TN4037).
Good Spring	Originally planned to be an IGCC in March 2014 EmberClear announced a partnership with Tyr Energy for the development of two 337-MW NGCC plants	30 mi SW of the Humboldt site	Proposed, under development (Tyr Energy 2015-TN4361).
Montour Power Plant	1,504-MW coal power plant	34 mi NW of the Humboldt site	Operational (Talen 2015-TN4412).

Table 9-10. (contd)

Project Name	Summary of Project	Location	Status
Shamokin Dam Project	4.5-MW hydroelectric power, added to the already existing USACE Shamokin Dam	40 mi W of the Humboldt site	Application for preliminary permit submitted August 2011 to FERC (76 FR 52656-TN1218).
Green Knight Energy Center	9.9-MW biomass landfill gas facility	41 mi W of the Humboldt site	Operational (GKEDC 2005-TN4362).
Tenaska Lebanon Valley Generating Station	Up to 950-MW natural-gas facility	42 mi SW of Humboldt site	Proposed. Construction scheduled in 2015; expected online in 2018 (Tenaska 2014-TN3533).
Taylor Energy Partners LP Waste Plant	1.7-MW biomass landfill gas facility	42 mi SW of the Humboldt site	Operational (EPA 2015-TN4357).
Panda Hummel	Converting retired Sunbury coal plant to 3 NGCC generating burners capable of producing 1,064-MW power	42 mi W of the Humboldt site	Application process begun (PADEP 2015-TN4350); NPDES permit obtained (PADEP 2015-TN4351).
Ironwood Power Plant	660-MW natural gas facility	43 mi SW of the Humboldt site	Operational (Talen 2015-TN4363).
Bucknell University Gas Combined Heat and Power Plant	5-MW dual-fuel turbine generator set (natural gas first, oil second); generates thermal energy in heat-recovery steam generators and electricity	44 mi W of the Humboldt site	Operational (Bucknell University 2014-TN3737).
White Deer Energy Project	7-MW tire-derived energy	44 mi W of the Humboldt site	Application submitted Oct. 2011 to the PADEP (White Deer Energy 2012-TN1188; White Deer Energy 2013-TN4035). Project terminated January 2014 (PADEP 2014-TN4366).
Lackawanna Energy Center	1,480-MW NGCC generating facility	46 mi NE of the Humboldt site	Proposed (Lackawanna Energy 2015-TN4352).
Lower Mt. Bethel Power Plant	538-MW natural gas facility	50 mi E of the Humboldt site	Operational (Talen 2015-TN4364).
Brunner Island Power Plant	1,411-MW three-unit, coal-fired plant (Talen Energy-owned)	67 mi SW of the Humboldt site	Operational (EPA 2014-TN3531; Talen 2015-TN4413).
Blossburg Generating Station	Gas plant	74 mi NW of the Humboldt site	Operational (EPA 2014-TN3744).
Susquehanna-Roseland 500-kV transmission line and other transmission lines in the region	500-kV power transmission lines	Throughout the region	Operational, May 2015 (PPL 2015-TN4263).

Table 9-10. (contd)

Project Name	Summary of Project	Location	Status
Project Compass	345-kV power transmission line	First segment from Blakely, PA (44 mi NE of the Humboldt site) to Ramapo, NY	Proposed (PRNewswire 2015-TN4421).
Marcellus gas pipelines	Numerous natural-gas transmission pipelines including Diamond East Pipeline, PennEast Pipeline, Constitution Pipeline	Throughout the region	Proposed (Clean Air Council 2015-TN4367).
Leidy to Long Island Expansion Project	Natural gas transmission pipeline	3.4 mi of pipeline in Lycoming County (Hughesville Loop) and 5.3 mi in Luzerne County (Dorrance Loop); 11.5 mi in Luzerne and Monroe Counties (Franklin Loop)	Construction began in July 2015 (FERC 2015-TN4348).
Sunbury Pipeline	Natural gas transmission pipeline	35-mi long, will originate in Lycoming County and end at Shamokin Dam	Proposed; filed application with FERC in July 2015 (FERC 2015-TN4349).
Atlantic Sunrise Project	Natural-gas transmission pipeline	Throughout the region in Columbia and Luzerne Counties	Includes Central Penn pipeline; FERC process has begun and construction is anticipated for summer 2016 (Williams 2014-TN3614).
Eureka Resources Wastewater Treatment Facilities	Fracking wastewater treatment	Two sites: 47 mi NW of Humboldt (new construction) and 57 mi NW of the Humboldt site (operational since 2008)	Construction began in March of 2013 (Eureka Resources 2013-TN2615). Became operational in October 2013 (Williams 2013-TN3613; Eureka 2014-TN3673). Industrial waste Permit (PA Bulletin 2014-TN3501; Lowenstein 2013-TN3510).
Koppers Susquehanna Waste Plant	The facility's product lines include pressure-creosoted railroad ties, bridge timbers, switch ties, and crossing panels	45 mi NW of the Humboldt site	Operational (EPA 2014-TN3745).
Viking Energy of Northumberland Waste Plant	18-MW biomass power-generation facility	40 mi W of the Humboldt site	Operational (EPA 2014-TN3738; Biomass Magazine 2014-TN3923).
Other fossil-fuel operational energy projects	Numerous operating fossil-fuel power-generating stations such	Throughout the region	Operational (EPA 2012-TN1193; EPA 2012-TN1192; EPA 2012-

Table 9-10. (contd)

Project Name	Summary of Project	Location	Status
	as: Wheelabrator Frackville Energy Coal Plant, Foster Wheeler Mt. Carmel Cogen Coal Plant, Northeastern Power Co/McAdoo Cogen, Williams Hazleton, Paxton Creek, Shawville, Northeast Natural Gas Portfolio (Hazleton), Saint Nicholas Cogeneration Project, Gilberton Power Co., Kline Township Cogen Facility, Panther Creek Energy Facility, Archibald Power Station		TN1593; Red Rock 2012-TN1602; Clearfield 2015-TN4393; Starwood 2015-TN4394; EPA 2014-TN3506; EPA 2014-TN3507; EPA 2014-TN3735; EPA 2014-TN3736; EPA 2014-TN3928; EPA 2014-TN3929; EPA 2015-TN4360).
Wind-energy projects	Various wind-power-generating projects such as Locust Ridge Wind Farm, Bear Creek Wind Farm, Humboldt Wind	Throughout the region	Operational (Community Energy 2015-TN1195; Iberdrola Renewables 2012-TN1194).
Solar energy projects	Various solar power-generating projects (e.g., Romark PA Solar, Masser Farms Realty Solar, PA Solar Park, Pocono Raceway Solar Project)	Throughout the region	Operational (EPA 2014-TN3339; Masser 2014-TN3340; CED 2015-TN4355; EDF 2012-TN4356).
Hydropower energy projects	Various hydro projects such as Conowingo, York Haven, Holtwood, Safe Harbor, Muddy Run, Goodyear Lake. Proposed: Francis Walter Hydroelectric Project	Throughout the region	Operational (Enel 2012-TN1603; Olympus 2012-TN1600; Exelon 2012-TN1596; Exelon 2012-TN1595; Safe Harbor 2012-TN1604; Talen 2015-TN4414). Proposed (76 FR 73619-TN3621; FERC 2013-TN3622).
Other renewable energy projects	Proposed: Miscellaneous biomass projects	Throughout the region	Proposed biomass (Booth 2012-TN3508).
Mining Projects			
Spike Island operation	Coal refuse removal	16 mi NW of the Humboldt site	Application pending, water permit pending with SRBC (SRBC 2012-TN1196).
Various surface and subsurface mining projects	Numerous operating anthracite and stone/quarry mining facilities such as Bear Gap Stone/Quarry, UAE Coal	Throughout the 50-mi region	Operational (EPA 2012-TN1289; EPA 2012-TN1290; EPA 2012-TN1197; EPA 2012-TN1198).

Table 9-10. (contd)

Project Name	Summary of Project	Location	Status
	Corp/Harmony Mine, Talen Energy Brunner Island		
Mt. Pisgah uranium deposit	Uranium mines	16 mi E of the Humboldt site	Test mines conducted in the 1950s, never developed commercially (Klemic and Baker 1954-TN1998).
Various Marcellus natural-gas projects	Various natural-gas extraction sites	24+ mi NW of the Humboldt site	Operational and Proposed (SRBC 2015-TN4358; SRBC 2013-TN1999; PDCNR 2012-TN3505).
Various acid mine drainage and abandoned mine remediation	Mine remediation	Throughout the region	Ongoing (PADEP 2014-TN3503; PADEP 2005-TN690; PADEP 2014-TN3504).
Transportation Projects			
Susquehanna River transportation projects	Bridge replacements, road, traffic, and pedestrian projects	Throughout the region	Ongoing (PennDOT 2014-TN4359).
Parks and Aquaculture Facilities			
Locust Lake State Park	Activities include picnicking, boating, swimming, camping, fishing, and hiking	11 mi SW of the Humboldt site	Development unlikely in this park (PDCNR 2012-TN1203).
Nescopeck State Park	Activities include hunting, fishing, and hiking	12 mi NE of the Humboldt site	Development unlikely in this park (PDCNR 2012-TN1200).
Other state parks	Various operating state parks in the Susquehanna River Basin such as Lehigh Gorge State Park, Hickory Run State Park, Ricketts Glen State Park, Loyalsock Township Riverfront Park	Throughout the region	Development unlikely (PDCNR 2012-TN1199; PDCNR 2012-TN1202; PDCNR 2012-TN1201; Van Auken 2012-TN3986).
Other State Game Lands	Public recreational activities in the Susquehanna River Basin	Throughout the region	Development unlikely in these areas (PGC 2012-TN1223).
Other Actions/Projects			
Assorted flood control projects	Construction of levees, floodwalls, closure of structures, and interior drainage structures	Throughout the region	Ongoing (PADEP 2014-TN3502).

Table 9-10. (contd)

Project Name	Summary of Project	Location	Status
Sandy-Longs Run	Abandoned mine-drainage watershed and aquatic restoration	Throughout the region	Ongoing (USACE 2012-TN1222).
Various wastewater-treatment plant facilities	Sewage treatment	Throughout the region	Operational
Various hospitals and industrial facilities that use radioactive materials	Medical and other industrial isotopes	Throughout the region	Operational
Safety Light Corporation	Manufacturing, former user of radioactive materials	17 mi NW of the Humboldt site	Superfund site, cleanup of radioactive waste in process (NRC 2012-TN1211).
Procter and Gamble Mehoopany Mill	Paper products and natural-gas power generation for facility use	44 mi N of the Humboldt site	Operational (EPA 2012-TN1212).
US Gypsum/Ancillary Improvements	660,000-ft^2 wallboard manufacturing facility. Use synthetic gypsum generated as flue gas desulfurization byproduct at the adjacent Montour plant	34 mi NE of the Humboldt site	Operational (Walbridge 2012-TN1213; EPA 2014-TN3499).
Cherokee Pharmaceutical Plant	Merck-owned steam-generation (natural gas) facility for pharmaceutical production	31 mi W of the Humboldt site	Operational (EPA 2012-TN1214).
Great Dane Trailers	Trailer manufacturing	30 mi W of the Humboldt site	Operational (Great Dane 2014-TN3514).
Benton Foundry	Iron foundries	27 mi NW of the Humboldt site	Operational (EPA 2012-TN1215).
Foam Fabricators Inc./Bloomsburg Plant	Polystyrene foam product manufacturing	15 mi NW of the Humboldt site	Operational (EPA 2012-TN1216).
KYDEX	Unlaminated plastics film and sheet	16 mi NW of the Humboldt site	Operational (EPA 2012-TN1217).
Jersey Shore Steel Company	Blast furnace/steel works/rolling	68 mi NW of the Humboldt site	Operational (EPA 2012-TN1291).
Corixa Corporation	Pharmaceutical preparations	66 mi SW of the Humboldt site	Operational (EPA 2012-TN1590).
Weatherly Casting & Weatherly Plant	Iron foundries	13 mi E of the Humboldt site	Operational (EPA 2012-TN1300).
Seedco Industrial Park	Various industry and energy projects	26 mi SW of the Humboldt site	Operational and proposed (Jones Lang Laselle 2012-TN1292).
Hershey Foods Corporation	Chocolate and cocoa products	55 mi SW of the Humboldt site	Operational (EPA 2012-TN1293).

Table 9-10. (contd)

Project Name	Summary of Project	Location	Status
Adam T. Bower Memorial Dam	Inflatable dam used in summer to make reservoir	40 mi W of the Humboldt site	Seasonal (Sunbury 2014-TN3516).
Various other large-scale industrial facilities	Industrial/manufacturing facilities	Throughout the region	Operational (EPA 2012-TN1592; EPA 2012-TN1591; EPA 2012-TN1590; EPA 2012-TN1589; EPA 2012-TN1588; EPA 2012-TN1293; EPA 2012-TN1291).
Misc. golf courses	Golf courses	Throughout the region	Operational
Other manufacturing	Other manufacturing plants	Throughout the region	Operational (EPA 2014-TN3739; EPA 2014-TN3740).
Future urbanization	Construction of housing units and associated commercial buildings; roads, bridges, and rail; construction of water- and/or wastewater-treatment and distribution facilities and associated pipelines, as described in local land-use planning documents	Throughout the region	Construction would occur in the future, as described in state and local land-use planning documents.

The Humboldt site is a brownfield site located west of the City of Hazleton in Luzerne County, Pennsylvania. SR 924 abuts a portion of the southern perimeter of the site. Figure 9-11 provides a location map showing a 6-mi (9.7-km) radius surrounding the Humboldt site (PPL Bell Bend 2013-TN3377).

The potential transmission- and water-corridor routes for the Humboldt site are shown in Figure 9-12. If built at the Humboldt site, the NRC staff assumed a new nuclear power plant would be subjected to the same SRBC consumptive water-use mitigation and site-specific low-flow protection requirements described in Section 2.2.2. The location of the Humboldt site in relationship to the sources of water for consumptive-use mitigation and site-specific low-flow protection is shown on Figure 9-13.

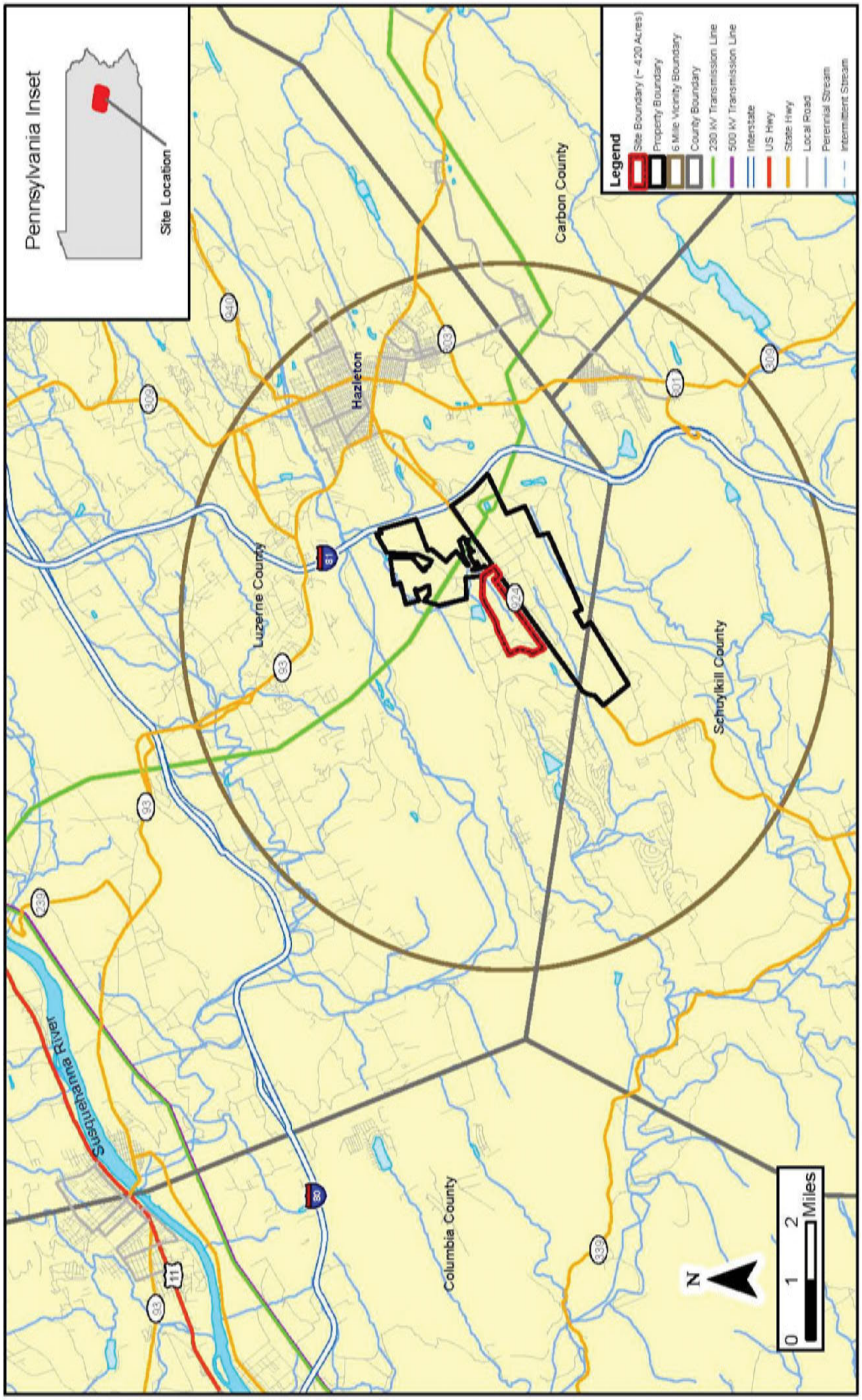

Figure 9-11. The Humboldt Site Region

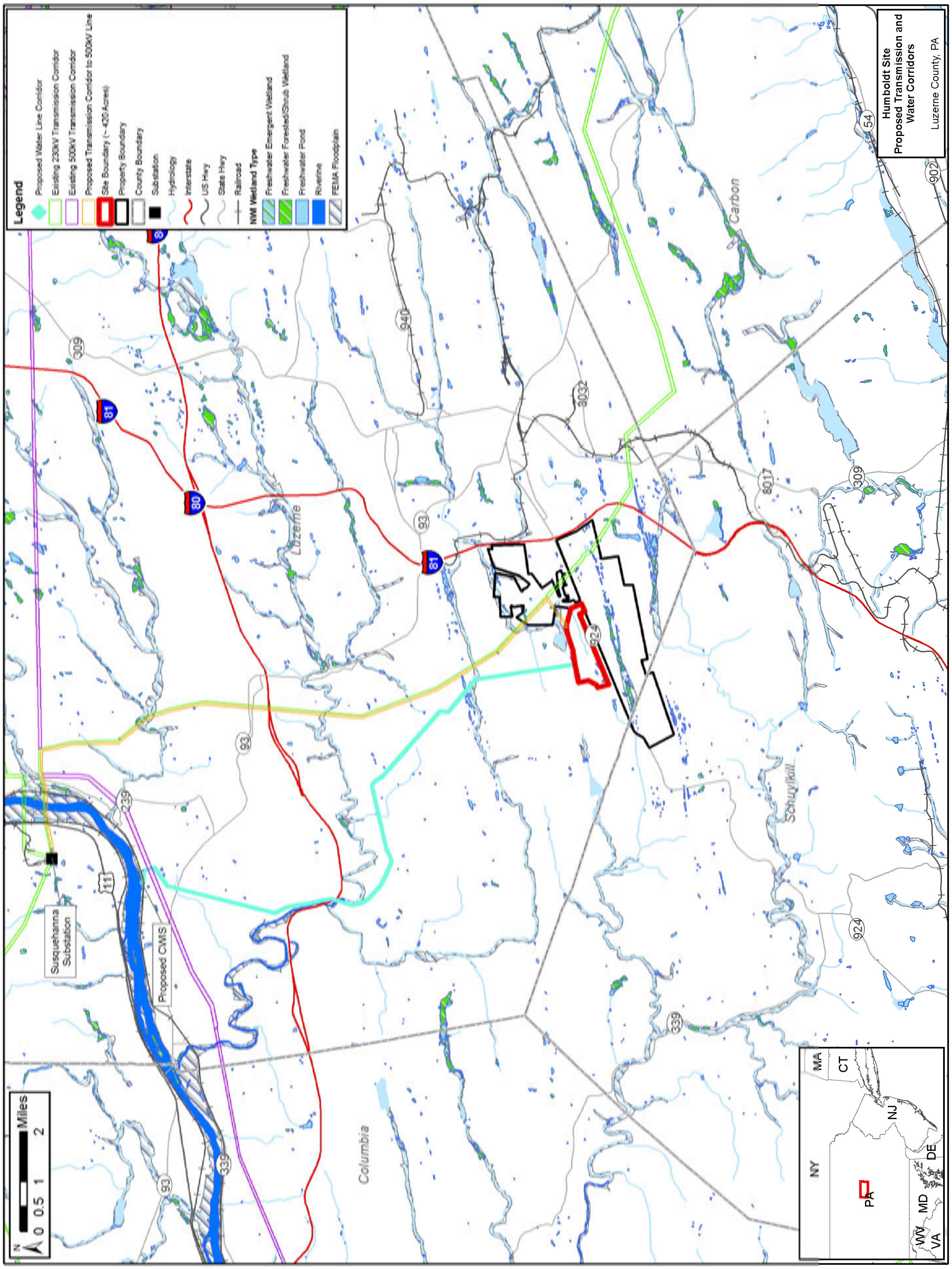

Figure 9-12. The Humboldt Site Transmission- and Water-Corridor Routes

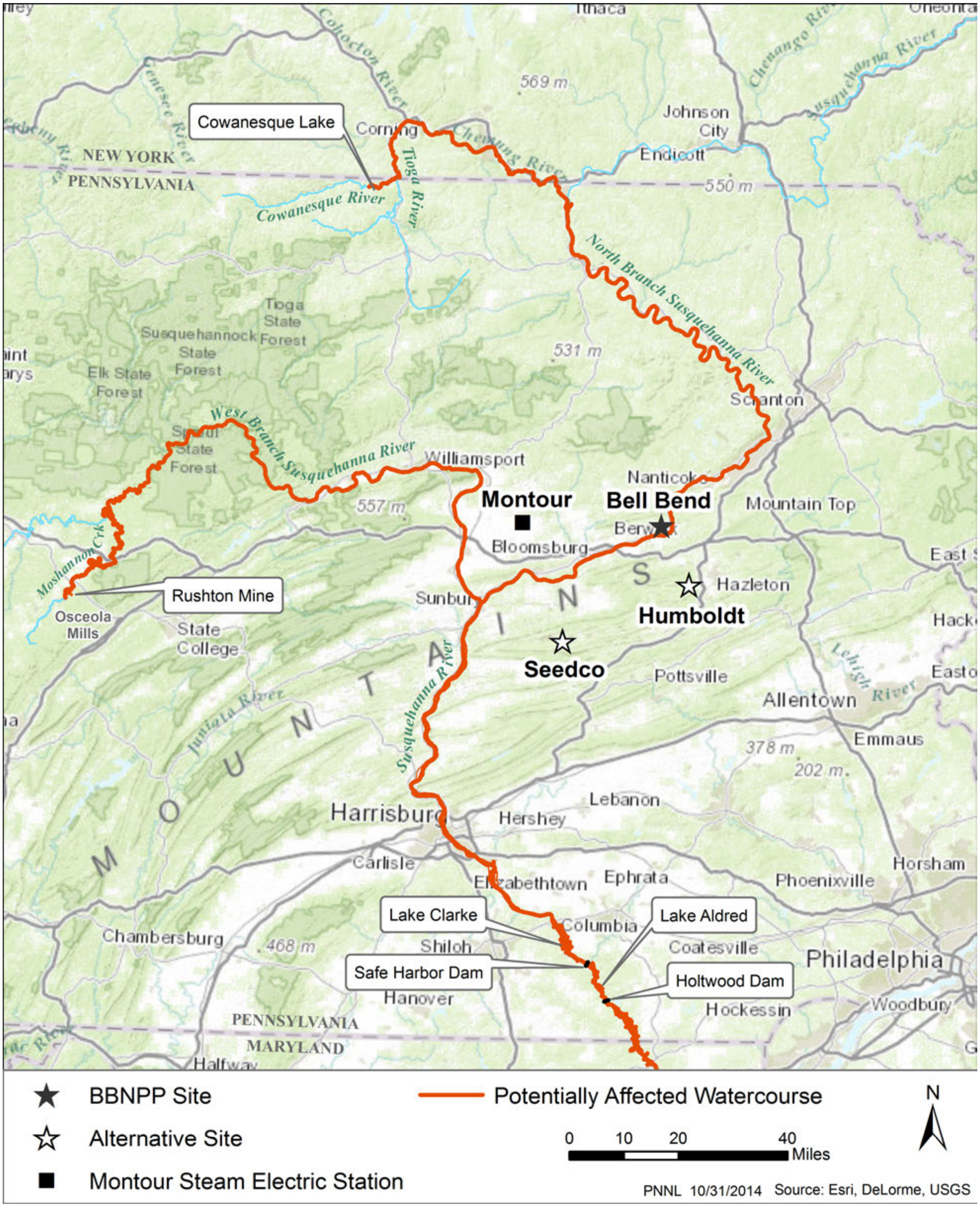

Figure 9-13. Waterbodies and Power Plants that are Part of PPL's Plan for Consumptive-Use Mitigation for the Humboldt and Seedco Alternative Sites

9.3.3.1 Land Use

The following analysis includes impacts from building and operating a nuclear power plant at the Humboldt site, along with transmission lines needed to connect the plant to the electrical grid. The analysis also considers other past, present, and reasonably foreseeable future actions that affect land use, including the other Federal and non-Federal projects listed in Table 9-10. For this analysis, the geographic area of interest is considered to be the 25-mi region centered on the Humboldt site plus any transmission-line and pipeline corridors that extend beyond that range. The review team determined that a 25-mi radius would represent the smallest area that would be directly affected because it includes the primary communities that would be affected by the proposed project if it were located at the Humboldt site. The geographic area of interest also includes lands bordering or otherwise closely associated with water features (e.g., shorelines, riparian zones, floodplains, and water-based recreation areas) affected by proposed consumptive-use mitigation and site-specific low-flow protection activities associated with use of the Humboldt site.

Site Description

The 420-ac Humboldt site is a partially developed site located west of the City of Hazleton in Luzerne County, Pennsylvania (Figure 9-11). The site is located along the northwestern edge of an irregularly shaped 3,796-ac property that straddles Luzerne and Schuylkill Counties. In general, the eastern portion of the site is level. Elevation gains in the north and northwestern portions of the site result in approximately 230 ft of topographic relief across the site. Approximately 85 percent of the site is undeveloped forestland, and a portion of the site along the southern boundary adjacent to SR 924 is abandoned mining land. Two large commercial/industrial buildings are located in the northeastern corner of the Humboldt site. The Humboldt site is zoned as I-2 (Industrial) and approximately 21 ac (i.e., 5 percent) of the land within the site area is prime farmland (UniStar 2011-TN505).

Land-use surrounding the Humboldt site includes undeveloped land to the north, the Humboldt Reservoir to the northeast, industrial park development to the south and east, and a residential community with a private golf course (i.e., Eagle Rock Resort and Country Club) to the west. Hazleton Municipal Airport, north of the City of Hazleton, is approximately 5.5 mi from the Humboldt site. SR 924 parallels the southeastern edge of the site and I-81 is located approximately 1.5 mi east of the site (UniStar 2011-TN505).

Building and Operation Impacts

Based on information provided by the applicant and the review team's independent assessment, development of a proposed power plant at the Humboldt site would convert the 420-ac site to utility uses for the nuclear facility and associated structures and infrastructure. Additional areas would be affected by laydown yards, stormwater-detention ponds, and borrow pits both during and after construction. Table 9-11 summarizes expected land-use impact parameters for the Humboldt site, including the construction and operation of new water and transmission lines. The project appears to be consistent with the I-2 zoning. The review team is not aware of any substantial conflicts with existing land-use plans. However, site development could pose possible land-use conflicts with two large commercial/industrial buildings located in the northeastern corner of the Humboldt site. Development of the Humboldt site would result in the loss of about 21 ac of prime farmland, which would have, at most, a minimal effect on agriculture in the geographic area of interest. This is especially true considering the industrial park setting for the site.

Table 9-11. Land-Use Impact Parameters for the Humboldt Site

Parameter	Value
Property acreage (ac)	3,796
Site acreage (ac)	420
Estimated onsite land disturbance area (ac)	420
Length of new water pipelines (mi)	12.5
ROW clearing for new water pipelines (ac)[(a)]	182
Length of transmission-line corridor (mi)	14.3
ROW clearing for transmission-line corridor (ac)[(b)]	342

(a) The water line construction ROW is assumed to be 120 ft wide to allow installation of two 60-in. diameter pipes. The ROW width would be reduced to 80 ft at wetland and stream crossings.
(b) A 200-ft-wide cleared ROW is assumed for new transmission-line construction across open land. A 100-ft-wide cleared ROW is assumed in areas where the new line would parallel an adjacent existing transmission line.

Source: Bell Bend Nuclear Power Plant Alternative Site Evaluation v.[2], May 2011 (UniStar 2011-TN505)

New water-intake and water-discharge pipelines would need to be constructed to obtain water from the Susquehanna River. An initial conceptual design conducted by the applicant identified an approximately 12.5-mi-long pipeline route that would extend north from the site and end at the main branch of the Susquehanna River (UniStar 2011-TN505). The ROW for the new water lines would need to be 120-ft wide to allow installation of two 60-in. diameter pipes. An estimated 182 ac would be cleared within the ROW to install the new water lines. In addition to the pipeline ROW, development of the water lines would require acquiring a small amount of riverfront land sufficient for an intake, major pumping station, and ancillary structures, as well as additional land for the construction of a pipeline large enough to provide approximately 50 Mgd of river water to the plant site. The pipeline would cross numerous local roads, but no major roads would be crossed between the river and the Humboldt site (UniStar 2011-TN505).

Development of a proposed power plant at the Humboldt site would require building one new transmission line between the new plant and the nearest existing substation. One option being considered by the applicant is to construct a new, ~14.3-mi transmission line from the eastern boundary of the site north to the existing substation. The total amount of cleared ROW for the transmission line would be approximately 342 ac.

Most of the new and expanded transmission-line ROW would cross low-density rural land that is primarily agricultural land and forest. In addition, the new transmission lines would cross numerous roads and highways. Where a new transmission-line ROW crosses farmland, existing agricultural activities would be allowed to continue, and the effect of these corridors on land usage would be minimal. In some limited areas, expansion of the existing ROW may encroach onto adjacent residential or commercial lands requiring land acquisition and potentially causing conflicts with existing land uses.

Cumulative Impacts

Ongoing urbanization in the geographic area of interest could contribute to additional decreases in open areas, forests, and wetlands and generally result in some increase in residential and industrialized areas. However, if recent trends described for the surrounding area (PDCED 2011-TN2225) continue, the region is likely to experience continued slow rates of development. In addition, future climate change could result in changes in land use similar to those described in Section 7.1. Most of the other projects described in Table 9-10 do not suggest a likelihood of substantial changes in general land-use patterns within the geographic area of interest.

If additional transmission lines, pipelines, and other utility lines were built for other energy projects, a cumulative land-use impact could occur from the additional amount of land converted to utility-corridor use within the geographic area of interest. Multiple new utility line corridors could alter the land-use classification proportions within the area. However, the review team expects that the utility lines would be consistent with the land-use plans and zoning regulations implemented by the affected counties.

The review team concludes that the cumulative land-use impacts associated with the proposed project at the Humboldt site, related development of offsite corridors needed for transmission lines and other appurtenant facilities, and other projects in the geographic area of interest would be MODERATE. This conclusion primarily reflects (1) possible land-use conflicts with two large commercial/industrial buildings located in the northeastern corner of the Humboldt site and (2) the need to traverse numerous offsite properties to establish new ROWs for transmission lines and water pipelines for a new reactor at the Humboldt site. In addition, the surrounding area is experiencing substantial ongoing urban and light industrial development. Building and operating a new nuclear unit at the Humboldt site would be a significant contributor to these impacts.

9.3.3.2 Water Use and Quality

This section describes the review team's assessment of impacts on water use and quality associated with building and operating a nuclear power plant at the Humboldt site. The assessment considers other past, present, and reasonably foreseeable future actions that affect water use and quality, including the other Federal and non-Federal projects listed in Table 9-10. The Humboldt site hydrology, water use, and water quality are discussed in Section 9.3.2.3.3 of the ER (PPL Bell Bend 2013-TN3377).

The ROI consists of the Susquehanna River Basin because water would be withdrawn from and wastewater would be discharged to the river if the proposed project were located at the Humboldt site. The intake and discharge structures would be located on the Susquehanna River, approximately 2.5 mi downstream from the discharge location for the proposed BBNPP unit (PPL Bell Bend 2013-TN3377). The Susquehanna River flow conditions at this point would be similar to those at the proposed locations for the intake and discharge for the proposed BBNPP unit. The same record of discharge used for assessing impacts from the proposed BBNPP unit (i.e., USGS Gage 01536500 on the Susquehanna River at Wilkes-Barre) would be most representative of flow conditions at the Humboldt site intake and discharge location. Flows at this gage were described in Section 2.3.1.1 and Tables 2-8 and 2-9. Mean annual discharge for the period from 1899 to 2013 is 13,770 cfs, and the P90 flow (the daily flow that is exceeded 90 percent of the time) for the same period is 1,730 cfs. The baseline water-quality conditions described in 2.3.3.1 would also be representative of water quality near the location of the Humboldt site intake and discharge.

For groundwater, the geographic area of interest is limited to the site and the immediate surroundings because PPL has indicated it would not use groundwater to build or operate the plant (PPL Bell Bend 2013-TN3377). Bedrock underlying the Humboldt site is composed of the predominantly conglomerate rock of the Sharp Mountain and Schuylkill members of the Pottsville Formation and the interbedded claystone, siltstone, sandstone, and conglomerate upper member of the Mauch Chunk Formation (Schasse et al. 2012-TN3699). Both of these formations are described as having good aquifer potential. Surficial deposits in the area of the Humboldt site are sandy to clayey glacial tills of pre-Illinoisan age (>770,000 yr) (Sevon 1989-TN3700; Sevon and Braun 2000-TN3701).

Building Impacts

Because building activities at the Humboldt site would be similar to those for the BBNPP site, the review team assumed the amount of water needed for building activities at the Humboldt site would be the same as that required for building activities at the BBNPP site. A dedicated line from the PAWC municipal groundwater-supply system at Berwick would provide water for construction and preconstruction (PPL Bell Bend 2013-TN3377). As described in Section 4.2.2, the review team determined that the average work-day water demand for building activities is about 5 percent of the average un-utilized capacity of the PAWC Berwick well system, and the resulting impact on water resources would be minor.

The intake and discharge structures for a plant at the Humboldt site would be similar in design to those for the BBNPP site (PPL Bell Bend 2013-TN3377). PPL would locate the structures to minimize impacts on wetlands and the Susquehanna River (PPL Bell Bend 2013-TN3377). Building the structures would be subject to the same regulatory and monitoring conditions as described in Section 4.2 at the BBNPP site. Therefore, the review team determined that the effects on river flows and water quality of building the intake and discharge structures would be temporary and limited to a small portion of the river and shoreline.

A plant at the Humboldt site would require new intake and effluent discharge pipelines to be built from the site approximately 12.5 mi to the Susquehanna River. PPL estimated that about 1 ac of wetlands and 600 ft of streams would be affected by building the pipelines. The review team assumed that these activities would conform to applicable local and state requirements so that impacts on the affected water resources would be localized and temporary.

Surface-water quality could be affected by stormwater runoff during building of a plant at the Humboldt site. The Humboldt site is drained by Stony Creek, and there are small ponds adjacent to and on the site. Building activities at the site would be required to conform to the conditions of a NPDES permit issued by the PADEP. An erosion and sediment control plan would be required as part of the permit, which would identify BMPs to be used to control the impacts of stormwater runoff. The review team assumed that facilities such as stormwater detention and infiltration ponds would be used to control site runoff and minimize sediment transport offsite. As a result, stormwater runoff is not anticipated to affect water quality of the local waterbodies.

Because the effects from building-related activities for a plant at the Humboldt site would be minimized using BMPs, would be localized and temporary, and would be controlled under various permits, the review team concludes that the impact from building-related activities on surface water use and quality would be minor.

Building activities at the Humboldt site would include building a safety-related onsite impoundment to provide water for the ultimate heat sink (PPL Bell Bend 2013-TN3377). This impoundment would be similar in size and construction to the safety-related ESWEMS pond proposed for the BBNPP site. The review team considered that building the impoundment at the Humboldt site would involve dewatering of the excavation, similar to the one proposed for the BBNPP site. Dewatering for the power-block and cooling-tower excavations also would likely be required. The potential effects of the excavation dewatering may include changes in groundwater levels in the surrounding area. Based on the description of the bedrock in the Humboldt site area (Schasse et al. 2012-TN3699), the aquifer underlying the Humboldt site may be more permeable than the bedrock at the BBNPP site. The review team assumed that the impact of dewatering the excavations would be managed by methods such as grouting and installing low-permeability barriers, as proposed for dewatering at the BBNPP site. Because there would be no groundwater use at the Humboldt site and the impact of dewatering during building would be controlled and temporary, the review team concludes that building impacts on groundwater resources would be minor.

While building the proposed plant at the Humboldt site, groundwater quality may be affected by inadvertent spills of chemicals (e.g., petroleum products). The review team assumed that the BMPs PPL would follow for the BBNPP site would be in place during building activities at the Humboldt site, and therefore concludes that any spills would be quickly detected and remediated. The review team evaluated the BMPs described in Section 4.2.1.9 of the ER (PPL Bell Bend 2013-TN3377) and the commitments made by PPL in Section 4.2.1.8 of the ER to comply with the applicable hydrological standards and regulations. Because runoff, groundwater, and surface waterbodies would be monitored for contaminants, and any spills related to building activities would be quickly remediated under the BMPs, the review team concludes that the impact on groundwater quality from building a plant at the Humboldt site would be minor.

Operational Impacts

The review team assumed that water withdrawal, consumptive use, and effluent discharge for operating a plant at the Humboldt site would be identical to the estimated water flows for operating the proposed BBNPP unit. The average withdrawal from the Susquehanna River to operate a plant at the Humboldt site would be 25,729 gpm (57.3 cfs), and the average consumptive use would be 17,064 gpm (38.0 cfs). Water-use impacts of operating the proposed BBNPP unit were evaluated using the requested withdrawal and consumptive-use limits in PPL's permit application to the SRBC. These maximum amounts are 65 cfs for withdrawal and 43 cfs for consumptive use. These flow rates are less than 1 percent of the mean annual flow of the Susquehanna River at Wilkes-Barre. Consumptive use would be 4 to 5 percent of the monthly P95 flows at Wilkes-Barre (i.e., the average monthly flow, as shown in Table 5-1). For the 7Q10 flow (i.e., the 7-day average low flow that occurs on average once every 10 years), which is 826 cfs at Wilkes-Barre, consumptive use by a plant at the

Humboldt site would result in about a 5 percent reduction in river flow. Because operating the plant would reduce Susquehanna River flow by a small fraction, the review team determined that the operational impact on surface water of the proposed plant at the Humboldt site would be minor.

The NRC staff assumed that the requirements for consumptive-use mitigation and site-specific low-flow protection specified by SRBC for the proposed BBNPP unit also would apply to a plant at the Humboldt site. PPL has indicated that their primary plan for consumptive-use mitigation, described in Section 2.2.2, also would apply to a plant at the Humboldt site (PPL Bell Bend 2014-TN3494). As described in Section 5.2.2.1, the NRC staff evaluated the effects of this plan on the following affected waterbodies: Cowanesque Lake, the Cowanesque River below the dam, Moshannon Creek below the Rushton Mine discharge, and downstream at the Holtwood hydroelectric facility. The NRC staff determined that the effects of consumptive-use mitigation and site-specific low-flow protection would be minor, except for reductions in Cowanesque Lake elevations during low-flow conditions. These occasional reductions in lake level could have a small adverse effect on recreational use of the lake but would not impact downstream water use. The SRBC would adjust the flows triggering consumptive-use mitigation and site-specific low-flow protection to reflect the location of the intake for a plant at the Humboldt site, but these adjustments would be minor. Therefore, the NRC staff determined that the water-use impacts from consumptive-use mitigation and site-specific low-flow protection for a plant at the Humboldt site would be minor.

As stated above, onsite groundwater would not be used for operating a plant at the Humboldt site. The review team assumed that the water supply for potable and sanitary uses during operations would be the PAWC well system at Berwick. The review team also assumed that the amount of water required from the PAWC municipal system would be the same as that required for operating the proposed BBNPP unit. As described in Section 5.2.2, the review team determined that the average water demand during plant operation would be about 5 percent of the average unutilized capacity of the PAWC Berwick well system, and the resulting impact on water resources would be minor.

During operation of a proposed plant at the Humboldt site, impacts on surface-water quality could result from stormwater runoff, discharge of sanitary and other wastewater, and discharge of blowdown from the cooling towers into the Susquehanna River. Stormwater runoff and discharges from the site would be regulated under the NPDES permit administered by the PADEP. BMPs for controlling stormwater would be described in a post-construction stormwater management plan. The review team assumed that the concentration of solutes in the liquid effluent and the blowdown discharge rate (19 cfs) would be the same as that for the proposed BBNPP. Because the blowdown rate is only 2.2 percent of the 7Q10 flow, constituents in the effluent would be rapidly diluted by the much larger flow in the river. The extent of the thermal plume would be similar to that determined for the discharge from the proposed BBNPP unit. As described in Section 5.2.3, under conservative conditions, the maximum extent of the thermal plume in winter is anticipated to be about 50 ft as determined by the isotherm 2°F above the ambient river temperature. Because stormwater controls would be in place and the blowdown discharge would be regulated under an NPDES permit, the review team concludes that the impacts on surface-water quality from operating a plant at the Humboldt site would be minor.

During operation of a nuclear plant at the Humboldt site, impacts on groundwater quality could result from accidental spills. Spills that might affect the quality of groundwater would be prevented and mitigated by using BMPs as described above. Because BMPs would be used to mitigate spills and no intentional discharge to groundwater should occur, the review team concludes that the groundwater-quality impacts from operation of a plant at the Humboldt site would be minor.

Cumulative Impacts

In addition to water-use and water-quality impacts from building and operating activities, this cumulative-impacts analysis considers past, present, and reasonably foreseeable future actions that affect the same water resources. For the cumulative analysis of impacts on surface water, the geographic area of interest is considered to be the drainage basin of the Susquehanna River upstream and downstream of the proposed intake and discharge structures at the Humboldt site. For the cumulative analysis of impacts on groundwater, two geographic areas of interest have been identified: (1) the proposed Humboldt site and the surrounding area that could be affected by dewatering activities during preconstruction and construction, and (2) the area contributing to the PAWC well system that is the source of water for site activities during preconstruction and construction and for potable and sanitary uses during operations.

Cumulative Water-Use Impacts

Based on a review of the history of water-use and water-resources planning in the Susquehanna River Basin, the review team determined that past and present use of the surface waters in the basin has been noticeable, necessitating consideration, development, and implementation of careful planning (SRBC 2013-TN3568). As described in Section 7.2, the SRBC anticipates that population in the basin will increase 4.4 percent between 2010 and 2030, with this growth occurring almost entirely in the Lower Susquehanna sub-basin. Population growth is projected to decrease about 2 percent during the same period in the Middle and Upper Susquehanna sub-basins and about 7 percent in the Chemung sub-basin. Consumptive use in the basin is projected to increase by about 320 Mgd (495 cfs) between 2005 and 2025 (SRBC 2013-TN3568), with a substantial portion of this occurring in the Middle Susquehanna sub-basin (SRBC 2008-TN699).

The review team is aware of the potential climate changes that could affect the water resources available for cooling and the impacts of reactor operations on water resources for other users. Because the Humboldt site is located near the BBNPP site, the potential changes in climate would be similar (GCRP 2014-TN3472). Therefore the review team concludes that the impact of climate change on water resources would be similar to that for the BBNPP site.

Of the projects listed in Table 9-10, those that were considered for cumulative impacts on the surface-water resource are natural gas extraction and the continued operation of the SSES and other power-generation facilities. These projects also were considered in assessing the cumulative impacts for the proposed BBNPP unit in Section 7.2. Other projects in Table 9-10 do not affect the surface-water resource or their surface-water use is insignificant. Because the consumptive use of a new nuclear power plant at the Humboldt site would be similar to the consumptive use of the proposed BBNPP unit, and because the intake and discharge locations would be only 2.5 mi from the intake and discharge locations for the proposed BBNPP unit, the review team determined that the cumulative water-use impacts for the two sites would be similar.

Unconventional natural gas extraction is less than 10 percent of current basin-wide consumptive use (excluding public water supply diversions), and is expected to remain a relatively small proportion of total consumptive use in the future. Impacts from gas extraction are of greatest concern in small watersheds where most of the gas development has occurred. Therefore, the review team determined that the cumulative impacts from unconventional gas extractions would be limited.

Consumptive use of 43 cfs of water for operation of a plant at the Humboldt site is about 0.3 percent of the mean annual Susquehanna River discharge at Wilkes-Barre of 13,770 cfs. This mean annual discharge is for the full period of record (1899-2013), and it reflects the cumulative consumptive use of current consumers. Total consumptive use of water in the Susquehanna River Basin upstream of the intake location for a plant at the Humboldt site is anticipated to increase by about 160 Mgd (248 cfs) between 2005 and 2025 (SRBC 2008-TN699). This amount of consumptive use is about 2 percent of the mean annual flow at Wilkes-Barre, and would result in minor cumulative impacts at that flow rate. During low-flow conditions, however, cumulative impacts from an additional 160 Mgd (248 cfs) of consumptive use would be significant without mitigation. Addressing the need for additional consumptive-use mitigation in the basin is a primary concern of the SRBC.

Under PPL's plan for consumptive-use mitigation and site-specific low-flow protection described in Section 2.2.2, releases from Cowanesque Lake for consumptive use of a plant at the Humboldt site would interact with mitigation releases made for SSES Units 1 and 2. The combined releases would result in minor alteration of flows in the Cowanesque River. No cumulative impacts would occur on Moshannon Creek. In addition, releases from Cowanesque Lake would eliminate any cumulative impacts on users downstream of the intake location for a plant at the Humboldt site. Releases for the two plants would interact to cause drawdown in the elevation of Cowanesque Lake. In about 74 percent of years, maximum annual drawdown resulting from the combined releases would be less than 2 ft. However, during relatively dry years, maximum annual drawdown would be larger, exceeding 7 ft in about 15 percent of years prior to the end of November. During the recreation season (May 20 to September 14), lake drawdown of 7 ft or more would be expected in about 8 percent of years.

Mainly because of extensive past and present use of surface water in the Susquehanna River Basin, the NRC staff determined that cumulative impacts on surface-water resources from building and operating a new nuclear power plant at the Humboldt site would be MODERATE. However, the NRC staff further concludes that building and operating a new nuclear power plant at the Humboldt site would not be a significant contributor to these impacts.

As stated above, a new nuclear plant at the Humboldt site would use no onsite groundwater. Most of the projects in Table 9-10 are more than 10 mi from the Humboldt site and thus would not contribute to a cumulative impact on groundwater supply within the ROI. Water for potable and sanitary uses would be obtained from the PAWC municipal supply at Berwick. The amount required would be less than 11 percent of the available unused capacity of the PAWC system. Because population in the Middle Susquehanna sub-basin is anticipated to decrease, the review team determined that the capacity of the PAWC system is unlikely to be exceeded during operation of a plant at the Humboldt site. No other significant groundwater use that would affect the capacity of the PAWC system was identified in Table 9-10. Therefore, the review team concludes that the cumulative impact on groundwater use at the Humboldt site would be SMALL.

Cumulative Water-Quality Impacts

As stated in Section 7.2.2.1, SRBC has implemented careful planning and regulation of water quality in the Susquehanna River Basin. In addition, the PADEP monitors water quality throughout most of the basin and enforces water-quality regulations through the NPDES permitting program. Although there have been improvements in water quality in the basin (e.g., reductions in iron concentrations), water quality remains a priority for the SRBC (SRBC 2013-TN3568). In its review of the SSES license-renewal application, the NRC staff concluded that water quality in the Susquehanna River Basin has been significantly impacted by past activities, and will likely continue to be adversely affected by human activities in the future (NRC 2009-TN1725). The review team concludes that past and present actions in the Susquehanna River Basin have resulted in noticeable impacts on water quality.

The projects listed in Table 9-10 may result in alterations to land surface, surface-water drainage pathways, and waterbodies. These projects would need Federal, State, and local permits that would require implementation of BMPs. Therefore, the impacts on surface-water quality from these projects are not expected to be noticeable. The discharge for a plant at the Humboldt site would be located 2.5 mi from the SSES discharge. The analysis of the thermal plume of the proposed BBNPP unit described in Section 5.2.3 indicates that, at a downstream distance of 2.5 mi, the excess temperature above ambient river temperature in the discharge plume from SSES Units 1 and 2 would be much less than 1°F. The area affected by the thermal plume from a plant at the Humboldt site would be small, would be localized near the discharge location, and would not significantly interact with the thermal plume from the SSES. Therefore, the review team determined that the cumulative impact of the combined discharges from the SSES and a plant at the Humboldt site would be minor.

The review team concludes that the cumulative impact on surface-water quality in the Susquehanna River Basin from past and present actions and building and operating the proposed plant at the Humboldt site would be MODERATE. However, the review team further concludes that building and operating a new nuclear power plant at the Humboldt site would not be a significant contributor to these impacts.

Based on the reasonably foreseeable projects listed in Table 9-10, most of which are located more than 10 mi from the Humboldt site, additional impacts on groundwater quality are expected to be minimal. As discussed previously in this section, BMPs would be implemented to minimize groundwater contamination and quickly remediate any inadvertent spills. Engineering controls would be used to limit the impacts of dewatering activities during building, and no onsite groundwater would be used during operation. Therefore, the review team concludes that the cumulative groundwater-quality impacts of a new plant at the Humboldt site would be SMALL.

9.3.3.3 Terrestrial and Wetland Resources

The following analysis includes impacts from building and operating the proposed new nuclear plant on terrestrial ecology resources at the Humboldt site. The analysis also considers past, present, and reasonably foreseeable future actions that affect the terrestrial ecological resources, including other Federal and non-Federal projects and the projects listed in Table 9-10. For the analysis of terrestrial ecological impacts at the Humboldt site, the geographic area of interest includes the portions of Luzerne, Carbon, Snyder, Schuylkill, Columbia, and Northumberland Counties that are within a 21-mi radius of the site. The 21-mi geographic area of interest was selected to encompass closely interrelated nearby terrestrial habitats and ensure inclusion of all associated pipelines and transmission lines. The land within the 21-mi area lies within the Ridge and Valley ecoregion (Woods et al. 2003-TN1806). The geographic area of interest is expanded to also include the waterbodies affected by consumptive-use mitigation and site-specific low-flow protection releases.

This geographic area of interest encompasses all of the offsite facilities discussed below in the site description section. The geographic area of interest would also encompass other important animal and plant species and communities that could potentially be affected by plant construction and operation. The 21-mi distance was also used by PDCNR, PFBC, and PGC for their occurrence analysis for special status species and habitats (PNHP 2013-TN3900). The NRC definition for important species is discussed in Section 4.3.1.3.

In accordance with ESRP Section 9.3, the review team relied upon reconnaissance-level information to perform the alternative site evaluation for this EIS (NRC 2000-TN614). Reconnaissance-level information is data readily available from agencies and other public sources (e.g., scientific literature, books, and Internet websites) and information obtained from site visits. To identify terrestrial resources at the Humboldt site, the review team relied primarily on the following information:

- tours of the Humboldt site in April 2009 (NRC 2009-TN1889), June 2010 (NRC 2010-TN1891), and March 2014 (NRC 2014-TN3639)
- responses to RAIs provided by PPL that were incorporated into its ER (PPL Bell Bend 2013-TN3377)
- information from State and Federal sources on important species and community occurrences within 21 mi (PNHP 2013-TN3900)
- correspondence from Federal and State agencies regarding important species and communities (FWS 2013-TN3847; PDCNR 2012-TN3910; PGC 2012-TN3901).

Site Description

The Humboldt site and offsite facilities are situated within the Ridge and Valley ecoregion (Woods et al. 1999-TN1805; Woods et al. 2003-TN1806). As described in Section 7.3.1, the Ridge and Valley ecoregion is characterized by alternating forested ridges and agricultural valleys. Natural vegetation varies from north to south, and in the north is characterized as mostly Appalachian oak forest dominated by white oak (*Quercus alba*) and red oak (*Q. rubra*) (USGS 2012-TN1800; Woods et al. 1999-TN1805; Woods et al. 2003-TN1806). Three land-cover types dominate the ecoregion: forest (56 percent), agriculture (about 30 percent), and developed areas (about 9 percent). The greatest recent land-cover change has been the conversion of forest to disturbed lands, followed by disturbed lands reverting back to forest. Forest and disturbed land are both also being converted to developed land (USGS 2012-

TN1800). Today, farming is prevalent over much of the landscape, and woodland occurs on steeper sites (Woods et al. 1999-TN1805; Woods et al. 2003-TN1806). This has resulted in the overall reduction and fragmentation of forest, resulting in a mosaic of habitat types in various stages of succession, a greater amount of forest-edge habitat, and a lesser amount of forest-interior habitat and forest-interior wildlife (PGC and PFBC 2005-TN3815).

The Humboldt site is a 420-ac site located in Hazle Township in Luzerne County, Pennsylvania. A portion of the site consists of reclaimed coal strip-mine. Offsite facilities needed to serve a new reactor at the Humboldt site include a new makeup/blowdown water pipeline and new transmission lines. The proposed corridor for the pipeline would extend approximately 12.5 mi from the site to the North Branch of the Susquehanna River. The transmission lines would include a new 0.7-mi segment and a 13.6-mi expansion of an existing 230-kV transmission line. Combined, the new transmission lines would connect the site to an existing 500-kV transmission line (PPL Bell Bend 2013-TN3377) located approximately 10.2 mi north of the site (UniStar 2011-TN505). The makeup-water and blowdown pipeline and conceptual transmission-line corridors would be located within Luzerne County (PPL Bell Bend 2013-TN3377).

Land use in the area surrounding the Humboldt site includes undeveloped land to the north, Humboldt Reservoir to the northeast, industrial park development to the south and east, and residential and private recreational development to the west. The Humboldt site consists primarily of reclaimed mine land (PPL Bell Bend 2013-TN3377). Natural habitats on and in the area of the Humboldt site include mixed-deciduous forest, forested wetlands and bogs, shrub/scrub swamps, emergent wetlands, shrub lands/early successional forests, heath and heath-shrub habitats, and riparian forests/thickets. Human structures also occur onsite. Natural habitats onsite have been significantly altered through historical strip-mining operations and associated land reclamation (PPL Bell Bend 2013-TN3377).

Terrestrial habitat types present on the Humboldt site include approximately 349 ac of forest habitat, 40 ac of barrens habitat, 6 ac of cropland/pasture, and 3.8 ac of wetland habitat (PPL Bell Bend 2011-TN4010; PPL Bell Bend 2013-TN3377). Barrens are areas that are naturally infertile as a consequence of nutrient-poor soils, and often form on resistant rock such as quartz, sandstone, or highly weathered and leached glacial material. Fire is a natural process in the ridgetop barrens of Luzerne County (PNHP 2006-TN1570). In addition, the site contains approximately 8 ac of open water and 9 ac of urban land. There are no floodplains on the Humboldt site (UniStar 2011-TN505).

The wetlands on the site are identified on National Wetland Inventory maps as Palustrine Unconsolidated Bottom, permanently flooded, excavated (PUBHx) features. They appear to be isolated depressions in reclaimed strip-mining land. Although features identified on National Wetland Inventory maps as Palustrine Unconsolidated Bottom are commonly small ponds or open waters rather than wetlands, the review team believes that the features are shallow depressions that receive localized runoff from the surrounding reclaimed land and function much like Palustrine Emergent Wetlands. Therefore, for purposes of the following analysis, the review team considers the features to be wetlands rather than open waters.

The proposed corridors traverse substantial areas of forest. The water-pipeline corridor traverses approximately 94 ac of forested habitat and 89 ac of non-forested habitat. The transmission-line corridor traverses approximately 66 ac of forested habitat and 276 ac of non-forested habitat (PPL Bell Bend 2011-TN4010).

The offsite facilities needed to support a nuclear plant at the Humboldt site would traverse small areas of wetlands. No wetlands are associated with the cooling-water intake pump house. However, 0.2, 1.1, and 7.2 ac of wetlands, totaling 8.5 ac, occur at the cooling-water intake, water-pipeline corridor, and transmission-line corridor, respectively PPL Bell Bend 2013-TN3377).

The NRC staff visited the Humboldt site in April 2009 (NRC 2009-TN1889), June 2010 (NRC 2010-TN1891), and March 2014 NRC 2014-TN3639). Former strip-mine lands onsite are currently occupied by old-field vegetation (NRC 2010-TN1891). Sphagnum moss (*Sphagnum* spp.) occurs along Stony Creek onsite. Sphagnum is present in various naturally occurring wetland and forest plant communities in Pennsylvania (Fike 1999-TN3816). Three areas with plant communities exhibiting a sphagnum-rich component occur near the Humboldt site in Hazle Township, Valmont Industrial Park, Dreck Creek Watershed, and Black Creek Flats (PNHP 2006-TN1570). No riparian vegetation, plant species, or soil conditions (e.g., deep muck, accumulation of sphagnum into peat layers) that typify such sphagnum-rich areas, as described by the Pennsylvania Natural Heritage Program (PNHP) (PNHP 2006-TN1570), were observed on the Humboldt site during the site visit (PPL Bell Bend 2013-TN3377). Thus, the sphagnum areas onsite appear to currently lack the ecological value normally attributed to sphagnum-rich communities (PNHP 2006-TN1570; PPL Bell Bend 2013-TN3377).

Three seeps were observed on the Humboldt site during the site visit (NRC 2010-TN1891). All were located within fill material or cut areas associated with a recent mine reclamation project. No plants typically restricted to acidic seeps, such as those found at the acid seeps of the nearby Valmont Industrial Park (PNHP 2006-TN1570), were observed (PPL Bell Bend 2013-TN3377). Thus, either the seeps are not acidic or have not yet developed the characteristic flora associated with natural acidic seeps (Fike 1999-TN3816). Thus, these seeps appear to currently lack the ecological value normally attributed to natural acidic seeps (PNHP 2006-TN1570; PPL Bell Bend 2013-TN3377).

The Humboldt Barrens natural area is located just to the east and northeast of the Humboldt site. The Humboldt Barrens support a Ridgetop Dwarf Tree Forest natural community that contains scrub oak (*Quercus ilicifolia*) and pitch pine (*Pinus rigida*) with an understory of grasses, forbs, and heath species. It is unusual among barrens areas in Luzerne County in that pitch pine is at least as abundant as scrub oak (PNHP 2006-TN1570).

During the site visit (NRC 2010-TN1891), the northern portion of the Humboldt site was observed to contain common woody vegetation (e.g., heath species [scrub oak] and trees [pitch pine]) typical of the Humboldt Barrens (PNHP 2006-TN1570; PPL Bell Bend 2013-TN3377). As noted above, this barrens area makes up 40.5 ac of the Humboldt site. Thus, the northern portion of the Humboldt site likely represents the southern edge of the Ridgetop Dwarf Tree Forest Natural Community extending from the Humboldt Barrens (PDCNR 2012-TN3910; PPL Bell Bend 2013-TN3377).

Federally Listed, State-Listed, and State-Ranked Species and Communities

PPL did not provide field survey information for the Humboldt site and the review team is unaware of any field surveys at this location or at the locations of the offsite facilities. The presence or absence of Federally listed, State-listed, and State-ranked species and communities in the project footprint cannot be ascertained without field surveys.

A query of the Pennsylvania Natural Heritage Program database (PNHP 2013-TN3900) indicates the presence of 2 Federally listed species, 1 proposed Federally listed species, 29 State-listed species, 78 State-ranked species, and 19 State-ranked communities within 21 mi of the Humboldt site in Luzerne, Carbon, Snyder, Schuylkill, Columbia, and Northumberland Counties (Table 9-12). Table 9-12 lists species habitat affinities. The number of important species and communities that occur within 21 mi provide a basis for comparison of the proposed BBNPP site and the Humboldt alternative site.

Of the 96 species documented in Table 9-12, only the Indiana bat (*Myotis sodalis*) and northeastern bulrush (*Scirpus ancistrochaetus*) are listed as Federally endangered. The northern long-eared bat (*Myotis septentrionalis*) is listed as Federally threatened. A description of the Indiana bat follows. Descriptions of species discussed in correspondence from State agencies (FWS 2013-TN3847; PDCNR 2012-TN3910; PGC 2012-TN3901), including State-listed and State-ranked species and State-ranked communities, are also provided below.

<u>Indiana Bat (*Myotis sodalis*), Federally Endangered (FE)</u>

The Indiana bat is a small insectivorous bat that is a true hibernator, entering hibernation in the fall and surviving on stored fat until spring. Mating occurs in late August and September during fall swarming, when bats move in and out of winter hibernacula at night and roost individually in surrounding forests during daytime. Hibernation occurs communally in abandoned mines and caves. Reproductive females migrate from hibernacula to summer roosting habitat where they establish maternity colonies. Maternity roosts are found in dead or nearly dead trees, or dead parts of living trees. Males and non-reproductive females are most commonly found in the vicinity of their hibernaculum but may also disperse throughout the summer range and roost individually or in small groups in trees. In summer and fall, Indiana bats primarily use wooded or semi-wooded habitats, usually near water. Foraging often occurs in riparian areas, ponds, and wetlands, but also takes place in upland forests and fields. Flying insects are typical prey of the Indiana bat. Significant threats to the Indiana bat include human-induced disturbance and alterations at hibernation sites, loss of summer roosting habitat, contaminants, and white nose syndrome (see Section 2.4.1.3) (Normandeau 2012-TN1784).

The historical range of the Indiana bat includes much of the eastern United States. The species has disappeared from, or greatly declined in, most of its former range in the northeastern United States (Normandeau 2012-TN1784). Rangewide, the total population of hibernating Indiana bats was estimated to be about 534,239 in 2013 (FWS 2013-TN3848). About 42 percent of the total hibernating population occurs in Indiana, with 0.02 percent (about 120 hibernating bats) estimated to occur in Pennsylvania (FWS 2013-TN3848). The population of hibernating Indiana bats in Pennsylvania has dropped by about 77 percent since 2011 (FWS 2013-TN3848). Indiana bats are known to occur within 21 mi of the Humboldt site (PNHP 2013-TN3900).

Table 9-12. Federally and State-Listed and State-Ranked Terrestrial Species (Except Birds [see Table 2-17]) and Communities Occurring within the Geographic Area of Interest (21-mi Radius) around the Humboldt Site (PFBC 2014-TN4430; PNHP 2013-TN3900) and Their Known or Likely Presence in the Project Area Based on Field Surveys

Scientific Name	Common Name	Federal Status[(a)]	State Status[(a)]	State Rank[(a)]	Potentially Suitable Habitat Onsite	Observed or Likely to Occur Onsite	Habitat
Plants							
Amelanchier bartramiana	oblong-fruited serviceberry		PE	S1	Yes	No	Swamps, sphagnum bogs, and peaty thickets[(b)]
Amelanchier humilis	serviceberry			S1	Yes	No	Dry, open, high ground, and bluffs[(b)]
Amelanchier obovalis	coastal juneberry			S1	Yes	No	Peaty barrens, thickets, and roadsides[(b)]
Aplectrum hyemale	puttyroot		PR	S3	Yes	No	Moist woodlands, forested slopes, and stream banks[(c)]
Arabis missouriensis	Missouri rock-cress		PE	S1	Yes	No	Dry slopes[(b)]
Bartonia paniculata	screw-stem			S3	Yes	No	Hummocks in wet woods, wooded bogs, and sphagnous pond margins[(b)]
Bidens discoidea	small beggar-ticks			S3	Yes	No	Bogs, vernal ponds, and swampy ground[(b)]
Carex bicknellii	Bicknell's sedge		PE	S1	Yes	No	Dry woods, thickets, fields, and serpentine barrens[(b)]
Carex disperma	soft-leaved sedge		PR	S3	Yes	No	Swamps, wet thickets, wetlands, and bogs[(c)]
Carex lasiocarpa	slender sedge		PR	S3	Yes	No	Bogs, wetlands, and marshes[(c)]
Carex limosa	mud sedge			S2	Yes	No	Bogs and floating sphagnum moss mats at bog pools[(c)]
Carex longii	Long's sedge			S2S3	Yes	No	Swamps, open thickets, moist meadows, old gravel pits, and swales[(b)]
Carex polymorpha	variable sedge		PE	S2	Yes	No	Openings along woods and road margins[(c)]
Cyperus diandrus	umbrella flatsedge		PE	S2	Yes	No	Shorelines of ponds, lakes, and streams; in bogs and marshes[(c)]
Dodecatheon radicatum	jeweled shooting-star		PT	S2	No	No	Moist, shaded areas of limestone outcrops and river bluffs[(c)]
Dryopteris clintoniana	Clinton's wood fern			S2	Yes	No	Swampy woodlands[(c)]
Elymus trachycaulus	slender wheatgrass			S3	Yes	No	Sunny, well-drained habitats such as woods borders, rocky banks, grasslands, barrens, thickets, and utility ROW[(c)]
Eurybia radula	rough-leaved aster			S2	Yes	No	Wet woods, swamps, seeps, bogs, and along streams[(c)]
Gaultheria hispidula	creeping snowberry		PR	S3	Yes	No	Bogs, peaty wetlands, and swamps[(c)]
Helianthemum bicknellii	Bicknell's hoary rockrose		PE	S2	Yes	No	Open rocky places, riverbed scours, exposed banks, slopes, woods, rock outcrops, and serpentine barrens[(c)]
Juncus filiformis	thread rush		PR	S3	Yes	No	Bogs and sandy shores[(b)]
Ledum groenlandicum	common Labrador-tea		PR	S3	Yes	No	Bogs and peaty wetlands[(c)]
Lonicera hirsuta	hairy honeysuckle			S1	Yes	No	Moist woods, swamps, and rocky thickets[(b)]

Table 9-12. (contd)

Scientific Name	Common Name	Federal Status[a]	State Status[a]	State Rank[a]	Potentially Suitable Habitat Onsite	Observed or Likely to Occur Onsite	Habitat
Lupinus perennis	lupine		PR	S3	Yes	No	Woods borders, open woods, and clearings[c]
Muhlenbergia uniflora	fall dropseed muhly		PE	S2	Yes	No	Bogs and peaty wetlands[c]
Piptatherum pungens	slender mountain-ricegrass		S2	PE	No	No	Sunny, well-drained, sandy habitats, rocky open woods, bedrock outcrops, heath barrens, balds, and mountain summits[c]
Platanthera blephariglottis	white-fringed orchid			S2S3	Yes	No	Bogs, peaty wetlands, swamps, and floating sphagnum moss mats at bog pools[c]
Platanthera ciliaris	yellow-fringed-orchid			S2	Yes	No	Bogs, moist meadows, and woods[b]
Polemonium vanbruntiae	Jacob's-ladder		PE	S1	Yes	No	Wet soil in woods, thickets, and openings[c]
Polystichum braunii	Braun's holly fern		PE	S1	Yes	No	Cool, rocky slopes, and shaded ravines[b]
Potentilla tridentata	three-toothed cinquefoil		PE	S1	No	No	Rock outcrops at high elevations[c]
Prunus pumila var. susquehanae	Susquehanna sand cherry			S2	No	No	Dry, exposed rock outcrops and mountain tops[b]
Ribes lacustre	swamp currant			S1	Yes	No	Damp soil on rocky slopes and talus, moist to seepy rock outcrops and cliffs, cool woods, and swamps[c]
Rosa virgiana	Virginia rose			S1	Yes	No	Pastures, fields, open woods, thickets, and roadsides[b]
Schoenoplectus subterminalis	water bulrush			S3	Yes	No	Lakes, ponds, and slow-moving streams[c].
Schoenoplectus torreyi	Torrey's bulrush		PE	S1	Yes	No	Shallow water along shorelines of lakes and ponds[b]
Scirpus ancistrochaetus	northeastern bulrush	FE	PE	S3	Yes	No	Edges of seasonal pools, wet depressions, beaver ponds, wetlands, and small ponds[b]
Stellaria borealis	mountain starwort			S1S2	Yes	No	Seeps and spring-fed streamlets in wooded areas[c]
Streptopus amplexifolius	white twisted-stalk		PT	S1	No	No	Cool shaded areas on seepy cliffs and rock outcrops[c]
Utricularia cornuta	horned bladderwort		PT	S2	Yes	No	Shallow water or wet peaty substrate in ponds, bogs, seepages, and along shorelines[c]
Utricularia intermedia	flat-leaved bladderwort		PT	S2	Yes	No	Bogs, wetlands, floating bog mat islands, and shorelines[c]
Viola selkirkii	great-spurred violet			S3S4	Yes	No	Cool, moist woods, humus/moss rock outcrops and boulders[c]
Vittaria appalachiana	Appalachian gametophyte fern		PT	S2	No	No	Cool, damp, shaded rock outcrops and cliffs in forested areas[c]

Table 9-12. (contd)

Scientific Name	Common Name	Federal Status[(a)]	State Status[(a)]	State Rank[(a)]	Potentially Suitable Habitat Onsite	Observed or Likely to Occur Onsite	Habitat
Insects							
Amblyscirtes vialis	common roadside skipper			S2	Yes	No	Riparian forest[(d)]
Boloria selene myrina	silver bordered fritillary			S3	Yes	Yes[(e)]	Open, marshy, or boggy areas with violets[(d)]
Carterocephalus palaemon mandan	Arctic skipper			S2	Yes	No	Glades, roadsides, swampy places, streamside grassy openings in forests, sometimes bogs or fens[(d)]
Chlosyne harrisii	Harris' checkerspot			S3	Yes	No	Bog/fen, wetlands, riparian, grassland/old-field, and ROW[(d)]
Erynnis persius persius	Persius duskywing			S1	Yes	No	Bog/fen, scrub/shrub wetland, riparian, and forest[(d)]
Euphyes conspicua	black dash				Yes	Yes[(e)]	Open, shrubby or partially wooded (e.g., red maple) bogs/fens, wetlands, and riparian areas[(d)]
Euphydryas phaeton	Baltimore checkerspot			S3	Yes	Yes[(f)]	Bog/fen, wetlands, riparian, grassland/old-field, and woodland[(d)]
Glena cognataria	blueberry gray			S1	No	No	Heathlands, bogs, and pine barrens[(e)]
Hemileuca maia	barrens buckmoth			S1S2	No	No	Scrub oak-pine sand barrens and oak woods[(g)]
Hesperia leonardus	Leonard's skipper			S3	Yes	No	Grassland/old-field, shrubland, and woodland[(d)]
Itame sp. 1 nr. inextricata	barrens Itame (Cf I. Inextricata)			S1	No	No	Xeric pine-oak scrub[(d)]
Lethe eurydice	eyed brown			S3	Yes	No	Open sedge meadows and open wetlands[(d)]
Lycaena epixanthe	bog copper			S2	No	No	Acid bogs and wetlands containing cranberries[(c)]
Poanes massasoit	mulberry wing			S2	Yes	Yes[(f)]	Bogs, fens, wetlands, and riparian [(d)]
Speyeria atlantis	Atlantis fritillary			S3	Yes	No	Bogs, fens, forested wetland, riparian, grassland, and woodland [(d)]
Sphinx gordius	apple sphinx			S3	Yes	No	Bogs and deciduous forest [(g)]
Reptiles and Amphibians							
Acres crepitans	northern cricket frog		PE	S1	Yes	Yes[(e)]	Slow-moving creeks, pools, herbaceous and shrub/scrub wetlands, and bogs and fens in open country [(h)]
Clemmys guttata	spotted turtle			S3	Yes	Yes[(i)]	Slow-moving creeks, pools, wetlands, bogs, and fens [(d)]
Crotalus horridus	timber rattlesnake		PC	S3S4	Yes	No	Deciduous forest and rock outcrops[(c)]
Glyptemys insculpta	wood turtle			S3S4	Yes	Yes (e, i)	Low-gradient creeks, moderate-gradient medium sized rivers, forested wetlands, and herbaceous wetlands[(d)]
Heterodon platirhinos	eastern hognose snake			S3	Yes	No	Riparian, cropland/hedgerow, grassland/old-field, and woodland[(d)]
Lithobates pipiens	northern leopard frog			S2S3	Yes	Yes[(i)]	Springs, slow streams, marshes, bogs, ponds, canals, flood plains, reservoirs, and lakes[(d)].

Table 9-12. (contd)

Scientific Name	Common Name	Federal Status[a]	State Status[a]	State Rank[a]	Potentially Suitable Habitat Onsite	Observed or Likely to Occur Onsite	Habitat
Scaphiopus holbrookii	eastern spadefoot		PT	S1			Breeding – temporary pools; non-breeding – sandy, gravelly, or soft, light soils in wooded or unwooded terrain[d]
Terrapene carolina carolina	eastern box turtle			S3S4	Yes	Yes (e, i)	Wide variety of habitats from wooded swamps to dry, grassy fields[j]
Thamnophis sauritus	eastern ribbon snake			S3	Yes	Yes[e]	Slow-moving creeks, pools, wetlands, riparian, and bare rock/scree[d]
Birds							
Podilymbus podiceps	pied-billed grebe			S3B, S4N			Wetlands near open water[b]
Mammals							
Felis rufus	bobcat			S3S4	Yes	Yes[e]	Large forest tracts with thick undergrowth[d]
Glaucomys sabrinus	northern flying squirrel		PE	SU	No	No	Old-growth forests with moist soil[k]
Lontra canadensis	river otter			S3	Yes	Yes[f]	Lowland marshes and swamps interconnected with meandering streams and small lakes[l]
Microtus chrotorrhinus	rock vole			S2	Yes	No	Forested wetland, coniferous/mixed forests and woodlands[d]
Myotis lucifugus	little bown myotis			S1	Yes	Yes[e]	Hibernation in caves, tunnels, and mines; maternity sites in man-made structures, caves, and hollow trees[d]
Myotis leibii	eastern small-footed myotis		PT	S1B, S1N	Yes	No	Hibernation in caves and mines; maternity sites in forests[d, k]
Myotis septentrionalis	northern long-eared bat	FT		S1	Yes	Yes[e, m]	Hibernation in caves and mines; maternity sites in riparian, conifer/mixed late-successional forest[c, d]
Myotis sodalis	Indiana bat	FE	PE	SUB, S1N	Yes	Yes[n]	Hibernation in caves and mines; maternity sites in trees in upland and wetland forest and buildings[d, k]
Neotoma magister	Allegheny woodrat		PT	S3	No	No	Bare rock/talus/scree surrounded by unfragmented hardwood or mixed forest (d, k)
Perimyotis subflavus	tri-colored bat			S1	Yes	Yes[m]	Hibernation in caves and mines; maternity sites in tree foliage in riparian, upland woodland/grassland area[d]
Sorex palustris albibarbis	water shrew			S3	Yes	No	Stream and lake edges and boulders[c]
Communities							
	calcareous opening/cliff			S2	No	No	Calcareous cliffs, outcrops, and rocky slopes with variable vegetation composition[c]
hemlock (*Tsuga canadensis*)	hemlock palustrine forest			S3	No	No	Wetland forests dominated or co-dominated by eastern hemlock[c]

Table 9-12. (contd)

Scientific Name	Common Name	Federal Status[a]	State Status[a]	State Rank[a]	Potentially Suitable Habitat Onsite	Observed or Likely to Occur Onsite	Habitat
	herbaceous vernal pool			S3S4	Yes	Yes[o]	Seasonally fluctuating water levels, and variable herbaceous composition[c]
hemlock (*Tsuga canadensis*)	hemlock - mixed hardwood palustrine forest			S3S4	No	No	Wetland forests dominated by a mixture of conifer and hardwood species[c]
oak (*Quercus* spp.)	dry oak - heath woodland			S3	No	No	Dry sites dominated by various oak species[c]
leatherleaf (*Chamaedaphne calyculata*) – bog rosemary (*Andromeda polifolia*)	leatherleaf – bog rosemary peatland			S2S3	No	No	Bogs dominated by leatherleaf with bog rosemary associated[c]
leatherleaf (*Chamaedaphne calyculata*) cranberry (*Vaccinium oxycoccos and/or macrocarpon*)	leatherleaf – cranberry peatland			S2S3	No	No	Bogs dominated by leatherleaf, cranberry, and sphagnum moss[c]
little bluestem (*Schizachyrium scoparium*) - Pennsylvania sedge (*Carex pensylvanica*)	little bluestem - Pennsylvania sedge opening			S3S4	No	No	Dry acidic sites without invasion of woody plant species[c]
	low heath shrubland			S1	No	No	Sites dominated by huckleberry (*Vaccinium* spp.)[c]
pitch pine (*Pinus rigida*) rhodora (*Rhododendron canadense*) – scrub oak (*Quercus ilicifolia*)	pitch pine – rhodora - scrub oak woodland			S1	No	No	Part of the "Mesic till barrens complex" with pitch pine dominant in the overstory and rhododendron and scrub oak dominant in the understory[c]
pitch pine (*Pinus rigida*) – scrub oak (*Quercus ilicifolia*)	pitch pine – scrub oak woodland			S2S3	No	No	Sites with acidic, dry soils and drought-stressed trees of small stature where pitch pine is dominant and scrub oak is dominant in the understory[c]
red maple (*Acer rubrum*) – black gum (*Nyssa sylvatica*)	red maple – black gum palustrine forest			S3S4	Yes	Yes[p]	Wetland forest dominated by red maple or black gum[c]
red spruce (*Picea rubens*)	red spruce – mixed hardwood palustrine forest			S3	No	No	Wetland forests dominated by a mixture of conifer and hardwood species[c]

Table 9-12. (contd)

Scientific Name	Common Name	Federal Status[a]	State Status[a]	State Rank[a]	Potentially Suitable Habitat Onsite	Observed or Likely to Occur Onsite	Habitat
red spruce (*Picea rubens*)	red spruce palustrine forest			S3	No	No	Wetland forests dominated or co-dominated by red spruce[c]
scrub oak (*Quercus ilicifolia*)	scrub oak shrubland			S3	No	No	Sites without a tree layer dominated by scrub oak[c]
	Talus cave community			S2S4	No	No	None provided[c]
Virginia pine (*Pinus virginianus*)	Virginia pine – mixed hardwood shale woodland			S2	No	No	Dry shale slopes with southerly exposure dominated by Virginia pine and various hardwood tree species[c]

(a) Federal status FE = Federally endangered, FT = Federally Threatened; State status PE = Pennsylvania endangered, PT = Pennsylvania threatened, PC = Pennsylvania candidate, PR = Pennsylvania rare; NatureServe rank S1 = critically imperiled (five or fewer populations, especially vulnerable to extirpation), S2 = imperiled (20 or fewer populations, very vulnerable to extirpation), S3 = vulnerable (80 or fewer occurrences, vulnerable to extirpation), S4 = apparently secure (uncommon but not rare, some cause for long-term concern) (PNHP 2014-TN3975).
(b) Morris Arboretum 2014-TN3858.
(c) PNHP 2015-TN4431.
(d) NatureServe 2015-TN4432.
(e) Normandeau 2011-TN490.
(f) PNHP 2006-TN1570.
(g) Lotts and Naberhaus 2014-TN3857.
(h) NYNHP 2012-TN3909.
(i) PPL 1978-TN4036.
(j) Davidson College 2014-TN3863.
(k) PGC 2013-TN3845.
(l) Hardisky 2013-TN3386.
(m) Normandeau 2014-TN3828.
(n) FWS 2009-TN3868.
(o) PPL Bell Bend 2013-TN3377.
(p) Normandeau 2011-TN489.

Northern Long-Eared Bat (*Myotis septentrionalis*), Federally Threatened (FT)

The northern long-eared bat is a small insectivorous bat that is a true hibernator. It ranges over 39 states in the eastern and north-central United States, and has been considered to be more prevalent in the eastern portion of its range. The species predominantly overwinters in hibernacula that include caves and abandoned mines, but has also been found overwintering in other types of man-made habitat that resemble cave or mine hibernacula (e.g., railroad tunnels, sewers, aqueducts, and wells). The species arrives at hibernacula in August or September, enters hibernation in October and November, and leaves the hibernacula in March or April. A total of 112 of the 780 known hibernacula in the United States are found in Pennsylvania. Migration distances between hibernacula and summer roosts are typically 35 to 55 mi (78 FR 61046-TN3207).

Breeding occurs when males swarm hibernacula from late July in northern regions to early October in southern regions. Fertilization of a single egg occurs in the spring following hibernation (78 FR 61046-TN3207). During the summer, the species roosts singly or in colonies underneath tree bark or in cavities or crevices of both live and dead trees (Johnson et al. 2011-TN1852; 78 FR 61046-TN3207) but may also roost in colonies in man-made structures (e.g., buildings, under eaves, and behind shutters). In addition, males and non-reproductive females may roost in caves and mines during summer. Summer roost selection is similar to that of the Indiana bat. Adult females give birth to a single pup in May to early June. Volancy (i.e., flight) occurs in 21 days (78 FR 61046-TN3207).

Most hunting takes place on forested hillsides and ridges above the understory but under the canopy. Therefore, mature forests are an important foraging habitat for the species (78 FR 61046-TN3207; PGC and PFBC 2005-TN3815). The species consumes a variety of night-flying insects (e.g., moths, beetles, and flies) (78 FR 61046-TN3207; NatureServe 2015-TN4432).

The northern long-eared bat is known to occur within 21 mi of the Humboldt site (PNHP 2013-TN3900).

Eastern Small-Footed Myotis (*Myotis leibii*), State Threatened (PT)

The eastern small-footed myotis is a small, insectivorous bat that hibernates in caves primarily under large rocks or in crevices and mine shafts in the winter, and roosts in caves (or cracks and crevices in rock walls) and hollow trees (under bark) in the summer. Little is known about the species' reproductive behavior, habitat, or food requirements because very few have been captured during summer mist-netting surveys (PGC 2013-TN3845). The eastern small-footed myotis is known to occur within 21 mi of the Humboldt site (PNHP 2013-TN3900).

Scrub Oak Shrubland, State Rare (S3)

Scrub oak shrubland occurs in dry and acidic soil conditions, either on sandy soils or on thin soils over bedrock. It most commonly occurs on rocky ridgetops, and may be part of what is known as the ridgetop acidic barrens complex. It may also occur on sites where frequent or recent disturbance has removed the tree layer. Scrub oak shrubland also includes most of what is known as sand barrens. Sand barrens are areas of sandy (Morrison series) infertile soils that form extensive, gently rolling expanses of mostly scrub oak with occasional patches of blueberries (low heath shrubland) and grassy frost pockets (little bluestem/Pennsylvania sedge grassy opening) (Fike 1999-TN3816).

In scrub oak shrubland, scrub oak (*Quercus ilicifolia*) is the dominant shrub species, although low shrubs such as low sweet blueberry (*Vaccinium angustifolium*), lowbush blueberry (*V. pallidum*), teaberry (*Gaultheria procumbens*), sheep laurel (*Kalmia angustifolia*), black huckleberry (*Gaylussacia baccata*), dwarf upland willow (*Salix humilis*), Appalachian sand cherry (*Prunus pumila* var. *susquehanae*), and sweet-fern (*Comptonia peregrina*) sometimes occur beneath the taller shrub stratum. Tree species may occur as scattered individuals or as small patches of woodland. Characteristic tree species include quaking aspen (*Populus tremuloides*), chinquapin oak (*Quercus prinoides*), and pitch pine (*Pinus rigida*). Herbs include northern oatgrass (*Danthonia compressa*), bracken *fern* (*Pteridium aquilinum*), cow-wheat (*Melampyrum lineare*), big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), and orange-grass (*Hypericum gentianoides*) (Fike 1999-TN3816).

Sand barrens in Pennsylvania are found primarily in Huntingdon and Centre Counties (Fike 1999-TN3816) and Morrison series soils, upon which sand barrens develop, are not known to occur in Luzerne County (MCSS 2012-TN4012). Thus, sand barrens are not likely to occur in Luzerne County. However, ridgetop barrens occur throughout in Luzerne County (PNHP 2006-TN1570). As indicated above, the Humboldt Barrens natural area is located just to the east and northeast of the Humboldt site and supports a Ridgetop Dwarf Tree Forest community dominated by pitch pine and scrub oak (PNHP 2006-TN1570). Pitch pine and scrub oak were also observed along the northern edge of the Humboldt site during the site visit (NRC 2009-TN1889; NRC 2010-TN1891) and are thought to be an extension of the Ridgetop Dwarf Tree Forest natural community found in the Humboldt Barrens (PNHP 2006-TN1570). Scrub oak shrubland occurs on the Humboldt site (PDCNR 2012-TN3910) and is part of the pitch pine and scrub oak area (Ridgetop Dwarf Tree Forest community) observed there during the site visit (NRC 2009-TN1889; NRC 2010-TN1891). Barrens communities are important habitat for a variety of rare species, especially moths. The Humboldt Barrens were trapped for lepidopterans (butterflies and moths) in 2000. None were found and additional surveys are warranted (PNHP 2006-TN1570). The review team is not aware of any such inventories conducted on the Humboldt site; thus, the site could potentially support rare lepidopterans.

State-listed and State-ranked plant and animal species occur in the sphagnum-rich communities that occur at nearby Valmont Industrial Park, Dreck Creek Watershed, and Black Creek Flats, and in association with the acid seeps at Valmont Industrial Park (PNHP 2006-TN1570). These plant and animal species were not observed on the during Humboldt site visit (NRC 2010-TN1891). Thus, because the plant communities in sphagnum and seep areas on the Humboldt site appear not to be developed, as noted in the previous subsection, they are unlikely to support the important plant and animal species that occur at Valmont Industrial Park, Dreck Creek Watershed, and Black Creek Flats. However, the Humboldt site has not been surveyed and only anecdotal observations were made during the site visit. Thus, the presence of State-listed and State-ranked plant and animal species on the Humboldt site cannot be ruled out.

Building Impacts

The entirety of the 420-ac Humboldt site would be disturbed for construction of a new nuclear plant (PPL Bell Bend 2011-TN4010). Thus, approximately 349 ac of forest, 40 ac of barrens habitat, 6 ac of cropland/pasture, and 3.8 ac of wetland habitat (PPL Bell Bend 2011-TN4010; PPL Bell Bend 2013-TN3377) would be disturbed.

The makeup-water and blowdown pipelines would be collocated with or near an existing water line for most of its length and would thus largely be placed in previously disturbed areas. Approximately 14.3 mi of transmission-line would be built. Much of the route is through agricultural and forest land (PPL Bell Bend 2013-TN3377). Approximately 94 ac of forested habitat and 89 ac of non-forested habitat would be disturbed within the water-pipeline corridor, and approximately 66 ac of forested habitat and 276 ac of non-forested habitat would be disturbed within the transmission-line corridor (PPL Bell Bend 2011-TN4010).

There would be no impacts on wetlands associated with construction of the cooling-water intake pump house. Construction of the cooling-water intake, water-pipeline corridor, and transmission-line corridor would affect approximately 8.5 ac of wetland (PPL Bell Bend 2013-TN3377). Offsite wetland impacts total 8.1 ac and include 3.9 ac of riverine wetlands; 0.3 ac emergent wetland; 3.0 ac of wetlands, associated with freshwater ponds; and 0.9 ac forested/shrub wetland (PPL Bell Bend 2013-TN3377).

The amount of barrens habitat (Ridgetop Dwarf Tree Forest community [pitch pine/scrub oak]) within the Humboldt site (approximately 40 ac) is small compared to that within the adjacent Humboldt Barrens (PNHP 2006-TN1570; PPL Bell Bend 2013-TN3377). Development of the barrens habitat on the Humboldt site would isolate the Humboldt Barrens with development where the two adjoin, which would reduce its value as wildlife habitat, even though there would be no direct loss of Humboldt Barrens land. However, loss of this habitat from the Humboldt site would be expected to have an indirect impact on the Humboldt Barrens via partial isolation, which would be a minor overall impact considering that there are other similar barrens (Ridgetop Dwarf Tree Forest community [pitch pine/scrub oak]) habitats in Luzerne County (e.g., the 5,000- to 6,000-ac Arbutus Peak oak barrens complex located southeast of Wilkes-Barre, Stockton Mountain Barrens, Nescopeck Mountain Barrens, Wyoming Mountain Barrens) (PNHP 2006-TN1570).

Likewise, the scrub oak shrubland area that is part of the barrens habitat on the Humboldt site is likely small compared to the scrub oak shrubland area that composes a large part of the adjacent Humboldt Barrens (PNHP 2006-TN1570; PPL Bell Bend 2013-TN3377). Thus, loss of the scrub oak shrubland from the Humboldt site would be expected to have only a minor overall impact on this plant community, because the same habitat exists in the adjacent Humboldt Barrens and at the other barrens noted above that occur in Luzerne County (PNHP 2006-TN1570).

It is anticipated that wildlife mortality, disturbance, and displacement would be incurred to a much greater extent for upland forest than for wetland or riparian species on the Humboldt site based on the aerial extent of impacts on these habitats noted above. Impacts on wildlife at the Humboldt site would be noticeable, similar to those described for the proposed BBNPP site in Section 4.3.1.

Impacts on wildlife from habitat fragmentation associated with installation of the water-pipeline and transmission-line corridors at the Humboldt site have no parallel at the BBNPP site because there are no offsite facilities. However, collocating the water pipeline and transmission lines, to the extent practicable, within or adjacent to existing corridors would reduce such impacts (PPL Bell Bend 2013-TN3377).

Species adapted to early successional habitat would be lost from affected upland shrub/scrub habitats within proposed water-pipeline and transmission-line corridors. Such species may disperse into shrub/scrub habitats in adjacent areas, and colonize new shrub/scrub habitats created by installation of the water-pipeline and transmission-line corridors. Similarly, species adapted to forest/clearing interface environments within proposed water-pipeline and transmission-line corridors may be lost from the edge habitats destroyed by forest clearing, but may disperse into edge habitats in adjacent areas and colonize new edge habitats created by installation of the water-pipeline and transmission-line corridors. Thus, overall, water-pipeline and transmission-line corridor installation could pose minor adverse effects or could be beneficial for some species that inhabit early successional habitat or use edge environments. However, species dependent on interior forests could only disperse into contiguous forest habitats, which are likely less prevalent in adjacent areas and are not created by installation of these corridors. Thus, forest-interior wildlife may be locally affected to a greater extent than wildlife adapted to early successional or forest-edge habitats.

As noted above, the sphagnum and acid seep areas on the Humboldt site currently appear to lack plant communities characteristic of such areas that are present at the nearby Valmont Industrial Park, Dreck Creek Watershed, and Black Creek Flats (PNHP 2006-TN1570; PPL Bell Bend 2013-TN3377). Thus, it is also unlikely than many, if any, State-listed and State-ranked plant and animal species currently inhabit the sphagnum or acid seep areas on the Humboldt site, as they do at Valmont Industrial Park, Dreck Creek Watershed, and Black Creek Flats (PNHP 2006-TN1570). Consequently, the loss of small amounts of limited quality or developing sphagnum and acid seep habitat from the Humboldt site would be anticipated to have only a minor impact on any local populations of State-listed and State-ranked plant and animal species known to inhabit similar habitats in nearby areas.

The PGC (2012-TN3901) indicated that impacts on the Indiana bat, northern long-eared bat, and eastern small-footed myotis would be unlikely.

Operational Impacts

Impacts on terrestrial ecological resources from operation of a new nuclear plant at the Humboldt site would be minor and similar to those for the proposed BBNPP site as described in Section 5.3.1, including for consumptive-use mitigation and site-specific low-flow protection. The Humboldt site consumptive-use mitigation and site-specific low-flow protection would involve the same waterbodies as the BBNPP site. There may be minor differences in operational impacts because of factors such as climate, topography, and elevation. The staff's independent review did not identify any information specific to the Humboldt site that would contradict the conclusions for the BBNPP site in Section 5.3.1.

Cumulative Impacts

Overlaying the historic impacts in the Ridge and Valley ecoregion discussed in the site description above are the current projects listed in Table 9-10. Projects located within the geographic area of interest include the following:

- energy (e.g., SSES; Northeastern Power Co./McAdoo Cogen, waste anthracite coal as fuel source; Harwood and Fishbach oil plants; and other fossil-fuel plants, including Wheelabrator Frackville Energy Coal Plant, Moxie Freedom Project, and Foster Wheeler Mt. Carmel Cogen Coal Plant)
- wind farms (e.g., Locust Ridge I and II Wind Power Projects)
- solar energy projects
- pipelines
- a variety of industry (e.g., Kydex, Foam Fabricators, Safety Light, Weatherly Casting/Weatherly Plant [iron foundry])
- surface and subsurface mines (e.g., Spike Island coal refuse removal and Mt. Pisgah uranium mine)
- manufacturing (e.g., Cherokee Pharmaceutical Plant, Great Dane Trailers)
- food processing (e.g., Hershey Foods Corporation Hazleton Plant)
- natural areas (including State game lands, Locust Lake State Park, Nescopeck State Park) in Luzerne, Carbon, Snyder, Schuylkill, Columbia, and Northumberland within a 21-mi radius of the site (PNHP 2014-TN4013).

The development of most of these projects has or will further reduce, fragment, and degrade natural forests and wetland and floodplain habitat and decrease habitat connectivity. In contrast, the State game lands and parks protect such terrestrial resources in perpetuity. Reasonably foreseeable projects within the geographic area of interest that would affect terrestrial resources include the proposed Susquehanna to Roseland 500-kV transmission line. Reasonably foreseeable land conversions within the geographic area of interest that would affect terrestrial resources include the following:

- ongoing conversion of forest to disturbed lands for agriculture and other uses
- succession of open habitats to forest
- continued urbanization, whereby terrestrial habitats are converted to developed land (e.g., commercial and residential buildings, roads, and landfills)
- continued reclamation of abandoned surface mine lands.

Summary

Impacts on terrestrial ecology resources are estimated based on the information provided by PPL and the review team's independent review. Site preparation and development of the Humboldt site for a new nuclear plant and for the new transmission-line and water-pipeline corridors would affect approximately 509 ac of forest habitat, approximately 40 ac of barrens habitat (including State-ranked rare [S3] scrub oak shrubland), and approximately 12.3 ac of wetlands. The overall impact of these activities on habitat and wildlife would be noticeable and permanent. There are 96 Federally listed, State-listed, and State-ranked species and communities that potentially occur at the Humboldt site and associated offsite facilities that may be affected (Table 9-12). There are past, present, and future activities and land-use conversions in the geographic area of interest that have affected and would continue to affect habitat and wildlife in ways similar to site preparation and development for a new nuclear plant and offsite facilities.

The review team concludes that the cumulative impacts from past, present, and reasonably foreseeable future actions, including new nuclear facilities at the Humboldt site and associated offsite facilities, on baseline conditions for terrestrial ecological resources in the geographic area of interest would be MODERATE. Building and operating a new nuclear plant at the Humboldt site would be a significant contributor to the MODERATE impact.

9.3.3.4 Aquatic Resources

The following impact analysis includes impacts from building activities and operations on aquatic ecology resources at the Humboldt site. The analysis also considers cumulative impacts from other past, present, and reasonably foreseeable future actions that could affect aquatic resources, including the other Federal and non-Federal projects listed in Table 9-10. In developing this EIS, the review team relied on reconnaissance-level information to perform the alternative site evaluation in accordance with ESRP 9.3 (NRC 2000-TN614). Reconnaissance-level information is data that are readily available from regulatory and resources agencies (e.g., SRBC, FWS, PADEP, PFBC) and other public sources such as scientific literature, books, and Internet websites. It can also include information obtained through site visits (e.g., PNNL 2009-TN3667; NRC 2010-TN1891; NRC 2012-TN1890; NRC 2014-TN3639) and documents provided by the applicant.

The geographic area of interest for the assessment of the potential cumulative aquatic ecosystem impacts of building and operating a new reactor at the Humboldt site is the same as for the BBNPP site and includes the North Branch and the West Branch of the Susquehanna River Basin to their confluence and south to Conowingo Dam, as described in Section 7.3.2. As previously discussed in Section 9.3.3.2, the NRC staff also assumed that the SRBC would impose consumptive-use mitigation and site-specific low-flow protection requirements for a plant at the Humboldt site. Those impacts are also discussed below.

Affected Environment – Onsite and Supporting Infrastructure (Pipeline and Transmission-Line Corridors)

The Humboldt site is 12 mi south of SSES and just west of the City of Hazleton in Luzerne County (Figure 9-11). A new nuclear plant on the Humboldt site would draw cooling water from the North Branch of the Susquehanna River at a location approximately 2.5 mi downriver from Bell Bend (PPL Bell Bend 2013-TN3377). The water-intake/discharge pipeline corridor and the new/widened transmission-line corridor would be entirely within Luzerne County. Consumptive-use mitigation and site-specific low-flow protection releases would involve the same geographic areas and aquatic resources as described for the BBNPP site (Section 2.4.2).

The primary aquatic resources that would be affected by a new plant on the Humboldt site are the North Branch of the Susquehanna River, Stony Creek, Black Creek, and Lower Nescopeck Creek. This region of the North Branch of the Susquehanna River is similar to the BBNPP region for water quality and aquatic biota and is described in Sections 2.3.3 and 2.4.2, respectively. Humboldt Reservoir, which supplies drinking water to the City of Hazleton and other communities, spans 31.2 ac approximately 500 ft north of the site and would not be affected by the building of a nuclear plant on the Humboldt site (PPL Bell Bend 2013-TN3377).

Building a water-intake/discharge pipeline corridor for the water-intake and discharge structures and the installation of a new/widened transmission-line corridor would affect several small offsite streams. The creeks that would be affected by building a new plant on the Humboldt site are part of the Nescopeck Creek watershed. Stony Creek originates on the proposed site (Figure 9-14), flows eastward across the middle part of the site, and flows north-northeast to join Cranberry Creek, eventually flowing into Black Creek northwest of Hazleton. Black Creek originates northeast of Hazleton, generally flowing west, and then north to its confluence with Nescopeck Creek. Nescopeck Creek from this point flows northwest to the Susquehanna River. Cranberry, Black, Little Nescopeck, Nescopeck, and Stony Creeks are Category 4a streams, which have waters that are impaired for one or more designated uses and have total maximum daily loads established (PADEP 2014-TN3450). Small mine discharges affect Stony Creek and Black Creek. Sampling at the lower reach of Stony Creek showed acidic conditions, with the pH ranging from about 4.3 to 4.8. In Black Creek, pH ranged from 6.3 to 7.0 above the Gowen discharge and from 3.9 to 4.2 just below it (PADEP 2005-TN690). Aluminum, manganese, and acidity loads exceeded water-quality standards at many of the locations sampled in the watershed. The protective uses for the Black Creek and Stony Creek are not directly designated, but tributaries of Nescopeck Creek from PA Route 309 to the mouth, which includes both creeks, are designated for cold-water fish (PA Code 25-93-TN611).

Figure 9-14. Stony Creek on the Humboldt Site

Consumptive-Use Mitigation and Site-Specific Low-Flow Protection Areas

PPL would propose to use a consumptive-use mitigation and site-specific low-flow protection plan similar to that proposed for the BBNPP site (PPL Bell Bend 2014-TN3494); it is described in Section 2.2.2. The primary aquatic resources that would be affected by required consumptive-use mitigation and site-specific low-flow protection releases are Cowanesque Lake (Tioga County, PA), Cowanesque River (Tioga County, PA, and Steuben County, NY), and Moshannon Creek (Centre County, PA). These aquatic resources and their biotic communities are described in Section 2.4.2.

Recreationally Important Species

The North Branch of the Susquehanna River is a popular recreational fishing area. Species commonly caught include Smallmouth Bass, Walleye, and Muskellunge. These species are discussed in Section 2.4.2. Additional recreational species that could occur in the streams on the Humboldt site and along the water-intake/discharge pipeline corridor include Bluegill, Pumpkinseed, Redbreast Sunfish, Rock Bass, Black Crappie, White Crappie, Yellow Perch, Largemouth Bass, Channel Catfish, and bullhead catfish (PPL Bell Bend 2013-TN3377). The PFBC stocks Brown Trout and Brook Trout (*Salvelinus fontinalis*) every year in Nescopeck Creek well upstream from its confluence with Black Creek but does not stock them in Black Creek or Stony Creek (PFBC 2014-TN3471). It is not likely that a naturally reproducing trout population exists in Stony Creek at the Humboldt site (PPL Bell Bend 2010-TN3642).

Consumptive-use mitigation and site-specific low-flow protection releases would involve the same geographic areas and therefore the same discussion of recreationally important aquatic species as presented for the BBNPP site in Section 2.4.2.

Species of Historic Interest

American Shad is a species of considerable historical interest in the Susquehanna River Basin. Shad biology and restoration efforts in the Susquehanna River as well as the occurrence of American Shad in the waters within the consumptive-use mitigation and site-specific low-flow protection release areas are discussed in Section 2.4.2.3.

The American Eel, another fish species of historical interest, spends most of its life in freshwater and returns to the ocean to spawn. A large commercial eel fishery existed in the Susquehanna River until the early 1900s when dam construction blocked eel passage (Steiner 2000-TN1918). Efforts are under way to restore eels to the Susquehanna River above the Conowingo Dam (Minkkinen and Park 2011-TN1719). The PFBC has stocked American Eel fingerlings in the North Branch of the Susquehanna River and downriver from the confluence of the North and West Branches of the Susquehanna River (PFBC 2014-TN3468).

Non-Native and Nuisance Species

The zebra mussel, the Asian clam, the rusty crayfish, and the Flathead Catfish are four non-native nuisance species that have been recorded in sections of the Susquehanna River. In addition, two non-native plant species occur in the North Branch of the Susquehanna River near Bell Bend. Ecology III (2012-TN1645) found Eurasian watermilfoil and curly pondweed in the

Bell Bend pool and off Goose and Hess Islands. Didymo, a non-native colony-forming, large, single-celled alga, is not yet known to occur in the North Branch of the Susquehanna River. These non-native species and their potential effects on freshwater ecosystems are discussed in more detail in Section 2.4.2.3.

Federally and State-Listed Species

There are no Federally listed threatened or endangered aquatic species on or near the Humboldt site, in the North Branch of the Susquehanna River near the water-intake/discharge site, or along the water-intake/discharge pipeline corridor and new/widened transmission-line corridor routes in Luzerne County (FWS 2013-TN3847; PPL Bell Bend 2013-TN3377). The Pennsylvania-endangered and threatened aquatic species and PFBC candidate species are the same as those listed for the BBNPP site and are described in Section 2.4.2.3 and listed in Tables 2-21 and 2-22. There are no Federally listed threatened or endangered species in the waterbodies associated with consumptive-use mitigation or site-specific low-flow protection releases (FWS 2014-TN3967), and State-listed species are described for these waterbodies in Section 2.4.2.3 and listed in Table 2-23.

Building Impacts

The onsite aquatic resources have not been quantitatively characterized, but onsite stream impacts would affect 5,057 linear ft of the one small stream onsite (Stony Creek) (PPL Bell Bend 2013-TN3377). Table 9-11 summarizes expected land-use impact parameters for the Humboldt site, including the installation and operation of the water-intake/discharge pipelines and a new/widened transmission-line corridor. Section 9.3.3.2 discusses surface-water quality and assumed use of stormwater detention and infiltration ponds as well as conformance with the NPDES permit and required BMPs to control stormwater runoff. The impact on the aquatic ecology of the onsite and offsite streams should be minimal.

New cooling-water intake and discharge structures would be required for a new plant at the Humboldt site and new water-intake and discharge pipelines would need to be installed between the North Branch of the Susquehanna River and a new plant on the Humboldt site. Building the water-intake and discharge pipelines along the conceptual route as described in Section 9.3.3.1 may affect approximately 596 linear ft of streams, including parts of Black Creek and Little Nescopeck Creek (PPL Bell Bend 2013-TN3377). Impacts on aquatic resources would be minimized through the use of BMPs required by Federal, State, and local permits. PPL would not need to build or upgrade a railroad spur or access roads because those features already extend to the site (PPL Bell Bend 2013-TN3377).

The intake and discharge structure designs are assumed to be similar to those at the proposed BBNPP site (Section 3.2.2.2), and building impacts would be similar to those described for the BBNPP site (Section 4.3.2.1). The conceptual location of the intake and discharge structures would be approximately 2.5 mi downriver from the proposed BBNPP structures (PPL Bell Bend 2013-TN3377). This location is near the downriver end of the same deep-water pool that is the proposed site of the BBNPP intake and discharge structures; therefore, the aquatic impacts are likely to be similar to those described for the BBNPP structures (Section 4.3.2.1). Installation of the water-intake and discharge structures and associated dredging would result in some loss of benthic habitat in the North Branch of the Susquehanna River and temporary degradation of water quality due to localized turbidity and sedimentation effects. Use of cofferdams to facilitate in-water building activities and dredging would minimize the amount and transport of disturbed sediments. Predators that rely on vision to capture prey could be temporarily affected, but most motile aquatic organisms would likely avoid the area of in-water activities. Effects on aquatic biota would be short-term and localized and would be mitigated through the use of BMPs. Prior to commencement of dredging, sediments within the areas proposed for dredging would be characterized in accordance with Federal and State permitting procedures. PPL anticipates that no construction-related effluents from building the intake and discharge structures would enter aquatic resources and PPL would use BMPs to minimize runoff (PPL Bell Bend 2013-TN3377).

Approximately 0.7 mi of transmission-line corridor would need to be built and 13.6 mi would need to be upgraded to connect a new nuclear plant on the Humboldt site to the closest potential substation (PPL Bell Bend 2013-TN3377). The conceptual route may affect parts of Stony, Black, Nescopeck, Little Nescopeck, and Wapwallopen Creeks and some of their tributaries (PPL Bell Bend 2013-TN3377). Building or upgrading this transmission-line corridor may affect approximately 2,210 linear ft of streams (PPL Bell Bend 2013-TN3377). The severity of impacts would depend on the characteristics of the aquatic resources within the corridor, but would be minimized by the placement of footings outside of waterbodies, the use of BMPs during building to reduce sedimentation and erosion, and management of stormwater through NPDES compliance.

No building activities are planned for any of the offsite consumptive-use mitigation and site-specific low-flow protection release areas, except at the Rushton Mine. As previously discussed in Section 4.3.2.3, facility expansion activities should not affect aquatic resources.

Building a new nuclear plant on the Humboldt site, including the water-intake/discharge pipeline corridor and the new/widened transmission-line corridor, may affect approximately 7,863 linear ft of streams onsite and offsite (PPL Bell Bend 2013-TN3377).

Operational Impacts

The most likely effects on aquatic populations from the operation of a new nuclear unit at the Humboldt site would be the impingement and entrainment of organisms from the North Branch of the Susquehanna River. Assuming that a new reactor at the Humboldt site would use a closed-cycle cooling system that meets the EPA's Phase I regulations for new facilities (66 FR 65256-TN243), has a maximum through-screen velocity of 0.5 fps, and meets the appropriate EPA intake flow-to-source water volume criterion, adverse impacts at the population level of many North Branch of the Susquehanna River aquatic species from impingement and entrainment would not be anticipated. Because the intake structure for the proposed Humboldt unit would be in the same general habitat type as the proposed intake structure for the BBNPP unit, the potential effects from impingement and entrainment on aquatic resources in the North Branch of the Susquehanna River should be similar to those described for the BBNPP unit (Section 5.3.2). The North Branch of the Susquehanna River at the conceptual discharge location, which would be approximately 2.5 mi downstream from the proposed BBNPP discharge location, is within an area described as pool habitat eventually transitioning to run/glide habitat (Normandeau et al. 2010-TN1825). This habitat is similar to that at the location of the proposed BBNPP discharge, and therefore discharge effects are expected to be similar to effects described for the BBNPP unit. Maintenance activities onsite and in offsite corridors would follow BMPs required by Federal and State permits to minimize impacts on aquatic resources (PPL Bell Bend 2013-TN3377). Consequently, impacts on aquatic ecology due to operations at the Humboldt site are expected to be minor. The operational impacts on aquatic biota from the transmission lines would also be minor assuming that BMPs are used for the maintenance of the transmission-line corridor. The effects of water-intake and discharge system maintenance, and stormwater runoff are expected to be minor.

The NRC staff assumed the Humboldt unit would have the same requirements for consumptive-use mitigation and site-specific low-flow protection as those specified by the SRBC for the BBNPP unit, described in Section 2.2.2. Operational effects of consumptive-use mitigation and site-specific low-flow protection releases on aquatic resources at the Humboldt site would be expected to be similar to those for the BBNPP site as discussed in Section 5.3.2, and are expected to be minor.

Cumulative Impacts

In addition to the impacts from construction, preconstruction, and operation, the cumulative analysis also considers other past, present, and reasonably foreseeable future projects that could affect aquatic resources. A new plant built on the Humboldt site would rely on the North Branch of the Susquehanna River for cooling water and involve much of the river basin in consumptive-use mitigation and a site-specific low-flow protection release plan. Therefore, the geographic area of interest for the assessment of the potential cumulative aquatic ecosystem impacts of building and operating a new reactor at the Humboldt site is the North Branch and the West Branch of the Susquehanna River Basin to their confluence and south to Conowingo Dam. The Conowingo Dam is in Maryland approximately 3 mi upriver from Deer Creek, which is the general location of the tidal extent in the river (Normandeau and Gomez and Sullivan 2011-TN3681).

The major actions identified in Table 9-10 that would contribute to the potential cumulative impacts affecting the aquatic resources within the area of interest include historic anthropogenic activities, abandoned mine drainage, the operation of the existing SSES and other power-generation facilities within the defined geographic area of interest, increased urban/suburban development (creating increased runoff, increased sewage effluent, consumptive-water use), agricultural runoff, Marcellus Shale gas extraction, and climate change. The primary activities associated with the preconstruction, construction, and operation of a new nuclear plant at the Humboldt site that could interact with these actions include the impingement and entrainment of the North Branch of the Susquehanna River biota, thermal discharges and chemical releases into the river, the consumptive use of river water, and site-specific low-flow protection requirements. The staff considered these potential sources of impacts in its evaluation of the cumulative aquatic ecosystem impacts as described for the BBNPP site in Section 7.3.2.

Summary

Impacts on aquatic ecology resources are estimated based on the information provided by PPL, SRBC, FWS, the Commonwealth of Pennsylvania, and the review team's independent review. Properly siting the associated transmission line and switchyard; minimizing interactions with waterbodies and watercourses along the utility corridors; and use of BMPs during water-intake and discharge structure installation, pipeline installation, transmission-line corridor preparation, and tower placement would minimize building and operation impacts and are required by Federal and State permit requirements. As required by law, the SRBC would identify the requirements for consumptive-use mitigation and site-specific low-flow protection to avoid adverse effects from low flow events (SRBC 2012-TN2453). Thus, building and operational impacts on aquatic resources and Federally and State-listed species should be minor.

The review team concludes that the cumulative impacts on most aquatic resources in the region of building and operating the proposed plant on the Humboldt site combined with other past, present, and future activities would be MODERATE to LARGE, primarily from past actions, such as the building of dams in the watershed, abandoned mine drainage, and urbanization, but building and operating a new nuclear plant at the Humboldt site would not be a significant contributor to the cumulative impact.

9.3.3.5 Socioeconomics

For the analysis of socioeconomic impacts at the Humboldt site, the geographic area of interest is considered to be the 50-mi region centered on the site with special consideration of Luzerne and Schuylkill Counties. In evaluating the socioeconomic impacts of building and operating a nuclear power plant at the Humboldt site in Luzerne County, the review team undertook a reconnaissance survey at the site using readily obtainable data from the Internet or published sources.

The Humboldt site is located in Luzerne County, and the nearest community is Hazleton, which is located approximately 5 mi (8 km) east of the site. Conyngham (population 1,958 in 2010), Mahanoy City (population 4,647 in 2010), McAdoo (population 2,274 in 2010), West Hazleton (population 3,542 in 2010), Hometown (population 1,399 in 2010), Berwick (population 10,477 in 2010), Wilkes-Barre (population 41,498 in 2010), and Pottsville (population 14,324 in 2010) are other nearby communities. The largest communities located within the 50-mi radius of the Humboldt site include Allentown (population 118,032 in 2010), Bethlehem (population 74,982 in 2010), Reading (population 88,082 in 2010), and Scranton (population 76,089 in 2010). The review team drew upon USCB data, workforce data provided by PPL, and other State and Federal sources to evaluate the impacts of building and operations activities within a 50-mi (80-km) region and the two-county economic impact area made up of Luzerne and Schuylkill Counties.

For the Humboldt site, the review team employed a gravity model to estimate the distribution of in-migrating workers between cities located in the 50-mi region. The gravity model is a standard economic location model inspired by Newton’s law of gravitation to evaluate trade and migration patterns between competing countries, cities, or economies. The simplified model employed for this analysis measured the “gravitational pull” of each community surrounding the Humboldt site on in-migrants based on the population of the community divided by the square of the distance of that community from the site (Anderson 2010-TN1947). Each community was, in turn, assigned a value based on the calculation described above. These values were used to determine the proportion of the in-migrating population that would reside in each community. The gravity model evaluated all communities located within 10 mi of the Humboldt site and all communities with populations in excess of 5,000 located within the 50-mi region. The results of the gravity model for the Humboldt site indicate that 60.0 percent of the in-migrants would locate in Luzerne County, 17.4 percent in Schuylkill County, and 22.6 percent in other counties within the 50-mi region. Communities with the highest concentration of in-migrating workers identified by the gravity model include Hazleton, West Hazleton, Conyngham, Wilkes-Barre, and McAdoo.

Based on the results of the gravity model, the review team identified Luzerne County and the adjacent Schuylkill County as the economic impact area for the nuclear unit in Luzerne County and the bases of expected effects of in-migrating construction and operations workers and their families. Table 9-13 provides socioeconomic data for each county located within the economic impact area.

Table 9-13. Selected Socioeconomic Data for the Humboldt Site Economic Impact Area

	Luzerne	Schuylkill	Data Source
Population			
1980	343,079	160,630	(a)
1990	328,149	152,585	(a)
2000	319,250	150,336	(b)
2010	320,918	148,289	(c)
Vacant Housing Units			
1990	10,241	5,684	(a)
2000	13,999	7,276	(b)
2010	16,816	9,131	(c)
Total Housing Units			
1990	138,724	66,457	(a)
2000	144,686	67,806	(b)
2010	148,748	69,323	(c)
Workforce			
Employed	147,286	64,730	(d)
Construction	8,148	4,442	(d)
Unemployment Rate	7.0%	7.6%	(d)
Median Household Income	42,224	42,315	(d)
Education			
Total Schools	37 E, 19 E-M, 6 M, 6 E-M-H, 9 M-H, 10 H	16 E, 9 E-M, 6 M, 1 E-M-H, 4 M-H, 10 H	(e)
Student-to-Teacher Ratio	15.0	13.7	(e)
Sheriff and Police			
Law Enforcement Employees	640	268	(f)
Officers	572	245	(f)
Officer per 1,000 people	1.8	1.7	(f)
Emergency Services			
Firefighters	2,324	2,180	(g)
Firefighters per 1,000 people	7.2	14.7	(g)
Demographics			
White	94.0%	96.0%	(h)
Black	3.7%	3.1%	(h)
Hispanic or Latino Origin	5.4%	2.4%	(h)
Below Poverty Level	13.7%	11.9%	(h)

(a) USCB 1990-TN1869.
(b) USCB 2001-TN1873.
(c) UCSB 2011-TN1874.
(d) USCB 2011-TN1876.
(e) NCES 2013-TN4026.
(f) Pennsylvania State Police 2010-TN1868.
(g) USFA 2013-TN1867.
(h) USCB 2011-TN1875.
E=elementary school; M = middle school; H = high school

Physical Impacts

Many of the physical impacts of building and operation would be similar regardless of the site. Building activities can cause temporary and localized physical impacts (e.g., noise, odors, vehicle exhausts, vibration, shock from blasting [if used], and dust emissions). The use of public roadways, railways, and waterways would be necessary to transport construction materials and equipment. Offsite areas that would support building activities (e.g., borrow pits, quarries, and disposal sites) would be expected to be already permitted and operational.

Potential impacts from station operation include noise, odors, exhausts, thermal emissions, and visual intrusions (the latter are discussed under aesthetics and recreation). The new unit would produce noise from the operation of pumps, cooling towers, transformers, turbines, generators, and switchyard equipment. Traffic at the site also would be a source of noise. Any noise coming from the proposed site would be controlled in accordance with standard noise protection and abatement procedures. This practice also would be expected to apply to all alternative sites, including the Humboldt site. Good road conditions and appropriate speed limits would minimize the noise level generated by the workforce commuting to the alternative site.

The new unit at the Humboldt site would have standby diesel generators and auxiliary power systems. Permits obtained for these generators would ensure that air emissions comply with applicable regulations. In addition, the generators would be operated on a limited, short-term basis. During normal plant operation, the new unit would not use a significant quantity of chemicals that could generate odors that exceed odor threshold values. Access roads and appropriate speed limits would minimize the dust generated by the commuting workforce.

The building and operation of transmission lines to support the site would also have an aesthetic impact on the region. The review team concludes that the visual impact associated with site development and operation of one nuclear unit on this site would have a noticeable impact on the visual aesthetic resources in the area because plumes from the proposed site would be visible over a vast distance, the site is located adjacent to the Eagle Rock Country Club and the site is currently only partially developed, with two large commercial/industrial buildings located in the northeastern corner of the Humboldt site.

Based on the information provided by PPL and the review team’s independent evaluation, the review team concludes that the physical impacts of building and operating one nuclear unit on workers and the local public, buildings, and roads near the Humboldt site would be minor. The review team concludes that aesthetic impacts would be noticeable.

Demographic Impacts

The Humboldt site is located in Luzerne County, approximately 5 mi (8 km) west of Hazleton, Pennsylvania (population 25,340 in 2010). Conyngham (population 1,958 in 2010), Mahanoy City (population 4,647 in 2010), McAdoo (population 2,274 in 2010), West Hazleton (population 3,542 in 2010), Hometown (population 1,399 in 2010), Berwick (population 10,477 in 2010), Wilkes-Barre (population 41,498 in 2010), and Pottsville (population 14,324 in 2010) are other nearby communities. The largest communities located within the 50-mi radius of the Humboldt site include Allentown (population 118,032 in 2010), Bethlehem (population 74,982 in 2010), Reading (population 88,082 in 2010), and Scranton (population 76,089 in 2010). In 2010, Luzerne County's population reached 320,918, representing an increase in population of 0.5 percent from 2000 levels. As of 2010, the population density in Luzerne County was 360.4 persons per square mile compared to 283.9 persons per square mile for the Commonwealth of Pennsylvania. In 2010, the population of Schuylkill County was 148,289. The population density in Schuylkill County was 190.4 persons per square mile in 2010 (USCB 2011-TN1875).[6]

PPL estimated that the peak number of building workers would be 3,950 with an additional 363 operations workers onsite during the final phase of building activities (PPL Bell Bend 2013-TN3377). In the BBNPP ER, PPL indicated that staffing levels at each alternative site would be similar to those estimated for the BBNPP (PPL Bell Bend 2013-TN3377). In 2010, the total construction workforce available in the economic impact area was 12,590. While the construction workforce in the economic impact area is sufficient to meet the needs of the project, many of these workers are engaged in other activities and will not be available to participate in nuclear power plant construction at the Humboldt site. The review team therefore concludes that resident and commuting workers could meet the majority but not all of the building workforce needs. Thus, the review team has retained the 20 to 35 percent in-migration assumption presented in Sections 4.4.2 and 5.4.2. The review team has also adopted PPL's bounding assumption that 100 percent of the operations workforce would in-migrate into the area. The results of the gravity model calculations indicate that 60.0 percent and 17.4 percent of the in-migrating workforce population would reside in Luzerne and Schuylkill Counties, respectively. At these levels of in-migration, populations in Luzerne and Schuylkill Counties would grow by 0.4 to 0.6 percent and 0.3 to 0.4 percent, respectively.

If the facility is constructed and commences operation, the operational workforce would number approximately 363. They would already be at the site during the period of peak building-related employment and are included in the above analysis, meaning that there would be very little demographic impact during operations in any of the counties mentioned above. Based on the information provided by PPL and the review team's independent evaluation, the review team concludes that the demographic impacts of building and operating the nuclear unit at the Humboldt site would be minor.

Economic Impacts

The principal economic centers in the economic impact area include Back Mountain, Hazleton, Kingston, Mountain Top, Pottsville, and Wilkes-Barre. The USCB reports that the top five industries in the economic impact area in 2010 were educational, health, and social services (23.6 percent); manufacturing (15.5 percent); retail trade (13.7 percent); arts, entertainment, recreation, accommodation, and food services (7.3 percent); and professional, scientific, management, administrative and waste-management services (6.7 percent). Together, these

---

[6] The U.S. Census Bureau (USCB) data used in this section were obtained from American Community Survey (ACS) results released in 2011. During the preparation of this EIS, the results of the 2012 ACS were released in topical and regional data sets. The review team has examined the latest ACS data, and is not aware of any information that appears to be inconsistent with the earlier information sets and those sets projected from the earlier survey.

five industries accounted for 66.8 percent of the employment in the economic impact area in 2010 (USCB 2011-TN1876).

The review team determined that the impact of jobs associated with building would have a noticeable and beneficial impact on total employment in Luzerne County. The impact of 611 to 1,070 construction-related jobs and 281 operations jobs filled by in-migrating workers, as well as the 851 to 1,185 indirect jobs, would be minor and beneficial in the economic impact area. Note the estimated indirect jobs created as a result of building and operating a nuclear power plant at the Humboldt site. When a new job is added to an economy, that new (direct) job supports the creation of other (indirect) jobs. Every new direct job in a given area—in this case, a job building the plant at the Humboldt site—stimulates spending on goods and services. This spending results in the economic need for a fraction of another indirect job, typically in the service industries. The U.S. Department of Commerce BEA provided RIMS II regional multipliers for industry employment and earnings in the Bell Bend economic impact area. As noted in Section 4.4.2, the employment multiplier for construction jobs in the Bell Bend economic impact area is 1.73, meaning that for each construction job created a total of 1.73 jobs (including the direct job) would be supported in the two-county economic impact area. The employment multiplier for operations jobs during the building phase is 2.44 (BEA 2014-TN3624). For comparative purposes, the review team applied these multipliers to the Humboldt site economic impact area. The BEA employment multiplier is applied only to in-migrating workers because the BEA model assumes the direct employment of workers that already live in the area would have no additional impact on employment.

The review team assumed that tax revenue generated from sales and use taxes associated with construction and operation of a nuclear unit at the Humboldt site would be similar to those evaluated for the BBNPP site in Sections 4.4.3.3 and 5.4.3.3, with a similarly beneficial impact on revenues in the economic impact area. For the BBNPP site, property taxes are estimated by PPL at $2.4 million annually (PPL Bell Bend 2013-TN3377). Adjusting the property tax rate differential between Salem Township (16.544 mills) and Hazle Township (16.0376 mills) results in an annual property tax assessment of $2.3 million if the nuclear power plant is constructed at the Humboldt site. Hazle Township would receive approximately $109,000 of the annual property tax payments. The review team estimates that the proposed nuclear power plant would also generate $3.1 million annually in local earned income taxes throughout the region. It would also generate $224,276 in annual LST revenue for Hazle Township during the peak construction period and $18,876 annually during the operations phase (PDCED 2014-TN3915). In 2012, total revenue to Hazle Township was $4.9 million, indicating the addition of the nuclear power plant, and the resulting increase in property and LST tax proceeds, would result in a minimum 4.6 percent increase in revenues during the peak construction period and 2.6 percent growth over current levels during the operations period (PDCED 2012-TN3916).

The new unit would employ an operations workforce of 363 people who would earn $28 million annually (average annual salaries of $77,135) (PPL Bell Bend 2013-TN3377). The building workforce of 3,950 would collectively earn $279 million annually at its peak (average annual salaries of $70,720). As shown in Table 9-13, these salaries far exceed the median household incomes in the economic impact area ($42,224 in Luzerne County and $42,315 in Schuylkill County) (USCB 2011-TN1876). The in-migrating building and operations workforce would stimulate the creation of 851 to 1,185 additional indirect jobs within the economic impact area during the peak of employment during the building period. These indirect jobs would generate an additional $15.2 to $21.2 million annually in the economic impact area (average annual salary of $17,870) (PPL Bell Bend 2013-TN3377). In addition, PPL estimates that, within the 50-mi region, $260.8 million will be spent on materials, equipment, and outside services during the construction period and $9 million would be spent annually during operations (PPL Bell Bend 2013-TN3377). The economic multiplier effect of the increased spending by the direct and indirect workforce and the businesses serving PPL directly would increase the economic activity in the region, most noticeably in the communities near the Humboldt site.

Based on the information provided by PPL, and the review team's own independent evaluation, the review team concludes that the economic impacts of building and operating a new nuclear unit at the Humboldt site would similar to those estimated for the BBNPP site; impacts would be noticeable but not destabilizing in Luzerne County and minor in the 50-mi region. Tax impacts on Hazle Township would be noticeable but not destabilizing and beneficial.

Transportation Impacts

Primary access to the Humboldt site is from Pennsylvania SR 924 and I-81. Based on information provided by PPL, extensions and/or an upgrade to an existing rail spur would be required and new roads would be constructed to access the site (PPL Bell Bend 2013-TN3377). The review team expects that the transportation impacts from site development of a plant at the Humboldt site would be noticeable. The temporary (6-year) impact on transportation near the Humboldt site would be noticeable during shift changes but could be reduced through a number of mitigation strategies outlined in the BBNPP ER, including scheduling shift changes and deliveries during off-peak hours and improvements to local roads, intersections, and signals (PPL Bell Bend 2013-TN3377). PPL identified a number of mitigation strategies for the BBNPP ER, and the review team assumes that similar mitigation strategies would be identified for the Humboldt site. Any mitigation strategies must be agreed to by applicable PennDOT regions prior to PPL submitting final HOP engineering plans for review. Mitigation strategies that are agreed upon with PennDOT in the final approved TIS will be required as a condition of issuing an HOP (PPL Bell Bend 2013-TN3377).

In addition to congestion impacts, construction-related traffic will also result in emissions, traffic accidents, injuries, and fatalities. The heavy vehicles that transport construction-related equipment and materials and the autos carrying the commuting workforce to the Humboldt site will emit several pollutants, including CO, CO_2, NO_X, fine PM, volatile organic compounds, and SO_2. Construction-related traffic will also result in an increase in the number of accidents, injuries, and fatalities. The costs associated with these incidents include workers' compensation premiums, lost productivity, environmental remediation, property damage, fines and penalties, insurance premiums, and medical costs. As discussed in Sections 4.4 and 5.4, the review team expects the impacts of BBNPP construction and operation to be minor with respect to emissions and the number of traffic accidents. Impacts at the Humboldt site would be expected to be similar to those estimated for the BBNPP. Therefore, the socioeconomic impacts of emissions and traffic accidents would also be minor.

Operation impacts would be significantly lower than the building phase impacts of traffic due to the much smaller workforce and because roads would have been improved during site development. During the operations phase, traffic impacts would be minor.

Recreation Impacts

Recreation in the area includes 21 parks located in Luzerne County, including 9 state game lands, 3 state parks, 1 field site, 2 cultural sites, and 6 local parks (PPL Bell Bend 2013-TN3377). Impacts of the plant operations from the vantage point of local recreation areas would be minimal. There could be larger impacts at Cowanesque Lake because of the compensatory upstream water requirements during low-flow conditions. Impacts associated with the Humboldt site would be similar to those outlined for the BBNPP site in Section 5.4.4.2. The NRC staff concludes these impacts would be minor.

Housing Impacts

Within a 50-mi (80-km) radius of the Humboldt site, there were a total of 156,777 vacant housing units in 2010, with 16,816 of those located within Luzerne County (PPL Bell Bend 2013-TN3377; UCSB 2011-TN1874). Within the two-county economic impact area, there were 218,071 housing units and 25,947 vacant units in 2010 (UCSB 2011-TN1874). The housing figures presented in Table 9-13 do not include recreational vehicle parks, campgrounds, or hotels, and thus provide a lower bound of what would be available to house workers.

The review team compared the vacant housing units to the number of direct workforce households projected for the peak workforce years. Using the approach outlined in Section 4.5.2, the review team estimates the number of workforce households at 892 to 1,351 during peak workforce years. In the 50-mi radius surrounding the Humboldt site, 0.6 to 0.9 percent of the year 2010 vacant housing units would be needed to house in-migrating workers. In the economic impact area, 3.4 to 5.2 percent of the vacant housing units would be needed. In Hazleton, there were 11,936 housing units, and 1,891 (15.8 percent) were vacant in 2010 (USCB 2011-TN2072). The results of the gravity model estimate that the in-migrating workforce would require 17.1 to 25.9 percent of the vacant houses in Hazleton. The review team assumes that current residents who would not require additional housing would fill all of the indirect jobs.

The review team expects that the in-migrating workforce could be absorbed into the existing housing stock in the 50-mi (80-km) region around the Humboldt site and the economic impact area without a noticeable impact. Based on the information provided by PPL and the review team's independent evaluation, the review team concludes that the housing impacts of building and operating a nuclear unit at the Humboldt site would be minor.

Impacts on Public Services and Education

In-migrating construction workers and plant operations staff would impact local municipal water, wastewater-treatment facilities, and other public services in the region. These impacts would likely be in proportion with the demographic impacts experienced in the region, unless these resources have excess capacity or are particularly strained during building, which would decrease or increase the impact.

In Luzerne and Schuylkill Counties, 121 community public water systems have a total design capacity of 119.4 Mgd, average use of 58.0 Mgd, and excess capacity of 61.4 Mgd. Based on assumptions presented in Section 4.4.4.4, water use onsite and offsite by the workforce population during the peak building period would require 298,228 to 463,701 gallons per day or 0.2 to 0.4 percent of the design capacity for public water systems in the economic impact area. There are 39 wastewater/sanitary sewer treatment plants within the economic impact area with a collective wastewater flow of 107.9 Mgd (PPL Bell Bend 2013-TN3377). In addition, Dupont Borough recently completed construction on a $5 million sewer collection system. The in-migrating workers represent a small portion of the economic impact area population. Even if all in-migrating workers resided in Luzerne County, onsite and offsite wastewater generation would total less than 1 percent of the economic impact area's wastewater-treatment capacity.

Within the two-county economic impact area, there are 178 fire stations and 4,504 career, volunteer, and paid-per-call firefighters (Table 9-13). There are 7.2 and 14.7 firefighters per 1,000 people in Luzerne and Schuylkill Counties, respectively. In 2011, the national average rate of firefighters per 1,000 people was 3.5 (Karter and Stein 2012-TN1871). During the period when the peak construction workforce is present, 2,204 to 3,337 people would be expected to move into the economic impact area. To meet the demands placed on the fire protection network, an additional 21 to 32 firefighters would need to be hired based on the economic impact area average rate of 9.6 firefighters per 1,000 people. With that noted, the firefighter rates in the economic impact area far exceed the national average.

Within the economic impact area, there are 817 law enforcement officers, with officer rates per 1,000 people of 1.7 in Schuylkill County and 1.8 in Luzerne County (Pennsylvania State Police 2010-TN1868). Four to six law enforcement officers would need to be hired to maintain the current officer rate in the economic impact area of 1.7 per thousand people.

There are 12 hospitals located within the economic impact area. From 2010 to 2011, economic impact area hospitals provided 333,590 patient days of care and were operating at 65.0 percent capacity (PADOH 2012-TN2224). Based on the size and availability of medical services in the region, temporary construction workers would not overburden existing medical services. The review team concludes adverse impacts on medical services near the proposed site would be minor and temporary.

In the 2011 to 2012 school year, student enrollment in the economic impact area reached 68,135 (NCES 2013-TN4026). With a population of 469,207, there are 6.9 individuals for every student enrolled in schools within the economic impact area. Applying this ratio to the peak construction workforce population, the review team expects a peak building-related increase of approximately 320 to 485 new students in the economic impact area. The student-to-teacher ratio within the economic impact area is 14.6 to 15.0 for Luzerne County and 13.7 for Schuylkill County. As shown in Table 9-13, the student-to-teacher ratio in Schuylkill County is below the statewide average of 13.8, while the rate in Luzerne County exceeds the statewide average (NCES 2013-TN4026). When adding the influx of students generated during plant construction, student-to-teacher ratios increase only slightly from 14.6 to 14.7 within the economic impact area. With that noted, to keep student-to-teacher ratios at current levels within the economic impact area, schools would need to add 22 to 33 teachers. In the nearby Hazleton School District, student-to-teacher ratios exceed the statewide average. The student-to-teacher ratio for Hazleton High School is 15.9, and ratios in the Hazleton School District reach as high as 17.6 at the Drums Elementary/Middle School.

For the Hazleton Area School District, the review team estimates that student populations would grow by 178 to 269 students, thus expanding the total student population from the present enrollment of 10,301 to between 10,479 and 10,570. An influx of students of this magnitude would increase the district's student-to-teacher ratio from 15.1 to between 15.4 and 15.5 (NCES 2013-TN4026). In Pennsylvania, the statewide average student-to-teacher ratio is 13.8 (NCES 2013-TN4026). To keep student-to-teacher ratios at current levels after the influx of students, the review team estimates that the Hazleton Area School District would need to hire 12 to 17 teachers. Based on the analysis above, the review team has concludes that in-migrating students would have a minor impact on schools throughout the 50-mi region, with the exception of the Hazleton Area School District where the impacts would be noticeable but not destabilizing because of the temporary nature of the building-related impact. During operation, the impact on schools would be less because the number of in-migrating students would be lower, thus the impact would be minor.

Summary of Project-Related Socioeconomic Impacts

Physical impacts on workers and the general public include impacts on existing buildings, transportation, aesthetics, noise levels, and air quality. Social and economic impacts span issues of demographics, economy, taxes, infrastructure, and community services. On the basis of information provided by PPL and the review team's independent evaluation, the review team concludes that the impacts of building and operating a nuclear unit at the Humboldt site on socioeconomics would be SMALL and adverse for the 50-mi region with some exceptions. In Luzerne County near the Humboldt site, transportation impacts would be MODERATE during building-related shift changes but could be somewhat mitigated through a number of strategies outlined in the BBNPP ER, including scheduling shift changes and deliveries during off-peak hours and improvements to local roads, intersections, and signals. Any mitigation strategies must be agreed to by applicable PennDOT regions prior to PPL submitting final HOP engineering plans for review. Mitigation strategies that are agreed upon with PennDOT in the final approved TIS will be required as a condition of issuing an HOP (PPL Bell Bend 2013-TN3377). Impacts on aesthetics would be MODERATE because plumes from the proposed site would be visible over a vast distance, the site is located adjacent to the Eagle Rock Country Club, and the site is currently only partially developed, with two large commercial/industrial buildings located in the northeastern corner of the Humboldt site. In-migrating students would likely represent a SMALL impact on schools throughout the economic impact area with the exception of the Hazleton Area School District where the review team expects the impact to be MODERATE. The economic impact on the area economy and tax base during plant development and operation likely would be SMALL, except for the MODERATE and beneficial economic impact on Luzerne County and MODERATE and beneficial tax impacts on Hazle Township.

Cumulative Impacts

The review team concludes that the current and reasonably foreseeable projects listed in Table 9-10 with the greatest potential to affect cumulative socioeconomic impacts would be the SSES (located 12 mi north of the Humboldt site), Moxie Freedom Project (located 14 mi northwest of the Humboldt site), Northeastern Power Cogen Plant (proposed site located 6 mi southeast of the Humboldt site), the Spike Island Operation (located 15 mi northwest of the Humboldt site), planned improvements to Federal, State, and county roads and bridges, and other renewable energy projects, fossil-fuel operational energy projects, and natural gas drilling operations throughout the region. The projects with the greatest potential to affect cumulative socioeconomics impacts would be the proposed Northeastern Power Cogen Plant, the SSES, and planned improvements to Federal, State, and county roads and bridges. Other projects involve continuation of ongoing activities and are expected to result in little or no change in current levels of employment at existing establishments. Any resulting new development is expected to be consistent with controls in existing county comprehensive plans.

The review team determined that the cumulative socioeconomic effects of a nuclear power plant located at the Humboldt site and other past, present, and reasonably foreseeable projects would be SMALL with some exceptions. In Luzerne County near the Humboldt site, the cumulative transportation impacts would be MODERATE during the 6 years of construction, and traffic during shift changes at the nuclear plant would be a significant contributor to these impacts. PPL identified a number of mitigation strategies in the BBNPP ER, and the review team assumes that similar mitigation strategies would be identified for the Humboldt site. Any mitigation strategies must be agreed to by applicable PennDOT regions prior to PPL submitting final HOP engineering plans for review. Mitigation strategies agreed upon with PennDOT in the final approved TIS would be required as a condition of issuing an HOP (PPL Bell Bend 2013-TN3377). Cumulative aesthetic impacts would be MODERATE because plumes from the proposed site would be visible over a vast distance, the site is located adjacent to the Eagle Rock Country Club, and the site is currently only partially developed. The nuclear power plant would be a significant contributor to these aesthetic effects. Cumulative impacts associated with in-migrating students would represent a SMALL impact on schools throughout the economic impact area with the exception of the Hazleton Area School District, where the review team expects the impact to be MODERATE. The impacts of the nuclear power plant would be expected to be a significant contributor to these impacts. Cumulative physical impacts on roads of planned improvements to Federal, State, and county roads and bridges are expected to be MODERATE. However, the review team concludes that the incremental physical impacts on local road systems from building and operating a nuclear power plant at the Humboldt site would not be a significant contributor to these impacts. The cumulative economic impact on the area economy and tax base during plant development and operation would be expected to be SMALL, except for the MODERATE and beneficial economic impact on Luzerne County and MODERATE and beneficial tax impacts on Hazle Township. The nuclear power plant would be a significant contributor to these beneficial impacts.

9.3.3.6 Environmental Justice

To evaluate the distribution of minority and low-income populations near the Humboldt site, the review team conducted a demographic analysis of populations within the 50-mi region surrounding the proposed site in accordance with the methodology discussed in Section 2.6.1. The review team identified 1,909 census block groups within a 50-mi radius of the Humboldt site, 211 of which were classified as having aggregate minority populations. Of these minority populations, 17 are located in Luzerne County, and 2 are located in Schuylkill County. No aggregate minority populations are located in adjacent Carbon or Columbia Counties. A total of

9 of the 17 census block groups with aggregate minority populations are located in Hazleton within 10 mi of the Humboldt site. The highest concentrations of aggregate minority populations within the 50-mi region are located in Berks (64 census block groups), Lehigh (64 census block groups), and Northampton (28 census block groups) Counties. These groups are clustered around Reading (Berks County), Allentown (Lehigh County), and Bethlehem (Northampton County). Within the 50-mi region, 32 census block groups meet at least one of the two significance criteria outlined in Section 2.6 for black populations. Two census block groups meet the criteria for Asian populations, and 194 meet the criteria for Hispanic ethnicity (USCB 2011-TN2009).[7] Figure 9-15 shows the aggregate minority block groups within the 50-mi region surrounding the Humboldt site.

Figure 9-16 shows the location of low-income populations within the 50-mi region surrounding the Humboldt site. The review team identified 147 census block groups with low-income populations of interest. The closest low-income populations of interest are located in Hazleton. Of the 147 census block groups with low-income populations, 4 are located in Columbia County, 21 in Luzerne County, and 6 in Schuylkill County. The most significant concentration of low-income census blocks (13 census blocks) in Luzerne County is in Wilkes-Barre, Pennsylvania.

Almost all of the potential physical impacts of building and operation would occur within the vicinity of the Humboldt site. These physical impacts would not affect any of the populations of interest because they attenuate with distance, topography, and intervening foliage.

The review team also investigated for the presence of unique characteristics or practices in minority or low-income communities that could result in different socioeconomic impacts from the building and operation at the Humboldt site. The review team's analysis did not find any information suggesting that minority or low-income populations in the area were dependent on natural resources that would be adversely affected by a nuclear power plant at the Humboldt site. Finally, the review team did not identify any potential pathways by which any building or operations activity could affect any minority and low-income populations within the 50-mi region surrounding the Humboldt site.

The review team determined that, for the Humboldt site, although aggregate minority and low-income groups are located near the site, there would be no disproportionate and adverse impacts on minority or low-income populations from building and operating one nuclear unit.

Cumulative Impacts

The cumulative impacts portion of Section 9.3.3.5 details the projects that would contribute to the environmental justice impacts at the Humboldt site. The review team found no evidence that, in conjunction with a Humboldt site nuclear power plant, the traffic contributions of the SSES, Northeastern Power Cogen Plant, Susquehanna River bridge replacement projects, the

---

[7] The U.S. Census Bureau (USCB) data used in this section were obtained from American Community Survey (ACS) results released in 2011. During the preparation of this EIS, the results of the 2012 ACS were released in topical and regional data sets. The review team has examined the latest ACS data, and is not aware of any information that appears to be inconsistent with the earlier information sets and those sets projected from the earlier survey.

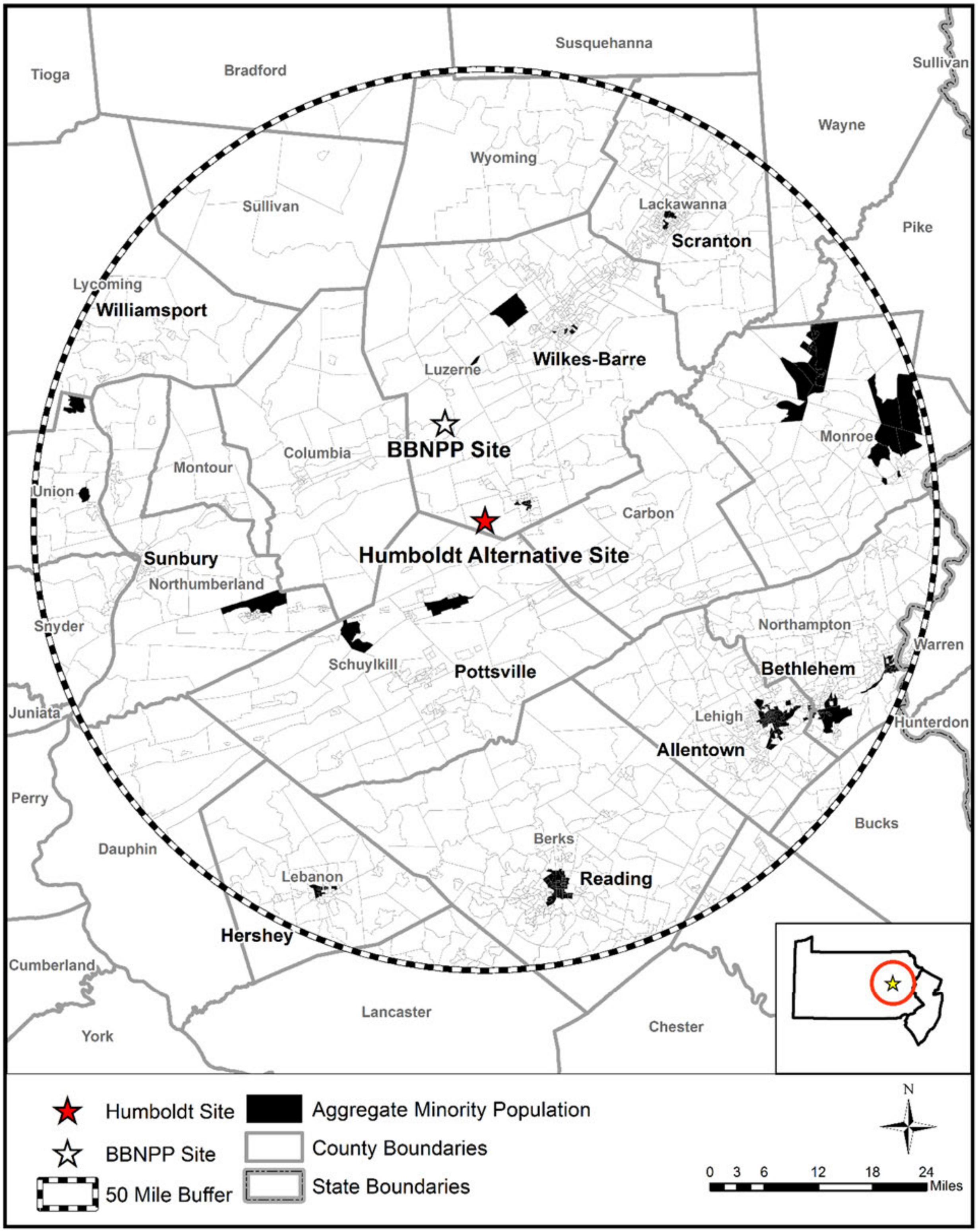

Figure 9-15. Aggregate Minority Block Groups within 50 mi of the Humboldt Site

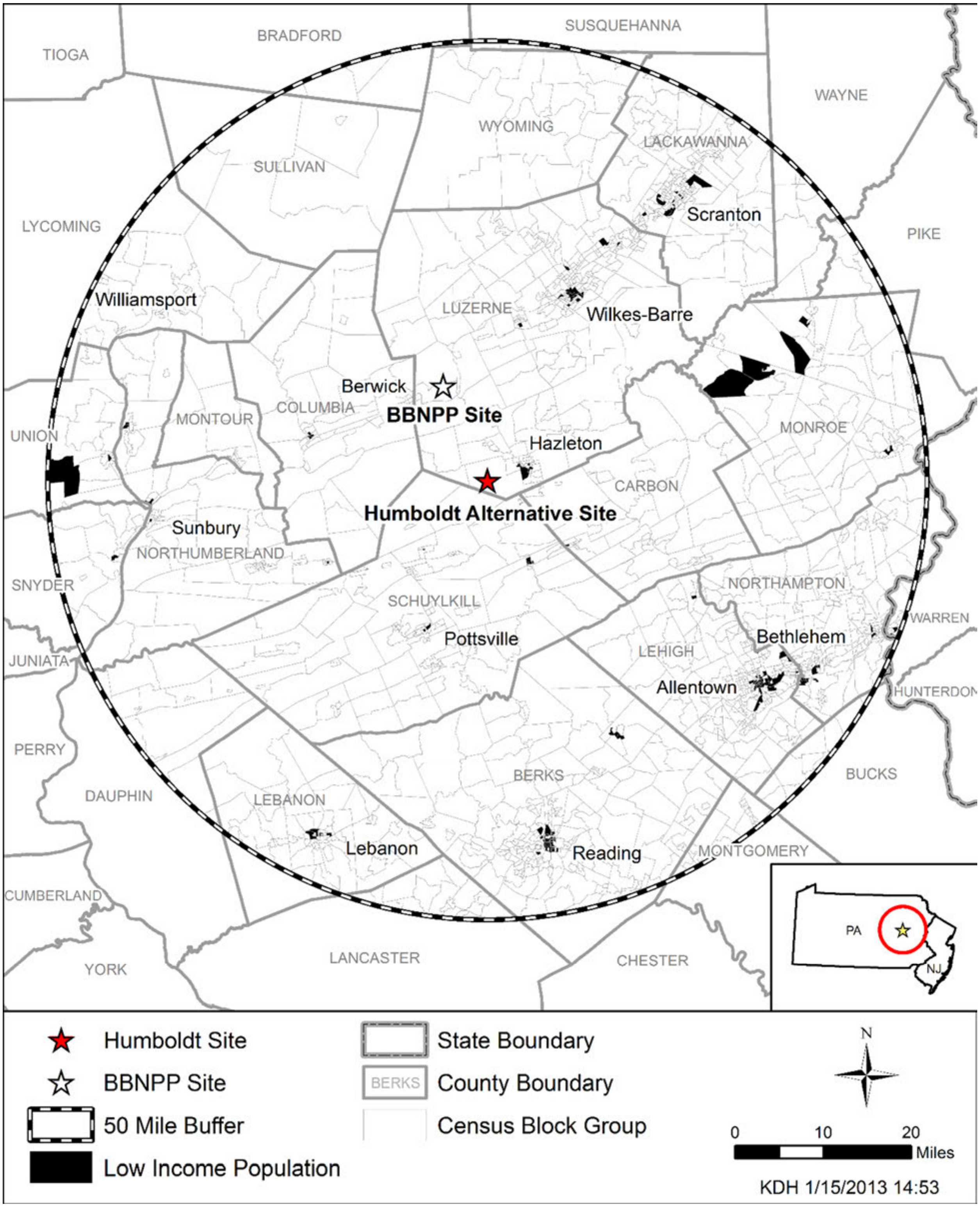

Figure 9-16. Low-Income Block Groups within 50 mi of the Humboldt Site

Spike Island Operation, and other renewable energy projects, fossil-fuel operational energy projects, and natural gas drilling operations throughout the region could impose disproportionately high and adverse effects on minority or low-income populations. The review team concludes that, in addition to other past, present, and reasonably foreseeable future projects, building and operating a nuclear power plant at the Humboldt site would not impose disproportionately high and adverse effects on minority or low-income populations.

9.3.3.7 Historic and Cultural Resources

The following analysis includes impacts on historic and cultural resources from building and operating a new nuclear generating unit at the Humboldt site. The analysis also considers other past, present, and reasonably foreseeable future actions that could cause cumulative impacts on cultural resources, including other Federal and non-Federal projects listed in Table 9-10. For the analysis of cultural resources impacts at the Humboldt site, the geographic area of interest is considered to be the onsite and offsite direct, physical and indirect, visual APEs associated with the proposed undertaking. This includes direct-physical APEs, defined as the onsite areas directly affected by site development and operation activities, as well as offsite areas such as railroad corridors, transmission lines, and new reservoirs. Indirect-visual APEs are also included and defined generally as a 1-mi radius buffer around the proposed direct-physical APEs, which encompasses the approximate maximum distance from which tall structures could be seen.

Reconnaissance activities in a cultural resource review have particular meaning. Typically such activities include preliminary field investigations to confirm the presence or absence of historic properties or cultural resources. However, in developing this EIS, the review team relied upon reconnaissance-level information to perform the alternative sites evaluation. In this context, reconnaissance-level information is data readily available from agencies and other public sources. It can also include information obtained through site visits. To identify historic and cultural resources at the Humboldt site, the review team relied on the following information:

- the revised BBNPP ER (PPL Bell Bend 2013-TN3377)
- the PHMC and PennDOT CRGIS
- NRC alternative sites visits in April 2009 and June 2010.

Site Description

The Humboldt site is a brownfield site located west of the City of Hazleton in Luzerne County, Pennsylvania. The project area encompasses steep-sloped uplands in the Wyoming Valley. Elevations within the project change by approximately 230 ft from the lowest points to the highest. Level ground is largely restricted to the eastern portions of the project area. There are no permanent streams within the Humboldt site. The nearest natural water sources are Stony Creek and other permanent and intermittent streams that drain adjacent valleys and empty into the Susquehanna River located to the north. There are extensive disturbances within the project area, including surface mining and more recent commercial development. The most extensive ground disturbances coincide with level areas to the east. Two large commercial/industrial buildings are located in the northeastern corner of the Humboldt site.

The history of northeastern Pennsylvania spans more than 10,000 years, beginning with the earliest Paleondian hunter-gatherers and continuing into the historic period (PHMC 2014-TN3938). Historic Native American tribes that occupied the region include the Delaware, and the Iroquois claimed the region. Luzerne County was established in 1786 from Northumberland County, in part to settle land disputes by settlers from Connecticut who established settlements in the fertile Wyoming Valley during the 1760s. Historically, the Susquehanna River was a major transportation route that connected the Wyoming Valley to southern Pennsylvania and the Chesapeake Bay.

The Humboldt project area is considered to have a low potential for prehistoric sites. The steep slopes within the project area would not have been likely settings for subsistent settlement activities and the lack of nearby water sources would have made lengthier occupations in the more level areas untenable. Furthermore, mining destroyed much of the project area, including most level areas. Had prehistoric archaeological sites been present, they are likely to have been destroyed. For similar reasons the potential for historic archaeological sites is limited. Based on information available on the PHMC/PennDOT CRGIS database, two large professional surveys for archaeological sites encompassing a total of 1,984 ac (803 ha) were conducted near the project area in 1993 by K. Beckman and J. Custer; reports are on file at the PHMC – Bureau of Historic Preservation, Harrisburg, Pennsylvania.

Two APEs for cultural resources were evaluated for the Humboldt site, the direct-effects APE and the indirect-effects APE. The direct-effects APE includes the area within the project area that may be impacted during preconstruction and/or construction activities. No previously recorded archaeological sites are reported within the direct-effects APE. The indirect-effects APE includes the direct-effects APE as well as a 1-mi (1.6-km) buffer around it. No historic properties (e.g., archaeological sites, buildings, or districts) listed in the NRHP are recorded within either APE.

Two historic structures and districts are located in Hazleton City, which is more than 4.5 mi (7.2 km) east of the Humboldt project area. The Markle Bank and Trust Company is a 1910 commercial building and the St. Gabriel’s Catholic Parish Complex consists of a series of contributing buildings dating from 1907 to 1937. In addition to these two NRHP-listed historic properties, the PHMC/PennDOT CRGIS database indicates that additional NRHP-eligible or NRHP-undetermined structures are located in Hazleton, all of which are more than 3.5 mi (5.6 km) from the Humboldt site. Because of the distance and the terrain of the Humboldt site, these historic properties are outside of the indirect-effects APE.

A portion of the historic Lehigh Valley Railroad runs adjacent to State Highway 924 to the south of the Humboldt project area within the 1-mi (1.6-km) indirect-effects APE. The railroad is a linear historic district that is listed as not having been assessed for NRHP eligibility in the Pennsylvania SHPO records. The railroad itself is not listed on the NRHP. However, elsewhere along the rail-line route, outside the indirect APE there are contributing structures that are significant and are NRHP-listed. Much of the nearby rail line runs along or adjacent to areas heavily disturbed by historic surface mining. The potential is minimal that there are NRHP-eligible structures associated with the Lehigh Valley Railroad within the Humboldt site direct-effects or indirect-effects APEs. Portions of the rail line were investigated during archaeological surveys adjacent to the Humboldt project area and no intact archaeological or architectural resources associated with the district were documented.

Building and Operation Impacts

To accommodate building a nuclear generating unit on the Humboldt site, up to 420 ac (170 ha) could be impacted through preconstruction and construction activities. In the event that the Humboldt site was chosen for the proposed project, identification of cultural resources would be accomplished through cultural resource surveys and consultation with the SHPO, tribes, and interested parties. The results would be used in the site planning process to avoid or mitigate cultural resources impacts. In the event significant cultural resources were identified by these surveys, the review team assumes that PPL would develop protective measures in a manner similar to those for the BBNPP site.

The main source of cooling water for the Humboldt site would be the Susquehanna River, which lies approximately 10 mi (16 km) to the north of the project area. To obtain the water from the Susquehanna River, new water-intake and discharge pipelines would need to be constructed. A conceptual plan for the proposed pipeline would include a 23.5-mi (37.6-km)-long, 120-ft (36.6-m)-wide right-of-way corridor. Archaeological sites and historic structures may be directly impacted by placement of the water pipeline. Building the pipeline may have temporary visual impacts to historic structures and historic districts. Above ground structures (e.g., pumping stations) may have permanent visual impacts to historic structures and historic districts. In the event that the Humboldt site was chosen for the proposed project, the review team assumes that PPL would conduct its water-pipeline-related cultural resource surveys and procedures in a manner similar to that for the BBNPP site.

Section 9.3.2.3.10 of the ER describes the transmission-line corridors (PPL Bell Bend 2013-TN3377). There are no existing transmission corridors connecting directly to the Humboldt site. However, there are 2 existing 500-kV transmission lines and 11 existing 230-kV transmission lines that could be connected to a plant at the Humboldt site (PPL Bell Bend 2013-TN3377). A new transmission corridor would need to be created to connect these lines to the Humboldt site. Archaeological sites and historic structures may be directly impacted by building the transmission lines and aboveground structures (e.g., power lines and support poles), which may have permanent visual impacts to historic structures and historic districts. In the event that the Humboldt site was chosen for the proposed project, the review team assumes that PPL would conduct its transmission-line-related cultural resource surveys and procedures in a manner similar to that for the BBNPP site.

Activities associated with building a nuclear power-generating unit and supporting facilities that can potentially destabilize important attributes of archaeological sites, historic structures, and other cultural resources include land clearing, excavation, and grading activities. The potential to impact significant cultural resources within the 420-ac Humboldt project area is minimal given the lack of recorded NRHP-listed historic properties, the low potential for prehistoric and historic sites due to the steep terrain, lack of water, and extensive disturbances within the direct-effects APE and indirect-effects APE. Placement of water pipelines and electrical transmission lines may impact archaeological sites and historic structures. In addition, visual impacts from aboveground structures associated with the water pipeline and transmission lines may result in significant alterations to the visual landscape within the geographic area of interest. The review team assumes that PPL would develop procedures and consult with the SHPO to develop a cultural resource management program to avoid or mitigate adverse impacts to significant archaeological sites, historic structures, and other historic properties during preconstruction and construction activities.

Impacts on historic and cultural resources from operation of a new nuclear generating unit at the Humboldt site would include those associated with the operation of a new unit and maintenance of water pipelines and electrical transmission lines. The review team assumes that the same procedures currently used by PPL would be used for onsite and offsite maintenance activities. Consequently, the incremental effects of the maintenance of transmission-line corridors and operation of a new unit and associated impacts on the cultural resources would be negligible for the direct-effects and indirect-effects APEs.

Cumulative Effects

The geographic area of interest for cumulative impacts on historic and cultural resources at the Humboldt site corresponds to the onsite and offsite direct (physical) and indirect (visual) APEs defined for the site. As indicated in Table 9-10, past actions in the geographic area of interest that could have affected historic and cultural resources in a manner similar to those associated with the building and operation of the new nuclear power plant and other project components include rural, agricultural, and industrial development and activities associated with these land-disturbing activities such as road development. Table 9-10 also lists past, present, and reasonably foreseeable projects and other actions that may contribute to cumulative impacts on historic and cultural resources in the geographic area of interest. No other activities in Table 9-10 in the geographic area of interest were identified that would significantly affect historic and cultural resources in a manner similar to those associated with the operation of a new nuclear power plant.

Summary

Cultural resources are non-renewable; therefore, the impact of destruction of cultural resources is cumulative. Based on the information provided by the applicant and the review team's independent evaluation, the review team concludes that the cumulative impacts from building and operating a new nuclear power plant on the Humboldt site would be SMALL. This impact level determination reflects the lack of known archaeological sites, historic structures, or other cultural resources within the direct-effects and indirect-effects APEs of the Humboldt site and the limited potential that unrecorded cultural resources might be present. If the Humboldt site were to be developed for a nuclear power plant, then cultural resource surveys of the APEs along with the APEs for waterlines and electrical transmission lines would need to be conducted, and PPL would assess and resolve adverse effects of the undertaking. Adverse effects could result in greater cumulative impacts.

9.3.3.8 Air Quality

The following impact analysis includes impacts from building activities and operations. The analysis also considers other past, present, and reasonably foreseeable future actions that affect air quality, including other Federal and non-Federal projects listed in Table 9-10. The geographic area of interest for the Humboldt site is Luzerne County, which is in the Northeast Pennsylvania-Upper Delaware Valley Interstate AQCR (40 CFR 81.55 [TN255]); these are the same county and AQCR as analyzed in Chapters 2, 4, and 5 for the proposed BBNPP site.

Emissions related to building and operating a nuclear power plant at the Humboldt would be similar to those at the BBNPP site, as described in Chapters 4 and 5. The air-quality attainment status for Luzerne County, as set forth in 40 CFR Part 81, reflects the effects of past and present emissions from all pollutant sources in the region. Luzerne County is designated as unclassifiable or in attainment for all criteria pollutants for which NAAQSs have been established (40 CFR 81.339 [TN255]). Luzerne County was designated as in attainment of the 1997 ozone standard on December 19, 2007 (72 FR 64948-TN2084), and is therefore considered a maintenance area with respect to the 1997 ozone standard. Maintenance areas require the state to submit a State Implementation Plan that provides for continued attainment for at least 10 years after achieving redesignation status. The State Implementation Plan was submitted by the PADEP and approved by the EPA (72 FR 64948-TN2084).

Federal actions taking place within maintenance areas must conform to the State Implementation Plan and are therefore subject to the EPA's General Conformity Rule (40 CFR Part 93-TN2495). Ozone precursor emissions from NRC-authorized construction and operation activities of a new plant at the Humboldt site would likely be similar to those analyzed for the proposed BBNPP site. As noted in Chapters 4 and 5, these emissions are below the de minimis rate for air conformity applicability. Therefore, a conformity determination would likely not be required for the Humboldt site.

Atmospheric emissions related to building and operating a nuclear power plant at the BBNPP site in Luzerne County are described in Chapters 4 and 5. Emissions of criteria pollutants were found to have a SMALL impact on air quality. In Chapter 7, the cumulative impacts of the criteria pollutants at the BBNPP site were evaluated and also determined to be SMALL.

Reflecting on the projects listed in Table 9-10, several energy-related and industrial projects are considered major sources of NAAQS criteria pollutants in Luzerne County or nearby counties within the AQCR. Any new projects would either have minimal emissions or be subject to permitting by the PADEP. Given that these projects would be subject to permitting requirements to ensure compliance with the NAAQSs, it is unlikely that the air quality in the region would degrade to the extent that the region is in nonattainment of NAAQSs.

The impact of Humboldt site development on air quality would be local and temporary. The distance from building activities to the site boundary would be sufficient to generally avoid significant air-quality impacts. There are no land uses or projects, including projects listed in Table 9-10, that would have emissions during site development that would, in combination with emissions from the Humboldt site, result in degradation of air quality in the region.

Emissions from operations at the Humboldt site would be intermittent. The air-quality impacts of existing major and minor sources are included in the baseline air-quality status. The cumulative impacts from emissions of effluents from the Humboldt site and the projects listed in Table 9-10 would be minor.

The cumulative impacts of GHG emissions related to nuclear power are discussed in Section 7.6 of this EIS. Impacts of the emissions are not sensitive to location of the source. Consequently, the discussion in Section 7.6 is applicable to a nuclear power plant located at the Humboldt site. The review team concludes that the national and worldwide cumulative impacts of GHG emissions are noticeable but not destabilizing. The review team further concludes that the cumulative impacts would be noticeable but not destabilizing with or without the GHG emissions of a nuclear power plant at the Humboldt site.

Cumulative impacts on air-quality resources are estimated based in the information provided by PPL and the review team's independent evaluation. Other past, present, and reasonably foreseeable future activities exist in the geographic areas of interest (local for criteria pollutants and global for GHG emissions) that could affect air-quality resources. The cumulative impacts on criteria pollutants from emissions of effluents from the Humboldt site, other projects, and existing sources would be minor.

The review team concludes that cumulative impacts from other past, present, and reasonably foreseeable future actions on air-quality resources in the geographic areas of interest would be SMALL for criteria pollutants and MODERATE for GHG emissions. Building and operating a new unit at the Humboldt site would not be a significant contributor to these impacts.

9.3.3.9 Nonradiological Health Impacts

The following analysis considers nonradiological health impacts from building and operating a new nuclear unit at the Humboldt site. Nonradiological health impacts at the Humboldt site are estimated based on information provided by PPL and the review team's independent evaluation. The analysis also includes past, present, and reasonably foreseeable future actions that could contribute to cumulative nonradiological health impacts on site workers (construction and operations workers) and members of the public, including other Federal and non-Federal projects and the projects listed in Table 9-10 within the geographic area of interest. For the analysis of nonradiological health impacts at the Humboldt site, the geographic area of interest is the site and immediate vicinity of the Humboldt site (~6-mi radius) and the associated transmission-line corridors. This geographic area of interest is based on the localized nature of nonradiological health impacts and expected to encompass all nonradiological health impacts.

Building activities with the potential to affect the health of members of the public and construction workers at the Humboldt site include exposure to dust, vehicle exhaust, and emissions from construction equipment; noise; occupational injuries; and the transport of construction materials and personnel to and from the site. The operations-related activities that may affect the health of members of the public and workers include exposure to etiological (disease-causing) agents, noise, EMFs, occupational injuries, and impacts from the transport of workers to and from the site.

Building Impacts

Nonradiological health impacts on construction workers and members of the public from building a new nuclear unit at the Humboldt site would be similar to those evaluated in Section 4.8 for the BBNPP site. During the site-preparation and building phase, PPL would comply with applicable Federal and State regulations on air quality and noise. The frequency of construction worker accidents is expected to be the same as that estimated for the BBNPP site. The Humboldt site is located in a rural area, and building impacts would likely be negligible on the surrounding populations, which are classified as medium- and low-population areas.

The review team concludes that the impacts on nonradiological health from building a new nuclear unit and associated transmission lines at the Humboldt site would be minimal.

Operational Impacts

Nonradiological health impacts on occupational health of workers and members of the public would include those associated with the operation of cooling towers and transmission lines as described in Section 5.8. Based on the configuration of the proposed new unit at the Humboldt site (see detailed site layout description in Chapter 3), etiological agents would not likely increase the incidence of waterborne diseases in the vicinity due to the temperature attenuation in the discharge pipe and diffuser and the temperature limitations outlined in the plant NPDES permit requirements for thermal discharge. Impacts on workers' health from occupational injuries, noise, and EMFs would be similar to those described in Section 5.8 for the BBNPP site. Noise would be monitored and controlled in accordance with applicable Occupational Safety and Health Administration regulations and effects of EMFs on human health would be controlled and minimized by conformance with National Electrical Safety Code criteria. Nonradiological impacts of traffic during operations would be less than the impacts during building. The review team concludes that nonradiological health impacts on onsite workers and the public from operating a new nuclear unit and associated transmission lines at the Humboldt site would be minimal.

Cumulative Impacts

Past actions in the geographic area of interest that have similarly affected nonradiological health of workers and members of the public include the development and operations of the Williams Cogeneration-Hazleton natural gas-fired peaking unit, located approximately 1.5 mi east of the Humboldt site; the Humboldt Industrial Park Wind Farm, located approximately 3 mi northeast of the Humboldt site; and the Northeastern Power Company coal waste plant, located approximately 6 mi southeast of the Humboldt site. No major current projects in the geographic area of interest would cumulatively affect nonradiological health in a similar way.

Proposed future actions that would affect nonradiological health in a way similar to development and operations of a new nuclear unit at the Humboldt site would include transmission-line creation and/or upgrading throughout the designated geographic area of interest and future urbanization.

In addition, the review team is aware of the potential climate changes that could affect human health. A recent compilation of the state of the knowledge in this area (GCRP 2014-TN3472) has been considered in the preparation of this EIS. Projected changes in the climate for the region include an increase in average temperature, increased likelihood of drought in summer, more heavy downpours, and an increase in precipitation, especially in the winter and spring, which may alter the presence of microorganisms and parasites. In view of the water source characteristics, the review team did not identify anything that would alter its conclusion regarding the presence of etiological agents or the incidence of waterborne diseases.

The review team concludes that the cumulative impacts on nonradiological health from building and operating a new nuclear power plant and associated transmission lines at the Humboldt site would be minimal.

Summary

Impacts on nonradiological health from development and operation of a new unit and associated facilities at the Humboldt site are estimated based in the information provided by PPL and the review team's independent evaluation. Although some past and future activities in the geographical area of interest could affect nonradiological health in ways similar to the building and operation of a new unit at the Humboldt site, those impacts would be localized and managed through adherence to existing regulatory requirements. The review team concludes that health impacts on construction workers and the public resulting from the development of a new nuclear unit at the Humboldt site would be minimal. The review team expects that the occupational health impacts on the operations employees of a new nuclear unit at the Humboldt site would be minimal. Similarly, impacts on public health from operating a new nuclear unit at the Humboldt site would be expected to be minimal. Finally, the review team concludes that cumulative impacts on nonradiological health from past, present, and future actions in the geographic area of interest would be SMALL.

9.3.3.10 Radiological Impacts of Normal Operations

The following impact analysis includes radiological impacts from building activities and operation of a new nuclear unit at the Humboldt site. The analysis also considers other past, present, and reasonably foreseeable future actions that affect radiological health, including other Federal and non-Federal projects listed in Table 9-10. As described in Section 9.3.3, the Humboldt site is a brownfield site located at the existing Humboldt Industrial Park, west of the City of Hazleton, Pennsylvania. The geographic area of interest is the area within a 50-mi radius of the Humboldt site. The existing SSES Units 1 and 2 are the only facilities that potentially could affect radiological health within this geographic area of interest. In addition, there are likely to be hospitals and industrial facilities that use radioactive materials within 50 mi of the Humboldt site.

The radiological impacts of building and operating the proposed U.S. EPR reactor at the Humboldt site include doses from direct radiation and liquid and gaseous radioactive effluents. Releases of radioactive materials and all pathways of exposure would produce doses well below regulatory limits to people and biota offsite. The impacts are expected to be similar to those estimated for the BBNPP site.

The radiological impacts of SSES Units 1 and 2 include doses from direct radiation and liquid and gaseous radioactive effluents. These pathways result in low doses to people and biota offsite that are well below regulatory limits, as demonstrated by the ongoing radiological environmental monitoring program conducted around SSES Units 1 and 2. The NRC staff concludes that the dose from direct radiation and effluents from hospitals and industrial facilities that use radioactive material would be an insignificant contribution to the cumulative impact around the Humboldt site. This conclusion is based on the radiological monitoring program conducted for the currently operating nuclear power plant.

Based on the information provided PPL and the NRC staff's independent analysis, the NRC staff concludes that the cumulative radiological impacts from building and operating the one proposed U.S. EPR unit and other past, present, and reasonably foreseeable projects and actions in the geographic area of interest around the Humboldt site would be SMALL.

9.3.3.11 Postulated Accidents

The following impact analysis includes radiological impacts from postulated accidents from operations for one nuclear unit at the Humboldt site. The analysis also considers other past, present, and reasonably foreseeable future actions that affect radiological health from postulated accidents, including other Federal and non-Federal projects and the projects listed in Table 9-10 within the geographic area of interest. As described in Section 9.3.3, the Humboldt site is a brownfield site; there are no nuclear facilities at the site. The geographic area of interest considers all existing and proposed nuclear power plants that have the potential to increase the probability-weighted consequences (i.e., risks) from a severe accident at any location within 50 mi of the Humboldt site. Facilities potentially affecting radiological accident risk within this geographic area of interest are SSES Units 1 and 2, Limerick Generating Station Units 1 and 2, Three Mile Island Nuclear Station Unit 1, and Peach Bottom Atomic Power Station Units 2 and 3. Other than the proposed BBNPP unit, no other reactors have been proposed within the geographic area of interest.

As described in Section 5.11.1, the NRC staff concludes that the environmental consequences of DBAs at the BBNPP site would be SMALL for a U.S. EPR reactor. DBAs are addressed specifically to demonstrate that a reactor design is robust enough to meet NRC safety criteria. The U.S. EPR design is independent of site conditions and the meteorology of the Humboldt site and BBNPP site are similar; therefore, the NRC staff concludes that the environmental consequences of DBAs at the Humboldt site would be SMALL.

Because the meteorology, population distribution, and land use for the Humboldt site are expected to be similar to the proposed BBNPP site, risks from a severe accident for a U.S. EPR reactor located at the Humboldt site are expected to be similar to those analyzed for the proposed BBNPP site. The risks for the proposed BBNPP site are presented in Table 5-20 and Table 5-21 and are well below the median value for current-generation reactors. In addition, as discussed in Section 5.11.2, estimates of average individual early fatality and latent cancer fatality risks are well below the Commission's safety goals (51 FR 30028-TN594). For existing nuclear power plants within the geographic area of interest (i.e., SSES Units 1 and 2, Limerick Generating Station Units 1 and 2, Three Mile Island Nuclear Station Unit 1, and Peach Bottom Atomic Power Station Units 2 and 3), the Commission has determined that the probability-weighted consequences of severe accidents are small (10 CFR Part 51, Appendix B, Table B-1-TN250).

Because of the NRC safety review criteria, it is expected that risks for any new reactors at any other locations within the geographic area of interest for Humboldt site would be below the risks for current-generation reactors and would meet Commission safety goals. The severe accident risk due to any particular nuclear power plant becomes smaller as the distance from that plant increases. However, the combined risk at any location within 50 mi of Humboldt site would be bounded by the sum of risks for all these operating nuclear power plants and would still be low. Although several plants have the potential to be included in the combination, the combined risk would still be low. On this basis, the NRC staff concludes that the cumulative risks of severe accidents at any location within 50 mi of the Humboldt site would be SMALL.

9.3.4 Seedco

This section covers the review team's evaluation of the potential environmental impacts of siting a new nuclear unit at the Seedco site located in Northumberland County, Pennsylvania. The following sections describe a cumulative impact assessment conducted for each major resource area. The specific resources and components that could be affected by the incremental effects of the proposed action if it were implemented at the Seedco site, and other actions in the same geographic area were considered. This assessment includes the impacts of NRC-authorized construction, operations, and preconstruction activities. Also included in the assessment are other past, present, and reasonably foreseeable Federal, non-Federal, and private actions that could have meaningful cumulative impacts when considered together with the proposed action if implemented at the Seedco site. Other actions and projects considered in this cumulative analysis are described in Table 9-14.

Table 9-14. Past, Present, and Reasonably Foreseeable Projects and Other Actions Considered in the Seedco Site Cumulative Analysis

Project Name	Summary of Project	Location	Status
Energy Projects			
SSES Units 1 and 2	Two 1,140-MW(e) boiling water reactors, Unit 1 was issued an operating license in 1982, Unit 2 was issued an operating license in 1984. Extension of operations of SSES Units 1 and 2 for an additional 20-year period beyond the end of the current license term, or until 2042 and 2044, respectively. Power uprates − currently operating at 3,952 MW(t), 1,300 MW(e)	29 mi NE of the Seedco site	Operational (NRC 2014-TN3964). Renewed operating licenses issued November 2009 (NRC 2014-TN3964). Units 1 and 2 approved for combined 48-MW(t) (1.4%) power uprate in 2001 and combined 463-MW(t) (13%) power uprate in 2008 (NRC 2012-TN1538; NRC 2012-TN1900).
Three Mile Island Nuclear Station, Unit 1	One 2,568-MW(t), 786-MW(e) pressurized water reactor, Unit 1 was issued operation license in 1974	45 mi SW of the Seedco site	Operational (NRC 2014-TN3964); renewed operating license issued in October 2009 (NRC 2014-TN3964).

Table 9-14. (contd)

Project Name	Summary of Project	Location	Status
Three Mile Island Nuclear Station, Unit 2	Unit 2 is in a non-operating status since the March 1979 accident	45 mi SW of the Seedco site	Shut down (NRC 2014-TN3964). Defueling was completed in April 1990. Plant is in a stable condition suitable for long-term management (post-defueling monitored storage) (NRC 2014-TN3285).
Limerick Generating Station, Units 1 and 2	Two 3,514-MW(t), 1,134-MW(e) boiling water reactors; Unit 1 was issued operation license in 1985, Unit 2 was issued operation license in 1989	62 mi SE of the Seedco site	Operational (NRC 2014-TN3964). Renewed operating licenses issued October 2014 (NRC 2014-TN4050). Units 1 and 2 approved for combined 260-MW(t) (17%) power uprate in 2011 (NRC 2012-TN1538). Water withdrawals from the Schuylkill River and Wadesville Mine pool were approved in May 2013 (DRBC 2013-TN3345).
Limerick Nuclear Power Plant demonstration project	Project will allow Exelon to put additional water into the Schuylkill River from a reservoir and an abandoned coal mine	62 mi SE of the Seedco site	The Delaware River Basin Commission approved docket May 8, 2013 (DRBC 2013-TN3345).
Peach Bottom Atomic Power Station, Units 2 and 3	Two 3,514-MW(t), 1,112-MWe boiling water reactors, Unit 2 was issued operation license in 1973, Unit 3 was issued operation license in 1974	72 mi SE of the Seedco site	Operational (NRC 2014-TN3964); renewed operating licenses issued in 2003 (NRC 2014-TN3964).
Peach Bottom Atomic Power Station, Unit 1	200-MW(t), high-temperature, gas-cooled reactor operated from June 1967 to final shutdown on October 31, 1974	72 mi SE of the Seedco site	Shut down (NRC 2014-TN3964). All spent fuel has been removed and the spent fuel pool is drained and decontaminated; Unit 1 is in SAFSTOR status (NRC 2014-TN3346).
Intelliwatt Renewable Energy	13-MW biomass (wood) energy	Adjacent	Proposed, secured 4.9 million state loan for construction in 2010 (IntelliWatt 2014-TN4037).
Good Spring	Originally planned to be an IGCC however in May of 2012 EmberClear announced the plant would be changed to a 300-MW NGCC plant	11 mi S of the Seedco site	Proposed, under development (Tyr Energy 2015-TN4361).

Table 9-14. (contd)

Project Name	Summary of Project	Location	Status
Fishbach Plant	28–MW oil-fired generation facility	16 mi SE of the Seedco site	Operational (PPUC 2015-TN4419).
Shamokin Dam Project	4.5-MW hydroelectric power, added to the already existing USACE Shamokin Dam	17 mi W of the Seedco site	Application for preliminary permit submitted Aug. 2011 to FERC (76 FR 52656-TN1218).
Panda Hummel	Converting retired Sunbury coal plant to 3 NGCC generating burners capable of producing 1,064-MW power	17 mi W of the Seedco site	Application process begun (PADEP 2015-TN4350); NPDES permit obtained (PADEP 2015-TN4351).
Montour Power Plant	1,504-MW coal power plant	22 mi NW of the Seedco site	Operational (Talen 2015-TN4412).
Bucknell University Gas Combined Heat and Power Plant	5-MW dual-fuel turbine generator set (natural gas first, oil second); generates thermal energy in heat-recovery steam generators and electricity	23 mi NW of the Seedco site	Operational (Bucknell University 2014-TN3737).
White Deer Energy Project	7-MW tire-derived energy	27 mi NW of the Seedco site	Application submitted Oct. 2011 to the PADEP (White Deer Energy 2012-TN1188; White Deer Energy 2013-TN4035). Project terminated January 2014 (PADEP 2014-TN4366).
Tenaska Lebanon Valley Generating Station	Up to 950-MW natural-gas facility	28 mi S of the Seedco site	Proposed. Construction scheduled in 2015; expected online in 2018 (Tenaska 2014-TN3533).
Harwood Plant		30 mi NE of the Seedco site	Operational ().
Panda Patriot Power Plant	829-MW (NGCC) generating station	33 mi NW of the Seedco site	Proposed. Formerly Moxie Patriot Power Plant, was acquired by Panda Power in 2013; projected commercial operations start date is 2016 (PPF 2013-TN3374).
Jenkins Plant	27.6–MW oil-fired generation facility	50 mi NE of the Seedco site	Operational (PPUC 2015-TN4419).
Brunner Island Power Plant	1,411-MW three-unit, coal-fired plant (Talen Energy-owned)	48 mi S of the Seedco site	Operational (EPA 2014-TN3531; Talen 2015-TN4413).

Table 9-14. (contd)

Project Name	Summary of Project	Location	Status
Blossburg Generating Station	Gas plant	68 mi NW of the Seedco site	Operational (EPA 2014-TN3744).
Eureka Resources Wastewater Treatment Facilities	Fracking wastewater treatment	Two sites: 67 mi N of the Seedco site (new construction) and 42 mi NW (operational since 2008)	Construction began in March of 2013 (Eureka Resources 2013-TN2615). Became operational in October 2013 (Williams 2013-TN3613; Eureka 2014-TN3673). Industrial waste permit (PA Bulletin 2014-TN3501; Lowenstein 2013-TN3510).
Koppers Susquehanna Waste Plant	The facility's product lines include pressure-creosoted railroad ties, bridge timbers, switch ties, and crossing panels	33 mi NW of the Seedco site	Operational (EPA 2014-TN3745).
Viking Energy of Northumberland Waste Plant	18-MW biomass power-generation facility	19 mi NW of the Seedco site	Operational (EPA 2014-TN3738; Biomass Magazine 2014-TN3923).
Other fossil-fuel operational energy projects	Numerous operating fossil-fuel power-generating stations such as Wheelabrator Frackville Energy Coal Plant, Foster Wheeler Mt. Carmel Cogen Coal Plant, Northeastern Power/McAdoo, Northwest Natural Gas Portfolio (Hazleton), Saint Nicholas Cogeneration Project, Gilberton Power Co.	Throughout the region	Operational (EPA 2012-TN1193; EPA 2012-TN1192; Red Rock 2012-TN1602; Clearfield 2015-TN4393; Starwood 2015-TN4394; EPA 2014-TN3507; EPA 2014-TN3500; EPA 2014-TN3735; EPA 2014-TN3736).
Wind-energy projects	Wind-power-generating projects including Locust Ridge Wind Farms	Throughout the region	Operational (Iberdrola Renewables 2012-TN1194).
Solar energy projects	Various solar power-generating projects (e.g., Romark PA Solar, Masser Farms Realty Solar, PA Solar Park, Pocono Raceway Solar Project)	Throughout the region	Operational (EPA 2014-TN3339; Masser 2014-TN3340; CED 2015-TN4355; EDF 2012-TN4356).
Hydropower energy projects	Safe Harbor, Goodyear Lake, York Haven, Muddy Run, Conowingo, and Holtwood. Proposed: Francis Walter Hydroelectric Project	Throughout the region	Operational (Safe Harbor 2012-TN1604; Enel 2012-TN1603; Olympus 2012-TN1600; Exelon 2012-TN1596; Exelon 2012-TN1595; Talen 2015-TN4414). Proposed (76 FR 73619-

Table 9-14. (contd)

Project Name	Summary of Project	Location	Status
			TN3621; FERC 2013-TN3622).
Susquehanna-Roseland 500-kV transmission line and other transmission lines in the region	500-kV power transmission lines	Throughout the region	Operational, May 2015 (PPL 2015-TN4263).
Marcellus gas pipelines	Numerous natural-gas transmission pipelines including Diamond East Pipeline, PennEast Pipeline, Constitution Pipeline	Throughout the region	Proposed (Clean Air Council 2015-TN4367).
Leidy to Long Island Expansion Project	Natural gas transmission pipeline	3.4 mi of pipeline in Lycoming County (Hughesville Loop) and 5.3 mi in Luzerne County (Dorrance Loop); 11.5 mi in Luzerne and Monroe Counties (Franklin Loop)	Construction began in July 2015 (FERC 2015-TN4348).
Sunbury Pipeline	Natural gas transmission pipeline	35-mi long, will originate in Lycoming County and end at Shamokin Dam	Proposed; filed application with FERC in July 2015 (FERC 2015-TN4349).
Atlantic Sunrise Project	Natural-gas transmission pipeline	Throughout the region in Columbia and Luzerne Counties	Includes Central Penn pipeline; FERC process has begun and construction is anticipated for summer 2016 (Williams 2014-TN3614).
Mining Projects			
Spike Island operation	Coal refuse removal	32 mi NE of the Seedco site	Application pending; water permit pending with SRBC (SRBC 2012-TN1196).
Various surface and subsurface mining projects	Numerous operating anthracite and stone/quarry mining facilities such as UAE Coal Corp./Harmony mine, Knorr Cont. Inc./Montour Twp. Plant	Throughout the region	Operational (EPA 2012-TN1289; EPA 2012-TN1290; EPA 2012-TN1197; EPA 2012-TN1198).
Mt. Pisgah uranium deposit	Uranium mines	40 mi NE of the Seedco site	Test mines conducted in the 1950s, never developed commercially (Klemic and Baker 1954-TN1998).

Table 9-14. (contd)

Project Name	Summary of Project	Location	Status
Various Marcellus natural-gas projects	Natural-gas extraction sites	29+ mi N and NW of the Seedco site	Operational and Proposed (SRBC 2015-TN4358; SRBC 2013-TN1999; PDCNR 2012-TN3505).
Various acid mine drainage and abandoned mine remediation	Mine remediation	Throughout the region	Ongoing (PADEP 2014-TN3503; PADEP 2005-TN690; PADEP 2014-TN3504).
Transportation Projects			
Susquehanna River transportation projects	Bridge replacements, road, traffic, and pedestrian projects	Throughout the region	Ongoing (PennDOT 2014-TN4359).
Parks and Aquaculture Facilities			
Shikellamy State Park	Activities include picnicking, boating, fishing, biking, and hiking	16 mi NW of the Seedco site	Development unlikely in this park (PDCNR 2012-TN1207).
Milton State Park	Activities include picnicking, boating, fishing, and hiking	25 mi NW of the Seedco site	Development unlikely in this park (PDCNR 2012-TN1206).
Other state parks	Public recreational activities: various operating State parks such as R.B. Winter State Park, Ricketts Glen State Park, Sand Bridge, McCalls Dam, Swatara, Locust Lake, Tuscarora, Nescopeck, Ricketts Glen, Susquehanna, Loyalsock Township Riverfront Park	Throughout ROI	Development unlikely (PDCNR 2012-TN1288; PDCNR 2012-TN1199; PDCNR 2012-TN1287; PDCNR 2012-TN1203; PDCNR 2012-TN1204; PDCNR 2012-TN1200; PDCNR 2014-TN3520; PDCNR 2014-TN3518; PDCNR 2014-TN3519; Van Auken 2012-TN3986).
Other State Game Lands	Public recreational activities	Throughout ROI	Development unlikely in these areas (PGC 2012-TN1223).
Other Actions/Projects			
Assorted flood control projects	Construction of levees, floodwalls, closure structures, and interior drainage structures	Throughout the region	Ongoing (PADEP 2014-TN3502).
Various wastewater-treatment plant facilities	Sewage treatment	Throughout the region	Operational
Various hospitals and industrial facilities that use radioactive materials	Medical and other industrial isotopes	Throughout the region	Operational
Safety Light Corporation	Manufacturing, former user of radioactive materials	18 mi NE of the Seedco site	Superfund site. Cleanup of radioactive waste in process (NRC 2012-TN1211).

Table 9-14. (contd)

Project Name	Summary of Project	Location	Status
Procter and Gamble Mehoopany Mill	Paper products and natural-gas power generation for facility use	59 mi NE of the Seedco site	Operational (EPA 2012-TN1212).
US Gypsum/Ancillary Improvements	660,000-ft^2 wallboard manufacturing facility. Use synthetic gypsum generated as flue gas desulfurization byproduct at the adjacent Montour plant	22 mi NW of the Seedco site	Operational (Walbridge 2012-TN1213; EPA 2014-TN3499).
Cherokee Pharmaceutical Plant	Merck-owned steam-generation (natural gas) facility for pharmaceutical production	14 mi NW of the Seedco site	Operational (EPA 2012-TN1214).
Great Dane Trailers	Trailer manufacturing	13 mi NE of the Seedco site	Operational (Great Dane 2014-TN3514).
Benton Foundry	Iron foundries	34 mi NW of the Seedco site	Operational (EPA 2012-TN1215).
Foam Fabricators Inc./Bloomsburg Plant	Polystyrene foam product manufacturing	20 mi NE of the Seedco site	Operational (EPA 2012-TN1216).
KYDEX	Unlaminated plastics film and sheet	19 mi NE of the Seedco site	Operational (EPA 2012-TN1217).
Jersey Shore Steel Company	Blast furnace/steel works/rolling	50 mi NW of the Seedco site	Operational (EPA 2012-TN1291).
Corixa Corporation	Pharmaceutical preparations	49 mi S of the Seedco site	Operational (EPA 2012-TN1590).
Seedco Industrial Park	Various industry and energy projects	Adjacent	Operational and Proposed (Jones Lang Laselle 2012-TN1292).
Hershey Foods Corporation	Chocolate and cocoa products	35 mi S of the Seedco site	Operational (EPA 2012-TN1293).
Adam T. Bower Memorial Dam	Inflatable dam used in summer to make reservoir	17 mi NW of the Seedco site	Seasonal (Sunbury 2014-TN3516).
Various other large-scale industrial facilities	Industrial/manufacturing facilities	Throughout the region	Operational (EPA 2012-TN1592; EPA 2012-TN1591; EPA 2012-TN1590; EPA 2012-TN1589; EPA 2012-TN1588; EPA 2012-TN1293; EPA 2014-TN3527; EPA 2014-TN3526; EPA 2014-TN3525; EPA 2014-TN3524; EPA 2014-TN3523; EPA 2014-TN3522; EPA 2014-TN3521).

Table 9-14. (contd)

Project Name	Summary of Project	Location	Status
Misc. golf courses	Golf courses	Throughout the region	Operational
Other manufacturing	Other manufacturing plants	Throughout the region	Operational (EPA 2014-TN3739; EPA 2014-TN3740).
Future urbanization	Construction of housing units and associated commercial buildings; roads, bridges, and rail; construction of water- and/or wastewater-treatment and distribution facilities and associated pipelines, as described in local land-use planning documents	Throughout the region	Construction would occur in the future, as described in State and local land-use planning documents.

The Seedco Industrial Park (Seedco site) is a brownfield site located east/southeast of the community of Ranshaw and the City of Shamokin in Northumberland County, Pennsylvania. SR61 is located less than 1 mi to the north of the site. Figure 9-17 provides a location map showing a 6-mi (9.7-km) radius surrounding the Seedco site (PPL Bell Bend 2013-TN3377).

The potential transmission- and water-corridor routes for the Seedco site are shown in Figure 9-18. If built at the Seedco site, the NRC staff assumed a new nuclear power plant would be subjected to the same SRBC consumptive-use mitigation and site-specific low-flow protection requirements described in Section 2.2.2. The location of the Seedco site in relationship to the sources of water for consumptive-use mitigation and site-specific low-flow protection was shown on Figure 9-13.

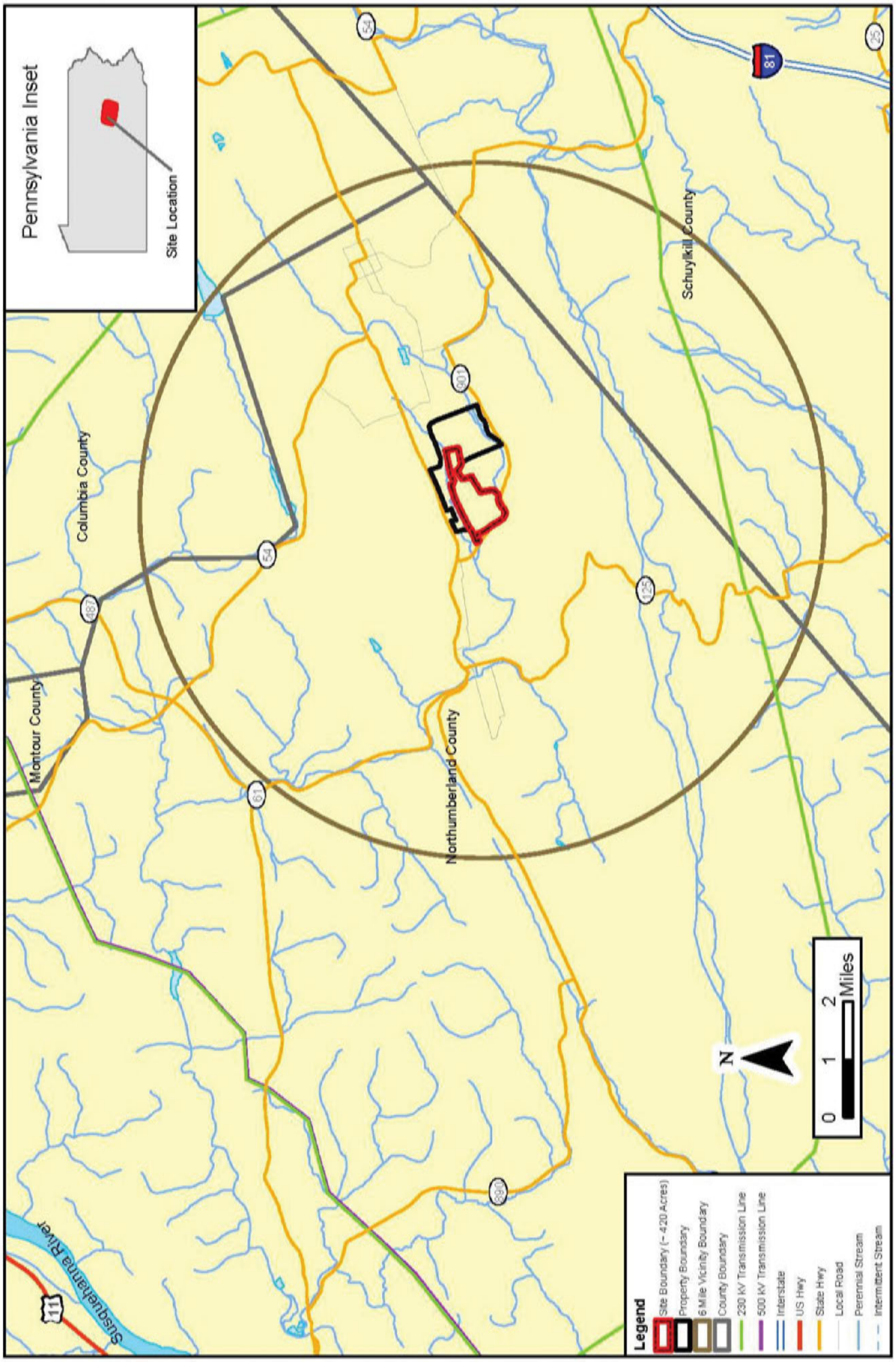

Figure 9-17. The Seedco Site Region (PPL Bell Bend 2013-TN3377)

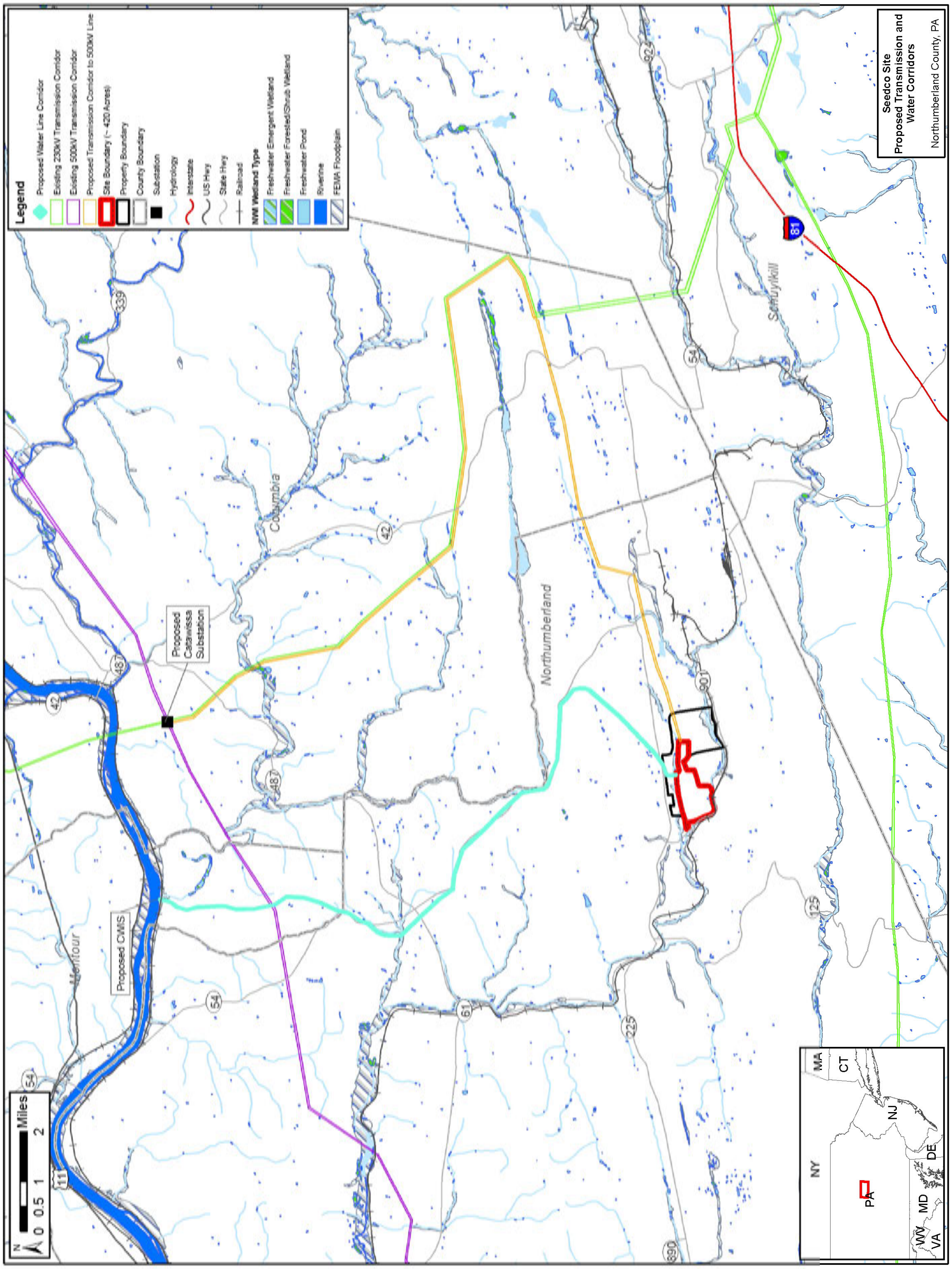

Figure 9-18. The Seedco Site Transmission and Water-Corridor Routes

9.3.4.1 Land Use

The following analysis includes impacts from building and operating a nuclear power plant at the Seedco site, along with transmission lines needed to connect the plant to the electrical grid. The analysis also considers other past, present, and reasonably foreseeable future actions that affect land use, including the other Federal and non-Federal projects listed in Table 9-14. For this analysis, the geographic area of interest is considered to be the 25-mi region centered on the Seedco site plus any transmission-line and pipeline corridors that extend beyond that range. The review team determined that a 25-mi radius would represent the smallest area that would be directly affected because it includes the primary communities that would be affected by the proposed project if it were located at the Seedco site. The geographic area of interest also includes lands bordering or otherwise closely associated with water features (e.g., shorelines, riparian zones, floodplains, and water-based recreation areas) affected by proposed consumptive-use mitigation and site-specific low-flow protection activities associated with use of the Seedco site.

Site Description

The Seedco site is located 2.5 mi east of the City of Shamokin on an undeveloped 1,061 ac property in Northumberland County, Pennsylvania (Figure 9-17). Located on a hill north of SR 901, the site has approximately 300 ft of topographic relief. Approximately 86 percent of the site is forested and portions of the southern and eastern sections of the site contain abandoned mine lands. The Seedco site is zoned as M-1 (manufacturing) (UniStar 2011-TN505).

Land use surrounding the Seedco site includes several commercial properties with buildings north and southeast of the site; residential communities to the north, northwest, and northeast (i.e., Ranshaw, Shamokin, and Kulpmont, respectively), and mostly undeveloped lands to the south and west. There is no prime farmland within the boundaries of the Seedco site or in the immediate surrounding area. SR 901 is located along the southern boundary of the site, and SR 61 is less than 1 mi north of the site. Schuylkill County Airport is located 8 mi southeast of the site (UniStar 2011-TN505).

Building and Operation Impacts

Based on information provided by the applicant and the review team's independent assessment, development of a proposed power plant at the Seedco site would convert the 420-ac site to utility uses for the nuclear facility and associated structures and infrastructure. Additional areas would be affected by laydown yards, stormwater-detention ponds, and borrow pits both during and after construction. The substantial variation in topography on the site would likely require substantial amounts of cut-and-fill activity. Table 9-15 summarizes expected land-use impact parameters for the Seedco site, including construction and operation of new water and transmission lines. The project appears to be consistent with the manufacturing zoning assigned to the site. The review team is not aware of any substantial conflicts with any existing land-use plans. Development of the Seedco site would not result in the loss of prime farmland and is not expected to interfere with agricultural activity.

Table 9-15. Land-Use Impact Parameters for the Seedco Site

Parameter	Value
Property acreage (ac)	1,061
Site acreage (ac)	420
Estimated onsite land disturbance area (ac)	420
Length of new water pipelines (mi)	14.3
ROW clearing for new water pipelines (ac)[(a)]	208
Length of transmission-line corridor (mi)	24.2
ROW clearing for new transmission-line corridor (ac)[(b)]	587

(a) The water line construction ROW is assumed to be 120 ft wide to allow installation of two 60-in. diameter pipes. The ROW width would be reduced to 80 ft at wetland and stream crossings.
(b) A 200-ft-wide cleared ROW is assumed for new transmission-line construction across open land. A 100-ft-wide cleared ROW is assumed in areas where the new line would parallel an adjacent existing transmission line.

Source: Bell Bend Nuclear Power Plant Alternative Site Evaluation v.[2], May 2011 (UniStar 2011-TN505)

New water-intake and water-discharge pipelines would need to be constructed to obtain water from the Susquehanna River. PPL's initial conceptual design identified a 14.3-mi pipeline route that would extend northeast from the site. An estimated 208 ac would be cleared within the ROW to install the new water lines. In addition to the pipeline ROW, development of the water lines would require acquiring a small amount of riverfront land sufficient for an intake, major pumping station, and ancillary structures, as well as additional land for the construction of a pipeline large enough to provide approximately 50 Mgd of river water to the site. The pipeline would cross a railroad and numerous local roads, but no major roads would be crossed between the river and the Seedco site.

Development of a proposed power plant at the Seedco site would require building a new transmission line between the new plant and the nearest existing substation. The applicant has identified a conceptual route that would extend east-northeast from the eastern boundary of the Seedco site for approximately 24.2 mi to reach the closest potential substation location. The total amount of cleared ROW for the new transmission line is estimated to be approximately 587 ac.

Most of the new and expanded transmission-line ROW would cross low-density rural land that is primarily agricultural land and forest. The new transmission lines also would cross numerous roads and highways. Where new transmission-line ROWs would cross farmland, existing agricultural activities would be allowed to continue and the effect of these corridors on land usage would be minimal. In some limited areas, expansion of the existing ROW may encroach onto adjacent residential or commercial lands requiring land acquisition and potentially causing conflicts with existing land uses.

Cumulative Impacts

Ongoing urbanization in the geographic area of interest could contribute to additional decreases in open areas, forests, and wetlands and generally result in some increase in residential and industrialized areas. However, if recent trends identified for the surrounding area (PDCED 2011-TN2225) continue, the region is likely to experience continued slow rates of development. In addition, future climate change could result in changes in land use similar to those described in Section 7.1. Most of the other projects described in Table 9-14 do not suggest a likelihood of substantial changes in general land-use patterns within the geographic area of interest.

If additional transmission lines, pipelines, and other utility lines were built for other energy projects, a cumulative land-use impact could occur from the additional amount of land converted to utility-corridor use within the geographic area of interest. Multiple new utility line corridors could alter land-use classification proportions within the area. However, the review team expects that the cumulative impact would be consistent with land-use plans and zoning regulations implemented by the affected counties.

The review team concludes that cumulative land-use impacts associated with the proposed project at the Seedco site, related development of offsite corridors needed for transmission lines and other appurtenant facilities, and other projects in the geographic area of interest would be MODERATE. This conclusion primarily reflects (1) potentially noticeable land-use challenges related to use of the steep topography at the Seedco site and (2) potential land-use conflicts from having to traverse numerous offsite properties to establish new ROW for transmission lines and water pipelines. In addition, the surrounding landscape continues to experience substantial land demands to support strip-mining activities. Building and operating a new nuclear unit at the Seedco site would be a significant contributor to these impacts.

9.3.4.2 Water Use and Quality

This section describes the review team's assessment of impacts on water use and quality associated with building and operating a nuclear power plant at the Seedco site. The assessment considers other past, present, and reasonably foreseeable future action that affect water use and quality, including the other Federal and non-Federal projects listed in Table 9-14. The Seedco site hydrology, water use, and water quality are discussed in Section 9.3.2.4.3 of PPL's ER (PPL Bell Bend 2013-TN3377).

The ROI would be the Susquehanna River Basin because water would be withdrawn from and wastewater would be discharged to the river if the proposed project were located at the Seedco site. The intake and discharge structures would be located on the Susquehanna River, which is approximately 4 mi upstream of Danville and more than 20 mi downstream from the discharge location for the proposed BBNPP unit (PPL Bell Bend 2013-TN3377). The USGS gage closest to the intake location for the Seedco site is at Danville (USGS Gage 01540500, Susquehanna River at Danville). The available daily discharge record for this gage is from 1905 to the present. Mean annual discharge for the period from 1905 to 2013 is 15,640 cfs, and the P90 flow (the daily flow that is exceeded 90 percent of the time) for the same period is 2,160 cfs (USGS 2014-TN4426). The baseline water-quality conditions described in Section 2.3.3.1 would also be representative of water quality near the location of the Seedco site intake and discharge. Baseline water quality data during Water Year 2013 at the USGS Danville gage are reported by USGS (2014-TN4426). The SRBC measured Susquehanna River water quality just upstream of Danville in its 2011 assessment (Shenk 2011-TN698).

For groundwater, the geographic area of interest is limited to the site and the immediate surroundings because PPL has indicated it would not use groundwater during construction or operation of the plant (PPL Bell Bend 2013-TN3377). Limited information on the bedrock geology of the Seedco site is available. The anticlinal and synclinal structures of the folded bedrock in the region between the Humboldt site and the Seedco site generally strike west-southwest. Based on this information, the review team assumed that bedrock underlying the Seedco site is similar to the bedrock at the Humboldt site, composed of predominantly conglomerate rocks and interbedded claystone, siltstone, and sandstone. The bedrock formations at the Humboldt site are described as having good aquifer potential, and the review team assumed the bedrock at the Seedco site would be similarly productive. Surficial deposits in the area of the Seedco site are sandy to clayey glacial tills of pre-Illinoisan age (>770,000 years) (Sevon 1989-TN3700; Sevon and Braun 2000-TN3701).

Building Impacts

Because building activities at the Seedco site would be similar to those for the BBNPP site, the review team assumed the amount of water needed for building activities at the Seedco site would be the same as that required for the BBNPP site. Water for construction and preconstruction would be supplied by a dedicated line from the PAWC municipal groundwater-supply system at Berwick (PPL Bell Bend 2013-TN3377). As described in Section 4.2.2, the review team determined that the average work-day water demand for building activities is about 5 percent of the average unutilized capacity of the PAWC Berwick well system, and the resulting impact on water resources would be minor.

The intake and discharge structures for a plant at the Seedco site would be similar in design to those for the proposed BBNPP unit (PPL Bell Bend 2013-TN3377). PPL would locate the structures to minimize impacts to wetlands and the Susquehanna River (PPL Bell Bend 2013-TN3377). Building the structures would be subject to the same regulatory and monitoring conditions as described in Section 4.2 for the BBNPP site. Therefore, the review team determined that the effects on river flows and water quality of building the intake and discharge structures would be temporary and limited to a small portion of the river and shoreline.

A plant at the Seedco site would require new intake and effluent discharge pipelines to be built from the site approximately 12.5 mi to the Susquehanna River. PPL estimated that 430 ft of streams would be affected by building the 14.3-mi-long pipelines. The review team assumed that these activities would conform to applicable local and state requirements so that impacts to the affected water resources would be localized and temporary.

Surface-water quality could be affected by stormwater runoff during building of a plant at the Seedco site. The Seedco site lies between Shamokin Creek and Quaker Run and there are small ponds adjacent to or on the site. Building activities at the site would be required to conform to the conditions of a NPDES permit issued by the PADEP. An erosion and sediment control plan would be required as part of the permit, which would identify BMPs to be used to control the impacts of stormwater runoff. The review team assumed that facilities such as stormwater detention and infiltration ponds would be used to control site runoff and minimize sediment transport offsite. As a result, stormwater runoff would not be anticipated to affect water quality of the local waterbodies.

Because the effects from building-related activities for a plant at the Seedco site would be minimized using BMPs, would be localized and temporary, and would be controlled under various permits, the review team concludes that the impact from building-related activities on surface-water use and quality would be minor.

Building activities at the Seedco site include building a safety-related onsite impoundment to provide water for the ultimate heat sink (PPL Bell Bend 2013-TN3377). This impoundment would be similar in size and construction to the safety-related ESWEMS pond at the BBNPP site. The review team considered that building the impoundment at the Seedco site would involve dewatering the excavation, similar to that needed at the BBNPP site. Dewatering for the power-block and cooling-tower excavations also would likely be required. The potential effects of the excavation dewatering may include changes in groundwater levels in the surrounding area. Based on the assumed description of the bedrock in the Seedco site area (Schasse et al. 2012-TN3699), the aquifer underlying the Seedco site may be more permeable than the bedrock at the BBNPP site. The review team assumed that the impact of dewatering the excavations would be managed by methods such as grouting and installing low-permeability barriers, similar to that proposed for dewatering at the BBNPP site. Because there would be no groundwater use at the Seedco site and the impact during building would be controlled and temporary, the review team concludes that building impacts on groundwater resources would be minor.

While building a plant at the Seedco site, groundwater quality may be affected by inadvertent spills of chemicals, such as petroleum products. The review team assumed that BMPs PPL would follow for the BBNPP site would be in place during building activities at the Seedco site and, therefore, concludes that any spills would be quickly detected and remediated. The review team evaluated the BMPs described in Section 4.2.1.9 of the ER (PPL Bell Bend 2013-TN3377) and the commitments made by PPL in Section 4.2.1.8 of the ER to comply with the applicable hydrological standards and regulations. Because runoff, groundwater, and surface waterbodies would be monitored for contaminants, and any spills related to building activities would be quickly remediated under the BMPs, the review team concludes that the impact on groundwater quality from building a plant at the Seedco site would be minor.

Operational Impacts

The review team assumed that water withdrawal, consumptive use, and effluent discharge for operating a plant at the Seedco site would be identical to the estimated water flows for operating the proposed BBNPP unit. The average withdrawal from the Susquehanna River to operate a plant at the Seedco site would be 25,729 gpm (57.3 cfs), and the average consumptive use would be 17,064 gpm (38.0 cfs). Water-use impacts of operating the proposed BBNPP unit were evaluated using the requested withdrawal and consumptive-use limits in PPL's permit application to the SRBC. These maximum amounts are 65 cfs for withdrawal and 43 cfs for consumptive use. These flow rates are less than 1 percent of the mean annual flow of the Susquehanna River at Danville. For the 7Q10 flow (i.e., the 7-day average low flow that occurs on average once every 10 years), which is approximately 1,200 cfs at Danville (Ehlke and Reed 1999-TN3705), consumptive use by a plant at the Seedco site would result in about a 3 percent reduction in river flow. Because operating the plant would reduce Susquehanna River flow by a small fraction, the review team determined that the operational impact on surface water of the proposed plant at the Seedco site would be minor.

PPL has indicated that their primary plan for consumptive-use mitigation and site-specific low-flow protection, specified by SRBC for the proposed BBNPP unit and described in Section 2.2.2, also would apply to a plant at the Seedco site (PPL Bell Bend 2014-TN3494). As described in Section 5.2.2.1, the NRC staff evaluated the effects of this plan on the affected waterbodies: Cowanesque Lake, the Cowanesque River below the dam, Moshannon Creek below the Rushton Mine discharge, and downstream at the Holtwood hydroelectric facility. The NRC staff determined that the effects of consumptive-use mitigation and site-specific low-flow protection would be minor, except for reductions in Cowanesque Lake elevations during low-flow conditions. These occasional reductions in lake level could have a small adverse effect on recreational use of the lake but would not impact downstream water use. The SRBC would adjust the flows triggering consumptive-use mitigation and site-specific low-flow protection to reflect the location of the intake for a plant at the Seedco site, but these adjustments would likely be minor. Therefore, the NRC staff determined that the water use impacts from consumptive-use mitigation and site-specific low-flow protection for a plant at the Seedco site would be minor.

As stated above, onsite groundwater would not be used for operating a plant at the Seedco site. The review team assumed that the water supply for potable and sanitary uses during operations would be the PAWC well system at Berwick. The review team also assumed that the amount of water required from the PAWC municipal system would be the same as that required for operating the proposed BBNPP unit. As described in Section 5.2.2, the review team determined that the average water demand during plant operation would be about 5 percent of the average unused capacity of the PAWC Berwick well system, and the resulting impact on water resources would be minor.

During operation of a proposed plant at the Seedco site, impacts on surface-water quality could result from stormwater runoff, discharge of sanitary and other wastewater, and discharge of blowdown from the cooling towers into the Susquehanna River. Stormwater runoff and discharges from the site would be regulated under the NPDES permit administered by the PADEP. BMPs for controlling stormwater would be described in a post-construction stormwater management plan. The review team assumed that the concentration of solutes in the liquid effluent and the blowdown discharge rate (19 cfs) would be the same as that for the proposed BBNPP unit. Because the blowdown rate is only 1.6 percent of the estimated 7Q10 flow, constituents in the effluent would be rapidly diluted by the much larger flow in the river. The extent of the thermal plume would be similar to that determined for the discharge from the proposed BBNPP unit. As described in Section 5.2.3, under conservative conditions, the maximum extent of the thermal plume in winter is anticipated to be about 50 ft as determined by the isotherm 2°F above the ambient river temperature. Because stormwater controls would be in place and the blowdown discharge would be regulated under an NPDES permit, the review team concludes that the impacts on surface-water quality from operating a plant at the Seedco site would be minor.

During operation of a nuclear plant at the Seedco site, accidental spills could impact groundwater quality. Spills that might affect the quality of groundwater would be prevented and mitigated by using BMPs as described above. Because BMPs would be used to mitigate spills and no intentional discharge to groundwater should occur, the review team concludes that the groundwater-quality impacts from operation of a plant at the Seedco site would be minor.

Cumulative Impacts

In addition to water-use and water-quality impacts from building and operations activities, this cumulative-impacts analysis considers past, present, and reasonably foreseeable future actions that affect the same water resources. For the cumulative analysis of impacts on surface water, the geographic area of interest is considered to be the drainage basin of the Susquehanna River upstream and downstream of the Seedco site intake and discharge structures. For the cumulative analysis of impacts on groundwater, two geographic areas of interest have been identified: (1) the proposed Seedco site and the surrounding area that could be affected by dewatering activities during preconstruction and construction, and (2) the area contributing to the PAWC well system that is the source of water for site activities during preconstruction and construction and for potable and sanitary uses during operations.

<u>Cumulative Water-Use Impacts</u>

Based on a review of the history of water-use and water-resources planning in the Susquehanna River Basin, the review team determined that past and present use of the surface waters in the basin has been noticeable, necessitating consideration, development, and implementation of careful planning (SRBC 2013-TN3568). As described in Section 7.2, the SRBC anticipates that population in the basin will increase 4.4 percent between 2010 and 2030, with this growth occurring almost entirely in the Lower Susquehanna sub-basin. Population growth is projected to decrease about 2 percent during the same period in the Middle and Upper Susquehanna sub-basins and about 7 percent in the Chemung sub-basin. Consumptive-water use in the basin is projected to increase by about 320 Mgd (495 cfs) between 2005 and 2025 (SRBC 2013-TN3568), with a substantial portion of this occurring in the Middle Susquehanna sub-basin (SRBC 2008-TN699).

The review team is aware of the potential climate changes that could affect the water resources available for cooling and the impacts of reactor operations on water resources for other users. Because the Seedco site is located near the proposed BBNPP site, the potential changes in climate would be similar (GCRP 2014-TN3472). Therefore the review team concludes that the impact of climate change on water resources would be similar to that for the BBNPP site.

Of the projects listed in Table 9-14, those that were considered for cumulative impacts on the surface-water resource are natural gas extraction, and continued operation of the SSES and other power-generation facilities. These projects were also considered in assessing the cumulative impacts of the proposed BBNPP unit in Section 7.2. Other projects listed in Table 9-14 either do not affect the surface-water resource or their surface-water use is insignificant. Because the consumptive use of a new nuclear power plant at the Seedco site would be similar to the consumptive use at the proposed BBNPP unit, and because the intake and discharge locations would be about 20 mi from the intake and discharge for the proposed BBNPP unit, the review team determined that the cumulative water-use impacts for the two sites would be similar.

Unconventional natural gas extraction is less than 10 percent of current basin-wide consumptive use (excluding public water supply diversions), and is expected to remain a relatively small proportion of total consumptive-water use in the future. Impacts from gas extraction are of greatest concern in small watersheds where most of the gas development has occurred. Therefore, the review team determined that the cumulative impacts from unconventional gas extractions would be limited.

Consumptive-water use of 43 cfs for operation of a plant at the Seedco site is about 0.3 percent of the mean annual Susquehanna River discharge at Danville of 15,640 cfs. This mean annual discharge is for the full period of record (1905-2013), and it reflects the cumulative consumptive use of current users. Total consumptive use of water in the Susquehanna River Basin upstream of the intake location for a plant at the Seedco site is anticipated to increase by about 160 Mgd (248 cfs) between 2005 and 2025 (SRBC 2008-TN699). This amount of consumptive use is about 2 percent of the mean annual flow at Danville, and would result in minor cumulative impacts at that flow rate. During low-flow conditions, however, cumulative impacts from an additional 160 Mgd (248 cfs) of consumptive use would be significant without mitigation. Addressing the need for additional consumptive-use mitigation in the basin is a primary concern of the SRBC.

Under PPL’s plan for consumptive-use mitigation and site-specific low-flow protection described in Section 2.2.2, releases from Cowanesque Lake for consumptive use of a plant at the Seedco site would interact with mitigation releases made for the SSES. The combined mitigation releases would result in minor alteration of flows in the Cowanesque River. No cumulative impacts would occur on Moshannon Creek. In addition, the releases from Cowanesque Lake would eliminate any cumulative impacts on users downstream of the intake location for a plant at the Seedco site. Releases for the two plants would interact to cause drawdown in the elevation of Cowanesque Lake. In about 74 percent of years, maximum annual drawdown resulting from the combined releases would be less than 2 ft. During relatively dry years, however, maximum annual drawdown would be larger, exceeding 7 ft in about 15 percent of years prior to the end of November. During the recreation season (May 20 to September 14), lake drawdown of 7 ft or more would be expected in about 8 percent of years.

Mainly because of extensive past and present use of surface water in the Susquehanna River Basin, the NRC staff determined that the cumulative impacts on surface-water resources from building and operating a new nuclear power plant at the Seedco site would be MODERATE. However, the NRC staff further concludes that building and operating a new nuclear power plant at the Seedco site would not be a significant contributor to these impacts.

As stated above, no onsite groundwater would be used when building or operating a new nuclear plant at the Seedco site. Most of the projects in Table 9-14 are more than 10 mi from the Seedco site and thus would not contribute to a cumulative impact on groundwater supply within the ROI. Water for potable and sanitary uses would be obtained from the PAWC municipal supply at Berwick. The amount required would be less than 11 percent of the available unused capacity of the PAWC system. Because population in the Middle Susquehanna sub-basin is anticipated to decrease, the review team determined that the capacity of the PAWC system is unlikely to be exceeded during operation of a plant at the Seedco site. No other significant groundwater use was identified in Table 9-14 that would affect the capacity of the PAWC system. Therefore the review team concludes that the cumulative impact on groundwater use at the Seedco site would be SMALL.

Cumulative Water-Quality Impacts

As stated in Section 7.2.2.1, SRBC has implemented careful planning and regulation of water quality in the Susquehanna River Basin. In addition, the PADEP monitors water quality throughout most of the basin and enforces water-quality regulations through the NPDES permitting program. Although there have been improvements in water quality in the basin (e.g., reductions in iron concentrations), water quality remains a priority for the SRBC (SRBC 2013-TN3568). In its review of the SSES license-renewal application, the NRC staff concluded that water quality in the Susquehanna River Basin has been significantly impacted by past activities, and will likely continue to be adversely affected by human activities in the future (NRC 2009-TN1725). The review team concludes that past and present actions in the Susquehanna River Basin have resulted in noticeable impacts to water quality.

The projects listed in Table 9-14 may result in alterations to land surface, surface-water drainage pathways, and waterbodies. These projects would need Federal, State, and local permits that would require implementation of BMPs. Therefore, the impacts to surface-water quality from these projects are not expected to be noticeable. The discharge for a plant at the Seedco site would be located about 20 mi from the SSES discharge. The analysis of the thermal plume for the proposed BBNPP unit, described in Section 5.2.3, indicates that, at a downstream distance of 20 mi, the SSES discharge plume excess temperature above ambient river temperature would be undetectable. The area affected by the thermal plume from a plant at the Seedco site would be small, would be localized near the discharge location, and would not significantly interact with the thermal plume from the SSES. Therefore, the review team determined that the cumulative impact of the combined discharges from the SSES and a new plant at the Seedco site would be minor.

Because of extensive past and present use, the review team concludes that the cumulative impact on surface-water quality in the Susquehanna River Basin from past and present actions and building and operating the proposed plant at the Seedco site would be MODERATE. However, the review team further concludes that building and operating a new nuclear power plant at the Seedco site would not be a significant contributor to these impacts.

Based on the proposed or possible projects listed in Table 9-14, most of which are located more than 10 mi from the Seedco site, additional impacts to groundwater quality are expected to be minimal. As discussed previously in this section, BMPs would be implemented to minimize groundwater contamination and quickly remediate any inadvertent spills. Engineering controls would be used to limit the impacts of dewatering activities during building, and no onsite groundwater would be used during building or operation of the plant. Therefore, the review team concludes that the cumulative groundwater-quality impacts of a new plant at the Seedco site would be SMALL.

9.3.4.3 Terrestrial and Wetland Resources

The following analysis includes impacts from building and operating the proposed nuclear plant on terrestrial ecology resources at the Seedco site. The analysis also considers past, present, and reasonably foreseeable future actions that affect the terrestrial ecological resources, including other Federal and non-Federal projects and the projects listed in Table 9-14. For the analysis of terrestrial ecological impacts at the Seedco site, the geographic area of interest includes the portions of Northumberland, Montour, Snyder, Union, Lycoming, Columbia, and Schuylkill Counties that are within a 21-mi radius of the site. The 21-mi geographic area of interest was selected to encompass closely interrelated nearby terrestrial habitats and ensure inclusion of all associated pipelines and transmission lines. The land within the 21-mi area lies within the Ridge and Valley ecoregion (Woods et al. 2003-TN1806). The geographic area of interest is expanded to also include the waterbodies affected by consumptive-use mitigation and site-specific low-flow protection releases.

This geographic area of interest encompasses all of the offsite facilities discussed below in the site description section. The geographic area of interest would also encompass other important animal and plant species and communities that could potentially be affected by constructing and operating the plant. The 21-mi distance was also used by PDCNR, PFBC, and PGC for their occurrence analysis for special status species and habitats (PNHP 2013-TN3900). The NRC definition for important species is discussed in Section 4.3.1.3.

In accordance with ESRP Section 9.3 (NRC 2000-TN614), the review team relied on reconnaissance-level information to perform the alternative site evaluation for this EIS. Reconnaissance-level information is data that are readily available from agencies and other public sources (e.g., scientific literature, books, and Internet websites) and information obtained from site visits. To identify terrestrial resources at the Seedco site, the review team relied primarily on the following information:

- tours of the Seedco site in April 2009 (NRC 2009-TN1889) and June 2010 (NRC 2010-TN1891)
- responses to RAIs provided by PPL that were incorporated into its ER (PPL Bell Bend 2013-TN3377)
- State and Federal information on important species and community occurrences within 21 mi (PNHP 2013-TN3900)
- correspondence from Federal and State agencies regarding important species and communities (FWS 2013-TN3847; PDCNR 2012-TN3910; PGC 2012-TN3901).

Site Description

The Seedco site and offsite facilities are situated within the Ridge and Valley ecoregion (Woods et al. 1999-TN1805; Woods et al. 2003-TN1806). As described in Section 7.3.1, the Ridge and Valley ecoregion is characterized by alternating forested ridges and agricultural valleys. Natural vegetation varies from north to south, and in the north is characterized as mostly Appalachian oak forest dominated by white oak (*Quercus alba*) and red oak (*Q. rubra*) (USGS 2012-TN1800; Woods et al. 1999-TN1805; Woods et al. 2003-TN1806). Three land-cover types dominate the ecoregion: forest (56 percent), agriculture (about 30 percent), and developed areas (about 9 percent). The greatest recent land-cover change has been conversion of forest to disturbed lands, followed by disturbed lands reverting to forestland. Both forestland and disturbed land also are being converted to developed land (USGS 2012-TN1800). Today, farming is prevalent over much of the landscape, and woodland occurs on steeper sites (Woods et al. 1999-TN1805; Woods et al. 2003-TN1806). These activities have resulted in the overall reduction and fragmentation of forest, creating a mosaic of habitat types in various stages of succession, a greater amount of forest-edge habitat, and a lesser amount of forest-interior habitat and forest-interior wildlife (PGC and PFBC 2005-TN3815).

The Seedco site is a 420-ac brownfield site located within an undeveloped 1,061-ac property in Northumberland County, Pennsylvania. Offsite facilities that would be built extending out from the Seedco site include:

- a new 14.3-mi makeup/blowdown water-pipeline corridor that would extend north from the site to the North Branch of the Susquehanna River in Montour County
- a new 9.4-mi section of transmission line
- a 14.8-mi expansion of an existing 230-kV transmission line.

Both transmission lines would serve to connect the site to an existing 500-kV transmission line (PPL Bell Bend 2013-TN3377) located 9.2 mi north of the site in Columbia County (UniStar 2011-TN505).

Land use in the area surrounding the Seedco site includes commercial development to the north, residential development to the northwest, and undeveloped lands to the east, south, and west. The majority of the land at the Seedco site is forested and portions of the southern and eastern sections of the site contain abandoned mine lands (PPL Bell Bend 2013-TN3377).

Terrestrial habitat types present on the Seedco site include approximately 356 ac of forest, 46 ac of barrens, 7 ac of cropland/pasture, 0.2 ac shrub/scrub habitat, and 0.7 ac of wetland habitat (PPL Bell Bend 2011-TN4010; PPL Bell Bend 2013-TN3377). Barrens are areas that are naturally infertile as a consequence of nutrient-poor soils, and often form on resistant rock such as quartz, sandstone, or highly weathered and leached glacial material. Fire is a natural process in the ridgetop barrens of Northumberland County (PNHP 2006-TN1570). About 3 percent of the site (approximately 13 ac) lies with a 100- or 500-year floodplain (PPL Bell Bend 2013-TN3377; UniStar 2011-TN505). In addition, the site contains approximately 10 ac of open water and 2 ac of urban land.

The proposed corridors traverse substantial areas of forest. The water-pipeline corridor traverses approximately 99 ac of forested habitat and 112 ac of non-forested habitat. The transmission-line corridor traverses approximately 239 ac of forested habitat and 346 ac of non-forested habitat (PPL Bell Bend 2011-TN4010).

The offsite facilities needed to support a nuclear plant at the Seedco site would traverse small areas of wetlands. No wetlands are associated with the cooling-water intake pump house, water pipeline corridor, and railroad spur expansion. However, 0.2 ac and 4.5 ac of wetlands occur at the cooling-water intake and transmission-line corridor, respectively, totaling 4.7 ac (PPL Bell Bend 2013-TN3377).

The NRC staff visited the Seedco site in April 2009 (NRC 2009-TN1889) and June 2010 (NRC 2010-TN1891). Abandoned mine shafts overgrown with vegetation were observed, as were extensive lands that had been strip-mined (NRC 2010-TN1891). Deciduous forest overstory species observed included white oak (*Quercus alba*), black oak (*Q. velutina*), and chestnut oak (*Q. prinus*), eastern white pine (*Pinus strobus*), hickory (*Carya* spp.), black cherry (*Prunus serotina*), gray birch (*Betula populifolia*), and big-toothed aspen (*Populus grandidentata*). Understory species included hazelnut (*Corylus* sp.), huckleberry (*Vaccineum* sp.), bracken fern (*Pteridium aquilinum*), sassafras (*Sassafras albidum*), and pink ladyslipper orchid (*Cypripedium acaule*), all of which are common in late-successional communities. Portions of the site lacked a forest canopy and vegetation was early seral, dominated by disturbance species such as blackberry (*Rubus* sp.) and multiflora rose (*Rosa multiflora*). Forest-interior dwelling birds observed included the scarlet tanager (*Piranga olivacea*) and the wood thrush (*Hylocichla mustelina*).

Federally Listed, State-Listed, and State-Ranked Species and Communities

PPL provided no field survey information for the Seedco site and the review team is unaware of any field surveys at this location or at the locations of the offsite facilities. The presence or absence of Federally listed, State-listed, and State-ranked species and communities in the project footprint cannot be ascertained without field surveys.

A query of the Pennsylvania Natural Heritage Program database (PNHP 2013-TN3900) indicates the presence of 4 Federally listed species, 19 State-listed species, 72 State-ranked species, and 3 State-ranked communities within 21 mi of the Seedco site in Montour, Northumberland, Snyder, Union, Lycoming, Columbia, and Schuylkill Counties (Table 9-16). Table 9-16 lists species habitat affinities. The number of species and communities that occur and the number of their occurrences within 21 mi provide a basis for comparison of the proposed BBNPP site and the Seedco alternative site.

Of the 72 species documented in Table 9-16, only the Indiana bat (*Myotis sodalis*), northeastern bulrush (*Scirpus ancistrochaetus*), and bog turtle (*Glyptemys muhlenbergii*) are listed as Federally endangered. The northern long-eared bat (*Myotis septentrionalis*) is listed as Federally threatened. A description of the Indiana bat follows. Descriptions of species discussed in correspondence from State agencies (FWS 2013-TN3847; PDCNR 2012-TN3910; PGC 2012-TN3901), including State-listed and State-ranked species and State-ranked communities, are also provided below.

Table 9-16. Federally and State-Listed and State-Ranked Terrestrial Species (Except Birds [see Table 2-17]) and Communities Occurring within the Geographic Area of Interest (21-mi Radius) around the Seedco Site (PFBC 2014-TN4430; PNHP 2013-TN3900) and Their Known or Likely Presence in the Project Area Based on Field Surveys

Scientific Name	Common Name	Federal Status(a)	State Status(a)	State Rank(a)	Potentially Suitable Habitat Onsite	Observed or Likely to Occur Onsite	Habitat
Plants							
Amelanchier bartramiana	oblong-fruited serviceberry		PE	S1	Yes	No	Swamps, sphagnum bogs, and peaty thickets(b)
Amelanchier humilis	serviceberry			S1	Yes	No	Dry, open, high ground, and bluffs(b)
Amelanchier obovalis	coastal juneberry			S1	Yes	No	Peaty barrens, thickets, and roadsides(b)
Aplectrum hyemale	puttyroot		PR	S3	Yes	No	Moist woodlands, forested slopes, and stream banks(c)
Arabis missouriensis	Missouri rock-cress		PE	S1	Yes	No	Dry slopes(b)
Bartonia paniculata	screw-stem			S3	Yes	No	Hummocks in wet woods, wooded bogs, and sphagnous pond margins(b)
Bidens discoidea	small beggar-ticks			S3	Yes	No	Bogs, vernal ponds, and swampy ground(b)
Carex bicknellii	Bicknell's sedge		PE	S1	Yes	No	Dry woods, thickets, fields, and serpentine barrens(b)
Carex disperma	soft-leaved sedge		PR	S3	Yes	No	Swamps, wet thickets, wetlands, and bogs(c)
Carex lasiocarpa	slender sedge		PR	S3	Yes	No	Bogs, wetlands, marshes(c)
Carex limosa	mud sedge			S2	Yes	No	Bogs, floating sphagnum moss mats at bog pools(c)
Carex longii	Long's sedge			S2S3	Yes	No	Swamps, open thickets, moist meadows, old gravel pits, and swales(b)
Carex polymorpha	variable sedge		PE	S2	Yes	No	Openings along woods and road margins(c)
Cyperus diandrus	umbrella flatsedge		PE	S2	Yes	No	Shorelines of ponds, lakes, and streams; in bogs and marshes(c)
Dodecatheon radicatum	jeweled shooting-star		PT	S2	No	No	Moist, shaded areas of limestone outcrops and river bluffs(c)
Dryopteris clintoniana	Clinton's wood fern			S2	Yes	No	Swampy woodlands(c)
Elymus trachycaulus	slender wheatgrass			S3	Yes	No	Sunny, well-drained habitats such as woods borders, rocky banks, grasslands, barrens, thickets, and utility ROW(c)
Eurybia radula	rough-leaved aster			S2	Yes	No	Wet woods, swamps, seeps, bogs, and along streams(c)
Gaultheria hispidula	creeping snowberry		PR	S3	Yes	No	Bogs, peaty wetlands, and swamps(c)

Table 9-16. (contd)

Scientific Name	Common Name	Federal Status(a)	State Status(a)	State Rank(a)	Potentially Suitable Habitat Onsite	Observed or Likely to Occur Onsite	Habitat
Helianthemum bicknellii	Bicknell's hoary rockrose		PE	S2	Yes	No	Open rocky places, riverbed scours, exposed banks, slopes, woods, rock outcrops, and serpentine barrens(c)
Juncus filiformis	thread rush		PR	S3	Yes	No	Bogs and sandy shores(b)
Ledum groenlandicum	common Labrador-tea		PR	S3	Yes	No	Bogs and peaty wetlands(c)
Lonicera hirsuta	hairy honeysuckle			S1	Yes	No	Moist woods, swamps, and rocky thickets(b)
Lupinus perennis	lupine		PR	S3	Yes	No	Woods borders, open woods, and clearings(c)
Muhlenbergia uniflora	fall dropseed muhly		PE	S2	Yes	No	Bogs and peaty wetlands(c)
Piptatherum pungens	slender mountain-ricegrass		S2	PE	No	No	Sunny, well-drained, sandy habitats, rocky open woods, bedrock outcrops, heath barrens, balds, and mountain summits(c)
Platanthera blephariglottis	white-fringed orchid			S2S3	Yes	No	Bogs, peaty wetlands, swamps, and floating sphagnum moss mats at bog pools(c)
Platanthera ciliaris	yellow-fringed-orchid			S2	Yes	No	Bogs, moist meadows, and woods(b)
Polemonium vanbruntiae	Jacob's-ladder		PE	S1	Yes	No	Wet soil in woods, thickets, and openings(c)
Polystichum braunii	Braun's holly fern		PE	S1	Yes	No	Cool, rocky slopes and shaded ravines(b)
Potentilla tridentata	three-toothed cinquefoil		PE	S1	No	No	Rock outcrops at high elevations(c)
Prunus pumila var. susquehanae	Susquehanna sand cherry			S2	No	No	Dry, exposed rock outcrops and mountain tops(b)
Ribes lacustre	swamp currant			S1	Yes	No	Damp soil on rocky slopes and talus, moist to seepy rock outcrops and cliffs, cool woods, and swamps(c)
Rosa virgiana	Virginia rose			S1	Yes	No	Pastures, fields, open woods, thickets, and roadsides(b)
Schoenoplectus subterminalis	water bulrush			S3	Yes	No	Lakes, ponds, and slow-moving streams(c)
Schoenoplectus torreyi	Torrey's bulrush		PE	S1	Yes	No	Shallow water along shorelines of lakes and ponds(b)
Scirpus ancistrochaetus	northeastern bulrush	FE	PE	S3	Yes	No	Edges of seasonal pools, wet depressions, beaver ponds, wetlands, and small ponds(b)
Stellaria borealis	mountain starwort			S1S2	Yes	No	Seeps and spring-fed streamlets in wooded areas(c)
Streptopus amplexifolius	white twisted-stalk		PT	S1	No	No	Cool shaded areas on seepy cliffs and rock outcrops(c)
Utricularia cornuta	horned bladderwort		PT	S2	Yes	No	Shallow water or wet peaty substrate in ponds, bogs, seepages, and along shorelines(c)

Table 9-16. (contd)

Scientific Name	Common Name	Federal Status(a)	State Status(a)	State Rank(a)	Potentially Suitable Habitat Onsite	Observed or Likely to Occur Onsite	Habitat
Utricularia intermedia	flat-leaved bladderwort		PT	S2	Yes	No	Bogs, wetlands, floating bog mat islands, and shorelines[(c)]
Viola selkirkii	great-spurred violet			S3S4	Yes	No	Cool, moist woods, humus/moss rock outcrops, and boulders[(c)]
Vittaria appalachiana	Appalachian gametophyte fern		PT	S2	No	No	Cool, damp, shaded rock outcrops and cliffs in forested areas[(c)]
Insects							
Amblyscirtes vialis	common roadside skipper			S2	Yes	No	Riparian forest[(d)]
Boloria selene myrina	silver bordered fritillary			S3	Yes	Yes[(e)]	Open, marshy or boggy areas with violets[(d)]
Carterocephalus palaemon mandan	Arctic skipper			S2	Yes	No	Glades, roadsides, swampy places, and streamside grassy openings in forests; sometimes bogs or fens[(d)]
Chlosyne harrisii	Harris' checkerspot			S3	Yes	No	Bogs, fens, wetlands, riparian, grassland/old-field, and ROW[(d)]
Erynnis persius persius	Persius duskywing			S1	Yes	No	Bogs, fens, shrub/scrub wetland, riparian, and forest[(d)]
Euphyes conspicua	black dash				Yes	Yes[(e)]	Open, shrubby or partially wooded (e.g., red maple) bogs/fens, wetlands, and riparian areas[(d)]
Euphydryas phaeton	Baltimore checkerspot			S3	Yes	Yes[(f)]	Bogs, fens, wetlands, riparian, grassland/old-field, and woodland[(d)]
Glena cognataria	blueberry gray			S1	No	No	Heathlands, bogs, and pine barrens[(e)]
Hemileuca maia	barrens buckmoth			S1S2	No	No	Scrub oak-pine sand barrens, and oak woods[(f)]
Hesperia leonardus	Leonard's skipper			S3	Yes	No	Grassland/old-field, shrubland, and woodland[(d)]
Itame sp. 1 nr. inextricata	barrens Itame (Cf I. Inextricata)			S1	No	No	Xeric pine-oak scrub[(d)]
Lethe eurydice	eyed brown			S3	Yes	No	Open sedge meadows and open wetlands[(d)]
Lycaena epixanthe	bog copper			S2	No	No	Acid bogs and wetlands containing cranberries[(c)]
Poanes massasoit	mulberry wing			S2	Yes	Yes[(f)]	Bogs, fens, wetlands, and riparian[(d).]
Speyeria atlantis	Atlantis fritillary			S3	Yes	No	Bogs, fens, forested wetland, riparian, grassland, and woodland[(d)]
Sphinx gordius	apple sphinx			S3	Yes	No	Bogs and deciduous forest[(f)]

Table 9-16. (contd)

Scientific Name	Common Name	Federal Status(a)	State Status(a)	State Rank(a)	Potentially Suitable Habitat Onsite	Observed or Likely to Occur Onsite	Habitat
Reptiles and Amphibians							
Acres crepitans	northern cricket frog		PE	S1	Yes	Yes[e]	Slow-moving creeks, pools, herbaceous and shrub/scrub wetlands, and bogs and fens in open country[h].
Clemmys guttata	spotted turtle			S3	Yes	Yes[i]	Slow-moving creeks, pools, wetlands, bogs, and fens[d]
Crotalus horridus	timber rattlesnake		PC	S3S4	Yes	No	Deciduous forest and rock outcrops[c]
Glyptemys insculpta	Wood turtle			S3S4	Yes	Yes[e, i]	Low-gradient creeks, moderate-gradient medium sized rivers, forested wetlands, and herbaceous wetlands[d]
Heterodon platirhinos	eastern hognose snake			S3	Yes	No	Riparian, cropland/hedgerow, grassland/old-field, and woodland[d]
Lithobates pipiens	northern leopard frog			S2S3	Yes	Yes[i]	Springs, slow streams, marshes, bogs, ponds, canals, flood plains, reservoirs, and lakes[d]
Scaphiopus holbrookii	eastern spadefoot		PT	S1			Breeding – temporary pools; non-breeding – sandy, gravelly, or soft, light soils in wooded or unwooded terrain
Terrapene carolina carolina	eastern box turtle			S3S4	Yes	Yes[e, i]	Wide variety of habitats from wooded swamps to dry, grassy fields[i]
Thamnophis sauritus	eastern ribbon snake			S3	Yes	Yes[e]	Slow-moving creeks, pools, wetlands, riparian, bare rock/scree[d]
Birds							
Podilymbus podiceps	pied-billed grebe			S3B, S4N			Wetlands near open water[b]
Mammals							
Felis rufus	bobcat			S3S4	Yes	Yes[e]	Large forest tracts with thick undergrowth[d]
Glaucomys sabrinus	northern flying squirrel		PE	SU	No	No	Old-growth forests with moist soil[k]
Lontra canadensis	river otter			S3	Yes	Yes[f]	Lowland marshes and swamps interconnected with meandering streams and small lakes[l]
Microtus chrotorrhinus	rock vole			S2	Yes	No	Forested wetland, coniferous/mixed forests and woodlands[d]
Myotis lucifugus	little bown myotis			S1	Yes	Yes[e]	Hibernation in caves, tunnels, mines; maternity sites in man-made structures, caves, and hollow trees[d]
Myotis leibii	eastern small-footed myotis		PT	S1B, S1N	Yes	No	Hibernation in caves and mines; maternity sites in forests[d, k]

Table 9-16. (contd)

Scientific Name	Common Name	Federal Status(a)	State Status(a)	State Rank(a)	Potentially Suitable Habitat Onsite	Observed or Likely to Occur Onsite	Habitat
Myotis septentrionalis	northern long-eared bat	FT		S1	Yes	Yes[e, m]	Hibernation in caves and mines; maternity sites in riparian, conifer/mixed late-successional forest[c, d]
Myotis sodalis	Indiana bat	FE	PE	SUB, S1N	Yes	Yes[n]	Hibernation in caves and mines; maternity sites in trees in upland and wetland forest, buildings[d, k]
Neotoma magister	Allegheny woodrat		PT	S3	No	No	Bare rock/talus/scree surrounded by unfragmented hardwood or mixed forest[d, k]
Perimyotis subflavus	tri-colored bat			S1	Yes	Yes[m]	Hibernation in caves, mines; maternity sites in tree foliage in riparian, upland woodland/grassland area[d]
Sorex palustris albibarbis	water shrew			S3	Yes	No	Stream and lake edges and boulders[c]
Communities							
	calcareous opening/cliff			S2	No	No	Calcareous cliffs, outcrops, rocky slopes with variable vegetation composition[c]
hemlock (*Tsuga canadensis*)	hemlock palustrine forest			S3	No	No	Wetland forests dominated or co-dominated by eastern hemlock[c]
	herbaceous vernal pool			S3S4	Yes	Yes[o]	Seasonally fluctuating water levels, variable herbaceous composition[c]
hemlock (*Tsuga canadensis*)	hemlock - mixed hardwood palustrine forest			S3S4	No	No	Wetland forests dominated by a mixture of conifer and hardwood species[c]
oak (*Quercus* spp.)	dry oak - heath woodland			S3	No	No	Dry sites dominated by various oak species[c]
leatherleaf (*Chamaedaphne calyculata*) – bog rosemary (*Andromeda polifolia*)	leatherleaf – bog rosemary peatland			S2S3	No	No	Bogs dominated by leatherleaf with bog rosemary associated[c]
leatherleaf (*Chamaedaphne calyculata*) cranberry (*Vaccinium oxycoccos and/or macrocarpon*)	leatherleaf – cranberry peatland			S2S3	No	No	Bogs dominated by leatherleaf, cranberry, and sphagnum moss[c]
little bluestem (*Schizachyrium scoparium*) - Pennsylvania sedge (*Carex pensylvanica*)	little bluestem - Pennsylvania sedge opening			S3S4	No	No	Dry acidic sites without invasion of woody plant species[c]
	low heath shrubland			S1	No	No	Sites dominated by huckleberry (*Vaccinium* spp.)[c]
pitch pine (*Pinus rigida*) rhodora (*Rhododendron canadense*) – scrub oak (*Quercus ilicifolia*)	pitch pine – rhodora - scrub oak woodland			S1	No	No	Part of the "Mesic till barrens complex" with pitch pine dominant in the overstory and rhododendron and scrub oak dominant in the understory[c]

Table 9-16. (contd)

Scientific Name	Common Name	Federal Status(a)	State Status(a)	State Rank(a)	Potentially Suitable Habitat Onsite	Observed or Likely to Occur Onsite	Habitat
pitch pine (*Pinus rigida*) – scrub oak (*Quercus ilicifolia*)	pitch pine – scrub oak woodland			S2S3	No	No	Sites with acidic, dry soils and drought-stressed trees of small stature where pitch pine is dominant and scrub oak is dominant in the understory(c)
red maple (*Acer rubrum*) – black gum (*Nyssa sylvatica*)	red maple – black gum palustrine forest			S3S4	Yes	Yes(p)	Wetland forest dominated by red maple or black gum(c)
red spruce (*Picea rubens*)	red spruce – mixed hardwood palustrine forest			S3	No	No	Wetland forests dominated by a mixture of conifer and hardwood species(c)
red spruce (*Picea rubens*)	red spruce palustrine forest			S3	No	No	Wetland forests dominated or co-dominated by red spruce(c)
scrub oak (*Quercus ilicifolia*)	scrub oak shrubland			S3	No	No	Sites without a tree layer dominated by scrub oak(c)
	Talus cave community			S2S4	No	No	None provided(c)
Virginia pine (*Pinus virginianus*)	Virginia pine – mixed hardwood shale woodland			S2	No	No	Dry shale slopes with southerly exposure dominated by Virginia pine and various hardwood tree species(c)

(a) Federal status FE = Federally endangered, FT = Federally threatened; State status PE = Pennsylvania endangered, PT = Pennsylvania threatened, PC = Pennsylvania candidate, PR = Pennsylvania rare; NatureServe rank S1 = critically imperiled (five or fewer populations, especially vulnerable to extirpation), S2 = imperiled (20 or fewer populations, very vulnerable to extirpation), S3 = vulnerable (80 or fewer occurrences, vulnerable to extirpation), S4 = apparently secure (uncommon but not rare, some cause for long-term concern) (PNHP 2014-TN3975).
(b) Morris Arboretum 2014-TN3858.
(c) PNHP 2015-TN4431.
(d) NatureServe 2015-TN4432.
(e) Normandeau 2011-TN490.
(f) PNHP 2006-TN1570.
(g) Lotts and Naberhaus 2014-TN3857.
(h) NYNHP 2012-TN3909.
(i) PPL 1978-TN4036.
(j) Davidson College 2014-TN3863.
(k) PGC 2013-TN3845.
(l) Hardisky 2013-TN3386.
(m) Normandeau 2014-TN3828.
(n) FWS 2009-TN3868.
(o) PPL Bell Bend 2013-TN3377.
(p) Normandeau 2011-TN489.

Indiana Bat (*Myotis sodalis*), Federally Endangered (FE)

The Indiana bat is a small insectivorous bat that is a true hibernator, entering hibernation in the fall and surviving on stored fat until spring. Mating occurs in late August and September during fall swarming, when bats move in and out of winter hibernacula at night and roost individually in surrounding forests during daytime. Hibernation occurs communally in abandoned mines and caves. Reproductive females migrate from hibernacula to summer roosting habitat where they establish maternity colonies. Maternity roosts are found in dead or nearly dead trees, or dead parts of living trees. Males and non-reproductive females are most commonly found in the vicinity of their hibernaculum but may also disperse throughout the summer range and roost individually or in small groups in trees. In summer and fall, Indiana bats primarily use wooded or semi-wooded habitats, usually near water. Foraging often occurs in riparian areas, ponds, and wetlands, but also takes place in upland forests and fields. Flying insects are typical prey of the Indiana bat. Significant threats to the Indiana bat include human-induced disturbance and alterations at hibernation sites, loss of summer roosting habitat, contaminants, and white nose syndrome (see Section 2.4.1.3) (Normandeau 2012-TN1784).

The historical range of the Indiana bat includes much of the eastern United States. The species has disappeared from, or greatly declined in, most of its former range in the northeastern United States (Normandeau 2012-TN1784). Rangewide, the total population of hibernating Indiana bats was estimated to be about 534,239 in 2013 (FWS 2013-TN3848). About 42 percent of the total hibernating population occurs in Indiana, with 0.02 percent (about 120 hibernating bats) estimated to occur in Pennsylvania (FWS 2013-TN3848). The population of hibernating Indiana bats in Pennsylvania has dropped by about 77 percent since 2011 (FWS 2013-TN3848). Indiana bats are known to occur within 21 mi of the Seedco site (PNHP 2013-TN3900).

Northern Long-Eared Bat (*Myotis septentrionalis*), Federally Threatened (FT)

The northern long-eared bat is a small insectivorous bat that is a true hibernator. It ranges over 39 states in the eastern and north-central United States, and has been considered to be more prevalent in the eastern portion of its range. The species predominantly overwinters in hibernacula that include caves and abandoned mines, but has also been found overwintering in other types of man-made habitat that resemble cave or mine hibernacula (e.g., railroad tunnels, sewers, aqueducts, and wells). The species arrives at hibernacula in August or September, enters hibernation in October and November, and leaves the hibernacula in March or April. A total of 112 of the 780 known hibernacula in the United States are in Pennsylvania. Migration distances between hibernacula and summer roosts are typically 35 to 55 mi (78 FR 61046-TN3207).

Breeding occurs when males swarm hibernacula from late July in northern regions to early October in southern regions. Fertilization of a single egg occurs in the spring following hibernation (78 FR 61046-TN3207). During the summer, the species roosts singly or in colonies underneath tree bark or in cavities or crevices of both live and dead trees (Johnson et al. 2011-TN1852; 78 FR 61046-TN3207) but may also roost in colonies in man-made structures (e.g., buildings, under eaves, and behind shutters). In addition, males and non-reproductive females may roost in caves and mines during summer. Summer roost selection is similar to that of the

Indiana bat. Adult females give birth to a single pup in May to early June. Volancy (flight) occurs in 21 days (78 FR 61046-TN3207).

Most hunting takes place on forested hillsides and ridges above the understory but under the canopy. Therefore, mature forests are an important foraging habitat for the species (78 FR 61046-TN3207; PGC and PFBC 2005-TN3815). The species consumes a variety of night-flying insects (e.g., moths, beetles, flies, etc.) (78 FR 61046-TN3207; NatureServe 2015-TN4432).

The northern long-eared bat is known to occur within 21 mi of the Seedco site (PNHP 2013-TN3900).

Eastern Small-Footed Myotis (*Myotis leibii*), State Threatened (PT)

The eastern small-footed myotis is a small, insectivorous bat that hibernates in caves primarily under large rocks or in crevices and mine shafts in the winter, and roosts in caves (or cracks and crevices in rock walls) and hollow trees (under bark) in the summer. Little is known about the species' reproductive behavior or habitat or food requirements because very few have been captured during summer mist-netting surveys (PGC 2013-TN3845). The eastern small-footed myotis is known to occur within 21 mi of the Seedco site (PNHP 2013-TN3900).

Ester Moth (*Hypagirtis ester*), State Imperiled/Rare (S2/S3)

This moth species is known to exist in the project vicinity. It has been observed near strip mines with patches of pines (*Pinus* spp.) and scrubby grasslands. The most common habitat type for the species is presumably in or near pines, as the larvae feed only on pines (PDCNR 2012-TN3910). Evergreen forest and mixed forest exist on the Seedco site (PPL Bell Bend 2011-TN4010), as do lands that have been extensively strip-mined. Thus, this moth species may occur onsite.

Building Impacts

It is assumed that the entirety of the 420-ac Seedco site would be disturbed for construction of a new nuclear plant (PPL Bell Bend 2011-TN4010). Thus, approximately 355 ac of forest, 46 ac of barrens, 7 ac of cropland/pasture, 0.2 ac of shrub/scrub habitat, and 0.7 ac of wetland habitat (PPL Bell Bend 2011-TN4010; PPL Bell Bend 2013-TN3377) would be disturbed. This affected area would also include the approximately 13 ac of floodplain habitat on the site (UniStar 2011-TN505).

The makeup-water and blowdown pipelines would be collocated with or near an existing water line for most of their length and would thus largely be placed in previously disturbed areas. Approximately 24.2 mi of transmission-line would be built, much of the route through agricultural and forest land (PPL Bell Bend 2013-TN3377). Approximately 99 ac of forested habitat and 112 ac of non-forested habitat would be disturbed within the water-pipeline corridor, and approximately 239 ac of forested habitat and 346 ac of non-forested habitat would be disturbed within the transmission-line corridor (PPL Bell Bend 2011-TN4010).

There would be no impacts on wetlands associated with construction of the cooling-water intake pump house, water-pipeline corridor, and railroad spur expansion. Construction of the cooling-water intake and transmission-line corridor would affect approximately 4.7 ac of wetlands (PPL Bell Bend 2013-TN3377).

Based on the aerial extent of impacts on these habitats noted above, it is anticipated that wildlife mortality, disturbance, and displacement would be incurred to a much greater extent for upland forest than for wetland or riparian species on the Seedco site. Impacts on wildlife at the Seedco site would be noticeable, similar to those described in Section 4.3.1.for the proposed BBNPP site

Impacts on wildlife from habitat fragmentation associated with installation of the water-pipeline and transmission-line corridors at the Seedco site have no parallel at the BBNPP site because there are no offsite facilities. However, such impacts would be reduced by collocating the water pipeline and transmission lines to the extent practicable within or adjacent to existing corridors (PPL Bell Bend 2013-TN3377).

Species adapted to early successional habitat would be lost from affected upland shrub/scrub habitats within proposed water-pipeline and transmission-line corridors. Such species may disperse into shrub/scrub habitats in adjacent areas, and colonize new shrub/scrub habitats created by installation of the water-pipeline and transmission-line corridors. Similarly, species adapted to forest/clearing interface environments within proposed water-pipeline and transmission-line corridors may be lost from edge habitats that are destroyed by forest clearing, but may disperse into edge habitats in adjacent areas and colonize new edge habitats created by water-pipeline and transmission-line corridor installation. Thus, overall, water-pipeline and transmission-line corridor installation could pose minor adverse effects or could be beneficial for some species that inhabit early successional habitat or use edge environments. However, species dependent on interior forests could only disperse into contiguous forest habitats, which are likely less prevalent in adjacent areas and are not created by installation of these corridors. Thus, forest-interior wildlife may be locally affected to a greater extent than wildlife adapted to early successional or forest-edge habitats.

The PGC (2012-TN3901) indicated that impacts on the Indiana bat, northern long-eared bat, and eastern small-footed myotis would be unlikely. Because it is found in nearby pine, scrubby grassland habitat on strip-mined land, the ester moth (S2/S3) may be affected by construction at the Seedco site.

Operational Impacts

Impacts on terrestrial ecological resources from operation of a new nuclear plant at the Seedco site would be minor and similar to those described in Section 5.3.1 for the proposed BBNPP site, including consumptive-use mitigation and site-specific low-flow protection. The Seedco site consumptive-use mitigation and site-specific low-flow protection would involve the same waterbodies as the BBNPP site. There may be minor differences in operational impacts because of factors such as climate, topography, and elevation. The staff's independent review did not identify any information specific to the Seedco site that would contradict the conclusions for the BBNPP site in Section 5.3.1.

Cumulative Impacts

Overlaying the historic impacts in the Ridge and Valley ecoregion discussed in the site description above are the current projects listed in Table 9-14. Projects located within the geographic area of interest include the following:

- energy (e.g., Intelliwatt Renewable Energy, wood energy source, biomass energy source Fishbach Oil Plant, Good Spring, natural gas; and other fossil-fuel plants)
- solar energy projects
- pipelines
- wind farms (e.g., Locust Ridge I and II Wind Power Projects)
- various industrial activities (e.g., Kydex, Foam Fabricators, Safety Light, Cherokee Pharmaceutical Plant, and Benton Foundry)
- various other energy and industry projects located in the adjacent Seedco Industrial Park
- various surface and subsurface mines (e.g., UAE Coal Harmony and Knorr)
- natural areas (e.g., State game lands and Shikellamy State Park).

The development of most of these projects has or will further reduce, fragment, and degrade natural forests and wetland and floodplain habitat and decrease habitat connectivity. In contrast, natural areas (including State game lands and parks) in Northumberland, Montour, Snyder, Union, Lycoming, Columbia, and Schuylkill Counties within a 21-mi radius of the site (PNHP 2014-TN4013) protect such terrestrial resources in perpetuity. Reasonably foreseeable projects within the geographic area of interest that would affect terrestrial resources include the proposed Atlantic Sunrise pipeline for natural gas. Reasonably foreseeable land conversions within the geographic area of interest that would affect terrestrial resources include the following:

- ongoing conversion of forest to disturbed lands for agriculture and other uses
- succession of open habitats to forest
- continued urbanization, whereby terrestrial habitats are converted to developed land (e.g., commercial and residential buildings, roads, and landfills)
- continued reclamation of abandoned surface mine lands.

The review team expects that terrestrial habitats in the geographic area of interest will continue to experience changes related to global climate change. These changes would be similar to those discussed for the BBNPP site in Section 7.3.

Summary

Impacts on terrestrial ecology resources are estimated based on the information provided by PPL and the review team's independent review. Site preparation and development of the Seedco site for a new nuclear plant, site preparation and development of the new transmission-line and water-pipeline corridors, and extension of the existing railroad spur and roads would affect 693 ac of forest habitat, 46 ac of barrens habitat, 5.4 ac of wetlands, and approximately 13 ac of floodplain habitat. The overall impact of these activities on habitat and wildlife would be noticeable and permanent. There are 72 Federally listed, State-listed, and State-ranked species and communities that potentially occur at the Seedco site and associated offsite facilities that may be affected (Table 9-16). There are past, present, and future activities and land-use conversions in the geographic area of interest that have affected and would continue to affect habitat and wildlife in ways similar to site preparation and development for a new nuclear plant and offsite facilities.

The review team concludes that the cumulative impacts from past, present, and reasonably foreseeable future actions, including new nuclear facilities at the Seedco site and associated offsite facilities, on baseline conditions for terrestrial ecological resources in the geographic area of interest would be MODERATE. Building and operating a new nuclear power plant at the Seedco site would be a significant contributor to the MODERATE impact.

9.3.4.4 Aquatic Resources

The following impact analysis includes impacts from building activities and operations on aquatic ecology resources at the Seedco site. The analysis also considers cumulative impacts from other past, present, and reasonably foreseeable future actions that could affect aquatic resources, including the other Federal and non-Federal projects listed in Table 9-14. In developing this EIS, the review team relied on reconnaissance-level information to perform the alternative site evaluation in accordance with ESRP 9.3 (NRC 2000-TN614). Reconnaissance-level information is data that are readily available from regulatory and resources agencies (e.g., SRBC, FWS, PADEP, PFBC) and other public sources such as scientific literature, books, and Internet websites. It can also include information obtained through site visits (e.g., PNNL 2009-TN3667; NRC 2010-TN1891; NRC 2012-TN1890; NRC 2014-TN3639) and documents provided by the applicant.

The geographic area of interest for the assessment of the potential cumulative aquatic ecosystem impacts of building and operating a new reactor at the Seedco site is the same as for the BBNPP site and includes the North Branch and West Branch of the Susquehanna River Basin to their confluence and south to Conowingo Dam, as described in Section 7.3.2. As previously discussed in Section 9.3.4.2, the NRC staff also assumed that the SRBC would impose consumptive-use mitigation and site-specific low-flow protection requirements for a plant at the Seedco site. Those impacts are also discussed below.

Affected Environment – Onsite and Supporting Infrastructure (Pipeline and Transmission-Line Corridors)

The Seedco site is 2.5 mi east of the City of Shamokin in Northumberland County (Figure 9-17). A new nuclear plant on the Seedco site would draw cooling water from the North Branch of the Susquehanna River at a location approximately 4.3 mi upstream from Danville, Montour County, Pennsylvania (PPL Bell Bend 2013-TN3377). The water-intake/discharge pipeline corridor would pass through Northumberland and Montour Counties. The new/widened transmission-line corridor would pass through Northumberland and Columbia Counties. Consumptive-use mitigation and site-specific low-flow protection releases would involve the same geographic areas and aquatic resources as described for the BBNPP site (Section 2.4.2).

The primary aquatic resources that would be affected by a new plant on the Seedco site would be the North Branch of the Susquehanna River and Shamokin Creek. Several small offsite streams, including Little Roaring Creek and Quaker Run, would be affected by the building of a water-intake/discharge pipeline corridor for the water-intake and discharge structures and the installation of a new/widened transmission-line corridor.

The North Branch of the Susquehanna River is approximately 15 mi from the Seedco site and would provide the cooling water for a new nuclear plant (PPL Bell Bend 2013-TN3377). This region of the North Branch of the Susquehanna River is similar to the BBNPP region for water quality and aquatic biota, and is described in Sections 2.3.3 and 2.4.2, respectively.

Shamokin Creek (Figure 9-19) crosses the southern part of the proposed site, and its watershed flows throughout Northumberland and Columbia Counties. The headwaters of Shamokin Creek are underlain by part of the Western Middle Anthracite Field, and most of the watershed is impaired by abandoned mine drainage, sewage and septic system discharges, and agricultural runoff (PADEP 2001-TN689; Cravotta and Kirby 2004-TN609). The proposed alternative site is bounded by at least three primary abandoned mine-drainage discharges that rank within the top nine in the Shamokin Creek basin for abandoned mine-drainage metals (loadings of iron, aluminum, and manganese) and net alkalinity (Cravotta and Kirby 2004-TN609).

Figure 9-19. Shamokin Creek near the Southwest Part of the Seedco Alternative Site

The designated protected use for the main stem of Shamokin Creek is for warm-water fish (PA Code 25-93-TN611). The designated protected use for some unnamed tributaries to Shamokin Creek and Quaker Run is for cold-water fish. The water-intake/discharge pipelines may cross part of Little Roaring Creek, which is designated as a Class A wild trout stream (PFBC 2012-TN1910), and opens to the North Branch of the Susquehanna River just downriver from the proposed intake and discharge structures.

Consumptive-Use Mitigation and Site-Specific Low-Flow Protection Areas

PPL would propose to use a consumptive-use mitigation and site-specific low-flow protection plan similar to that proposed for the BBNPP site (PPL Bell Bend 2014-TN3494); it is described in Section 2.2.2. The primary aquatic resources that would be affected by required consumptive-use mitigation and site-specific low-flow protection releases are Cowanesque Lake (Tioga County, PA), Cowanesque River (Tioga County, PA, and Steuben County, NY), and Moshannon Creek (Centre County, PA). These aquatic resources and their biotic communities are described in Section 2.4.2.

Recreationally Important Species

The North Branch of the Susquehanna River is a popular recreational fishing area. Species commonly caught include Smallmouth Bass, Walleye, and Muskellunge. These species are discussed in Section 2.4.2. Additional recreational species that could occur in the streams along the pipeline corridor include Bluegill, Pumpkinseed, Redbreast Sunfish, Rock Bass, Black Crappie, White Crappie, Yellow Perch, Largemouth Bass, Channel Catfish, and bullhead catfish (PPL Bell Bend 2013-TN3377). The USGS sampled aquatic biota in Shamokin Creek and Quaker Run from 1999 to 2001. Upstream from the town of Shamokin, fish were not found in Shamokin Creek or Quaker Run near the proposed Seedco site or in the headwaters of Shamokin Creek (Cravotta and Kirby 2004-TN609). The PFBC does not stock trout into Shamokin Creek (PFBC 2014-TN3471).

Consumptive-use mitigation and site-specific low-flow protection releases would involve the same geographic areas and therefore the same discussion for recreationally important aquatic species as presented for the BBNPP site in Section 2.4.2.

Species of Historic Interest

American Shad is a species of considerable historical interest in the Susquehanna River Basin. Shad biology and restoration efforts in the Susquehanna River as well as the occurrence of American Shad in the waters within the consumptive-use mitigation and site-specific low-flow protection release areas are discussed in Section 2.4.2.3.

The American Eel, another fish species of historical interest, spends most of its life in freshwater and returns to the ocean to spawn. A large commercial eel fishery existed in the Susquehanna River until the early 1900s when dam construction blocked eel passage (Steiner 2000-TN1918). Efforts are under way to restore eels to the Susquehanna River above the Conowingo Dam (Minkkinen and Park 2011-TN1719). The PFBC has stocked American Eel fingerlings in the North Branch of the Susquehanna River and downriver from the confluence of the North and West Branches of the Susquehanna River (PFBC 2014-TN3468).

Non-Native and Nuisance Species

The zebra mussel, the Asian clam, the rusty crayfish, and the Flathead Catfish are four non-native nuisance species that have been recorded in sections of the Susquehanna River. In addition, two non-native plant species occur in the North Branch of the Susquehanna River near Bell Bend. Ecology III (2012-TN1645) found Eurasian watermilfoil and curly pondweed in the Bell Bend pool and off Goose and Hess Islands. Didymo, a non-native colony-forming, large, single-celled alga, is not yet known from the North Branch of the Susquehanna River. These non-native species and their potential effects on freshwater ecosystems are discussed in more detail in Section 2.4.2.3.

Federally and State-Listed Species

There are no Federally listed threatened or endangered aquatic species on or near the Seedco site (Northumberland County), in the North Branch of the Susquehanna River near the intake/discharge site (Montour County), along the intake/discharge pipeline corridor (Northumberland and Montour Counties), or along the new/widened transmission-line corridor route (Northumberland and Columbia Counties) (FWS 2013-TN3847; PPL Bell Bend 2013-TN3377). There are no Pennsylvania State-listed fish or mussel species listed for Northumberland, Montour, and Columbia Counties, and no aquatic plant species listed for Columbia County. The bushy naiad is listed as a Pennsylvania threatened aquatic plant in Montour County, and is described in Section 2.4.2.3. In addition, the northern water plantain, an aquatic plant, is State-listed as endangered in Northumberland County (PNHP 2015-TN4410). The northern water plantain grows to a height of approximately 3 ft and lives primarily in shallow water or mud but may occur in water as deep as 18 in. (PSU 2009-TN696). Although the distribution of the northern water plantain in Northumberland County is not known, appropriate habitat exists along the conceptual water-intake/discharge pipeline route, and potential effects on the species cannot be completely discounted. There are no Federally listed threatened or endangered species in the waterbodies associated with consumptive-use mitigation and site-specific low-flow protection (FWS 2014-TN3967) and State-listed species are described in Section 2.4.2.3 and listed in Table 2-23 for these waterbodies.

Building Impacts

The onsite aquatic resources have not been quantitatively characterized, but onsite stream impacts would affect 3,790 linear ft of Shamokin Creek, which courses through the site (PPL Bell Bend 2013-TN3377). PPL assumes that building a new plant on the Seedco site would affect all waterbodies on the development site, but that most impacts would involve Shamokin Creek and the North Branch of the Susquehanna River. Table 9-15 summarizes expected land-use impact parameters for the Seedco site, including the installation and operation of the water pipelines and a new/widened transmission-line corridor. Section 9.3.4.2 discusses surface-water quality and assumed use of stormwater detention and infiltration ponds as well as conformance with the NPDES permit and required BMPs to control stormwater runoff. The impact on the aquatic ecology of the onsite and offsite streams should be minimal.

New cooling-water intake and discharge structures would be required for a new plant at the Seedco site, and new water-intake and discharge pipelines would need to be installed between the North Branch of the Susquehanna River and a new plant on the Seedco site. Building the water-intake and discharge pipelines along the conceptual route as described in Section 9.3.4.1 may affect approximately 430 linear ft of streams, including part of Little Roaring Creek and Quaker Run (PPL Bell Bend 2013-TN3377). Impacts on aquatic resources would be minimized through the use of BMPs required by Federal, State, and local permits. PPL actions may affect 328 linear ft of streams to build or upgrade a railroad spur and access roads (PPL Bell Bend 2013-TN3377).

It is assumed that the water-intake and discharge structure designs would be similar to those at the proposed BBNPP site (Section 3.2.2.2), and building impacts would be similar to those described for the BBNPP site (Section 4.3.2.1). The conceptual location of the intake and discharge structures would be approximately 20 mi downriver to the south of the proposed BBNPP structures (PPL Bell Bend 2013-TN3377). The nature of the river bottom at the potential intake/discharge site upriver of Danville is not known. Installation of the water-intake and discharge structures and associated dredging would result in some loss of benthic habitat in the North Branch of the Susquehanna River and temporary degradation of water quality due to localized turbidity and sedimentation effects. Use of cofferdams to facilitate in-water building activities and dredging would minimize the amount and transport of disturbed sediments. Predators that rely on vision to capture prey could be temporarily affected, but most motile aquatic organisms would likely avoid the area of in-water activities. Effects on aquatic biota would be short-term and localized and would be mitigated through the use of BMPs. Prior to commencement of dredging, sediments within the areas proposed for dredging would be characterized in accordance with Federal and State permitting procedures. PPL anticipates that no construction-related effluents from building the intake and discharge structures would enter aquatic resources and PPL would use BMPs to minimize runoff (PPL Bell Bend 2013-TN3377).

Approximately 9.4 mi of transmission-line corridor would need to be built and 14.8 mi upgraded to connect a new nuclear plant on the Seedco site to the closest potential substation (PPL Bell Bend 2013-TN3377). The conceptual route may affect approximately 2,040 linear ft of streams (PPL Bell Bend 2013-TN3377). The severity of impacts would depend on the characteristics of the aquatic resources within the corridor, but would be minimized by the placement of footings outside of waterbodies, the use of BMPs during building to reduce sedimentation and erosion, and management of stormwater through NPDES compliance.

No building activities are planned for any of the offsite consumptive-use mitigation and site-specific low-flow protection release areas, except at the Rushton Mine. As previously discussed in Section 4.3.2.3, facility expansion activities should not affect aquatic resources.

Building a new nuclear plant on the Seedco site, including the water-intake/discharge pipeline corridor, new/widened transmission-line corridor, railroad spur, and access roads, may affect approximately 6,588 linear ft of streams onsite and offsite (PPL Bell Bend 2013-TN3377).

Operational Impacts

The most likely effects on aquatic populations from the operation of a new nuclear unit at the Seedco site would be the impingement and entrainment of organisms from the North Branch of the Susquehanna River. Assuming that a new reactor at the Seedco site would use a closed-cycle cooling system that meets the EPA's Phase I regulations for new facilities (66 FR 65256 -

TN243), has a maximum through-screen velocity of 0.5 ft/s, and meets the appropriate EPA intake flow-to-source water volume criterion, adverse impacts at the population level of many North Branch of the Susquehanna River aquatic species from impingement and entrainment would not be anticipated. Because the intake structure for the proposed Seedco unit would be in the same general habitat type as the proposed intake structure for the BBNPP unit, the potential effects from impingement and entrainment on aquatic resources in the North Branch of the Susquehanna River should be similar to those described for the BBNPP unit (Section 5.3.2). The North Branch of the Susquehanna River at the conceptual discharge location, which would be approximately 20 mi downstream and to the south from the proposed BBNPP discharge location, has not been characterized, but may be similar to that at the location of the proposed BBNPP discharge, and therefore discharge effects are expected to be similar to effects described for the BBNPP unit. Maintenance activities onsite and in offsite corridors would follow BMPs required by Federal and State permits to minimize impacts on aquatic resources (PPL Bell Bend 2013-TN3377). Consequently, impacts on aquatic ecology due to operations at the Seedco site are expected to be minor. The operational impacts on aquatic biota from the transmission lines would also be minor assuming that maintenance of the transmission-line corridor would be based on BMPs. The effects of water-intake and discharge system maintenance, and stormwater runoff are expected to be minor.

The NRC staff assumed the Seedco unit would have the same requirements for consumptive-use mitigation and site-specific low-flow protection as those specified by the SRBC for the BBNPP unit, described in Section 2.2.2. Operational effects of consumptive-use mitigation and site-specific low-flow protection releases on aquatic resources at the Seedco site would be expected to be similar to those for the BBNPP site as discussed in Section 5.3.2, and are expected to be minor.

Cumulative Impacts

In addition to the impacts from construction, preconstruction, and operation, the cumulative analysis also considers other past, present, and reasonably foreseeable future projects that could affect aquatic resources. A new plant built on the Seedco site would rely on the North Branch of the Susquehanna River for cooling water and involve much of the river basin in a consumptive-use mitigation and site-specific low-flow protection plan. Therefore, the geographic area of interest for the assessment of the potential cumulative aquatic ecosystem impacts of building and operating a new reactor at the Seedco site is the North Branch and West Branches of the Susquehanna River Basin to their confluence and south to Conowingo Dam. The Conowingo Dam is in Maryland approximately 3 mi upriver from Deer Creek, which is the general location of the tidal extent in the river (Normandeau and Gomez and Sullivan 2011-TN3681).

The major actions identified in Table 9-14 that would contribute to the potential cumulative impacts affecting the aquatic resources within the area of interest include historic anthropogenic activities, abandoned mine drainage, operation of the existing SSES and other power-generation facilities within the defined geographic area of interest, increased urban/suburban development (creating increased runoff, increased sewage effluent, consumptive-water use), agricultural runoff, Marcellus Shale gas extraction, and climate change. The primary activities associated with the preconstruction, construction, and operation of a new nuclear plant at the

Seedco site that could interact with these actions include the impingement and entrainment of the North Branch of the Susquehanna River biota, thermal discharges and chemical releases into the river, and the consumptive use of river water. The staff considered these potential sources of impacts in its evaluation of the cumulative aquatic ecosystem impacts as described for the BBNPP site in Section 7.3.2.

Summary

Impacts on aquatic ecology resources are estimated based on the information provided by PPL, SRBC, FWS, the Commonwealth of Pennsylvania, and the review team's independent review. Properly siting the associated transmission line and switchyard; minimizing interactions with waterbodies and watercourses along the utility corridors, railroad spur, and access roads; and use of BMPs during water-intake and discharge structure installation, pipeline installation, railroad spur and access road installation, transmission-line corridor preparation, and tower placement would minimize construction and operational impacts and are required by Federal and State permit requirements. As required by law, the SRBC would identify the requirements for consumptive-use mitigation and site-specific low-flow protection to avoid adverse effects from low flow events (SRBC 2012-TN2453). Thus, construction and operational impacts on aquatic resources and Federally and State-listed species should be minor.

The review team concludes that the cumulative impacts on most aquatic resources in the region of building and operating the proposed plant on the Seedco site combined with other past, present, and future activities would be MODERATE to LARGE, primarily from past actions such as the building of dams in the watershed, abandoned mine drainage, and urbanization, but building and operating a new nuclear plant at the Seedco site would not be a significant contributor to the cumulative impact.

9.3.4.5 Socioeconomics

For the analysis of socioeconomic impacts at the Seedco site, the geographic area of interest is the 50-mi (80-km) region centered on the site with special consideration of Northumberland County. In evaluating the socioeconomic impacts of building and operating a nuclear power plant at the Seedco site in Northumberland County, the review team undertook a reconnaissance-level survey of the site using readily obtainable data from the Internet and published sources.

The Seedco site is located in Northumberland County, and the nearest communities are Marshallton (population 1,437 in 2010), Mount Carmel (population 6,390 in 2010), Kulpmont (population 2,985 in 2010), and Shamokin (population 7,374 in 2010). The nearest community with a population in excess of 25,000 is Harrisburg, Pennsylvania (population 49,428 in 2010), which is located 38 mi from the Seedco site. The review team drew upon USCB data, workforce data provided by PPL, and other State and Federal sources to evaluate the impacts of building and operations activities within the host county and the 50-mi region.

The review team employed a gravity model to estimate the distribution of in-migrating workers between cities located near the Seedco site. The gravity model is a standard economic location model inspired by Newton's law of gravitation to evaluate trade and migration patterns between competing countries, cities, or economies. The simplified model employed for this analysis measured the “gravitational pull” of each community surrounding the Seedco site on in-migrants based on the population of the community divided by the square of the distance of that community from the site (Anderson 2010-TN1947). Each community was, in turn, assigned a value based on the calculation described above. These values were used to determine the proportion of the in-migrating population that would reside in each community. The gravity model evaluated all communities located within 10 mi of the Seedco site and all communities with populations in excess of 5,000 located within the 50-mi region. The results of the gravity model for the Seedco site indicate that 82.8 percent of the in-migrants would locate in Northumberland County, with concentrations found in Edgewood, Kulpmont, Marshallton, Shamokin, and Mount Carmel.

Based on the results of the gravity model, the review team identified Northumberland County as the primary economic impact area for the nuclear unit at the Seedco site and the basis of expected effects of in-migrating construction and operations workers and their families. Table 9-17 provides socioeconomic data for Northumberland County.

Physical Impacts

Many of the physical impacts of building and operating a nuclear power plant would be similar regardless of the site. Building activities can cause temporary and localized physical impacts (e.g., noise, odors, vehicle exhausts, vibrations, shocks from blasting [if used], dust emissions, etc.). The use of public roadways, railways, and waterways would be necessary to transport construction materials and equipment. Offsite areas that would support building activities (e.g., borrow pits, quarries, and disposal sites) would be expected to be already permitted and operational.

Potential impacts from station operations include noise, odors, exhausts, thermal emissions, and visual intrusions (the latter are discussed under aesthetics and recreation). A new unit would produce noise from the operation of pumps, cooling towers, transformers, turbines, generators, and switchyard equipment. Traffic at the site also would be a source of noise. Any noise coming from the proposed site would be controlled in accordance with standard noise protection and abatement procedures. This practice also would be expected to apply to all alternative sites, including the Seedco site. Commuter traffic would be controlled by speed limits. Good road conditions and appropriate speed limits would minimize the noise level generated by the workforce commuting to the Seedco site.

The new unit at the Seedco site would have standby diesel generators and auxiliary power systems. Permits obtained for these generators would ensure that air emissions comply with applicable regulations. In addition, the generators would be operated on a limited, short-term basis. During normal plant operation, the new unit would not use a significant quantity of chemicals that could generate odors that exceed odor threshold values. Access roads and appropriate speed limits would minimize the dust generated by the commuting workforce.

Table 9-17. Selected Socioeconomic Data for Northumberland County

	Northumberland	Data Source
Population		
1980	100,381	(a)
1990	96,771	(a)
2000	94,556	(b)
2010	94,517	(c)
Vacant Housing Units		
1990	3,164	(a)
2000	4,329	(b)
2010	5,883	(c)
Total Housing Units		
1990	41,900	(a)
2000	43,164	(b)
2010	45,125	(c)
Workforce		
Employed	42,097	(d)
Construction	2,738	(d)
Unemployment Rate	7.5%	(d)
Median Household Income	38,387	(d)
Education		
Total Schools	12 E, 1 E-M, 5 M, 8 E-M-H, 3 M-H, 6 H	(e)
Student-to-Teacher Ratio	13.5	(e)
Sheriff and Police		
Law Enforcement Employees	194	(f)
Officers	179	(f)
Officer per 1,000 people	2.0	(f)
Emergency Services		
Firefighters	888	(g)
Firefighters per 1,000 people	9.4	(g)
Demographics		
White	96.8%	(h)
Black	3.1%	(h)
Hispanic or Latino Origin	2.4%	(h)
Below Poverty Level	11.9%	(h)

(a) USCB 1990-TN1869.
(b) USCB 2001-TN1873.
(c) UCSB 2011-TN1874.
(d) USCB 2011-TN1876.
(e) NCES 2013-TN4026.
(f) Pennsylvania State Police 2010-TN1868.
(g) USFA 2013-TN1867.
(h) USCB 2011-TN1875.
E = elementary school; M = middle school; H = high school

The review team concludes that the visual impact associated with site development and operation of one nuclear unit on this site would have a noticeable impact on the visual aesthetic resources in the area because (1) plumes from the proposed site would be visible over a vast distance because of its location on a hilltop overlooking SR 901, (2) the site's proximity to adjacent commercial and residential development, (3) the proximity of the site to Shamokin, and (4) the fact that the site is currently undeveloped. Building and operating transmission lines to support the site would also aesthetically impact the region. Based on information provided by PPL and the review team's independent evaluation, the review team concludes that the aesthetic impacts of building and operating one nuclear unit at the Seedco site would be noticeable.

Based on information provided by PPL and the review team's independent evaluation, the review team concludes that the physical impacts of building and operating one nuclear unit on workers and the local public, buildings, and roads near the Seedco site would be minor. The review team concludes that aesthetic impacts would be noticeable.

Demographic Impacts

The Seedco site is located in Coal Township in Northumberland County, Pennsylvania. The nearest city is Marshallton (population 1,437 in 2010) located 1.8 mi (2.9 km) from the site. Other nearby communities include Shamokin (population 7,374 in 2010), Marion Heights (population 735 in 2010), Kulpmont (population 2,985 in 2010), Bloomsburg (population 14,855 in 2010), Berwick (population 10,477 in 2010), Sunbury (population 9,905 in 2010), Danville (population 4,699 in 2010), Milton (population 7,042 in 2010), and Pottsville (population 14,324 in 2010). Harrisburg (population 49,428), Reading (population 88,082 in 2010), and Wilkes-Barre (population 41,498 in 2010) are the largest communities located within the 50-mi radius of the Seedco site. In 2010, Northumberland County's population reached 94,517, down slightly from 2000 levels (USCB 2011-TN1875).[8] As of 2010, the population density in Northumberland County was 206.2 persons per square mile compared to 283.9 for the Commonwealth of Pennsylvania. The population density within a 20-mi radius of the Seedco site is 195 persons per square mile (PPL Bell Bend 2013-TN3377).

PPL estimates the peak construction workforce for the proposed BBNPP unit would be 3,950 (PPL Bell Bend 2013-TN3377). In the BBNPP ER, PPL indicated that staffing levels at each alternative site would be similar to those estimated for the BBNPP (PPL Bell Bend 2013-TN3377). In 2010, the total construction workforce available in Northumberland County was 2,738. While the construction workforce in Northumberland County is insufficient to meet the needs of the project, there are several large communities located within the 50-mi region (e.g., Wilkes-Barre, population 41,498; Harrisburg population, 49,428; and Reading, population 88,082) where construction workers could reside and commute to the site. The review team concludes that resident and commuting workers could meet the majority but not all of the

[8] The U.S. Census Bureau (USCB) data used in this section were obtained from American Community Survey (ACS) results released in 2011. During the preparation of this EIS, the results of the 2012 ACS were released in topical and regional data sets. The review team has examined the latest ACS data, and is not aware of any information that appears to be inconsistent with the earlier information sets and those sets projected from the earlier survey.

building workforce needs. Thus, the review team has retained the 20 to 35 percent in-migration assumption presented in Sections 4.4.2 and 5.4.2.

Based on the results of the gravity model calculations, the review team further estimates that 82.8 percent of those in-migrants would locate in Northumberland County. Based on these assumptions, the review team estimates that 955 to 1,445 construction and operations workers would in-migrate into Northumberland County. Using the average household size in Pennsylvania of 2.47 people, workers would bring an additional 1,403 to 2,125 family members. Thus, the review team estimates the in-migrating direct workforce population at 2,358 to 3,570 (USCB 2011-TN3623). At this level of in-migration, the population of Northumberland County would grow by 1.5 to 2.2 percent.

If the facility is constructed and commences operation, the 363-person operational workforce would already be onsite during the period of peak building-related employment and are included in the above analysis, meaning that there would be very little demographic impact during operations in Northumberland County. Based on information provided by PPL and the review team's independent evaluation, the review team concludes that the demographic impacts of building and operating the nuclear power plant at the Seedco site would be minor.

Economic Impacts

The principal economic centers in Northumberland County include Shamokin, Milton, Mount Carmel, and Sunbury. The USCB reports that the top five industries in Northumberland County in 2010 were education, health, and social services (25.9 percent); manufacturing (17.0 percent); retail trade (12.6 percent); arts, entertainment, recreation, accommodations, and food services (7.3 percent); and construction (6.5 percent). Together, these five industries accounted for 69.3 percent of the employment in Northumberland County in 2010 (USCB 2011-TN1876).

The review team determined that the impact of jobs associated with building would have a noticeable and beneficial impact on total employment in Northumberland County. The impact of 654 to 1,145 construction-related jobs and 301 operations jobs filled by in-migrating workers, as well as the 910 to 1,268 indirect jobs, would be noticeable in Northumberland County. Note the estimated indirect jobs created as a result of building and operating a nuclear power plant at the Seedco site. When a new job is added to an economy, that new (direct) job supports the creation of other (indirect) jobs. Every new direct job in a given area—in this case, a job building the plant at the Seedco site—stimulates spending on goods and services, which results in the economic need for a fraction of another indirect job, typically in the service industries. The BEA provided RIMS II regional multipliers for industry employment and earnings in the BBNPP economic impact area. As noted in Section 4.4.2, the employment multiplier for construction jobs in the BBNPP economic impact area is 1.73, meaning that for each construction job created a total of 1.73 jobs (including the direct job) would be supported in the two-county BBNPP economic impact area. The employment multiplier for operations jobs during the building phase is 2.44 (BEA 2014-TN3624). For comparative purposes, the review team applied these multipliers to Northumberland County. The BEA employment multiplier is applied only to in-migrating workers because the BEA model assumes the direct employment of workers that already live in the area would have no additional impact on employment.

The review team assumed that tax revenue generated from sales and use taxes associated with building and operating a nuclear power plant at the Seedco site would be similar to those evaluated for the BBNPP site in Sections 4.4.3.3 and 5.4.3.3., with a similarly noticeable and beneficial impact on revenues in Northumberland County. For the BBNPP site, property taxes are estimated by PPL at $2.4 million annually (PPL Bell Bend 2013-TN3377). Adjusting for the property tax rate differential between Salem Township (16.544 mills) and Coal Township (74.968 mills) results in an annual property tax assessment estimate of $10.9 million for the Seedco site. Coal Township would receive approximately $3.2 million of the annual property tax payments. The review team estimates that the proposed nuclear power plant would also generate $3.1 million annually in local earned income taxes throughout the region. It would also generate $202,711 in annual LST revenue for Coal Township during the peak construction period and $17,061 annually during the operations phase (PDCED 2014-TN3915). In 2012, total revenue to Coal Township was $3.8 million, indicating the addition of the nuclear power plant, and the resulting increase in property and LST tax proceeds, would result in a minimum 5.3 percent increase in revenues during the peak construction period and 84.7 percent growth over current levels during the operations period (PDCED 2012-TN3916).

The new unit would employ an operations workforce of 363 people who would earn $28 million annually (average annual salaries of $77,135). The constructions workforce of 3,950 would collectively earn $279 million annually at its peak (average annual salaries of $70,720) (PPL Bell Bend 2013-TN3377). As shown in Table 9-17, these salaries far exceed the median household income in Northumberland County ($38,387) (USCB 2011-TN1876). The in-migrating construction and operations workforce would stimulate the creation of 910 to 1,268 additional indirect jobs within Northumberland County during the peak of employment during the building period. These indirect jobs would generate an additional $16 to $23 million annually in Northumberland County (average annual salary of $17,870) (PPL Bell Bend 2013-TN3377). In addition, PPL estimates that within the 50-mi region, $260.8 million will be spent on materials, equipment, and outside services during the construction period and $9 million spent annually during operations (PPL Bell Bend 2013-TN3377). The economic multiplier effect of the increased spending by the direct and indirect workforce and the businesses serving the site directly would increase the economic activity in the region, most noticeably in the communities near the Seedco site.

Based on the information provided by PPL, and the review team's own independent evaluation, the review team concludes that the tax and economic impacts of building and operating a new nuclear plant at the Seedco site would be similar to those estimated for the BBNPP site; economic impacts would be noticeable but not destabilizing and beneficial in Northumberland County and minor in the 50-mi region. The beneficial tax impacts on Coal Township would be noticeable and destabilizing.

Transportation Impacts

Primary access to the Seedco site is from State Highway 91 and State Highway 61. Traffic impacts would be primarily along these highways. Based on the information provided by PPL, a rail spur would be required to extend west 0.3 mi (0.5 km) to an existing Conrail line, and an access road would extend from the northeast border of the site north to State Highway 61 for 0.5 mi (0.8 km) (PPL Bell Bend 2013-TN3377). The review team expects that the transportation impacts from site development of a new nuclear plant at the Seedco site would be noticeable. During the construction phase, the 6-year impact on transportation near the Seedco site would be noticeable during shift changes but could be reduced through a number of mitigation strategies outlined in the BBNPP ER, including scheduling shift changes and deliveries during off-peak hours and improvements to local roads, intersections, and signals (PPL Bell Bend 2013-TN3377). PPL identified a number of mitigation strategies for the BBNPP ER, and the review team assumes that similar mitigation strategies would be identified for the Seedco site. Any mitigation strategies must be agreed to by applicable PennDOT regions prior to PPL submitting final HOP engineering plans for review. Mitigation strategies that are agreed upon with PennDOT in the final approved TIS will be required as a condition of issuing an HOP (PPL Bell Bend 2013-TN3377).

In addition to congestion impacts, construction-related traffic will also result in emissions, traffic accidents, injuries, and fatalities. Heavy vehicles that transport construction-related equipment and materials and the automobiles that carry the commuting workforce to the Seedco site will emit several pollutants, including CO, CO_2, NO_X, fine PM, volatile organic compounds, and SO_2. Construction-related traffic will also result in an increase in the number of accidents, injuries, and fatalities. The costs associated with these incidents include workers' compensation premiums, lost productivity, environmental remediation, property damage, fines and penalties, insurance premiums, and medical costs. As discussed in Sections 4.4 and 5.4, the review team expects the impacts of BBNPP construction and operation to be minor with respect to emissions and the number of traffic accidents. Impacts at the Seedco site would be expected to be similar to those estimated for the BBNPP. Therefore, the socioeconomic impacts of emissions and traffic accidents would also be minor.

Operational impacts would be significantly lower than the building phase impacts of traffic due to the much smaller workforce and because roads would have been improved during site development. During the operational phase, traffic impacts would be minor.

Recreation Impacts

Recreation in the area includes 370 parks located within the 50-mi region surrounding the Seedco site. Within Northumberland County, there are 12 parks, including 5 state game lands, 2 state parks, 4 local parks, 1 state forest, and 1 stadium (PPL Bell Bend 2013-TN3377). Impacts of operations from the vantage point of local recreation areas would be minimal. There could be larger impacts at Cowanesque Lake because of the compensatory upstream water requirements during low-flow conditions. Impacts associated with the Seedco site would be similar to those outlined for the BBNPP site in Section 5.4.4.2. The NRC staff concludes that the recreation impacts of plant development at the Seedco site would be minor.

Housing Impacts

Within a 50-mi (80-km) radius of the Seedco site, there are a total of 125,072 vacant housing units, with 5,883 of those units located within Northumberland County (PPL Bell Bend 2013-TN3377; UCSB 2011-TN1874). The housing figures presented in Table 9-17 do not include recreational vehicle parks, campgrounds, or hotels, and thus provide a lower bound of what would be available to house workers.

The review team compared the vacant housing units to the number of workforce households projected for the peak workforce years. Using the approach outlined in Section 4.5.2, the review team estimates the number of workforce households at 955 to 1,445 during peak workforce years. In the 50-mi radius surrounding the Seedco site, 0.8 to 1.2 percent of the year 2010 vacant housing units would be needed to house in-migrating workers. In Northumberland County, 16.2 to 24.6 percent of the vacant housing units would be required to meet the housing demands placed upon the community.

The review team expects that the in-migrating workforce could be absorbed into the existing housing stock in both the 50-mi (80-km) region around the Seedco site and Northumberland County without a noticeable impact. Based on the information provided by PPL and the review team's independent evaluation, the review team concludes that the housing impacts of building and operating a nuclear power plant at the Seedco site would be minor.

Impacts on Public Services and Education

In-migrating construction workers and plant operations staff would impact local municipal water, wastewater-treatment facilities, and other public services in the region. These impacts would likely be in proportion with the demographic impacts experienced in the region, unless these resources have excess capacity or are particularly strained during building, which would decrease or increase the impact. In Northumberland County, there are 13 community public water systems that serve over 86,000 people. These public water systems have a total design capacity of 30.3 Mgd, average use of 14.8 Mgd, and excess capacity of 15.6 Mgd. Based on assumptions presented in Section 4.4.4.4, water use onsite and offsite by the workforce population during the peak building period would require 313,600 to 487,000 gal/day or 1.0 to 1.6 percent of the design capacity for public water systems in Northumberland County. In addition, there are 5 major and 14 minor municipal wastewater/sanitary sewer treatment plants within Northumberland County with a collective wastewater flow of 19.6 Mgd (PPL Bell Bend 2013-TN3377). Based on wastewater demand assumptions presented in Section 4.4.4.4, the in-migrating workforce and onsite activities during the peak building phase would require only a small portion (2.6 to 3.5 percent) of the sewer/wastewater capacity in Northumberland County. Operations impacts would be lower because of the relatively lower workforce population required to operate the plant. Therefore, the review team concludes that construction and operation of a plant at the Seedco site would not likely have a noticeable impact on existing municipal water or sewer/wastewater services.

Within Northumberland County, there are 51 fire stations and 888 career, volunteer, and paid-per-call firefighters in (Table 9-17). There are 9.4 firefighters per 1,000 people in Northumberland County. In 2011, the national average rate of firefighters per 1,000 people was 3.5 (Karter and Stein 2012-TN1871). During the period when the peak construction workforce is present, 2,358 to 3,570 people would be expected to move into Northumberland County. To meet the demands placed on the fire protection network, the review team estimates that 22 to 34 additional firefighters would need to be hired or would need to volunteer based on the average rate of firefighters per 1,000 people in Northumberland County. With that noted, the firefighter rates in Northumberland County would continue to far exceed the national average even without adding firefighters. Within Northumberland County, there are 179 law enforcement officers or 2.0 officers per 1,000 people (Pennsylvania State Police 2010-TN1868).

Because of the influx of the construction workforce, five to seven law enforcement officers would need to be hired to maintain the current officer rate in Northumberland County.

Two hospitals are located within Northumberland County: Shamokin Area Community Hospital and Sunbury Community Hospital. In 2010 to 2011, Northumberland County hospitals provided 19,598 patient days of care and were operating at 37.3 percent capacity (PADOH 2012-TN2224). Based on the size and availability of medical services in the region, temporary construction workers would not overburden existing medical services. The review team concludes adverse impacts on medical services near the proposed site would be minor and temporary.

During the 2011 to 2012 school year, student enrollment in Northumberland County reached 13,068 (NCES 2013-TN4026). In Northumberland County, there are 7.2 individuals for every student enrolled in schools. Applying this ratio to the peak construction workforce population, the review team expects a peak building-related increase of approximately 328 to 496 students in Northumberland County. The gravity model output indicates that the Shamokin Area School District and Mount Carmel Area School District would be most noticeably affected by the influx of students. The review team estimates that enrollment in the Shamokin Area School District would increase by 94 to 142 students reaching 2,672 to 2,720, up from 2,578. Such an influx of students would increase the school district's student-to-teacher ratio from 15.4, its current level, to 16.0 to 16.2. For the Mount Carmel Area School District, the review team estimates that student populations would increase by 104 to 158 students, thus expanding the total student population to 1,719 to 1,773. An influx of students of this magnitude would increase the district's student-to-teacher ratio from 14.1 to between 15.0 and 15.5. In Pennsylvania, the statewide average student-to-teacher ratio is 13.8 (NCES 2013-TN4026). To keep student-to-teacher ratios at current levels after the influx of students, the review team estimates that the Shamokin Area School District would need to add 6 to 9 teachers, and the Mount Carmel Area School District would need to add 7 to 11 teachers. Based on the analysis outlined above, the review team has concludes that in-migrating students would have a minor impact on schools throughout the 50-mi region, with the exception of the Shamokin Area School District and Mount Carmel Area School District where the impacts would be noticeable. During operations of a nuclear power plant at the Seedco site, this impact on schools would be significantly less because of the lower number of in-migrating students and would be minor.

The in-migrating workers represent a small portion of the total population in Northumberland County and would likely not have a noticeable impact on public services. In the small communities of Shamokin and Mount Carmel, impacts could place a strain on some public services based on the community's proportionately larger in-migrating workforce population. Based on the information provided by PPL and the review team's independent evaluation, the review team concludes that the public service and education impacts of building and operating a new nuclear power plant at the Seedco site would be minor in the 50-mi region, with the exception of the education impacts during building for the Shamokin Area School District and the Mount Carmel Area School District, which could be noticeable but not destabilizing because of the temporary nature of building-related activities.

Summary of Project-Related Socioeconomic Impacts

Physical impacts on workers and the general public include impacts on existing buildings, transportation, aesthetics, noise levels, and air quality. Social and economic impacts span issues of demographics, economy, taxes, infrastructure, and community services. In summary, on the basis of information provided by PPL and the review team's independent evaluation, the review team concludes that the socioeconomic impacts of building and operating a nuclear plant at the Seedco site would be SMALL and adverse for the 50-mi region with a few exceptions. In Northumberland County near the Seedco site, transportation impacts would be MODERATE during building-related shift changes but could be reduced through a number of mitigation strategies outlined in PPL's ER, including scheduling shift changes and deliveries during off-peak hours and improvements to local roads, intersections, and signals. PPL identified a number of mitigation strategies for the BBNPP ER, and the review team assumes that similar mitigation strategies would be identified for the Seedco site. Any mitigation strategies must be agreed to by applicable PennDOT regions prior to PPL submitting final HOP engineering plans for review. Mitigation strategies that are agreed upon with PennDOT in the final approved TIS will be required as a condition of issuing an HOP (PPL Bell Bend 2013-TN3377). The building and operating impact on aesthetics is MODERATE because (1) plumes from the proposed site would be visible over a vast distance due to its location on top of a hill overlooking Pennsylvania SR 901, (2) the site's proximity to adjacent commercial and residential development, (3) the proximity of the site to Shamokin, and (4) the fact that the site is currently undeveloped. In-migrating students may represent a MODERATE impact on the Shamokin Area School District and the Mount Carmel Area School District. Economic and tax impacts would similar to those estimated for the BBNPP site; economic impacts would be noticeable but not destabilizing and beneficial in Northumberland County, and minor in the 50-mi region. Tax impacts on Coal Township are expected to be LARGE and beneficial.

Cumulative Impacts

The review team concludes that the current and reasonably foreseeable projects listed in Table 9-14 with the greatest potential to affect cumulative socioeconomic impacts would be the SSES (located 29 mi northeast of the Seedco site), the Intelliwatt Renewable Energy 13-MW biomass energy-generation facility (located adjacent to the site), the Good Spring 300-MW natural gas combined-cycle power plant (located 11 mi south of the Seedco site), the Cherokee Pharmaceutical Plant (located 14 mi northwest of the Seedco site), the Panda Hummel Station (planned to be located 17 mi west of the Seedco site), Montour Power Plant (located 22 mi northwest of the Seedco site), planned improvements to Federal, State, and county roads and bridges, and other renewable energy projects, fossil-fuel operational energy projects, and natural gas drilling operations throughout the region. The projects with the greatest potential to affect cumulative socioeconomic impacts would be the proposed Intelliwatt Renewable Energy 13-MW biomass energy-generation facility, which if constructed would result in 32 to 63 permanent operations workers located adjacent to the Seedco site (Strawser 2010-TN1877), the Good Spring 300-MW natural gas combined-cycle power plant and planned improvements to Federal, State, and county roads and bridges. Other projects involve continuation of ongoing activities and are expected to result in little or no change in current levels of employment at existing establishments. Any resulting new development is expected to be consistent with controls in existing county comprehensive plans.

The review team determined that the cumulative socioeconomic effects of a nuclear power plant located at the Seedco site and other past, present, and reasonably foreseeable projects would be SMALL with some exceptions. In Northumberland County, the cumulative impacts on transportation near the Seedco site would be MODERATE during the 6 years of construction, and traffic during shift changes at the nuclear plant would be a significant contributor to these impacts. PPL identified a number of mitigation strategies for the BBNPP ER, and the review team assumes that similar mitigation strategies would be identified for the Seedco site. Any mitigation strategies must be agreed to by applicable PennDOT regions prior to PPL submitting final HOP engineering plans for review. Mitigation strategies that are agreed upon with PennDOT in the final approved TIS will be required as a condition of issuing an HOP (PPL Bell Bend 2013-TN3377). Cumulative aesthetic impacts would be MODERATE and the nuclear power plant would be a significant contributor to these effects because (1) plumes from the proposed site would be visible over a vast distance because of its location on a hilltop overlooking Pennsylvania SR 901, (2) the site's proximity to adjacent commercial and residential development; (3) the proximity of the site to Shamokin, and (4) the site is currently undeveloped. Cumulative impacts associated with in-migrating students would likely represent a MODERATE impact on the Shamokin Area School District and the Mount Carmel Area School District. The impacts of the nuclear power plant would be expected to be a significant contributor to these impacts. Cumulative physical impacts on roads of planned improvements to Federal, State, and county roads and bridges are expected to be MODERATE. However, the review team concludes that the physical impacts on local road systems from building and operating a nuclear power plant at the Seedco site would not be a significant contributor to these impacts. The cumulative economic and tax impacts would be similar to those estimated for the BBNPP site; impacts would be MODERATE and beneficial in Northumberland County and SMALL in the 50-mi region. Cumulative tax impacts on Coal Township are expected to be LARGE and beneficial. The nuclear power plant would be a significant contributor to the beneficial economic and tax impacts.

9.3.4.6 Environmental Justice

To evaluate the distribution of minority and low-income populations near the Seedco site, the review team conducted a demographic analysis of populations within the 50-mi region surrounding the proposed site in accordance with the methodology discussed in Section 2.6.1. The review team identified 1,663 census block groups within a 50-mi radius of the Seedco site, 157 of which were classified as having aggregate minority populations. Of these minority populations, one is located in Northumberland County and two are located in Schuylkill County (USCB 2011-TN2009).[9] No aggregate minority populations are located in adjacent Columbia or Montour Counties. The highest concentrations of aggregate minority populations within the 50-mi region are in Berks (64 census block groups) and Dauphin (57 census block groups) Counties. A total of 63 census block groups in the 50-mi region meet at least one of the two

---

[9] The U.S. Census Bureau (USCB) data used in this section were obtained from American Community Survey (ACS) results released in 2011. During the preparation of this EIS, the results of the 2012 ACS were released in topical and regional data sets. The review team has examined the latest ACS data, and is not aware of any information that appears to be inconsistent with the earlier information sets and those sets projected from the earlier survey.

significance criteria outlined in Section 2.6 for black populations, 44 of which are clustered around Harrisburg in Dauphin County. Two census block groups meet the criteria for Asian populations, and 112 groups meet the criteria for Hispanic ethnicity. Figure 9-20 shows the aggregate minority block groups within the 50-mi region surrounding the Seedco site.

Figure 9-21 shows the location of low-income populations within the 50-mi region surrounding the Seedco site. The review team identified 115 census block groups with low-income populations of interest. Of the 115 census block groups with low-income populations, 4 are located in Columbia County, 5 are located in Northumberland County, and 6 are located in Schuylkill County. No low-income populations are located in Montour County. The most significant concentrations of low-income census blocks within the 50-mi region are in and around Harrisburg and Wilkes-Barre, Pennsylvania.

Almost all of the potential physical impacts of building and operation would occur within the vicinity of the Seedco site. These physical impacts would not affect any of the populations of interest because they attenuate with distance, topography, and intervening foliage.

The review team also investigated for the presence of unique characteristics or practices in minority or low-income communities that could result in different socioeconomic impacts from building and operating a nuclear power plant at the Seedco site. The review team's analysis did not find any information suggesting that minority or low-income populations in the area were dependent on natural resources that would be adversely affected by a nuclear power plant at the Seedco site. Finally, the review team did not identify any potential pathways by which any building or operations activity could affect any minority and low-income populations within the 50-mi region surrounding the Seedco site.

The review team determined that, for the Seedco site, there would be no disproportionate and adverse impacts on minority or low-income populations from building and operating one nuclear unit.

Cumulative Impacts

The cumulative impacts portion of Section 9.2.4.5 details the projects that would contribute to the environmental justice impacts at the Seedco site. The review team found no evidence that, in conjunction with a nuclear power plant at the Seedco site, the minor traffic contributions of the SSES, the Intelliwatt Renewable Energy 13-MW biomass energy-generation facility, the Good Spring 300-MW natural gas combined-cycle power plant, the Panda Hummel Station, the Montour Power Plant, the Cherokee Pharmaceutical Plant, Susquehanna River bridge replacement projects, and other renewable energy projects, fossil-fuel operational energy projects, and natural gas drilling operations throughout the region could impose disproportionately high and adverse effects on minority or low-income populations. The review team concludes that, in addition to other past, present, and reasonably foreseeable future projects, building and operating a nuclear plant at the Seedco site would not impose a disproportionately large and adverse impact on any minority or low-income populations.

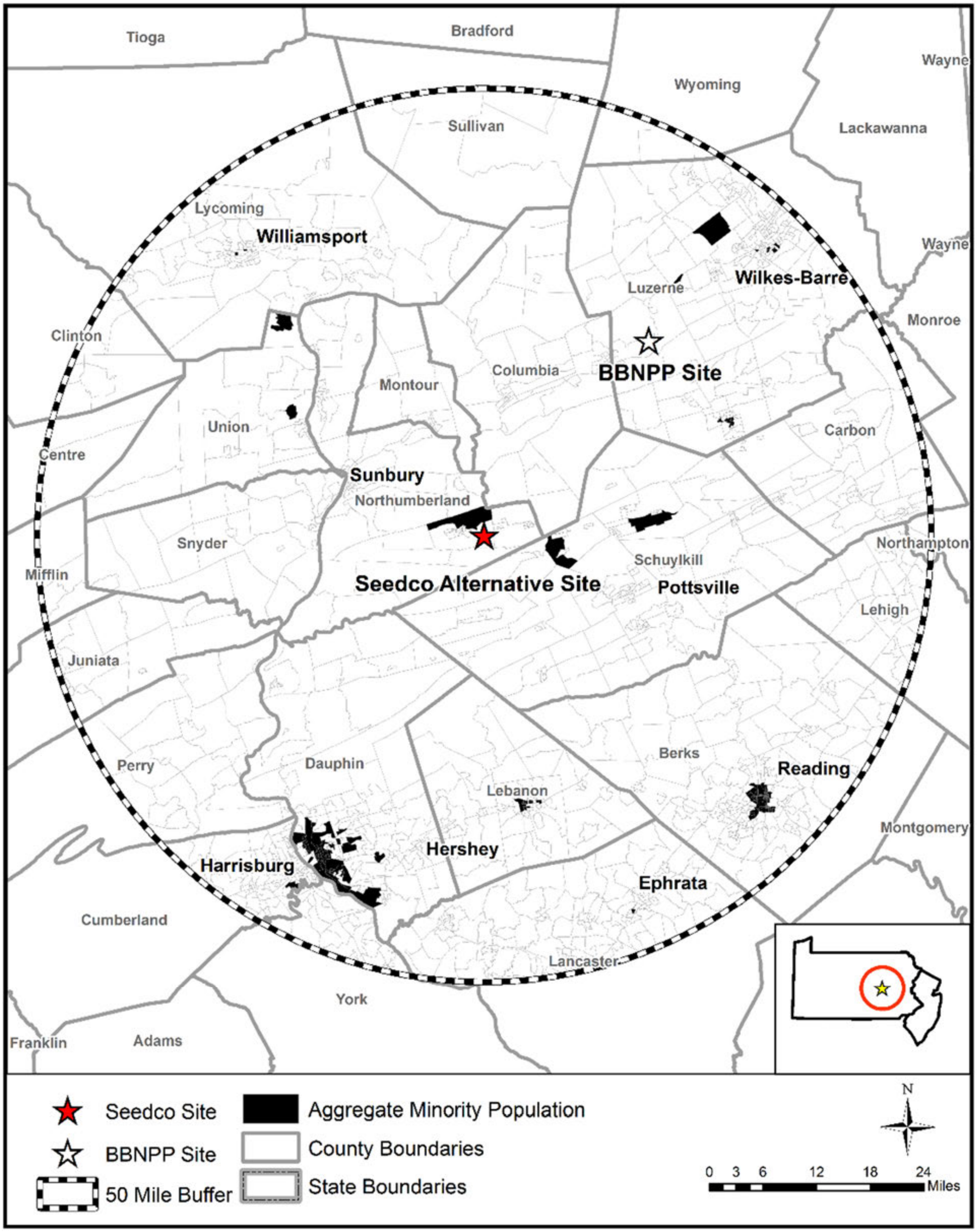

Figure 9-20. Aggregate Minority Block Groups within 50 mi of the Seedco Site

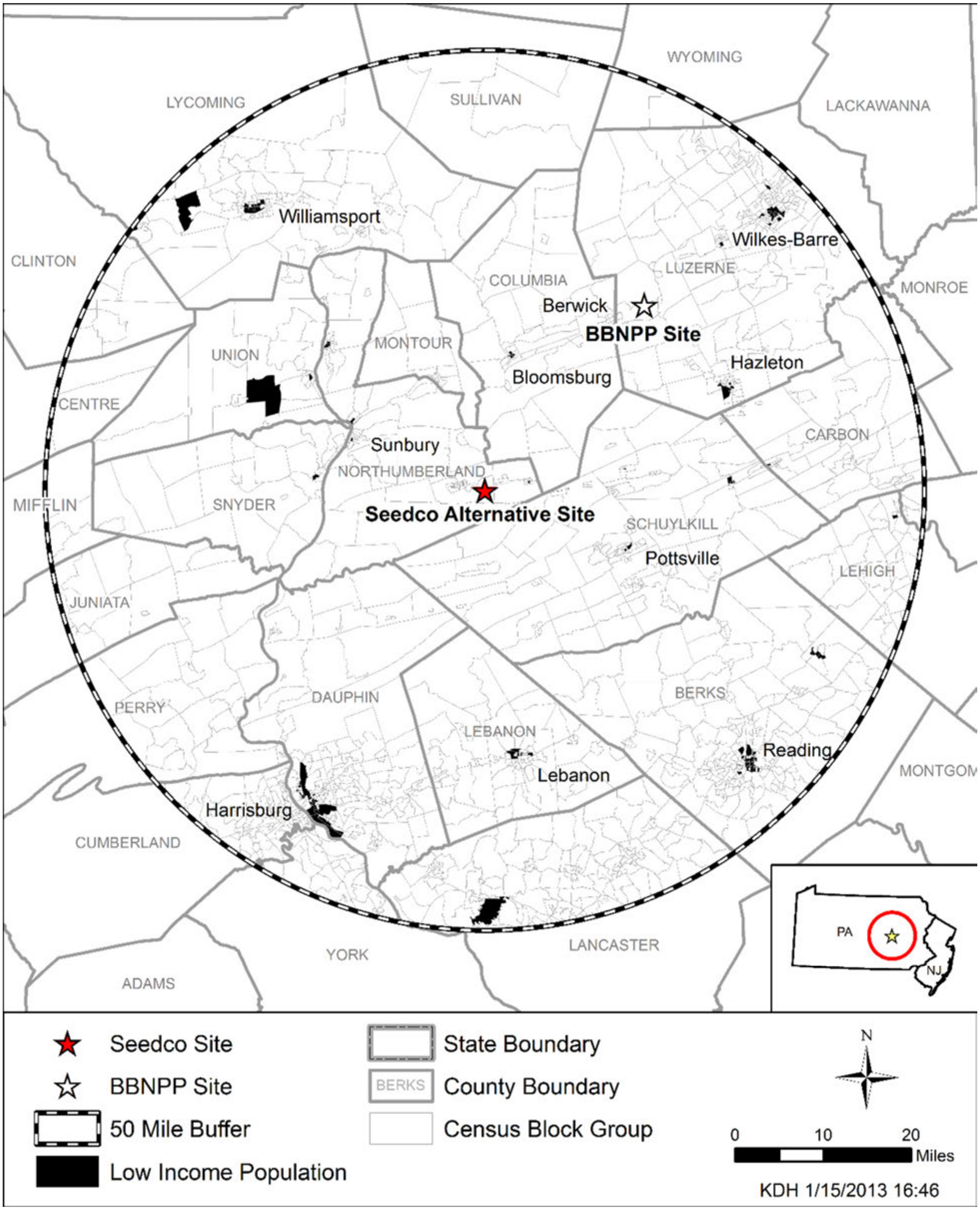

Figure 9-21. Low-Income Block Groups within 50 mi of the Seedco Site

9.3.4.7 Historic and Cultural Resources

The following analysis includes building and operating one new nuclear generating unit at the Seedco site. The analysis also considers other past, present, and reasonably foreseeable future actions that impact historic and cultural resources, including other Federal and non-Federal projects listed in Table 9-14. For the analysis of cultural resources impacts at the Seedco site, the geographic area of interest is considered to be the onsite and offsite direct-physical APEs and indirect-visual APEs associated with the proposed undertaking. This includes direct-physical-effects APEs, defined as onsite areas directly affected by site development and operation activities, as well as offsite areas such as water lines and transmission lines. Indirect-visual APEs are also included and defined generally as a 1-mi radius buffer around the proposed direct-physical APEs, which encompasses the approximate maximum distance from which tall structures could be seen.

Reconnaissance-level activities in a cultural resource review have particular meaning. Typically, such activities include preliminary field investigations to confirm the presence or absence of cultural resources. However, in developing this EIS, the review team relied upon reconnaissance-level information to perform the alternative sites evaluation in accordance with ESRP 9.3 (NRC 2000-TN614). In this context, reconnaissance-level information is data that are readily available from agencies and other public sources. It can also include information obtained through site visits. To identify historic and cultural resources at the Seedco site, the following information was used:

- the BBNPP revised ER (PPL Bell Bend 2013-TN3377)
- the PHMC and PennDOT CRGIS
- NRC alternative sites visit in June 2010.

Site Description

The Seedco site is a brownfield site located east/southeast of the community of Ranshaw and the City of Shamokin in Northumberland County, Pennsylvania. The project area is in the Upper Susquehanna Valley and encompasses steep-sloped, forested uplands that change elevation by more than 350 ft between narrow stream bottoms and ridge tops. Level ground within the Seedco site is restricted to ridge summits in the south-central portion of the project area. Areas not destroyed by mining activity are covered in secondary forest. Two permanent streams drain the project area. Shamokin Creek runs along the south of the project and Quaker Run, a tributary of Shamokin Creek, runs along the north. Shamokin Creek drains toward the Susquehanna River located 10 mi to the north. Much of the project area has been extensively disturbed by historic mining activities that date back to the 1800s. Areas disturbed by mining activity are interspersed with forested ridge tops and side slopes as well as areas disturbed by more recent residential and commercial development.

The history of the central Pennsylvania and the Susquehanna River valley spans more than 10,000 years, beginning with the earliest Paleondian hunter-gatherers and continuing into the historic period (PHMC 2014-TN3938). The Susquehannocks, an Iroquoian group, occupied much of the Susquehanna Valley at the time Europeans began colonizing Pennsylvania in the sixteenth and seventeenth centuries. However, disease and warfare caused the

Susquehannocks to disappear as a distinct tribe by the 1700s. The Delaware (an Algonkian group) later occupied the region, along with members of the Shawnee and Mohawk tribes and Iroquoian groups like the Oneida (PHMC 2014-TN3938). Transportation was a key factor in the development of the area. The Susquehanna River was heavily utilized by both Native American groups and Euro-American settlers. The Susquehannocks established the Indian village of Shamokin that was strategically located at the forks of the North Branch and the West Branch of the Susquehanna River. Euro-American settlers began to move into the region after the French and Indian Wars, occupying Shamokin, which they renamed to Sunbury. Sunbury became the county seat of Northumberland County when it was established in 1772 as the tenth county of Pennsylvania. The river continued to be the major transportation route for commerce and cargo until establishment of the great canal systems that linked the Great Lakes to the Chesapeake Bay, which were then quickly replaced by steam railways. Like most of rural historic Pennsylvania, the early economy was primarily agricultural. However, rich deposits of anthracite coal spurred the growth of coal mining, which dominated the region into the early twentieth century (Northumberland County 2012-TN1762). Much of the landscape is marked by mining activity.

The Seedco project area is considered to have a low potential for prehistoric sites. The steep-sloped, rugged terrain of the project area is not a favorable setting for the types of sustained Native American subsistence/settlement activities that leave their material trace in the archaeological record. There are few level areas that would be favorable settings for villages or camp sites. Access to water was also limited. Though Quaker Run goes through part of the project area and Shamokin Creek lies just to the south, they are narrow with very restricted level floodplains. Due to the steep ridge slopes, the streams would have been virtually inaccessible from the ridge summits. If prehistoric archaeological sites are present in the project area, they are likely to represent brief activities and not likely to have left evidence. Furthermore, much of the project area was destroyed by historic mining. For similar reasons, the potential for historic archaeological sites is limited. Given the steep terrain and lack of suitable farmland, there was little to attract historic settlers to the area. More recent surface mining activity is likely to have destroyed evidence of earlier historic mining that may have had archaeological significance.

Two APEs for cultural resources were evaluated for the Seedco site, including the direct-effects APE and the indirect-effects APE. No historic properties (archaeological sites, buildings, or districts) listed on the NRHP are recorded within either APE. The direct-effects APE includes the area within the project area that may be impacted during preconstruction and/or construction activities. No previously recorded archaeological sites or historic buildings are reported within the direct-effects APE. No cultural resources surveys of the direct-effects APE have been conducted.

The indirect-effects APE includes the direct-effects APE as well as a 1-mi (1.6 km) buffer around it. There are no NRHP-listed historic structures or districts within the indirect-effects APE. The nearest NRHP-listed structures are the Richards Covered Bridge and the Kreigbaum Covered Bridge. Both are located to the north of the Seedco site, just within 5 mi (8 km) of the project area.

While no NRHP-listed historic properties are located within the project direct-effects APE for cultural resources, there are NRHP-eligible properties located nearby. According to the

PHMC/PennDOT CRGIS database, one NRHP-eligible historic district, Buck Ridge Mine & Ranshaw Village, is located immediately west of the Seedco site within the indirect-effects APE. Portions of the 1861 Northern Central Railroad and the Philadelphia & Reading Railroad run along the southern boundary of the direct-effects APE within the 1-mi (1.6 km) indirect-effects APE. Both are documented as potentially eligible linear historic districts that are listed as not having been assessed for National Register eligibility in the SHPO records. While the railroads themselves are not listed on the NRHP, both have significant structures located outside the APEs along their historic routes that are either NRHP-listed or eligible for listing. Additional NRHP-eligible historic structures are located outside of the 1-mi (1.6 km) indirect-effects APE buffer, but within 5 mi (8 km) of the project area. The NRHP-eligible Saint Mary's Roman Catholic School, built in 1926, is located just over 1.5 mi (2.4 km) northeast of the project area. The NRHP-eligible Shamokin Historic District and several eligible structures are located in the town of Shamokin, 2 mi (3.2 km) west of the Seedco site. Additional NRHP-eligible structures are located in Mount Carmel, approximately 4 mi (6.4 km) to the east.

Building and Operation Impacts

To accommodate building a nuclear generating unit on the Seedco site, up to 420-ac (170-ha) could be impacted through preconstruction and construction activities. If the Seedco site were chosen for the proposed project, identification of cultural resources would be accomplished through cultural resource surveys and consultation with the SHPO, tribes, and interested parties. The results would be used in the site planning process to avoid or mitigate cultural resources impacts. If significant cultural resources were identified by these surveys, the review team assumes that PPL would develop protective measures in a manner similar to those for the BBNPP, and therefore, the impacts would be minimal. If direct effects on significant cultural resources could not be avoided, land clearing, excavation, and grading activities could potentially destabilize important attributes of historic and cultural resources.

The main source of cooling water for the Seedco site would be the main branch of the Susquehanna River, which lies approximately 15 mi (24.1 km) to the northwest of the project area. To obtain the water from the Susquehanna River, new water-intake and discharge pipelines would need to be built. A conceptual plan for the proposed pipeline would include a 21-mi (24-km)-long, 120-ft (36.6-m)-wide right-of-way corridor that would follow along Shamokin Creek from the eastern border of the project area to the Susquehanna River. Archaeological sites and historic structures may be directly impacted by placement of the water pipeline. Construction of the pipeline may have temporary visual impacts to historic structures and historic districts. Natural streams, such as Shamokin Creek, were favored locations for Native American settlements and campsites. The Susquehannock village of Shamokin was located at the town of Sunbury near the confluence of Shamokin Creek and the Susquehanna River. Aboveground structures, such as pumping stations, may have permanent visual impacts to historic structures and historic districts. If the Seedco site were chosen for the proposed project, the review team assumes that PPL would conduct its water pipeline-related cultural resource surveys and procedures in a manner similar to that for the BBNPP site.

There are no existing transmission corridors connecting directly to the Seedco site. However, there are four existing 500-kV transmission lines and five existing 230-kV transmission lines that could be connected to Seedco (PPL Bell Bend 2013-TN3377). A new transmission corridor would need to be created to connect the Seedco site to these lines. Archaeological sites and historic structures may be directly impacted by building the transmission lines and aboveground structures, such as power lines and support poles, which may have permanent visual impacts to historic structures and historic districts. If the Seedco site were chosen for the proposed project, the review team assumes that PPL would conduct its transmission-line-related cultural resource surveys and procedures in a manner similar to that for the BBNPP site.

Activities associated with building a nuclear power-generating unit and supporting facilities that can potentially destabilize important attributes of archaeological sites, historic structures, and other cultural resources include land clearing, excavation, and grading. Construction of a nuclear power plant at the Seedco site may adversely impact cultural resources. The NRHP-eligible Buck Ridge Mine & Ranshaw Village is located within the 1-mi (1.6 km) indirect-effects APE of the project. Structures associated with the nuclear power plant would alter the historic viewshed of the historic district, and potentially undermine the historic attributes critical to its NRHP eligibility assessment. Considering the high terrain, nuclear power plant structures may be visible for other NRHP-eligible structures or historic districts outside the 1-mi indirect-effects APE used for the reconnaissance-level study. Placement of water pipelines and electrical transmission lines may impact archaeological sites and historic structures. Additionally, visual impacts from aboveground structures associated with the water pipeline and transmission lines may result in significant alterations to the visual landscape within the geographic area of interest. The review team assumes that PPL would develop procedures and consult with the SHPO to develop a cultural resource management program to avoid or mitigate adverse impacts to significant archaeological sites, historic structures, and other historic properties during preconstruction and construction activities.

Impacts on historic and cultural resources from the operation of a new nuclear generating unit at the Seedco site would include those associated with the operation of a new unit as well as maintenance of water pipelines and electrical transmission lines. The review team assumes that the same procedures currently used by PPL would be used for onsite and offsite maintenance activities. Consequently, the incremental effects of maintaining transmission-line corridors and operating a new unit, as well as associated impacts on the cultural resources, would be negligible for the direct-effects and indirect-effects APEs.

Cumulative Impacts

The geographic area of interest for cumulative impacts on historic and cultural resources at the Seedco site corresponds to the onsite and offsite direct- (physical) and indirect- (visual) APEs defined for the site. Past actions in the geographic area of interest that have similarly affected historic and cultural resources include rural, agricultural, and industrial development, as well as activities associated with these land-disturbing activities, such as road development. Table 9-14 also lists future projects that may similarly affect historic and cultural resources and contribute to cumulative impacts in the geographic area of interest. No activities in Table 9-14 in the geographic area of interest were identified that would significantly affect historic and cultural resources in a manner similar to those associated with the operation of a new nuclear power plant.

Cultural resources are non-renewable; therefore, the impact of destruction of cultural resources is cumulative. Based on the information provided by the applicant and the review team's independent evaluation, the review team concludes that the cumulative impacts on cultural resources on the Seedco site would be MODERATE to LARGE, and that the impacts from building and operating a new nuclear power plant would be a significant contributor to these impacts. This impact level determination reflects the presence of known NRHP-eligible historic structures and/or districts within the APEs of the Seedco site, which includes the NRHP-eligible Buck Ridge Mine & Renshaw Village, and portions of the 1861 Northern Central Railroad and the Philadelphia & Reading Railroad, which are both linear historic districts with NRHP-listed or eligible contributing structures located elsewhere along their historic railway corridors. If the Seedco site were to be developed, then cultural resource surveys of the APEs, along with the APEs for waterlines and electrical transmission lines, would need to be conducted, and PPL would assess and resolve adverse effects of the undertaking. Adverse effects could result in greater cumulative impacts.

9.3.4.8 Air Quality

The following impact analysis includes impacts from building activities and operations at the Seedco alternative site. The analysis also considers other past, present, and reasonably foreseeable future actions that affect air quality, including other Federal and non-Federal projects listed in Table 9-14. The geographic area of interest for the Seedco alternative site is Northumberland County, which is in the Central Pennsylvania Intrastate AQCR (40 CFR 81.104 [TN255]).

The emissions related to building and operating a nuclear power plant at the Seedco alternative site would be similar to those at the BBNPP site, as described in Chapters 4 and 5. The air-quality attainment status for Northumberland County, as set forth in 40 CFR Part 81, reflects the effects of past and present emissions from all pollutant sources in the region. Northumberland County is designated as unclassifiable or in attainment for all criteria pollutants for which NAAQSs have been established (40 CFR 81.339 [TN255]).

Atmospheric emissions related to building and operating a nuclear power plant at the BBNPP site in Luzerne County are described in Chapters 4 and 5. Emissions of criteria pollutants were found to have a SMALL impact on air quality. In Chapter 7, the cumulative impacts of the criteria pollutants at the BBNPP site were evaluated and also determined to be SMALL.

Reflecting on the projects listed in Table 9-14, several energy-related and industrial projects are considered major sources of NAAQS criteria pollutants in Northumberland County or nearby counties within the AQCR. Any new projects would either have minimal emissions or be subject to permitting by the PADEP. Given that these projects would be subject to permitting requirements to ensure compliance with the NAAQSs, it is unlikely that the air quality in the region would degrade to the extent that the region is in nonattainment of NAAQSs.

The air-quality impact of Seedco site development would be local and temporary. The distance from building activities to the site boundary would be sufficient to generally avoid significant air-quality impacts. No land uses or projects, including projects listed in Table 9-14, would have emissions during site development that would, in combination with emissions from the Seedco site, result in degradation of air quality in the region.

Emissions from operations at the Seedco site would be intermittent. Air-quality impacts of existing major and minor sources are included in the baseline air-quality status. Cumulative impacts from emissions of effluents from the Seedco site and projects listed in Table 9-14 would be minor.

The cumulative impacts of GHG emissions related to nuclear power are discussed in Section 7.6. The impacts of the emissions are not sensitive to location of the source. Consequently, the discussion in Section 7.6 is applicable to a nuclear power plant located at the Seedco site. The review team concludes that the national and worldwide cumulative impacts of GHG emissions are noticeable but not destabilizing. The review team further concludes that the cumulative impacts would be noticeable but not destabilizing with or without GHG emissions of a nuclear power plant at the Seedco site.

Cumulative impacts on air-quality resources are estimated based on the information provided by PPL and the review team's independent evaluation. Other past, present, and reasonably foreseeable future activities exist in the geographic areas of interest (local for criteria pollutants and global for GHG emissions) that could affect air-quality resources. The cumulative impacts on criteria pollutants from emissions of effluents from the Seedco site, other projects, and existing sources would be minor.

The review team concludes that cumulative impacts from other past, present, and reasonably foreseeable future actions on air-quality resources in the geographic areas of interest would be SMALL for criteria pollutants and MODERATE for GHG emissions. Building and operating a new unit at the Seedco site would not be a significant contributor to these impacts.

9.3.4.9 Nonradiological Health Impacts

The following analysis considers nonradiological health impacts from building and operating a new nuclear plant at the Seedco site. The analysis also considers past, present, and reasonably foreseeable future actions that affect the nonradiological health resources, including other Federal and non-Federal projects and the projects listed in Table 9-14. For the analysis of nonradiological health impacts at the Seedco site, the geographic area of interest is considered to be the immediate vicinity surrounding the Seedco site (6-mi radius) and the associated transmission-line corridors. This geographic area of interest is based on the localized nature of nonradiological health impacts and is expected to encompass all nonradiological health impacts.

Building activities with the potential to affect the health of members of the public and construction workers at the Seedco site include exposure to dust, vehicle exhaust, and emissions from construction equipment; noise; occupational injuries; and the transport of construction materials and personnel to and from the site. The operations-related activities that may affect the health of members of the public and workers include exposure to etiological (disease-causing) agents, noise, EMFs, occupational injuries, and impacts from the transport of workers to and from the site.

Building Impacts

Nonradiological health impacts on construction workers and members of the public from building a new nuclear power plant at the Seedco site would be similar to those evaluated in Section 4.8 for the BBNPP site. During the site-preparation and building phases, PPL would comply with applicable Federal and State regulations on air quality and noise. The frequency of construction worker accidents is expected to be the same as those estimated for the BBNPP site. The Seedco site is located in a rural area, and building impacts would likely be negligible on the surrounding populations, which are classified as medium- and low-population areas.

The review team concludes that the impacts on nonradiological health from building a new nuclear power plant and associated transmission lines at the Seedco site would be minimal.

Operational Impacts

Nonradiological health impacts on occupational health of workers and members of the public would include those associated with plant operation and operation of the associated transmission lines as described in Section 5.8. Based on the configuration of the proposed new unit at the Seedco site (see detailed site layout description in Chapter 3), etiological (disease-causing agents would not likely increase the incidence of waterborne diseases in the vicinity of the site because of the temperature attenuation in the discharge pipe and diffuser and the temperature limitations outlined in the plant NPDES permit requirements for thermal discharge. Impacts on workers' health from occupational injuries, noise, and EMFs would be similar to those described in Section 5.8 for the BBNPP site. Noise would be monitored and controlled in accordance with applicable Occupational Safety and Health Administration regulations and effects of EMFs on human health would be controlled and minimized by conformance with National Electrical Safety Code criteria. Nonradiological impacts of traffic during operations would be less than the impacts during building. The review team concludes that nonradiological health impacts on onsite workers and the public from operating a new nuclear power plant and associated offsite facilities at the Seedco site would be minimal.

Cumulative Impacts

Past actions in the geographic area of interest that have similarly affected nonradiological health of workers and members of the public include the development and operations of the Seedco Industrial Park, located adjacent to the Seedco site, and the development and operations of the Foster Wheeler Mt. Carmel Cogeneration Coal Plant, located approximately 4 mi northeast of the Seedco site. No major current (ongoing) projects in the geographic area of interest would cumulatively affect nonradiological health in a similar way.

Proposed future actions that would affect nonradiological health in a way similar to development and operations at the Seedco site would include the Intelliwatt Renewable Energy biomass plant, transmission-line creation and/or upgrading throughout the designated geographic area of interest, and future urbanization.

The review team is also aware of the potential climate changes that could affect human health. A recent compilation of the state of the knowledge in this area (GCRP 2014-TN3472) has been considered in the preparation of this EIS. Projected changes in the climate for the region include an increase in average temperature, increased likelihood of drought in summer, more heavy downpours, and an increase in precipitation, especially in the winter and spring, which may alter the presence of microorganisms and parasites. In view of the water source characteristics, the review team did not identify anything that would alter its conclusion regarding the presence of etiological agents or change in the incidence of waterborne diseases.

The review team concludes that the cumulative impacts on nonradiological health from building and operation of a new nuclear power plant and associated transmission lines at the Seedco site would be minimal.

Summary

Impacts on nonradiological health from the building and operation of a new unit and associated facilities at the Seedco site are estimated based in the information provided by PPL and the review team's independent evaluation. The review team concludes that nonradiological health impacts on construction workers and the public resulting from the building of a new nuclear power plant at the Seedco site would be minimal. The review team expects that the occupational health impacts on the operations employees of a new nuclear power plant at the Seedco site would be minimal. Similarly, impacts on public health of a new nuclear power plant operating at the Seedco site would be expected to be minimal. Finally, the review team concludes that cumulative nonradiological health impacts from past, present, and future actions in the geographical area of interest would be SMALL.

9.3.4.10 Radiological Impacts of Normal Operations

The following impact analysis includes radiological impacts from building activities and operation of a new nuclear power plant at the Seedco site. The analysis also considers other past, present, and reasonably foreseeable future actions that affect radiological health, including other Federal and non-Federal projects listed in Table 9-14. As described in Section 9.3.4, the Seedco site is a brownfield site located at the existing Seedco Industrial Park, east/southeast of the community of Ranshaw and the City of Shamokin, Pennsylvania. The geographic area of interest is the area within a 50-mi radius of the Seedco site. The only facilities potentially affecting radiological health within this geographic area of interest are existing SSES Units 1 and 2. In addition, it is likely that hospitals and industrial facilities with 50 mi of the Seedco site use radioactive materials.

The radiological impacts of building and operating the proposed U.S. EPR reactor at the Seedco site include doses from direct radiation and liquid and gaseous radioactive effluents. Releases of radioactive materials and all pathways of exposure would produce low doses to people and biota offsite, well below regulatory limits. The impacts are expected to be similar to those estimated for the BBNPP site.

The radiological impacts of SSES Units 1 and 2 include doses from direct radiation and liquid and gaseous radioactive effluents. These pathways result in low doses to people and biota offsite that are well below regulatory limits, as demonstrated by the ongoing radiological environmental monitoring program conducted around SSES Units 1 and 2. The NRC staff concludes that the dose from direct radiation and effluents from hospitals and industrial facilities that use radioactive material would be an insignificant contribution to the cumulative impact around the Seedco site. This conclusion is based on the radiological monitoring program conducted for the currently operating nuclear power plant.

Based on the information provided by PPL and the NRC staff's independent analysis, the NRC staff concludes that the cumulative radiological impacts from building and operating the one proposed U.S. EPR unit and other past, present, and reasonably foreseeable projects and actions in the geographic area of interest around the Seedco site would be SMALL.

9.3.4.11 Postulated Accidents

The following impact analysis includes radiological impacts from postulated accidents from operations for one nuclear unit at the Seedco site. The analysis also considers other past, present, and reasonably foreseeable future actions that affect radiological health from postulated accidents, including other Federal and non-Federal projects and the projects listed in Table 9-14 within the geographic area of interest. As described in Section 9.3.2, the Seedco site is a brownfield site; there are no nuclear facilities on the site. The geographic area of interest considers all existing and proposed nuclear power plants that have the potential to increase the probability-weighted consequences (i.e., risks) from a severe accident at any location within 50 mi of the Seedco site. Facilities potentially affecting radiological accident risk within this geographic area of interest are SSES Units 1 and 2; Limerick Generating Station Units 1 and 2; Three Mile Island Nuclear Station Unit 1; and Peach Bottom Atomic Power Station Units 2 and 3. Besides the proposed BBNPP unit, no other reactors have been proposed within the geographic area of interest.

As described in Section 5.11.1, the NRC staff concludes that the environmental consequences of DBAs at the BBNPP site would be SMALL for a U.S. EPR reactor. DBAs are addressed specifically to demonstrate that a reactor design is robust enough to meet NRC safety criteria. The U.S. EPR design is independent of site conditions and the meteorology of the Seedco site and BBNPP site are similar; therefore, the NRC staff concludes that the environmental consequences of DBAs at the Seedco site would be SMALL.

Because the meteorology, population distribution, and land use for the Seedco site are expected to be similar to the proposed BBNPP site, risks from a severe accident for a U.S. EPR reactor located at the Seedco site are expected to be similar to those analyzed for the proposed BBNPP site. The risks for the proposed BBNPP site are presented in Table 5-20 and Table 5-21 and are well below the median value for current-generation reactors. In addition, as discussed in Section 5.11.2, estimates of average individual early fatality and latent cancer fatality risks are well below the Commission's safety goals (51 FR 30028-TN594). For existing nuclear power plants within the geographic area of interest (i.e., SSES Units 1 and 2; Limerick Generating Station Units 1 and 2; Three Mile Island Nuclear Station Unit 1; and Peach Bottom Atomic Power Station Units 2 and 3), the Commission has determined that the probability-weighted consequences of severe accidents are small (10 CFR Part 51, Appendix B, Table B-1 [TN250]).

Because of the NRC safety review criteria, it is expected that risks for any new reactors at any other locations within the geographic area of interest for Seedco site would be below the risks for current-generation reactors and would meet Commission safety goals. The severe accident risk due to any particular nuclear power plant becomes smaller as the distance from that plant increases. However, the combined risk at any location within 50 mi of Seedco site would be bounded by the sum of risks for all these operating nuclear power plants and would still be low.

Although several plants have the potential to be included in the combination, the combined risk would still be low. On this basis, the NRC staff concludes that the cumulative risks of severe accidents at any location within 50 mi of the Seedco site would be SMALL.

9.3.5 Comparison of the Impacts of the Proposed Action and the Alternative Sites

This section summarizes the NRC staff's impact characterizations for cumulative impacts related to locating one new U.S. EPR nuclear unit at the proposed site and each alternative site. The three Pennsylvania sites selected for detailed review as part of the alternative sites environmental analysis included the Montour site in Montour County, the Humboldt site in Luzerne County, and the Seedco site in Northumberland County. Comparisons are made between the proposed site and alternatives to determine if one of the alternative sites is environmentally preferable to the proposed site. The NRC's determination as to whether an alternative site is environmentally preferable to the proposed site for a new nuclear unit is independent of the USACE's determination of a LEDPA pursuant to the Clean Water Act Section 404(b)(1) Guidelines at 40 CFR Part 230 (TN427). The USACE will conclude its analysis of both offsite and onsite alternatives in its Record of Decision.

The need to compare the proposed site with alternative sites arises from the requirement in Section 102(2)(c)(iii) of NEPA (42 U.S.C. § 4321 et seq.-TN661) that EISs include an analysis of alternatives to the proposed action. The NRC criteria to be employed in assessing if a proposed site is to be rejected in favor of an alternative site are based on whether the alternative site is "obviously superior" or "environmentally preferable" to the site proposed by the applicant (Public Service Co. of New Hampshire 1977, [NRC 1977-TN3867]). An alternative site is "obviously superior" to the proposed site if it is "clearly and substantially" superior to the proposed site (Rochester Gas & Electric Corp. 1978 [NRC 1978-TN2636]). The standard of obviously superior "... is designed to guarantee that a proposed site will not be rejected in favor of a substitute unless, on the basis of appropriate study, the Commission can be confident that such action is called for" (NECNP v. NRC 1978-TN2632).

The "obviously superior" test is appropriate for two reasons. First, the analysis performed by the NRC staff in evaluating alternative sites is necessarily imprecise. Key factors considered in the alternative site analysis, such as population distribution and density, hydrology, air quality, aquatic and terrestrial ecological resources, aesthetics, land use, and socioeconomics, are difficult to quantify in common metrics. Given this difficulty, any evaluation of a particular site must have a wide range of uncertainty. Second, the applicant's proposed site has been analyzed in detail, with the expectation that most adverse environmental impacts associated with the site have been identified. The alternative sites have not undergone a comparable level of detailed study. For these reasons, a proposed site may not be rejected in favor of an alternative site when the alternative site is marginally better than the proposed site, but only when it is obviously superior (NRC 1978-TN2636). NEPA (42 U.S.C. § 4321 et seq.-TN661) does not require that a nuclear plant be constructed on the single best site for environmental purposes. Rather, "... all that NEPA requires is that alternative sites be considered and that the effects on the environment of building the plant at the alternative sites be carefully studied and factored into the ultimate decision" (NECNP v. NRC 1978-TN2632).

The NRC staff's review of alternative sites consists of a two-part sequential test (NRC 2000-TN614). The first part of the test determines whether any of the alternative sites are environmentally preferable to the applicant's proposed site. The NRC staff considers whether the applicant has (1) reasonably identified candidate sites, (2) evaluated the likely environmental impacts of building and operation at these sites, and (3) used a logical means of comparing sites that led to the applicant's selection of the proposed site. Based on NRC's own independent review, the NRC staff then determines whether any of the alternative sites are environmentally preferable to the applicant's proposed site. If the NRC staff determines that one or more alternative sites are environmentally preferable, then it would compare the estimated costs (i.e., environmental, economic, and time) of constructing the proposed plant at the proposed site and at the environmentally preferable site or sites (NRC 2000-TN614). The second part of the test determines whether an environmentally preferable alternative site is obviously superior to the proposed site. The NRC staff must determine that (1) one or more important aspects, either singly or in combination, of an environmentally preferable alternative site are obviously superior to the corresponding aspects of the applicant's proposed site and (2) the alternative site does not have offsetting deficiencies in other important areas. An NRC staff conclusion that an alternative site is obviously superior to the applicant's proposed site would normally lead to a recommendation that the application for the license be denied.

Section 9.3.5.1 discusses the process the NRC staff used to compare the alternative sites to the proposed BBNPP site. Sections 9.3.5.2 and 9.3.5.3, respectively, discuss the environmental impacts of the proposed site in relation to the alternative sites as they relate to environmentally preferable and obviously superior evaluations.

9.3.5.1 Comparison of Cumulative Impacts at the Proposed and Alternative Sites

The NRC staff's characterizations of the cumulative environmental impacts of building and operating a new nuclear generating unit at the proposed site (impact levels from Chapter 7) and three alternatives sites (from Sections 9.3.2 through 9.3.4) are listed in Table 9-18.

The NRC staff reviewed PPL's ER (PPL Bell Bend 2013-TN3377) and its supplemental alternative site evaluation document (UniStar 2011-TN505). The NRC staff conducted site visits at the proposed BBNPP site and each of the alternative sites. The NRC staff found that PPL implemented a reasonable process to select alternative sites and used a logical process to compare the impacts at the proposed site to those at the alternative sites. The following discussion summarizes the staff's independent assessment of the proposed and alternative sites.

The NRC staff's characterization of the expected cumulative environmental impacts of building and operating a new unit at the BBNPP site and alternative sites are summarized by impact category level in Table 9-18. Full explanations for the particular characterizations are provided in Chapter 7 for the proposed site and in Sections 9.3.2, 9.3.3, and 9.3.4 for the alternative sites. The staff's impact category levels are based on professional judgment, experience, and consideration of controls likely to be imposed under required Federal, State, or local permits that would not be acquired until an application for a COL is under way. These considerations and assumptions were similarly applied at each of the alternative sites to provide a common basis for comparison. In the following discussion, the NRC staff compares the impact levels between the proposed site and each alternative site.

Table 9-18. Comparison of Cumulative Impacts at the Proposed and Alternative Sites

Resource Area	Bell Bend	Montour	Humboldt	Seedco
Land Use	SMALL	MODERATE	MODERATE	MODERATE
Water-Related				
Surface-Water Use	MODERATE	MODERATE	MODERATE	MODERATE
Surface-Water Quality	MODERATE	MODERATE	MODERATE	MODERATE
Groundwater Use	SMALL	SMALL	SMALL	SMALL
Groundwater Quality	SMALL	SMALL	SMALL	SMALL
Ecology				
Terrestrial Ecosystems	MODERATE	MODERATE	MODERATE	MODERATE
Aquatic Ecosystems	MODERATE to LARGE	MODERATE to LARGE	MODERATE to LARGE	MODERATE to LARGE
Socioeconomic[(a)]				
Physical impacts	SMALL except for MODERATE cumulative impacts from other planned road improvements	SMALL except for MODERATE cumulative impacts from other planned road improvements	SMALL except for MODERATE aesthetic impacts	SMALL except for MODERATE aesthetic impacts
Demography	SMALL	SMALL	SMALL	SMALL
Economic impacts on the community	SMALL and beneficial except for MODERATE and beneficial economic impacts on Columbia County and MODERATE and beneficial tax impacts on Salem Township and the Berwick Area School District	SMALL and beneficial except for MODERATE and beneficial economic impacts on Montour County and LARGE and beneficial tax impacts on Derry Township	SMALL except for MODERATE and beneficial economic impacts on Luzerne County and MODERATE and beneficial tax impacts on Hazle Township	SMALL except for MODERATE and beneficial economic impacts on Northumberland County and LARGE and beneficial tax impacts on Coal Township

Table 9-18. (contd)

Resource Area	Bell Bend	Montour	Humboldt	Seedco
Infrastructure and community services	SMALL except for MODERATE traffic impacts on area highways, MODERATE housing impacts in the Borough of Berwick, and MODERATE student impacts on the Berwick Area School District	SMALL except for MODERATE traffic impacts on area highways	SMALL except for MODERATE traffic impacts on area highways and MODERATE student impacts on the Hazleton Area School District	SMALL except for MODERATE traffic impacts on area highways and MODERATE student impacts on the Shamokin Area School District and the Mount Carmel Area School District
Environmental Justice	NONE	NONE	NONE	NONE
Historic and Cultural Resources	SMALL	MODERATE to LARGE	SMALL	MODERATE to LARGE
Air Quality	SMALL for criteria pollutants to MODERATE for GHG emissions.	SMALL for criteria pollutants to MODERATE for GHG emissions.	SMALL for criteria pollutants to MODERATE for GHG emissions.	SMALL for criteria pollutants to MODERATE for GHG emissions.
Nonradiological Health	SMALL	SMALL	SMALL	SMALL
Radiological Health	SMALL	SMALL	SMALL	SMALL
Postulated Accidents	SMALL	SMALL	SMALL	SMALL

(a) Ranges indicate differences in counties.

The environmental impact areas listed in Table 9-18 have been evaluated using the NRC's three-level standard of significance – SMALL, MODERATE, or LARGE – as set forth in the footnotes to Table B 1 of 10 CFR Part 51, Subpart A, Appendix B (TN250).

> 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.

9.3.5.2 Environmentally Preferable Sites

The cumulative impacts of building and operating a new nuclear power plant at the BBNPP site and at each alternative site are SMALL for several impact categories. The resource categories for which the impact level at an alternative site would be the same as that for the proposed site do not contribute to the determination that the alternative site is environmentally preferable to the proposed site. Therefore, these categories are not discussed further in determining whether an alternative site is environmentally preferable to the proposed site. The resource areas for which an alternative site has a different impact level than the proposed site are discussed further to determine whether an alternative site is environmentally preferable to the proposed site. In addition, for those cases in which the cumulative impacts for a resource would be greater than SMALL, consideration is given to those cases in which the impacts of the project at the specific site would not make a significant contribution to the cumulative impact level. As shown in Table 9-18, there are some differences in impacts among the sites.

Montour Site

Land Use. The cumulative land-use impacts at the Montour site would be MODERATE, and a new nuclear power plant would be a significant contributor because of (1) unavoidable losses of farmland, including prime farmland, necessary to build the proposed new reactor at the Montour site and (2) possible land-use conflicts from having to traverse numerous offsite properties to establish new ROWs for transmission lines and water pipelines.

Comparatively, cumulative land-use impacts from a new nuclear power plant at the BBNPP site would be SMALL because, as discussed in Chapter 4, the proposed activities would be consistent with applicable zoning, would not conflict with any land-use plans or known land-use objectives, and would have no substantial effects on agriculture, forestry, and mineral development activities in the surrounding landscape. Further, as determined in Chapter 7 no other reasonably foreseeable projects within the ROI would add to the cumulative land-use impacts of the project at the BBNPP site.

Economic Impacts on the Community. The cumulative economic and tax impacts at the Montour site would be SMALL to LARGE and beneficial. A new nuclear power plant at the Montour site would be a significant contributor to these beneficial impacts, which would be SMALL and beneficial in the 50-mi region, but MODERATE and beneficial in the economic impact area. The tax impacts on Derry Township would be LARGE and beneficial.

Comparatively, cumulative economic and tax impacts from a new nuclear power plant at the BBNPP site would be SMALL to MODERATE and beneficial in Salem Township and the Berwick Area School District.

Infrastructure and Community Services. The cumulative housing impacts from a new nuclear power plant at the Montour site would be SMALL, because the region around this site would have a greater ability to absorb the in-migrating workforce and would not have an area such as Berwick that would disproportionately focus housing demand.

Comparatively, cumulative housing impacts from a new nuclear power plant at the BBNPP site would be MODERATE during construction and SMALL during operations. The analyses concluded that although the local area has the capacity to absorb the predicted influx of in-migrating workers, because of the limited availability of housing in the Berwick area, the housing demand would likely result in the use of campgrounds, motels, and other transient housing options, and this demand would result in an increase in prices of all forms of available housing, as experienced during construction of SSES.

The cumulative education impacts from a nuclear power plant at the Montour site would be SMALL because the student-to-teacher ratio would not be greatly exceeded. The reviewers noted that for all sites the beneficial economic and tax impacts could provide sufficient resources to hire additional teachers and mitigate any negative impacts on the local schools.

Comparatively, education impacts during construction from a new nuclear power plant at the BBNPP site would be MODERATE. Impacts would be most noticeable at the Berwick Area School District during the building phase. Education impacts would result because in-migrating students would result in an increase in student-to-teacher ratios in excess of Pennsylvania statewide average student-to-teacher ratios.

Historic and Cultural. The cumulative cultural and historical resources impacts at the Montour site would be MODERATE to LARGE and the impacts from a nuclear power plant would be a significant contributor to these impacts. This impact level determination reflects the high probability of archaeological sites within the direct-effects APE of the Montour site and indirect effects from visual impacts that could occur to the NRHP-listed Keefer Covered Bridge No. 7 and Exchange Historic District, both of which are within 1.7 mi (2.7 km) of the Montour site.

Comparatively, cultural and historical resources impacts from a new nuclear power plant at the BBNPP site would be SMALL. Planned construction would not affect known historical properties on the BBNPP site.

Humboldt Site

Land Use. Cumulative land-use impacts at the Humboldt site would be MODERATE, and a new nuclear power plant would be a significant contributor because of (1) possible land-use conflicts with two large commercial/industrial buildings located within the site boundary in the northeastern corner of the Humboldt site and (2) the need to traverse numerous offsite properties to establish new ROWs for transmission lines and water pipelines for a new reactor at the Humboldt site. In addition, the surrounding area is experiencing substantial ongoing urban and light industrial development.

As stated previously, comparatively, cumulative land-use impacts at the BBNPP site would be SMALL.

Physical Impacts. The physical impacts from building and operating a new nuclear power plant on workers and the local public, buildings, and roads near the Humboldt site would be SMALL. However, the cumulative aesthetic and recreational impacts from a new nuclear power plant at the Humboldt site would be MODERATE, and a new nuclear power plant would be a significant contributor to those impacts because plumes from the proposed site would be visible over a vast distance, the site is located adjacent to the Eagle Rock Country Club, and the site is currently largely undeveloped.

Comparatively, cumulative physical impacts at the BBNPP site would be SMALL, with the exception of the physical impacts on roads of planned improvements to Federal, State, and county roads and bridges, where impacts would be MODERATE. However, building and operating a nuclear power plant would not be a significant contributor to the MODERATE and temporarily adverse physical impacts on local road systems. Aesthetic impacts from a new nuclear power plant at the BBNPP site would be SMALL because the site is bounded by forests and rolling terrain and has already been affected by the presence of the SSES cooling towers. Recreational impacts within 50 mi (80 km) of the BBNPP site would also be SMALL.

Infrastructure and Community Services. Similar to the Montour site, the cumulative housing impacts at the Humboldt site would be SMALL, principally because the region around this site would have a greater ability to absorb the in-migrating workforce and would not have an area such as Berwick that would disproportionately focus housing demand.

Comparatively, cumulative housing impacts from a new nuclear power plant at the BBNPP site would be MODERATE during construction and SMALL during operations. The analyses concluded that although the local area has the capacity to absorb the predicted influx of in-migrating workers, because of limited availability of housing in the Berwick area, housing demand would likely result in the use of campgrounds, motels, and other transient housing options, and this demand would result in an increase in prices of all forms of available housing, as experienced during construction of SSES.

Seedco Site

Land Use. The cumulative land-use impacts at the Seedco site would be MODERATE, and a new nuclear power plant would be a significant contributor because of (1) potentially noticeable land-use challenges related to use of the steep topography at the Seedco site and (2) potential land-use conflicts from having to traverse numerous offsite properties to establish new ROWs for transmission lines and water pipelines. In addition, the surrounding landscape continues to experience substantial land demands to support strip-mining activities.

As stated previously, comparatively cumulative land-use impacts at the BBNPP site would be SMALL.

Physical Impacts. The cumulative physical impacts from building and operating a new nuclear power plant on workers and the local public, buildings, roads, and aesthetics near the Seedco site would be SMALL. However, the cumulative aesthetic impacts at the Seedco site would be MODERATE and a new nuclear power unit would be a significant contributor to the MODERATE impacts because (1) plumes from the proposed site would be visible over a vast distance due to its location on a hilltop overlooking Pennsylvania SR 901, (2) the site’s proximity to adjacent commercial and residential development, (3) the proximity of the site to Shamokin, and (4) the site is currently undeveloped.

Comparatively, cumulative physical impacts from a new nuclear power plant at the BBNPP site would be SMALL, with the exception of the physical impacts on roads of planned improvements to Federal, State, and county roads and bridges, where impacts would be MODERATE. However, the NRC-authorized activities would not be a significant contributor to the MODERATE and temporarily adverse physical impacts on local road systems. Aesthetic impacts from a new nuclear power plant at the BBNPP site would be SMALL because the site is bounded by forests and rolling terrain and has already been affected by the presence of the SSES cooling towers. Recreational impacts within 50 mi (80 km) of the BBNPP site also would be SMALL.

Economic Impacts on the Community. The cumulative economic and tax impacts at the Seedco site would be SMALL to LARGE and beneficial. A new nuclear power unit at the Seedco site would be a significant contributor to these beneficial impacts, which would be SMALL in the 50-mi region, MODERATE and beneficial in Northumberland County, and LARGE and beneficial in Coal Township.

Comparatively, cumulative economic and tax impacts from a new nuclear power plant at the BBNPP site would be SMALL to MODERATE and beneficial in Salem Township and the Berwick Area School District.

Infrastructure and Community Services. Similar to the Montour and Humboldt sites, the cumulative housing impacts from a new nuclear power plant at the Seedco site would be SMALL, principally because the region around this site would have a greater ability to absorb the in-migrating workforce and would not have an area such as Berwick that would disproportionately focus housing demand.

Comparatively, cumulative housing impacts from a new nuclear power plant at the BBNPP site would be MODERATE during construction and SMALL during operations. The analyses concluded that although the local area has the capacity to absorb the predicted influx of in-migrating workers, because of limited availability of housing in the Berwick area, housing demand would likely result in the use of campgrounds, motels, and other transient housing options, and this demand would result in an increase in prices of all forms of available housing, as experienced during construction of SSES.

Historic and Cultural. The cumulative historical and cultural resources impacts from a nuclear power plant at the Seedco site would be MODERATE to LARGE and a new nuclear power plant would be a significant contributor to these impacts because this impact level determination reflects the presence of known NRHP-eligible historic structures and/or districts within the APEs of the Seedco site, which includes the NRHP-eligible Buck Ridge Mine & Renshaw Village and portions of the 1861 Northern Central Railroad and the Philadelphia & Reading Railroad, which are both linear historic districts with NRHP-listed or eligible contributing structures located elsewhere along their historical railway corridors. Comparatively, historical and cultural resources impacts from a new nuclear power plant at the BBNPP site would be SMALL. Planned construction would not affect known historical properties on the BBNPP site.

Summary

As shown in Table 9-18, physical resources, infrastructure, and community services are the only resources for which cumulative impacts attributable to construction and operation of a nuclear plant at the BBNPP site might exceed similar impacts at one or more of the alternative sites. Like the alternatives sites, the physical resource impacts at the BBNPP site attributable to the proposed BBNPP unit would be SMALL. The MODERATE cumulative impacts on physical resources at the BBNPP and Montour sites resulting from planned highway upgrades would occur even if the new nuclear power plant was not built at those sites. The housing impacts would be limited to the construction period and would only noticeably affect the Berwick area near the BBNPP site. The education impacts at all sites could be easily mitigated by applying resources from the beneficial economic and tax impacts. In the case of impacts on taxes and the local economy, a new nuclear power plant would have beneficial impacts on all sites; benefits might be slightly larger at some alternative sites than at the BBNPP site because of unique features of the local economies. In contrast, use of the BBNPP site would have fewer impacts on land use, aesthetics and recreation, and historical and cultural resources than one or more of the alternative sites.

Although differences and distinctions exist between the cumulative environmental impacts of building and operating a new nuclear plant at the proposed BBNPP site and at the alternative sites, the review team concludes that none of these differences is sufficient to determine that any of the alternative sites would be environmentally preferable to the proposed site for building of a new nuclear generating unit.

9.3.5.3 Obviously Superior Sites

None of the alternative sites was determined to be environmentally preferable to the BBNPP site. Therefore, none of the alternative sites is obviously superior to the BBNPP site.

9.4 System Design Alternatives

The review team considered a variety of heat-dissipation system and circulating-water system (CWS) alternatives. While other heat-dissipation systems and water systems are part of a nuclear power plant, the largest and most capable of causing environmental impacts is the CWS that cools and condenses the steam for the turbine generator. Other water systems (e.g., the service-water system) are much smaller and therefore use less water than the CWS. As a result, the review team only considers alternative heat-dissipation and water-treatment systems for the CWS. The proposed CWS for the proposed BBNPP unit is a closed-cycle system that uses two natural draft cooling towers for heat dissipation (PPL Bell Bend 2013-TN3377). The proposed system is discussed in detail in Chapter 3.

9.4.1 Heat-Dissipation Systems

Approximately two-thirds of the heat from a commercial nuclear reactor is rejected as heat to the environment. The remaining one-third of the reactor-generated heat is converted into electricity. Normal heat-sink cooling systems transfer the rejected heat load into the atmosphere and/or nearby waterbodies, primarily as latent heat exchange (evaporating water) or sensible heat exchange (warming the air or water). Different heat-dissipation systems rely on different exchange processes. The following sections describe alternative heat-dissipation systems considered by the review team for the proposed BBNPP unit.

In its ER, PPL considered a range of CWS heat-dissipation systems, including a once-through cooling system and several closed-cycle cooling systems. In addition to the closed-cycle natural draft cooling towers selected, PPL considered mechanical draft cooling towers, once-through cooling into the Susquehanna River, cooling ponds, spray ponds, dry cooling towers, and a plume-abated cooling-tower system (PPL Bell Bend 2013-TN3377). In addition, the review team considered hybrid cooling towers.

9.4.1.1 Wet Mechanical Draft Cooling Towers

Wet mechanical draft cooling towers, which use about the same amount of water as the proposed natural draft cooling towers, use fans to force air through the stream of cooling water resulting in latent and sensible heat loss. The environmental aspects of wet natural draft cooling towers and mechanical draft cooling towers are very similar. Because both rely primarily on evaporation to dissipate the heat, water use is similar for natural and mechanical draft cooling towers; therefore, intake and discharge effects on aquatic biota would be similar. Notable differences are that natural draft cooling towers can be seen from a greater distance and that the greater tower height increases the potential for avian and bat collisions (NRC 2013-TN2654). The large size of natural draft cooling towers could have a greater visual and aesthetic impact than mechanical draft cooling towers. Because the BBNPP site is located in a relatively remote area, the aesthetic impacts of proposed wet natural draft towers would be similar because visual impacts would be dominated by the plume rather than the tower. The likelihood of bird collision impacts is higher for the proposed natural draft cooling towers than for mechanical draft cooling towers. The fans required for mechanical draft would consume some of the proposed plant's power; however, the energy savings from using natural draft versus mechanical draft cooling towers are minimal. Therefore, the review team determined that wet natural draft cooling towers and wet mechanical draft towers are environmentally equivalent for the proposed BBNPP unit.

9.4.1.2 Once-Through Cooling

Once-through cooling systems withdraw water from the source waterbody and return virtually the same volume of water at an elevated temperature to the receiving waterbody. Typically the source waterbody and the receiving waterbody are the same, and the intake and discharge structures are separated to limit recirculation. While there is essentially no consumptive use of water in a once-through heat-dissipation system, the elevated temperature of the receiving waterbody would result in some induced evaporative loss that decreases the net water supply. The elevated temperature also can adversely affect the biota of the receiving waterbody. The large intake flows would result in impingement and entrainment losses. Based on recent changes to implementation plans to meet Section 316(b) of the Clean Water Act (33 U.S.C. § 1344 et seq.-TN1019), the review team has determined that once-through cooling systems for new nuclear reactors are unlikely to be permitted in the future, except in rare and unique situations. The thermal impacts on aquatic biota during low-flow conditions may be significant. Therefore, in addition to the Clean Water Act 316(b) considerations, the review team determined that once-through designs were not a feasible alternative design and eliminated it from further consideration as part of the cooling system for the proposed BBNPP unit.

9.4.1.3 Cooling Pond

Use of a recirculating cooling pond was considered as an alternative cooling-system design. Studies performed by PPL determined the size pond needed for a 1,300-MW plant to be 2,470 ac (PPL Bell Bend 2013-TN3377). The pond would eliminate substantially greater areas of wetlands, terrestrial habitat, and natural surface-water habitat than would other CWS alternatives. The review team determined that, because of the land-use requirements, a cooling system using a recirculating cooling pond was not an environmentally preferable alternative at the BBNPP site.

9.4.1.4 Spray Pond

Spray-pond cooling systems reduce the land use required by cooling ponds by spraying water into the atmosphere to enhance evaporative cooling. In addition to evaporation, heat transfer from the spray canals to the atmosphere occurs through black-body radiation and conduction. Assuming the pond area could be reduced 10 percent of the standard cooling pond area with the introduction of sprays, the land-use requirement would be 247 ac (PPL Bell Bend 2013-TN3377), which is still a large amount of land. Furthermore, terrestrial and aquatic habitat adjacent to the canal could be exposed to drift from spray operations. Based on the additional land and terrain requirements to build the spray pond and the possible impact from spray drift, the review team concludes that use of a spray pond would not be an environmentally preferable alternative for the BBNPP site.

9.4.1.5 Dry Cooling Towers

Dry cooling towers have never been used to cool nuclear or fossil facilities of this size. Dry cooling towers would eliminate virtually all water-related impacts from the cooling-system operation. No makeup water would be needed for cooling, and no blowdown water would be generated. This alternative could reduce water-use impacts. Dry cooling systems would be larger than the proposed cooling-tower systems, and would require more onsite land to accommodate the large dry cooling structures. Dry cooling systems can result in a significant loss in dependable electrical generation capacity particularly during higher ambient temperature conditions because the theoretical approach temperature is limited to the dry-bulb temperature and not the lower wet-bulb temperature. Additional electrical losses occur with dry cooling because of the parasitic energy requirements of the large array of fans involved. This loss in generation efficiency translates into increased impacts on the fuel cycle. Therefore, the review team therefore determined that building and operation of dry cooling towers would not be an environmentally preferable alternative for the BBNPP site because of the impact on plant availability and capacity, as well as inefficiencies in energy production resulting in higher fuel-cycle impacts.

9.4.1.6 Combination Wet/Dry Hybrid Cooling-Tower System

Combination wet/dry hybrid cooling towers have never been used to cool nuclear or fossil facilities the size of the proposed BBNPP unit. A mechanical draft wet/dry hybrid cooling-tower system uses both wet and dry cooling cells to limit consumption of cooling water, often with the added benefit of reducing plume visibility. Water used to cool the turbine generators generally passes first through the dry portion of the cooling tower where heat is removed by drawing air at ambient temperature over tubes through which the water is moving. Cooling water leaving the dry portion of the tower then passes through the wet tower where the water is sprayed into a moving air stream and additional heat is removed through evaporation and sensible heat transfer. When ambient air temperatures are low, the dry portion of these cooling towers may be sufficient to meet cooling needs. During hot, dry summer months, a hybrid system still would rely on the wet portion of the system and, therefore, would have a reduced benefit at the same time that consumptive-use concerns are highest. The use of the dry portion of the system would result in a loss in generating efficiency that would translate into increased impacts on the fuel cycle. The review team determined that while such hybrid cooling technology may be feasible for the BBNPP site, it still poses several significant technical challenges for its installation and operation. Therefore, the review team concludes that the building and operation of a combined wet/dry cooling-tower system would not be an environmentally preferable alternative for the proposed BBNPP unit.

9.4.1.7 Mechanical Draft with Plume Abatement

Adding additional heat to a saturated cooling-tower exhaust, without adding additional water, would result in sub-saturated water vapor. Sub-saturated water vapor reduces the potential for a visible plume. The concept behind a mechanical draft cooling tower with plume abatement is similar to the wet/dry hybrid cooling system described above with the design parameters focused on reducing the visual plume. Such designs also may result in slightly less consumptive use than mechanical draft cooling towers without plume abatement. The aesthetic impacts at the BBNPP site with a mechanical draft cooling tower without plume abatement were determined to be SMALL; therefore, a mechanical draft tower with plume abatement offers no significant advantage. These towers often have a larger footprint and require additional energy to operate, resulting in a net loss of energy available to meet the demand for power. For these reasons, the review team concludes that the building and operation of mechanical draft cooling towers with plume abatement would not be an environmentally preferable alternative for the BBNPP site.

9.4.2 Circulating-Water Systems

The review team also evaluated alternatives to the proposed intakes and discharges for the normal heat-sink cooling system, based on the proposed heat-dissipation system water requirements. The capacity requirements of the intake and discharge system are defined by the proposed heat-dissipation system. For the proposed BBNPP unit, the proposed heat-dissipation system is a closed-cycle system that uses natural draft cooling towers for heat dissipation.

As indicated in Section 3.4.2.2, the maximum CWS makeup-water withdrawal for the proposed BBNPP unit is 23,808 gpm (53 cfs). PPL considered two potential alternative sources for supplying makeup water for the BBNPP site: municipal water (i.e., either potable water or reclaimed wastewater) and groundwater (PPL Bell Bend 2013-TN3377). Based on the small local capacities, the review team determined that municipal water is not a practical source of cooling water.

9.4.2.1 Intake Alternatives

The review team considered intake alternatives for taking water from the Susquehanna River for ultimate use by the condenser cooling system. The intake structure for the proposed BBNPP unit is described in detail in Section 3.2.2.2. PPL considered two alternative locations for the intakes: one north of the proposed location and one south of the proposed location. The review team also considered two alternative designs: a mid-channel intake and an infiltration bed intake.

Alternative Locations of Shoreline Intakes

PPL considered alternative locations both north and south of the proposed location. According to PPL, both of these alternative sites would potentially impact wetlands and archaeological sites.

Mid-Channel Intake

A mid-channel intake allows intake structures to be located away from the shoreline. A perforated pipe installed on the bottom of the river would allow water to be withdrawn from the river. Installing and maintenance of the intake would involve impacts to the riverbed. Aquatic organisms entrained in the intakes would be subsequently screened and returned to the river from a structure located away from the shoreline.

Infiltration Bed Intake/Radial Collector Well

An infiltration bed intake structure would consist of an infiltration bed with perforated pipes embedded in the gravel to collect the water. Larger pipes would carry the water from the perforated pipes to pumps located in a concrete structure on land. The intake system would include piping to backwash the gravel infiltration bed.

Construction would disturb less than 1 ac of the riverbed; however, it may require installation of a temporary cofferdam. These impacts would be expected to be temporary.

Intake velocities would be negligible, reducing the possibility of fish impingement. Backwashing the gravel bed would push entrapped sediment and debris back into the river current, allowing it to continue downstream. The frequency at which the gravel bed would need to be backwashed would be determined by head loss as the bed became loaded with debris. Backwashing would cause an increase in turbidity downstream of the gravel bed. In addition, river currents could scour the gravel bed leading to impaired performance.

A similar concept would be the installation of radial collector wells. Instead of constructing a gravel bed in the riverbed, this alternative would drill horizontally beneath the riverbed and thereby reduce installation impacts. However, several radial well systems would be required and likely would require expanding the proposed region into areas north and/or south of the proposed location.

Intake Alternatives Summary

Building intakes at locations north and south of the proposed location may impact wetlands and cultural resources. In addition, a number of installation and operational considerations related to the infiltration bed design and radial collector well design limit the practicality of this alternative. The impacts associated with aquatic ecology for the proposed intake have been determined to be minor in Chapters 4 and 5. Therefore, the review team determines that there are no alternative intake designs that would be environmentally preferable to the proposed intake design for the BBNPP site.

9.4.2.2 Discharge Alternatives

PPL proposes to discharge blowdown from the proposed BBNPP unit to the Susquehanna River through a multiport discharge pipe. A detailed description of the proposed discharge system is presented in Section 3.2.2.2. PPL mentioned no alternative discharge designs in its ER (PPL Bell Bend 2013-TN3377). They mentioned the history of a similar upstream discharge for the SSES that has been monitored for 24 years. The review team considered shoreline discharge and single port mid-channel discharges as alternatives. The review team determined that neither of these designs could reasonably be expected to dissipate the thermal plume more rapidly than the proposed design. The review team determined that the impacts of operation of the proposed discharge system would be minor and that no alternative discharge designs would be environmentally preferable to the proposed discharge design at the BBNPP site.

9.4.2.3 Water Supplies

The review team considered alternative sources for the CWS, including water reuse and groundwater.

Water Reuse

Sources of water for reuse can come either from the plant itself or from other local water users. Sanitary wastewater-treatment plants are the most ubiquitous sources of water for reuse. Agricultural processing, industrial processing, and oilfield production can also provide significant supplies of water for reuse. Additional treatment (e.g., tertiary treatment and chlorination) may be required to provide water of appropriate quality for the specific plant need. The population density is low, and few suitable industrial sources of wastewater are located around the BBNPP site, so adequate reliable wastewater sources are not currently available. Therefore, the review team determined that water reuse would not be an environmentally preferable alternative to PPL's proposed water supply, and it was not evaluated further.

Groundwater

Groundwater is not considered a viable source of cooling water for the proposed BBNPP unit because the geologic formations in the vicinity of the site generally are not permeable enough to sustain the well yields required to support the condenser cooling-water makeup need (23,808 gpm). Characterizations performed at the BBNPP site support this assertion (see Chapter 2). The review team finds that the groundwater resource could not practically meet the cooling-water demands of the proposed BBNPP unit. Therefore, the review team determined that groundwater would not be a feasible alternative to PPL's proposed water supply.

10.0 CONCLUSIONS AND RECOMMENDATIONS

The U.S. Nuclear Regulatory Commission (NRC or the Commission) received an application from PPL Bell Bend, LLC (PPL) for a combined construction permit and operating license (combined license or COL) for the Bell Bend Nuclear Power Plant (BBNPP). PPL notified the NRC of changes in its power generation business by letter dated May 12, 2015 (PPL Bell Bend 2015-TN4379). PPL Bell Bend, LLC was renamed Bell Bend, LLC, and Bell Bend, LLC became a generation affiliate of Talen Energy Corporation (Talen Energy). The transaction became official on June 1, 2015. For purposes of this review, the abbreviation "PPL" will still be used to indicate the applicant. Bell Bend, LLC, under Talen Energy, is the applicant. The location for the proposed BBNPP is a greenfield site near Berwick, in Luzerne County, Pennsylvania, approximately 115 mi northwest of Philadelphia, Pennsylvania. In its application, PPL specified the reactor design as AREVA NP Inc.'s (AREVA's) U.S. Evolutionary Power Reactor (U.S. EPR) design.

Section 102 of the National Environmental Policy Act of 1969, as amended (NEPA) (42 U.S.C. § 4321 et seq.-TN661), states that an environmental impact statement (EIS) is required for major Federal actions that significantly affect the quality of the human environment. Section 102(2)(C) of NEPA requires that an EIS include information on the following:

- the environmental impact of the proposed action
- any adverse environmental effects that cannot be avoided if the proposal is implemented
- alternatives to the proposed action
- the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity
- any irreversible and irretrievable commitments of resources that would be involved if the proposed action is implemented.

NRC has implemented NEPA in Title 10 of the *Code of Federal Regulations* (CFR) Part 51 (TN250). In 10 CFR 51.20, NRC requires preparation of an EIS for issuance of a COL. Subpart C of 10 CFR Part 52 (TN251) contains the NRC regulations related to a COL.

The proposed actions related to the COL application are (1) the NRC issuance of a COL for construction and operation of one new U.S. EPR unit at the BBNPP site, and (2) the U.S. Army Corps of Engineers (USACE) issuance of a permit pursuant to Section 404 of the Federal Water Pollution Control Act (also referred to as the Clean Water Act) (33 U.S.C. § 1251 et seq.-TN662) and Section 10 of the Rivers and Harbors Appropriation Act of 1899 (33 U.S.C. § 403 et seq.-TN660). If issued, the USACE permit would authorize the impact on waters of the United States, including jurisdictional wetlands, for the construction of the BBNPP and various associated, integral project components, including construction of the cooling-water intake system (including intake and blowdown pipelines), grading around the power block, access roads, expanding the existing Susquehanna Steam Electric Station (SSES) switchyard, and constructing a new 500-kV transmission line onsite from the BBNPP to the switchyard.

The environmental review described in this EIS was conducted by a review team consisting of NRC staff, its contractor's staff, and staff from the USACE. During the course of preparing this EIS, the review team reviewed the environmental report (ER) submitted by PPL (PPL Bell Bend 2013-TN3377) and supplemental revisions and documentation; consulted with Federal, State, Tribal, and local agencies; and followed the guidance set forth in NUREG-1555, *Environmental Standard Review Plans* (NRC 2000-TN614), and NUREG-0800, *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants* (NRC 2007-TN613), and Interim Staff Guidance "Environmental Issues Associated with New Reactors" (NRC 2014-TN3767). In addition, the NRC considered the public comments related to the environmental review. The public comments are provided in Appendix D and Appendix E.

Included in this EIS are (1) the results of the NRC staff's preliminary analyses, which consider and weigh the environmental effects of the proposed action and of constructing and operating a new unit at the BBNPP site, (2) mitigation measures for reducing or avoiding adverse effects, (3) the environmental impacts of alternatives to the proposed action, and (4) the NRC staff's recommendation regarding the proposed action based on its environmental review.

The USACE's role as a cooperating agency in the preparation of this EIS is intended to confirm that the information presented in the EIS is adequate to fulfill the requirements of USACE regulations and Clean Water Act Section 404(b)(1) Guidelines (hereafter referred to as 404(b)(1) Guidelines) to construct the preferred alternative identified in the EIS. The 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material (40 CFR Part 230-TN427) contains the substantive environmental criteria used by USACE in evaluating discharges of dredged or fill material into waters of the United States. The USACE's Public Interest Review (33 CFR Part 320-TN424) directs the USACE to consider a number of factors as part of a balanced evaluation process. While the USACE concurs as part of the review team with the designation of impact levels for terrestrial or aquatic resources, in so far as waters of the United States are concerned, the USACE must conduct a quantitative comparison of impacts on waters of the United States as part of the 404(b)(1) analysis and Public Interest Review process. Both USACE's 404(b)(1) Guidelines and Public Interest Review process will be part of its permit decision document and will not be addressed in this EIS. The USACE will document its conclusion of the review process, including the requirement for compensatory mitigation, in accordance with 33 CFR Part 332 (TN1472), Compensatory Mitigation for Losses of Aquatic Resources, in its permit decision document.

Environmental issues are evaluated using the three-level standard of significance—SMALL, MODERATE, or LARGE—developed by the NRC using guidelines from the Council on Environmental Quality (CEQ) (40 CFR 1508.27 [TN428]). Table B-1 of 10 CFR Part 51, Subpart A, Appendix B (TN250), provides the following definitions of the three significance levels:

> 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.

Mitigation measures were considered for each environmental issue and are discussed in the appropriate sections. During its environmental review, the review team considered planned activities and actions that PPL indicates it and others would likely take if PPL receives the COL. In addition, PPL provided estimates of the environmental impacts resulting from the building and operation of the proposed new nuclear unit on the BBNPP site.

10.1 Impacts of the Proposed Action

In a final rule dated October 9, 2007 (72 FR 57416-TN260), the Commission limited the definition of "construction" to those activities that fall within its regulatory authority (10 CFR 51.4 [TN250]). Many of the activities required to build a nuclear power plant are not part of the NRC action to license the plant. Activities associated with building the plant that are not within the purview of the NRC action are grouped under the term "preconstruction." Preconstruction activities include clearing and grading, excavating, erection of support buildings and transmission lines, and other associated activities. Because the preconstruction activities are not part of the NRC action, their impacts are not reviewed as a direct effect of the NRC action. Rather, the impacts of the preconstruction activities are considered in the context of cumulative impacts. Although the preconstruction activities are not part of the NRC action, they support, or are requisite to, the NRC action. In addition, certain preconstruction activities require permits from the USACE or other Federal, State, and local agencies.

Chapter 4 describes the relative magnitude of impacts related to construction and preconstruction activities and provides a summary of impacts in Table 4-14. Impacts associated with operation of the proposed facilities are discussed in Chapter 5 and summarized in Table 5-24. Chapter 6 describes the impacts associated with the fuel cycle, transportation, and decommissioning. Chapter 7 describes the impacts associated with construction and preconstruction activities and operation of the new unit at the BBNPP site when considered along with the cumulative impacts of other past, present, and reasonably foreseeable future projects in the geographic region around the BBNPP site.

10.2 Unavoidable Adverse Environmental Impacts

Section 102(2)(C)(ii) of the National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. § 4321 et seq.-TN661) requires that an EIS include information about any adverse environmental effects that cannot be avoided if the proposal is implemented. Unavoidable adverse environmental impacts are those potential impacts of the NRC action and the USACE action that cannot be avoided due to constraints inherent in utilizing the proposed BBNPP site and its associated offsite facilities.

The unavoidable adverse environmental impacts associated with the granting of the COL for the BBNPP unit would include impacts of construction, preconstruction, and operation.

10.2.1 Unavoidable Adverse Impacts during Construction and Preconstruction

Chapter 4 discusses in detail the potential impacts from construction and preconstruction of the proposed unit at the BBNPP site and presents mitigation and controls intended to lessen the adverse impacts. Table 10-1 presents the unavoidable adverse impacts associated with construction and preconstruction activities to each of the resource areas evaluated in this EIS, as well as the mitigation measures that would reduce the impacts. Impacts remaining after mitigation is applied (e.g., avoidance and minimization, but not including compensatory mitigation) are identified in Table 10-1 as unavoidable adverse impacts. Unavoidable adverse impacts are the result of both construction and preconstruction activities, unless otherwise noted. The impact determinations in Table 10-1 are for the combined impacts of construction and preconstruction. For impact determinations that differ for the combined construction and preconstruction activities and the NRC-regulated activities, the impacts from the NRC-regulated activities are also identified in Table 10-1.

The unavoidable adverse impacts are primarily attributable to preconstruction activities due to the initial land disturbance from clearing the land, land use, excavation, filling wetlands and waterways, adding impervious surfaces, and dredging. NRC-authorized construction activities partially contribute to most of the unavoidable adverse impacts. Approximately 357 ac within the BBNPP project boundary would be permanently disturbed. This total includes 39 ac of previously developed land associated primarily with existing SSES facilities. Areas disturbed to build these project features would be permanently converted to structures, pavement, and intensively maintained exterior grounds. Forested land within onsite transmission-line, vehicle, railroad-spur, and utility-bridge corridors not occupied by structures or improvements would be converted to scrub/shrub vegetation (PPL Bell Bend 2013-TN3377). Additional areas could be disturbed on a short-term basis as a result of temporary activities and facilities and laydown areas.

Surface water would not be used to support building activities for the BBNPP. Construction of the intake and discharge structures would alter the pattern of flow in the Susquehanna River, but these alterations would be localized and temporary, and the flow rate in the Susquehanna River would not be affected. Dewatering of excavations for construction of the nuclear island, the cooling towers, and the Essential Service Water Emergency Makeup System (ESWEMS) pond are expected to reduce the flow in Walker Run, but the effects of dewatering on the average Walker Run discharge would be minor and temporary. Dewatering of excavations is expected to locally alter groundwater elevations and the shallow groundwater flow patterns, but these effects would be localized and temporary. Dewatering is not expected to significantly alter groundwater quality. Groundwater withdrawn during dewatering would be discharged to surface waterbodies. Discharge of groundwater withdrawn during dewatering would be regulated as part of the National Pollutant Discharge Elimination System (NPDES) permit issued by the Pennsylvania Department of Environmental Protection (PADEP).

Table 10-1. Unavoidable Adverse Environmental Impacts from Construction and Preconstruction

Resource Area	Impacts	Mitigation Measures	Unavoidable Adverse Impacts
Land Use	SMALL	Mitigation measures proposed by the applicant to reduce preconstruction and construction activity impacts would include soil erosion and sedimentation control, controlled access roads, and restricted construction zones. Areas of temporary disturbance would be stabilized and restored after completion of building activities, and permanently disturbed locations would be stabilized and contoured to blend with the surrounding area. Vegetation stabilization and restoration methods would comply with applicable laws, regulations, permit requirements and conditions, good engineering and construction practices, and recognized environmental best management practices (BMPs). New onsite transmission lines would be situated entirely within the BBNPP site but would still be routed to avoid or minimize impacts on existing wetlands and any identified threatened and endangered species.	Much of the 975-ac BBNPP site would likely be needed until end of project operations to maintain exclusion areas and security, although some areas of land within the site could potentially be used by unrelated but compatible land uses. Approximately 357 ac within the BBNPP project boundary would be permanently converted to structures, pavement, and intensively maintained exterior grounds. Approximately 306 ac of additional land within the BBNPP project boundary would be temporarily disturbed during construction activities. Up to four residences and associated outbuildings located within the exclusion area boundary would be vacated and removed or relocated during preconstruction activities. Approximately 292 ac of prime farmland soils would be irreversibly disturbed. Building new onsite transmission lines would require the permanent removal of trees from under the new conductors.
Water Use	SMALL	None.	Local and temporary alteration of Susquehanna River flow. Local and temporary drawdown of local aquifers from excavation dewatering. Temporary reduction in groundwater discharge to Walker Run.

Table 10-1. (contd)

Resource Area	Impacts	Mitigation Measures	Unavoidable Adverse Impacts
Water Quality	SMALL	None.	Local and temporary increase in suspended solids from construction in Susquehanna River. Potential temporary increase in sediment discharge to waterbodies due to runoff and erosion. Temporary and localized impacts from discharge of excavation dewatering product and spills.
Ecological (terrestrial)	MODERATE (NRC-authorized construction impact level is SMALL)	Proposed wetland mitigation includes: (1) a stream and floodplain restoration project on two reaches of Walker Run, reconfiguring the stream channel and adjacent wetlands; (2) removing a section of Confers Lane, creating wetlands in the former roadbed and restoring a hydrologic connection between two separated forested wetlands; and (3) restoring a portion of the North Branch Canal, enhancing wetlands at the PPL Riverlands location, and extending the existing recreational trail system. Additionally, PPL plans to monitor wetlands potentially affected by groundwater drawdowns caused by building the ESWEMS pond and implement hydrologic corrective action if maximal drawdown targets are not met. PPL would limit cutting of trees over 5 inches in diameter at breast height to a period between November 16 and March 31 to avoid impacts to the Federally endangered Indiana bat during the non-hibernation period. PPL would make a monetary contribution to the Indiana bat Conservation Fund to set aside, in perpetuity, habitat for the species.	Approximately 11.1 ac of jurisdictional wetlands and approximately 0.14 ac of non-jurisdictional (isolated) wetlands would be disturbed by building BBNPP facilities. Building the ESWEMS pond could draw down localized groundwater levels temporarily affecting approximately 5.6 ac of wetlands not otherwise subject to project impacts. Approximately 222 ac of upland forest and 9.5 ac of forested wetlands would be cleared. Cutting trees over 3 inches in diameter at breast height would affect the Federally endangered Indiana bat and Federally threatened northern long-eared bat directly via mortality and injury, and indirectly via habitat losse. Site-preparation work could disturb host plants for multiple State-ranked butterfly species of conservation interest to PDCNR. Approximately 155.1 ac (including 7.6 ac of forested wetland) and 13.3 ac of habitat would be disturbed in Important Bird Area No. 72 and the Susquehanna Riverlands Environmental Preserve, respectively, by building BBNPP facilities.

Table 10-1. (contd)

Resource Area	Impacts	Mitigation Measures	Unavoidable Adverse Impacts
		PPL would remove trees greater than 3-in.-diameter at breast height only from November 16 through March 31 in order to protect the Federally endangered Indiana bat and Federally threatened northern long-eared bat from the direct effects of mortality and injury. PPL would incorporate planting host plants for State-ranked butterfly species into PPL's mitigation plans for wetland creation and enhancement (noted above) and restoration of temporarily affected wetlands.	
Ecological (aquatic)	SMALL	Comply with Federal permits and State 401 water-quality certification. Prepare and implement a Stormwater Pollution Prevention Plan (SWPPP) and BMPs to control erosion and sedimentation. Proposed mitigation includes (1) a stream and floodplain restoration project on two reaches of Walker Run to create 4,159 linear ft and enhance 853 linear ft of stream habitat. (2) restoration of the North Branch Canal system.	Physical alteration of habitat (e.g., infilling, coffer dam placement, dredging) including temporary or permanent removal of associated benthic organisms, sedimentation, and changes in water quality. Aquatic habitats affected would include the intake and discharge locations in the North Branch Susquehanna River, the North Branch Canal Outlet, and 2,799 linear ft of Walker Run. Other impacts include permanent shading over onsite tributaries from bridge installation, and installation of a culvert under the proposed rail extension.
Socioeconomic			
Physical and Aesthetic	SMALL	None.	None.
Demography	SMALL	None.	None.
Economic Impacts to Community	SMALL	None.	None.
Infrastructure and Community Services	SMALL to MODERATE. MODERATE for traffic impacts on the local highway network, housing impacts	PPL has identified a number of mitigation measures to address traffic impacts, including installing signals at the BBNPP entrance access road; realigning lanes on U.S. Route 11; adding new entrance and exit lanes on the access road at	Temporary, localized periodic traffic impacts during building. Temporary impacts on housing availability and prices in Berwick area during building. Temporary impacts on school facilities and student-to-

Table 10-1. (contd)

Resource Area	Impacts	Mitigation Measures	Unavoidable Adverse Impacts
	in the Borough of Berwick, and impacts on the Berwick Area School District. SMALL for other infrastructure and community service impacts.	the intersection of U.S. Route 11; retiming signals; restriping; adding through lanes, temporary traffic signals, parking restrictions, and additional school buses and drivers; possibly relocating school bus stops off of U.S. Route 11, and/or other measures at intersections affected by construction traffic. Increased property and worker-related taxes can help offset some of the problems related to increased population (e.g., community facilities and infrastructure, police, fire protection, and schools).	teacher ratios in Berwick Area School District during building.
Environmental Justice	SMALL	None.	None.
Historic and Cultural Resources	SMALL	Formal inadvertent discovery procedures are in place to minimize impacts on potential onsite historic and cultural resources. PPL and the Pennsylvania State Historic Preservation Office (SHPO) have agreed on “temporary avoidance and mitigation measures” that PPL will take to protect 36LU288 during preconstruction (Wise 2012-TN1755).	None.
Meteorology and Air Quality	SMALL	Implement a dust-control plan prior to site preparation. Obtain required air-quality permits from the PADEP.	Temporary degradation of local air quality due to vehicle emissions and fugitive dust emissions during ground clearing, grading excavation activities, and operation of other temporary sources.
Nonradiological Health	SMALL	Compliance with Federal, State, and local regulations governing construction activities and construction vehicle emissions, compliance with Federal and local noise-control ordinances, compliance with Federal and State occupational safety and health regulations, implementation of traffic management plan.	Dust emissions, noise, occupational injuries, traffic accidents.

Table 10-1. (contd)

Resource Area	Impacts	Mitigation Measures	Unavoidable Adverse Impacts
Radiological Health	SMALL	Use of as-low-as-reasonably-achievable principles.	Radiological doses to the public and to construction workers at the BBNPP site from the adjacent SSES Units 1 and 2 would be below the NRC public dose limits.
Nonradioactive Waste	SMALL	Implement BMPs to minimize waste generation. Manage wastes in accordance with Federal, State, and county requirements.	Consumption of some landfill capacity. Minor discharges to receiving waters and to atmosphere.

Onsite terrestrial habitats would be reduced through permanent or temporary losses of forests (approximately 222 ac), jurisdictional wetlands (approximately 11.1 ac, mostly of forested wetlands), and non-jurisdictional features (approximately 0.14 ac), as well as the potential temporary drawdown of as much as 5.6 ac of jurisdictional forested wetlands (PPL Bell Bend 2013-TN3377). Habitat loss and fragmentation would reduce the suitability of mature deciduous forest onsite for State-listed avian species and forest interior birds. Habitat loss and fragmentation would reduce the suitability of potential roosting habitat in deciduous forest for the Indiana bat and northern long-eared bat; both Federally listed species; as well as two State-ranked bat species. Uncertainty exists regarding the potential for groundwater drawdown related to pumping from excavations to affect wetlands. However, implementation of the conceptual dewatering mitigation plan would reduce the drawdown effects.

Onsite freshwater resources and the Susquehanna River would experience temporary impacts as a result of modifying riparian areas, temporarily dewatering the North Branch Canal, and abandoning part of Walker Run as part of creating a new stream channel. Building the new plant structures on the BBNPP site also would permanently change the Susquehanna River watershed, including the Walker Run watershed, by converting a portion of the existing watershed habitat to impervious surfaces. The potential effects of the dewatering project excavations on nearby aquatic resources would be reduced by using the pumped groundwater to irrigate the area around an onsite stream.

Cultural resource attributes would not be permanently altered by the construction, preconstruction, and operation of the proposed plant and transmission lines. Within the direct (physical) and indirect (visual) Area of Potential Effect (APE), one site is eligible for listing in the National Register of Historic Places. However, PPL and the Pennsylvania SHPO have agreed on “temporary avoidance and mitigation measures” that will protect the site. Therefore, the Pennsylvania SHPO has agreed that there will be no adverse effects on the eligible site. Three aboveground properties located within the viewshed of the proposed project have been determined to be eligible for the National Register of Historic Places. For these sites, the Pennsylvania SHPO determined the visual impact of the proposed new cooling towers and plumes would be minimal due to the relative location of the new cooling towers and plumes west of, and behind, the existing SSES cooling towers and plumes.

Socioeconomic impacts of building the proposed BBNPP unit would include an increase in traffic in the local highway network from construction workers, an increase in housing demand and prices in the Borough of Berwick, and noticeable impacts to the Berwick Area School District. However, increases in employment and tax revenues during the construction period would benefit the local economy and the Berwick Area School District. No unusual resource dependencies on minority and low-income populations in the region were identified.

Air-quality impacts include temporary degradation due to vehicle emissions and fugitive dust emissions during ground clearing, grading excavation activities, and operation of other temporary sources. Fugitive dust from land disturbances and building activities would be mitigated by the dust-control plan.

10.2.2 Unavoidable Adverse Impacts during Operation

Chapter 5 provides a detailed discussion of the potential impacts from operation of the proposed unit at the BBNPP site and presents mitigation and controls intended to lessen the adverse impacts. Table 10-2 presents the unavoidable adverse impacts on each of the resource areas evaluated in this EIS associated with operation of the proposed unit and the mitigation measures that would reduce the impacts. Those impacts remaining after mitigation is applied (e.g., avoidance and minimization, but not including compensatory mitigation) are identified in Table 10-2 as unavoidable adverse impacts. The unavoidable adverse impacts from operation for land use would be minimal and are associated with making land unavailable for other uses until after decommissioning of the proposed BBNPP unit.

Table 10-2. Unavoidable Adverse Environmental Impacts from Operation

Resource Area	Impact	Mitigation Measures	Unavoidable Adverse Impacts
Land Use	SMALL	None	Very small amounts of salt (0.0199 kg/ha/mo) would be deposited in the site vicinity from cooling-tower drift. Based on available data, these amounts are expected to not be capable of adversely affecting vegetation. Brief, minor shadowing effects caused by clouds generated during operation of the two cooling towers could affect properties located immediately outside the project boundary. Vegetation within the corridors of onsite transmission lines would be maintained by mowing; trimming; tree removal; and, if necessary, by applying herbicides and growth-regulating chemicals.

Table 10-2. (contd)

Resource Area	Impact	Mitigation Measures	Unavoidable Adverse Impacts
Water Use	SMALL	Comply with Susquehanna River Basin Commission consumptive-use mitigation and site-specific low-flow protection requirements.	Surface-water availability would not be noticeably altered, but during very dry years requiring prolonged consumptive-use mitigation and site-specific low-flow protection releases, drawdown of Cowanesque Lake would adversely affect recreational use of the lake.
Water Quality	SMALL	None.	Localized increase in water temperature and concentration of chemicals in cooling-tower blowdown downstream from the outfall diffuser.
Ecological (terrestrial)	SMALL to MODERATE	Implementation of BMPs associated with transmission-line corridor maintenance practices, including vegetation management BMPs and danger tree removal restrictions to protect the Federally endangered Indiana bat and Federally threatened northern long-eared bat. PPL would employ flashing lights and minimal lighting levels (per FAA regulations) for cooling towers to reduce avian collisions.	Minor impacts to species and habitats associated with vegetation maintenance on transmission-line rights-of-way. Minor impacts due to avian collisions with cooling towers, the meteorological tower, and transmission lines. Minor impacts to vegetation from salt drift deposition.
Ecological (aquatic)	SMALL	Implement BMPs. Control erosion and sedimentation. Limit intake velocity. Use small mesh screens on intake system. Implement the use of a return system for impinged river biota. Meet applicable Federal and State discharge permit requirements.	Increased stormwater runoff. Impingement and entrainment of river biota by cooling-water intake system. Temporarily increased turbidity from maintenance dredging and cleaning of intake and discharge systems. Temporary disturbance of receiving waters during consumptive-use mitigation water and site-specific low-flow releases.

Table 10-2. (contd)

Resource Area	Impact	Mitigation Measures	Unavoidable Adverse Impacts
Socioeconomic			
Physical and Aesthetic	SMALL	None.	None.
Demography	SMALL	None.	None.
Economic Impacts on Community and Taxes	SMALL	None.	None.
Infrastructure and Community Services	SMALL	None.	None.
Environmental Justice	SMALL	None.	None.
Historic and Cultural Resources	SMALL	Formal inadvertent discovery procedures are in place to minimize impacts on potential onsite historic and cultural resources.	None.
Meteorology and Air Quality	SMALL	Compliance with Federal, State, and local air-quality permits and regulations.	Slight increases in certain criteria pollutants and greenhouse gas emissions due to plant auxiliary combustion equipment (e.g., standby diesel generators) and plumes and drift deposition from cooling towers.
Nonradiological Health	SMALL	Use of antimicrobial agents in the cooling system, physical and administrative controls on exposure to cooling system discharge, compliance with Federal and local noise regulations, with Federal and State occupational safety regulations, and transmission-line design compliant with National Electric Safety Code standards.	Increase in etiological agent growth, cooling-tower and pump noise, occupational injuries, acute and chronic electromagnetic field exposures.
Radiological Health	SMALL	Doses to members of the public would be maintained below NRC and U.S. Environmental Protection Agency	Small radiation doses to members of the public below NRC and EPA standards; as low-as-reasonably-achievable doses to workers; and non-human biota doses less than

Table 10-2. (contd)

Resource Area	Impact	Mitigation Measures	Unavoidable Adverse Impacts
		(EPA) standards; workers' doses would be maintained below NRC limits and as low as reasonably achievable; and mitigative actions for members of the public would also ensure doses to biota other than humans would be well below National Council on Radiation and Measurements and the International Atomic Energy Agency guidelines.	National Council on Radiation and Measurements and International Atomic Energy Agency guidelines.
Fuel cycle, Transportation, and Decommissioning	SMALL	Industrywide changes in technology are reducing fuel cycle impacts. Implement waste-minimization program. Comply with the NRC and U.S. Department of Transportation (DOT) regulations	Small impacts from fuel cycle as presented in Table S-3, 10 CFR Part 51 (TN250). Small impacts from carbon dioxide, radon, and technetium-99. Small radiological doses that are within the NRC and DOT regulations from transportation of fuel and radioactive waste. Small impacts from decommissioning as presented in NUREG–0586 (NRC 2002-TN665)
Nonradioactive Waste	SMALL	All wastes disposed in compliance with applicable Federal, State, and local requirements.	Consumption of some landfill capacity. Minor discharges to receiving waters and to atmosphere.

Water-related impacts during operation would be mitigated through PPL's adherence to Susquehanna River Basin Commission permits for water withdrawal and discharge. Remaining adverse impacts on hydrological water-use and water-quality impacts during operation would be minimal and limited to increased water use, potential increases in sedimentation to bodies of surface water, and potential surface-water and groundwater contamination from inadvertent spills.

Unavoidable adverse impacts on terrestrial ecology resources would include increased risk of bird collisions with cooling towers, the meteorological tower, and transmission lines; reduced wildlife use or avoidance of some habitats due to noise and disturbance; minor impacts to vegetation and wildlife from transmission line corridor maintenance; and minor impacts to vegetation from salt deposition near the cooling towers. The potential impacts of increased traffic and nighttime security lighting on wildlife are likely to be minor. Impacts to riparian habitats from consumptive-use mitigation and site-specific low-flow release events would be relatively infrequent and would occur over relatively short periods.

Unavoidable adverse aquatic impacts would include impingement and entrainment loss of organisms at the BBNPP cooling-water-system intake and the disruption of aquatic resources in the Cowanesque Lake and Cowanesque River during consumptive-use mitigation and site-specific low-flow release events. Impingement and entrainment impacts would be minimal during operation because the intake structure on the Susquehanna River would be designed and located to minimize effects on aquatic organisms. Aquatic impacts from consumptive-use mitigation and site-specific low-flow release events would be relatively infrequent, would occur over relatively short periods, and would be less than those caused by natural events. The cooling-water discharge from BBNPP into the Susquehanna River also would have minimal effects on aquatic organisms because of design and placement of the discharge pipe multiport diffuser and rapid mixing of the station blowdown with the river water. Operation of the intake and discharge structures would comply with the BBNPP NPDES permit obtained by PPL. Stormwater impacts would be minimized by preparing and implementing BMPs and a SWPPP. Other impacts from operational activities (e.g., salt deposition from cooling-tower drift, road maintenance during the winter, maintenance dredging, onsite maintenance of transmission corridors, and consumptive-use mitigation water releases from the Rushton Mine) would be minor or negligible and temporary. Consumptive-use mitigation and site-specific low-flow water releases from Cowanesque Lake would have relatively infrequent and temporary effects on the biota in Cowanesque Lake and the Cowanesque River.

One significant cultural resource was identified within the direct effects APE, and three significant resources are located within the architectural APE. PPL has agreed to follow appropriate procedures if historic or cultural resources are discovered during operations activities.

It is expected that air-quality impacts would be negligible, and pollutants emitted during operations would be insignificant. Nonradiological and radiological health impacts would be minimal. Nonradiological health impacts to members of the public from operation, including etiological agents, noise, electromagnetic fields, occupational health, and transportation of materials and personnel would be minimal because PPL would apply controls and measures to ensure compliance with Federal and State regulations. Radiological doses to members of the public from operation of the proposed BBNPP unit would be below annual exposure limits set to protect the public.

Adverse socioeconomic impacts likely would be similar in character to those during the building phase but smaller due to the smaller project-related population and workforce and the fact that these impacts will follow the larger building period demand, which is likely to have resulted in adaptations and growth in the affected communities. Socioeconomic impacts would primarily be increased traffic, some damage to roads, increased demand for housing and public services, and increased employment opportunities. Substantial increases in tax revenue once the new BBNPP unit becomes operational would benefit local government services and the Berwick Area School District.

10.3 Relationship Between Short-Term Uses and Long-Term Productivity of the Human Environment

Section 102(2)(C)(iv) of NEPA (42 U.S.C. § 4321 et seq.-TN661) requires that an EIS include information about the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity.

The local use of the human environment by the proposed project can be summarized in terms of the unavoidable adverse environmental impacts of construction and operation and the irreversible and irretrievable commitments of resources. With the exception of the consumption of depletable resources as a result of plant construction and operation, these uses may be classed as short term. The principal short-term benefit of the plant is represented by the production of electrical energy. The economic productivity of the site, when used for this purpose, would be extremely large compared to the productivity from agriculture or other probable uses for the site.

The maximum long-term impact on productivity would result when the plant is not immediately dismantled at the end of the period of plant operation, and, consequently, the land occupied by the plant structures would not be available for any other use. However, the enhancement of regional productivity resulting from the electrical energy produced by the plant is expected to generate a correspondingly large increase in regional long-term productivity that would not be equaled by any other long-term use of the site. In addition, most long-term impacts resulting from land-use preemption by plant structures can be eliminated by removing these structures or by converting them to other productive uses. Once the unit is shut down the plant would be decommissioned according to NRC regulations. Once decommissioning is complete and the NRC license is terminated, the site would be available for other uses. The review team concludes that the negative aspects of plant construction and operation as they affect the human environment would be outweighed by the positive long-term enhancement of regional productivity through the generation of electrical energy.

10.4 Irreversible and Irretrievable Commitments of Resources

Section 102(2)(C)(v) of NEPA (42 U.S.C. § 4321 et seq.-TN661) requires that an EIS include information about any irreversible and irretrievable commitments of resources that would occur if the proposed actions are implemented. The term “irreversible commitments of resources” refers to environmental resources that would be irreparably changed by the building or operation activities authorized by the NRC licensing or USACE permitting decisions, where the environmental resources could not be restored at some later time to the resource’s state before the relevant activities. “Irretrievable commitments of resources” refers to materials that would be used for or consumed by the new unit in such a way that they could not, by practical means, be recycled or restored for other uses. The resources discussed in this section are the environmental resources discussed in Chapters 4, 5, and 6.

10.4.1 Irreversible Commitments of Resources

Irreversible commitments of environmental resources resulting from the BBNPP, in addition to the materials used for the nuclear fuel, are described in the following sections.

10.4.1.1 Land Use

The approximately 357 ac of land occupied by proposed BBNPP facilities would be unavailable for other uses during the operational period. The land used for the proposed BBNPP, with the exception of any filled wetlands, would not be irreversibly committed because once the proposed BBNPP ceases operations and the plant is decommissioned in accordance with NRC requirements, the land supporting the facilities could be returned to most other industrial or nonindustrial uses. The approximately 292 ac of prime farmland that would be affected by the project would be irreversibly converted to developed land or experience surface soil damage such that the soil properties responsible for the prime farmland designation would be irreversibly damaged.

10.4.1.2 Water Use

Under average conditions, 17,064 gpm (38 cfs) of surface water used as cooling water would be lost through evaporation and drift (i.e., referred to as consumptive use) during operation. There would be minor consumptive use of groundwater from a municipal supply (40 gpm) and no discharge to groundwater during operation.

10.4.1.3 Ecological Resources

Approximately 357 ac of terrestrial habitat would be permanently lost, at least for the duration of project operations. Approximately 306 ac of additional terrestrial habitat would be temporarily disturbed while project facilities are built. Several decades would be necessary for temporarily disturbed forest habitats to revert to the characteristics of a mature forest through natural succession, and even temporary soil disturbances could introduce uncertainty as to whether baseline ecological conditions could ever be regained. Approximately 1.25 ac of wetlands would be permanently filled (at least over the duration of project operations) and an additional 0.9 ac of wetlands would be temporarily filled. None of the filled wetlands can be expected to revert to wetlands through natural succession, and the success of any future purposeful efforts to remove the fill and restore natural wetlands resembling baseline conditions is uncertain. An estimated 9.0 ac of forested wetlands would be maintained in scrub-shrub condition over the course of project operations; these wetlands can be expected to revert to forested wetlands through natural succession if maintenance ceases.

Permanent losses of onsite aquatic habitats include filling of the 617 linear ft of the North Branch Canal Outlet, abandonment of 2,799 linear ft of Walker Run stream segments, and loss of 125 ft of benthic habitat in Unnamed Tributary 5. Dredging activities for the installation of the cooling-water intake and discharge structures would permanently remove 17,000 to 25,000 yd^3 of sediment, and result in a loss of 0.2 ac of river-bottom habitat. Benthic organisms present in these sediment habitats would be lost.

10.4.1.4 Socioeconomic Resources

The staff expects that no irreversible commitments would be made to socioeconomic resources because they would be reallocated for other purposes once the plant is decommissioned.

10.4.1.5 Historic and Cultural Resources

There are no irreversible or irretrievable commitments of resources for historic and cultural resources because these resources would not be permanently altered by the construction, preconstruction, and operation of the proposed plant.

10.4.1.6 Air and Water Resources

During construction, dust and other emissions (e.g., vehicle exhaust) would be released into the air. During operations, vehicle exhaust emissions would continue, and other air pollutants and chemicals, including very low concentrations of radioactive gases and particulates, would be released from the facility into the air and surface water. Because these releases would conform to applicable Federal and State regulations, their impact on the public health and the environment would be limited. The review team expects no irreversible commitment to air or water resources because all BBNPP releases would be made in accordance with duly issued permits.

10.4.2 Irretrievable Commitments of Resources

Irretrievable commitments of resources during construction of the proposed BBNPP generally would be similar to those of any major construction project. A study by the U.S. Department of Energy (DOE 2004-TN2240) of new reactor construction estimated that the following quantities of materials would be required for the reactor building of a typical new 1,300-MW(e) nuclear power unit: 12,239 yd^3 of concrete, 3,107 T of rebar, and 6,500,000 ft of cable. An estimated additional 275,000 ft of piping would be required for a two-unit plant. A total of approximately 182,900 yd^3 of concrete and 20,512 T of structural steel would be required to construct the reactor building, major auxiliary buildings, the turbine-generator building, and the turbine-generator pedestal. Because the BBNPP unit would be a 1,600-MW(e) unit, about 20% more than these amounts would be needed to build it, and more resources would be required for other site structures.

The review team expects that the use of construction materials in the quantities associated with those expected for the BBNPP, while irretrievable, would be of small consequence with respect to the availability of such resources.

The main resource that would be irretrievably committed during operation of the new nuclear unit would be uranium. The availability of uranium ore and existing stockpiles of highly enriched uranium in the United States and Russia that could be processed into fuel is sufficient (OECD/NEA and IAEA 2008-TN3992) so that the irreversible and irretrievable commitment of this resource would be negligible.

10.5 Alternatives to the Proposed Action

Alternatives to the proposed actions are discussed in Chapter 9 of this EIS. Alternatives considered are the no-action alternative, energy production alternatives, alternative sites, and system and design alternatives. For the benefit of the USACE, onsite alternatives showing relocation or reconfiguration of facility components are also addressed in Appendix J.

The no-action alternative, described in Section 9.1, refers to a scenario in which the NRC would deny the request for the COL or the USACE would either deny the Department of the Army Individual Permit, deny the selected alternative if it is different than the least environmentally damaging practicable alternative (LEDPA), or take no action as a result of the applicant electing to modify its proposal to eliminate work under the jurisdiction of the USACE. If no other power plant were built or no other electrical power supply strategy were implemented to take its place, the electrical capacity to be provided by the project would not become available, the benefits (electricity generation) associated with the proposed action would not occur, and the need for power would not be met.

Alternative energy sources are described in Section 9.2. Alternatives that would not require additional generating capacity are described in Section 9.2.1. Detailed analyses of coal- and natural-gas-fired alternatives are provided in Section 9.2.2. Other energy sources are discussed in Section 9.2.3. A combination of energy alternatives is discussed in Section 9.2.4. The NRC staff concluded that none of the alternative energy options were both (1) consistent with PPL's objective of building a baseload generation unit and (2) environmentally preferable to the proposed action.

Alternative sites are discussed in Section 9.3. The cumulative impacts of building and operating the proposed facilities at the alternative sites are compared to the impacts at the proposed BBNPP site in Section 9.3.6. Table 9-18 contains the review team's characterization of cumulative impacts at the proposed and alternative sites. Based on this review, the NRC staff concludes that while differences in cumulative impacts exist at the proposed and alternative sites, none of the alternative sites would be environmentally preferable or obviously superior to the proposed BBNPP site. The NRC's determination is independent of the USACE determination of the LEDPA pursuant to Section 404(b)(1) Guidelines. The USACE will conclude its analysis of both offsite and onsite alternatives in its permit decision document.

Alternative heat-dissipation, water sources, and circulating-water system designs are discussed in Section 9.4. The NRC staff concluded that none of the alternatives considered would be environmentally preferable to the proposed system designs.

10.6 Benefit-Cost Balance

The National Environmental Policy Act of 1969 (NEPA) requires that all agencies of the Federal government prepare detailed environmental statements on proposed major Federal actions that can significantly affect the quality of the human environment (42 U.S.C. § 4321 et seq. -TN661). A principal objective of NEPA is to require each Federal agency to consider, in its decision-making process, the environmental impacts of each proposed major action and the available alternative actions, including alternative sites. In particular, as stated below, Section 102 of NEPA requires all Federal agencies to the fullest extent possible:

> "(B) identify and develop methods and procedures, in consultation with the Council on Environmental Quality established by title II of this Act, which will insure that presently unquantified environmental amenities and values may be given appropriate consideration in decision-making along with economic and technical considerations."

However, neither NEPA nor the Council on Environmental Quality requires the benefits and costs of a proposed action be quantified in dollars or any other common metric.

The intent of this section is not to identify and quantify all of the potential societal benefits of the proposed activities and compare these to the potential costs of the proposed activities. Instead, this section will focus on only those benefits and costs of such magnitude or importance that their inclusion in this analysis can inform the decision-making process. This section compiles and compares the pertinent analytical conclusions reached in earlier chapters of this EIS. It gathers the expected impacts from construction and operations of the proposed BBNPP and aggregates them into two final categories: (1) the expected benefits to be derived from approval of the proposed action and (2) the expected environmental and economic costs.

This section identifies the benefits and costs of constructing and operating the proposed BBNPP. Although conceptually similar to a purely economic benefit-cost analysis, which determines the net present dollar value of a given project, the intent of this section is to identify all potential societal benefits of the proposed activities and compare these to the potential internal (i.e., private) as well as external (i.e., societal) costs of the proposed activities. The purpose is to generally inform the COL process by gathering and reviewing information that demonstrates the likelihood that the benefits of the proposed activities outweigh the aggregate costs.

General issues related to PPL's financial viability are outside NRC's mission and authority and, thus, are not considered in this EIS. Issues related to the financial qualifications of the applicant will be addressed in the staff's safety evaluation report. It is not possible to quantify and assign a value to all benefits and costs associated with the proposed action. This analysis, however, attempts to identify, quantify, and provide monetary values for benefits and costs when reasonable estimates are available.

Section 10.6.1 discusses the benefits associated with the proposed action. Section 10.6.2 discusses the costs associated with the proposed action. A summary of benefits is shown in Table 10-3. In accordance with the staff's guidance in NUREG–1555, internal costs of the proposed project are presented in monetary terms (NRC 2000-TN614). Internal costs include all of the costs included in a total capital cost assessment: direct and indirect cost of construction plus the annual costs of operation and maintenance. Section 10.6.3 provides a summary of the impact assessments, bringing previous sections together to establish a general impression of the relative magnitude of the proposed project's costs and benefits.

10.6.1 Benefits

The most apparent benefit from constructing and operating a power plant is that, once built, it would generate power and provide thousands of residential, commercial, and industrial consumers with electricity. Maintaining an adequate supply of electricity in any given region has social and economic importance because this resource is the foundation for economic stability and growth, and is fundamental to maintaining the current standard of living in the United States. In addition to nuclear power, however, there are a number of different power-generation technology options that could meet this need, including natural gas-fired and coal-fired plants. Because the focus of this EIS is on the generating capacity at the proposed BBNPP site, this section focuses primarily on the benefits of the proposed site relative to the costs of this option,

Table 10-3. Monetary and Non-Monetary Benefits of the Proposed BBNPP

Category of Benefit	Description of Benefit	Monetized Value of Benefit Over License Period
Electricity generated	13,294,538 MW(h) per year[a]	
Generating capacity	1,600 MW(e)[b]	
Fuel diversity and energy security	Nuclear generation provides diversity to coal- and natural-gas-fired baseload generation.	
Tax revenues	PPL will pay property taxes to Salem Township, the Berwick Area School District, and Luzerne County upon operation of the BBNPP in 2025. In addition, Pennsylvania will collect sales and use taxes on locally purchased goods and services during construction. PPL also will pay corporate income taxes to Pennsylvania over the 40-year life of the project. The construction and operations workforce will generate State and local income, local services, and sales taxes over the construction period and 40-year operating life of the project.	$2.4 million in property taxes annually[c] and up to $0.5 million in sales taxes statewide tied to the purchase of materials, equipment and outside services on an annual basis.[d] PPL estimates that within the 50-mi radius of the nuclear power plant site, $260.8 million will be spent on material, equipment, and outside services during the construction period. Applying the State's 6 percent sales tax rate generated total estimated sales tax payments of $15.6 million over the construction period. $9.5 million in annual State personal income tax would be generated from the construction workforce at the peak of construction and $0.8 million in State personal income tax would be generated annually over the 40-year life of the plant.[b] At the local level, the construction workforce will generate $3.1 million in annual earned income tax and $0.2 million in annual local services tax payments. The operations workforce will generate $280,000 annually in local earned income tax and $18,876 in local services tax payments over the 40-year operating life of the project. Over the 2025 to 2044 time period, the impact of BBNPP operations on PPL Corporation income tax payments are estimated at $2 billion ($100 million average annual) to the Federal government and $500 million ($25 million average annual) to Pennsylvania.[e]
Local economy	Increased jobs would benefit area economically and increase the economic diversity of region (Sections 4.4.3.1 and 5.4.3.1).	4,313 workers, including 363 operations workers onsite for training purposes, and 957-1,333 indirect workers at construction peak; $324-$331 million in income per year at construction peak. 363 operations workers and 456 indirect jobs added over 40-year life of plant; $36.1 million in income per year during 40-year life of plant.
Technical or other non-monetary benefits	Fuel diversity would reduce exposure to supply and price risk associated with single fuel source.	
Price volatility	Would lessen potential for fuel price volatility.	
Electrical reliability	Would enhance reliability of electricity supply.	

(a) PPL Bell Bend 2012-TN1347.
(b) PPL Bell Bend 2013-TN3377.
(c) PPL Bell Bend 2012-TN1348.
(d) Sales tax estimate based on Commonwealth of Pennsylvania 6 percent sales tax rate and PPL Bell Bend estimate of $9 million spent annually on materials, equipment, and outside services during 40-year life of plant.
(e) PPL Bell Bend 2012-TN1347.

rather than the broader, more general benefits of electricity supply. Table 10-3 summarizes the monetary and non-monetary benefits associated with the BBNPP.

10.6.1.1 Societal Benefits

For the production of electricity to be beneficial to a society, there must be a corresponding demand, or "need for power," in the region. Chapter 8 defines and discusses the need for power in more detail. From a societal perspective, price stability, longevity, energy security and fuel diversity are the primary benefits associated with nuclear power generation relative to most other alternative generating approaches. These benefits are described in this subsection.

Long-Term Price Stability

Because of its relatively low and stable fuel costs, nuclear energy is a dependable generator of electricity that can provide electricity to the consumer at relatively stable prices over long periods of time. Unlike some other energy sources, nuclear energy is generally not subject to unreliable weather or climate conditions, unpredictable cost fluctuations, and is less dependent on potentially unstable foreign suppliers than other energy sources. Nuclear power plants are generally not subject to the fuel price volatility that affects natural gas and oil power plants. In addition, uranium fuel constitutes only 3 to 5 percent of the cost of a kilowatt-hour of nuclear-generated electricity. Doubling the price of uranium increases the cost of electricity by about 9 percent. Doubling the price of gas would add about 66 percent to the price of electricity, and doubling the cost of coal would add about 31 percent to the price of electricity (WNA 2010-TN717).

Because of the high capacity factor and quantity of power generated, a nuclear baseload unit also provides for price stability by displacing marginal generating capacity that comes from higher cost generating units with much lower quantities of available power. This is done in two ways. First, displacing the highest cost generating units that participate in the hourly auction market dampens the variability in price that comes from these marginal units. Second, displacement also lowers the average price of electricity to all customers by reducing the cost of the marginal bidding unit. While the actual cost savings the review team expects is outside the scope of this analysis, for every cent saved in consumer price, the capacity of just the proposed BBNPP would generate annual savings across the PPL market area of about $133 million.

Energy Security and Fuel Diversity

Currently, more than 70 percent of the electricity generated in the United States is generated with fossil-based technologies. Thus, non-fossil-based generation, such as nuclear generation, is essential to maintaining diversity in the aggregate power-generation fuel mix. Nuclear power contributes to the diverse U.S. energy mix, hedging the risk of shortages and price fluctuations for any one power-generation system and reducing the nation's dependence on imported fossil fuels.

A diverse fuel mix helps to protect consumers from contingencies such as fuel shortages or disruptions, price fluctuations, and changes in regulatory practices. Chapter 8 of this EIS presents the finding that a need exists for the BBNPP project as proposed by PPL. The proposed BBNPP unit would generate approximately 1,600 MW(e) net, which would help meet the baseload need in the region. PPL estimates annual electricity generation for the BBNPP at 13,294,538 MWh (PPL Bell Bend 2012-TN1347).

10.6.1.2 Regional Benefits

Tax Revenue Benefits

The primary tax revenues associated with building the BBNPP would be from property taxes from the site and corporate income tax, which would accrue during the operations phase. Additional taxes would also benefit the 50-mi region, including sales and use taxes on goods and services purchased for building and by workers, and income taxes on personal wages.

With the completion of the BBNPP, Luzerne County, Salem Township, and the Berwick Area School District would receive additional property tax revenue. PPL estimates that in 2025, the first year of plant operation, the BBNPP would generate an additional $2.4 million in annual property taxes, of which $1.7 million would be paid to the Berwick Area School District (PPL Bell Bend 2012-TN1348). Over the life of the plant at a straight-line depreciation of 40 years, the BBNPP would pay $46.8 million in property taxes, of which the Berwick Area School District would receive $33.2 million.

The Commonwealth of Pennsylvania levies a 6 percent sales, use, and hotel occupancy tax. Total sales and use tax remittances in Pennsylvania totaled $8.8 billion in State fiscal year 2012 (PDR 2012-TN2021). Luzerne and Columbia Counties do not impose local sales taxes. PPL estimates that within the 50-mi radius of the BBNPP site, $260.8 million will be spent on materials, equipment, and outside services during the construction period. Applying the 6 percent sales tax rate generates total estimated sales tax payments of $15.6 million over the 68-month construction time horizon. PPL estimates that, within the 50-mi radius of the BBNPP site, it will spend $9 million annually on materials, equipment, and outside services for BBNPP operations. Applying the 6 percent sales tax rate generates annual estimated sales tax payments of $0.5 million over the 40-year operation period, or an additional $20 million over the life of the BBNPP license.

The Commonwealth of Pennsylvania imposes a 3.07 percent tax against the taxable income of resident and nonresident individuals, S corporations, business trusts, limited liability companies that are not taxed by the Federal government as corporations, and estates and trusts (PDR 2012-TN2020). In State fiscal year 2012, Pennsylvania collected $10.8 billion in personal income taxes (PDR 2012-TN2021). PPL assumes that some portion of the skilled craftsman workforce will relocate into the region during the construction phase, and would, thus, contribute additional income tax revenue to the Commonwealth of Pennsylvania. The review team estimates that the building workforce, including operations workers training onsite, would contribute $9.5 million in annual person income tax at the peak of construction. Earnings from the operations and associated indirect workforce residing in the two-county (Columbia and Luzerne Counties) economic impact area (EIA) would total about $32.5 million per year during the 40-year operations period. The review team estimates that the direct and indirect workforces would contribute up to $1 million in annual State personal income taxes.

At the local level in Pennsylvania, several jurisdictions also impose earned income taxes on both residents and nonresidents. Salem Township and Berwick both impose 1.0 percent earned income taxes on residents and nonresidents, with half of the proceeds from the resident earned income taxes allocated to the Berwick Area School District (PDCED 2014-TN3915). Nonresidents working in Salem Township would be subject to the local nonresident earned income tax unless the resident rate they pay to their local jurisdiction equals or exceeds the nonresident rate in Salem Township. Workers at the BBNPP would also be subject to a $52 annual local services tax, which would be paid to Salem Township. Salem Township would transfer $5 of each local services tax payment to the Berwick Area School District.

The review team estimates that the building workforce, including operations workers training onsite, would generate $3.1 million annually in earned income tax revenue during the peak building period. The earned income tax revenue would be allocated to jurisdictions throughout the region based on worker disbursement patterns. The review team further estimates that the peak building workforce would generate $224,276 in annual local services tax revenue for Salem Township, with $21,565 of that amount allocated to the Berwick Area School District. The review team estimates that the operations workforce will generate $280,000 annually in earned income tax revenue. The review team further estimates that operations workers will generate an additional $18,876 in annual local services tax revenue for Salem Township, with $1,815 of that amount allocated to the Berwick Area School District.

The Commonwealth of Pennsylvania also levies a 9.99 percent corporate net income tax. Assuming current tax regulations remain in effect, PPL estimates BBNPP corporate income tax payments over the first 20 years of plant operations as follows: Federal net income tax liability would increase by $2 billion ($100 million average annual), and State net income tax liability would grow by $500 million ($25 million average annual) (PPL Bell Bend 2012-TN1347).

Regional Productivity and Community Impacts

PPL estimated that the annual income for members of the construction workforce would be $70,720, resulting in an estimated $279.3 million in annual salaries for the peak workforce. Based on assessments of worker in-migration levels at nuclear power plants prepared by the NRC and cited by PPL in the ER, the review team estimates that 20-35 percent of the construction workforce would in-migrate into the 50-mi region and 87.1 percent of those workers would locate in the EIA (PPL Bell Bend 2013-TN3377). Using these assumptions, the review team estimates the total in-migrating workforce, including construction and operations workers present during the peak construction period, at 1,004 to 1,520 workers. Construction workforce salaries are expected to total $48.7-$85.2 million at peak employment. The income for the peak construction workforce could be as high as $123,760 annually with overtime, which would generate $488.9 million in annual salaries. For in-migrating workers, annual salaries could reach as high as $85.2-$149.0 million at peak employment (PPL Bell Bend 2013-TN3377). The income for the operations workforce at peak employment would be $24.4 million in the EIA, assuming an average salary of $77,135 (PPL Bell Bend 2013-TN3377).

When a new job is added to an economy, that new (direct) job supports the existence of other (indirect) jobs. Every new direct job in a given area—in this case, a construction job at the BBNPP—stimulates spending on goods and services within the region. This spending results in the economic need for a fraction of another indirect job, typically in the service industries. The U.S. Department of Commerce, Bureau of Economic Analysis (BEA) provided RIMS II regional multipliers for industry employment and earnings in the EIA. The BEA Regional Input-Output Modeling System (RIMS II) employment multiplier for construction jobs in the economic impact area is 1.73, meaning that for each construction job created a total of 1.73 jobs (including the direct job) would be supported in the two-county EIA. The employment multiplier for operations jobs during the building phase is 2.44 (BEA 2014-TN3624). For the 1,004-1,520 construction and operations workers in-migrating during the building phase, a total of 957-1,333 indirect jobs would be supported in the two-county EIA. Indirect and induced jobs are assumed to be allocated to area residents who were either unemployed or left other jobs. The review team estimated that the new indirect jobs would generate approximately $17.1-$23.8 million annually in the EIA. The average salaries for members of the indirect workforce were estimated at $17,870 (PPL Bell Bend 2013-TN3377) based on the average salary for service occupations in the Scranton-Wilkes-Barre MSA (PPL Bell Bend 2013-TN3377).

The BBNPP would require an operating workforce of 363 people. The review team expects 87.1 percent of the operations workforce or 316 workers to in-migrate into the two-county EIA. This assumption is based on the proportion of current operations and maintenance workers at the SSES site who live in Columbia County or Luzerne County (PPL Bell Bend 2013-TN3377). BEA estimated that each job for an in-migrating operations worker in the EIA would support an additional 1.44 indirect jobs (BEA 2014-TN3624). The BEA employment multiplier is applied only to in-migrating workers because the BEA model assumes the direct employment of workers that already live in the area would have no additional impact on employment. Based on the BEA multipliers, the review team estimates that BBNPP operations would stimulate the creation of an additional 456 indirect jobs within the EIA, or a total of approximately 819 new jobs maintained within the EIA throughout the life of the BBNPP.

The income for the operations workforce at peak employment would be $24.4 million in the EIA, assuming an average salary of $77,135 (PPL Bell Bend 2013-TN3377). In addition to the salaries of incoming construction and operations workers onsite during construction, the review team estimated that the new indirect jobs would generate approximately $17.1-$23.8 million in the EIA. The average salaries for members of the indirect workforce were estimated at $17,870 (PPL Bell Bend 2013-TN3377) based on the average salary for service occupations in the Scranton-Wilkes-Barre MSA (PPL Bell Bend 2013-TN3377).

10.6.2 Costs

Internal costs to Bell Bend LLC as well as external costs to the surrounding region and environment would be incurred during the construction and operation of the proposed BBNPP. A summary of these costs is provided in Table 10-4.

Internal costs include all of those identified in a total capital cost assessment—the direct and indirect cost to physically build the power plant (capital costs) plus the annual costs of operation and maintenance, fuel costs, waste disposal, and decommissioning costs. In accordance with the NRC staff's guidance in NUREG-1555 (NRC 2000-TN614), internal costs of the proposed project are presented in monetary terms. External costs include all costs imposed on the environment and region surrounding the plant that are not internalized by the company, such as a loss of regional productivity, loss of wildlife habitat, or other environmental degradation. The

Table 10-4. Internal and External Costs of the BBNPP

Category of Cost	Description of Cost	Impact Assessment
Construction cost[(a)]	$8.6 billion	N/A
Levelized cost of energy production[(a)]	$65.91 per MWh	N/A
Capital charge[(a)]	$41.51 per MWh	N/A
Operations and maintenance (variable, fixed and maintenance) [(a)]	$14.73 per MWh	
Fuel[(a)]	$8.76 per MWh	N/A
Decommissioning[(a)]	$0.91 per MWh	N/A
Land use	The BBNPP site is on land already owned by PPL. Approximately 357 ac within the BBNPP project boundary would be permanently disturbed. This total includes 39 ac of previously developed land associated primarily with existing SSES facilities. The proposed activities would be consistent with applicable zoning, would not conflict with any land-use plans or known land-use objectives, and would have no substantial effects on agriculture, forestry, and mineral development activities in the surrounding landscape. Approximately 292 ac of prime farmland soils would be irreversibly disturbed, although this represents a minimal regional loss. Minor encroachment into the 100-year floodplain would not substantially alter the patterns of surface-water runoff, stream flow, or flooding in the surrounding landscape. (Sections 4.1 and 5.1).	SMALL
Air Quality	Air emissions from diesel generators, auxiliary boilers and equipment, cooling towers, and vehicles that have a small impact on workers and local residents. With the exception of the cooling towers, emissions sources would be operated intermittently. Emissions from all sources would be within Federal, State, and local air-quality limits. Negligible impacts of sulfur dioxide, nitrogen oxide, carbon monoxide, carbon dioxide, and particulate emissions relative to other baseload fossil-fired generation. (Sections 4.7 and 5.7).	SMALL
Terrestrial Ecology	Impacts during the preconstruction phase would be noticeable. Preconstruction impacts would include disturbance of 663 ac of terrestrial habitats in the BBNPP project area, including permanent or temporary losses of forests (approximately 222 ac), jurisdictional wetlands (approximately 11.1 ac, mostly of forested wetlands), and non-jurisdictional wetland features (0.014 ac), as well as the potential temporary drawdown of as much as 5.6 ac of jurisdictional forested wetlands during the approximate 2-year ESWEMS pond installation period on the BBNPP site. The impacts would be spatially extensive and would considerably alter the terrestrial ecology of the local landscape. Habitat loss and fragmentation would reduce the suitability of mature deciduous forest onsite for State-listed avian species and forest interior birds, especially in Important Bird Area No. 72, a regional bird conservation area located onsite. Habitat loss and fragmentation would reduce the suitability of	MODERATE

Table 10-4. (contd)

Category of Cost	Description of Cost	Impact Assessment
	potential roosting habitat in deciduous forest for the Federally endangered Indiana bat and Federally threatened northern long-eared bat, as well as two State-ranked bat species. Habitat impacts due to stream and wetland mitigation may cause mortality and the loss of occupied habitat for a State-listed frog species, a State-ranked snake species, and a State-ranked turtle species. Wetland habitat loss would temporarily reduce the area containing host plants for four State-ranked butterfly species. (Sections 4.3.1 and 5.3.1).	MODERATE
Aquatic Ecology	Impacts from building and operating the BBNPP would have minimal effects on aquatic resources. Preconstruction impacts to aquatic resources include building six bridges over Walker Run and Unnamed Tributary 1, installing a culvert in Unnamed Tributary 5 and a new underground conveyance for Unnamed Tributary 2, eliminating the North Branch Canal Outlet, abandoning and creating new sections of Walker Run stream habitat, and the disruption and loss of minimal benthic habitat within the Susquehanna River. Construction impacts involve dewatering during installation of the ESWEMS pond, but are expected to be negligible. Operation impacts are also expected to be minor. Operation impacts to aquatic resources include entrainment and impingement of aquatic biota in the Susquehanna River; some impacts from minor thermal loading to the river, maintenance dredging, transmission corridor maintenance, and consumptive-use mitigation water releases from the Rushton Mine; relatively infrequent and temporary effects on the biota in Cowanesque Lake and the Cowanesque River from consumptive-use mitigation and site-specific low-flow water releases from Cowanesque Lake. (Sections 4.3.2 and 5.3.2).	SMALL
Socioeconomics	The physical impacts from building and operating the BBNPP would be minor and would occur within the boundaries of the site; negligible effects on immediate neighborhoods (Sections 4.4.1 and 5.4.1). Noticeable, intermittent congestion at several major intersections during building, minor during operations. Several necessary mitigation strategies (e.g., adding signals, retiming signals, adding through lanes, restricting parking, expanding interchanges) have been identified by PPL. These mitigation strategies are required to ensure that impacts remain noticeable. Sufficient housing stock is available in the EIA, with the exception of the Borough of Berwick (Sections 4.4.4.3 and 5.4.4.3). Potential short-term noticeable strain on some community services in Luzerne and Columbia Counties during the construction period, with the greatest impacts expected during the years of peak construction. Noticeable and temporary impacts are expected for the Berwick Area School District during peak building years. Most impacts would be minor during operations due to the smaller size of the workforce. At the beginning of the operations period, some community service impacts may still be noticeable but most would be partially mitigated when property and income tax revenues would be paid by PPL and the BBNPP workforce. Minor impacts on aesthetics and recreation from the population and activities associated with building and operating the BBNPP (Sections 4.4 and 5.4).	SMALL, with the exception of the temporary traffic impacts in the Berwick area and along U.S. Route 11, housing impacts in Berwick, and education impacts on the Berwick Area School District, where impacts would be MODERATE during the construction phase.

Table 10-4. (contd)

Category of Cost	Description of Cost	Impact Assessment
Environmental Justice	There would be no environmental, health, or socioeconomic pathways by which the identified minority or low-income populations in the 50-mi region would be likely to suffer disproportionately high and adverse environmental or health impacts as a result of construction or operation activities at the BBNPP site. (Section 4.5 and 5.5).	SMALL
Nonradioactive waste	Minor consumption of local or regional landfill space, offset by payment of tipping fees for waste disposal. Minor consumption of regional hazardous waste treatment or disposal capacity, offset by treatment and disposal costs (Sections 4.10 and 5.10).	SMALL
Uranium fuel cycle	Minor impacts distributed across multiple locations throughout the United States from the mining, milling, and enrichment of uranium, from fuel fabrication, from transportation of radioactive material, and from management of radioactive wastes (Chapter 6).	SMALL
Historic and cultural resources	No impacts on historic and cultural resources from impacts associated with building and operating the BBNPP, excepting any inadvertent discoveries. (Section 4.6 and 5.6).	SMALL
Health impacts (nonradiological and radiological)	Minor estimated temperature increases would not significantly increase the abundance of thermophilic microorganisms. Radiological doses and nonradiological health hazards to the public and occupational workers would be monitored and controlled in accordance with regulatory limits (Sections 4.8, 4.9, 5.8, and 5.9).	SMALL
Materials, energy, and uranium	Irreversible and irretrievable commitments of materials and energy, including depletion of uranium. Construction materials include concrete, aggregate, rebar, conduit, cable, piping, building supplies, and tools. Equipment needs include cranes, cement trucks, excavation equipment, dump trucks, and graders.	SMALL
Hazardous and radioactive waste	Mixed waste stored, transported, treated, and disposed in compliance with both NRC and EPA regulations would consume some regional or national waste treatment or disposal capacity, offset by treatment and disposal costs (Sections 4.10 and 5.10).	SMALL
Water use and water quality.	BBNPP water usage during construction and operations would have a minor impact on the availability and quality of the water resources in the area. Cooling water would be withdrawn from the Susquehanna River. Less than 43 cubic feet per second would be lost through evaporation and drift. Relatively small levels of pollutants and/or radioactive effluents would be discharged to the Susquehanna River. A small thermal plume would result from cooling-tower blowdown discharged to the Susquehanna River. Onsite groundwater withdrawals would be limited to temporary dewatering during construction. Water for potable and sanitary uses would be from a municipal supply (See Sections 4.2 and 5.2).	SMALL

(a) PPL Bell Bend 2012-TN1347. All values are expressed as 2010 dollars.

external costs listed in 10-2 summarize environmental impacts on resources that could result from preconstruction, construction, and operation of the proposed BBNPP.

10.6.2.1 Internal Costs

The most substantial monetary cost associated with nuclear energy is the plant capital cost. Nuclear power plants typically have relatively high capital costs for building the plant, but very low fuel costs relative to alternative power-generation systems. Because of the large capital costs for nuclear power plants, and the relatively long construction period before revenue is returned, servicing the capital costs of a nuclear power plant is one of the most important factors in determining the economic competitiveness of nuclear energy. Construction delays can add significantly to the cost of a plant. Because a power plant does not yield profits during construction, longer construction times can add significantly to the cost of a plant through higher interest expenses on borrowed construction funds.

10.6.2.2 Preconstruction and Construction Costs

PPL has estimated the cost of constructing the facility at $8.6 billion (PPL Bell Bend 2012-TN1347). This estimate includes $1.8 billion in owner’s development costs, including site prep, engineering support, training during construction, information technology, insurance, licensing/permitting costs, transmission costs, property taxes during construction, initial fuel load, and other miscellaneous costs (PPL Bell Bend 2012-TN1347).

Operation Costs

Operation costs are frequently expressed as levelized cost of electricity, which is the price per mega-watt hour of producing electricity, including the cost needed to cover operating costs and annualized capital costs. PPL estimates these costs at $65.91. Of this total cost of operation, $41.51 per MWh is a capital charge and $14.73 per MWh is tied to variable and fixed operations and maintenance costs (PPL Bell Bend 2012-TN1347).

Fuel Costs

Included in the calculation of levelized cost is the cost of fuel. PPL estimates these costs at $8.76 per MWh (PPL Bell Bend 2012-TN1347).

Waste Disposal

The back-end costs of nuclear power contribute a very small share of total cost, both because of the long lifetime of a nuclear reactor and the fact that provisions for waste-related costs can be accumulated over that time. It also should be recognized, however, that radioactive nuclear waste also poses unique disposal challenges for long-term management. The United States and other countries have yet to implement final disposition of spent fuel or high-level radioactive waste streams created at various stages of the nuclear fuel cycle. Because these radioactive wastes present some danger to present and future generations, the public and its elected representatives as well as prospective investors in nuclear power plants properly expect continuing and substantial progress towards solution to the waste-disposal problem.

The NRC acknowledges that, because of delays in the siting and licensing of a repository, the Federal government bears an increasing share of the financial responsibility for waste storage costs. Although the annual costs for continued storage are manageable, cumulative costs will continue to increase. The Federal government has estimated it will pay a total of approximately $20 billion in damage awards and settlements by the year 2020 and $500 million per year after that if DOE does not accept fuel by 2021 and spent fuel continues to accumulate at reactor sites (GAO 2013). Thus, the escalating costs of continued storage provide incentive for the Federal government to implement the national policy for disposal of spent fuel in a deep geologic repository.

Decommissioning

The NRC has requirements for licensees at 10 CFR 50.75 (TN249) to provide reasonable assurance that funds would be available for the decommissioning process. Because of the effect of discounting a cost that would occur as much as 40 years in the future, decommissioning costs have relatively little effect on the levelized cost of electricity generated by a nuclear power plant. Decommissioning costs are typically about 9 to 15 percent of the initial capital cost of a nuclear power plant. However, when discounted, decommissioning costs contribute only a few percent to the investment cost and even less to the generation cost. In the United States, decommissioning costs typically account for 0.1 to 0.2 cents per kWh ($1-$2 per MWh), which accounts for no more than 5 percent of the costs associated with electricity production (WNA 2013-TN2689). PPL estimates decommissioning costs for the BBNPP at $0.91 per MWh (PPL Bell Bend 2012-TN1347).

10.6.2.3 External Costs

External costs are social and/or environmental effects caused by the proposed construction of and operation of a new reactor at the BBNPP site. This EIS includes the review team's analysis that considers and weighs the environmental impacts of constructing and operating a new nuclear unit at the BBNPP site or at alternative sites, and mitigation measures available for reducing or avoiding these adverse impacts. It also includes the staff's recommendation to the Commission regarding the proposed action.

Environmental and Social Costs

Monetization of all indirect benefits and costs is beyond the scope of this EIS. These impacts have been identified and analyzed in Chapters 4 and 5, and a significance level of potential adverse impacts (i.e., SMALL, MODERATE, or LARGE) has been assigned to each impact category. Chapter 6 similarly addresses the environmental impacts from (1) the uranium fuel cycle and solid waste management, (2) the transportation of radioactive material, and (3) the decommissioning of the nuclear unit at the BBNPP site.

Unlike electricity generated from coal and natural gas, operation of a nuclear power plant does not result in any emissions of air pollutants associated with global warming and climate change (e.g., nitrogen oxides, sulfur dioxide, carbon dioxide) or methyl mercury. Chapter 9 of this EIS analyzes coal- and natural-gas-fired alternatives to the construction and operation of the BBNPP. Air emissions from these alternatives and nuclear power are summarized in Chapters 5 and 9.

10.6.3 Summary of Benefits and Costs

PPL's business decision to pursue generating capacity by adding a nuclear reactor at the BBNPP site is an economic decision based on private financial factors subject to regulation by the Pennsylvania Public Utility Commission. The internal costs to construct an additional unit appears to be substantial; however, PPL's decision to pursue this expansion implies that the company has already concluded that the private, or internal, benefits of the proposed facility outweigh the internal costs. The market-based discussion in Chapter 8 of this EIS supports this conclusion. In addition, the external socio-environmental costs imposed on the region appear to be relatively minor. Although no specific monetary values have been assigned to the identified societal benefits, the review teams determined it is not unreasonable to assume that the potential societal benefits of the proposed expansion of the BBNPP outweigh the potential social and private costs of the proposed action.

Table 10-3 and Table 10-4 include summaries of both internal and external costs of the proposed activities at BBNPP, as well as the identified benefits. The tables include references to other sections of this EIS when more detailed analyses and when impact assessments are available for specific topics.

The staff concludes that, based on the assessments summarized in this EIS, the construction and operation of the proposed BBNPP with mitigation measures identified by PPL would have accrued benefits that most likely would outweigh the economic, environmental, and social costs associated with constructing and operating a new unit at the BBNPP site.

10.7 Staff Conclusions and Recommendations

The NRC staff's recommendation to the Commission related to the environmental aspects of the proposed action is that the COL should be issued. The NRC staff's evaluation of the safety and emergency preparedness aspects of the proposed action will be addressed in the staff's safety evaluation report that is anticipated to be published in the future.

The staff's recommendation is based on (1) the ER submitted by PPL (PPL Bell Bend 2013-TN3377) and subsequent revisions; (2) consultation with Federal, State, Tribal, and local agencies; (3) the review team's own independent review; (4) the staff's consideration of public comments; and (5) the assessments summarized in this EIS, including the potential mitigation measures identified in the ER and the EIS. In addition, in making its recommendation, the NRC staff determined that none of the alternative sites assessed is obviously superior to the BBNPP site.

The NRC's determination is independent of the USACE's Department of the Army Individual Permit decision, which will be documented in the USACE's permit decision document.

11.0 REFERENCES

In this reference list, references that begin with numerical designations (e.g., 10 CFR Part 20, 40 FR 44149) are presented first in numerical order. The ensuing references are listed in alphabetical order by author name(s)—including author surname(s), company name(s), or the company abbreviation(s) used in the citations in the narrative—and their chronological year of publication. The associated Tracking Numbers (e.g.,TN3792) that appear at the end of each reference are assigned to each reference in numerical order within the publication year of the source (to account for numerous references by a source within a given year). All links in this list are subject to change over time.

10 CFR Part 20. *Code of Federal Regulations*, Title 10, *Energy*, Part 20, "Standards for Protection Against Radiation." Washington, D.C. TN283.

10 CFR Part 50. *Code of Federal Regulations*, Title 10, *Energy*, Part 50, "Domestic Licensing of Production and Utilization Facilities." Washington, D.C. TN249.

10 CFR Part 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions." Washington, D.C. TN250.

10 CFR Part 52. *Code of Federal Regulations*, Title 10, *Energy*, Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants." Washington, D.C. TN251.

10 CFR Part 71. *Code of Federal Regulations*, Title 10, *Energy*, Part 9671, "Packaging and Transportation of Radioactive Material." Washington, D.C. TN301.

10 CFR Part 73. *Code of Federal Regulations*, Title 10, *Energy*, Part 73, "Physical Protection of Plants and Materials." Washington, D.C. TN423.

10 CFR Part 100. *Code of Federal Regulations*, Title 10, *Energy*, Part 100, "Reactor Site Criteria." Washington, D.C. TN282.

18 CFR Part 806. *Code of Federal Regulations*, Title 18, *Conservation of Power and Water Resources*, Part 806, "Review and Approval of Projects." Washington, D.C. TN3811.

18 CFR Parts 801–808. *Code of Federal Regulations*, Title 18, *Conservation of Power and Water Resources*, Parts 801–808, "Susquehanna River Basin Commission." Washington, D.C. TN2010.

24 CFR Part 51. *Code of Federal Regulations*, Title 24, *Housing and Urban Development*, Part 51, "Environmental Criteria and Standards." Washington, D.C. TN1016.

29 CFR Part 1910. *Code of Federal Regulations*, Title 29, *Labor*, Part 1910, "Occupational Safety and Health Standards." Washington, D.C. TN654.

33 CFR Part 320. *Code of Federal Regulations*, Title 33, *Navigation and Navigable Waters*, Part 320, "General Regulatory Policies." Washington, D.C. TN424.

33 CFR Part 325. *Code of Federal Regulations*, Title 33, *Navigation and Navigable Waters*, Part 325, "Processing of Department of the Army Permits." Washington, D.C. TN425.

33 CFR Part 327. *Code of Federal Regulations*, Title 33, *Navigation and Navigable Waters*, Part 327, "Public Hearings." Washington, D.C. TN1788.

33 CFR Part 332. *Code of Federal Regulations*, Title 33, *Navigation and Navigable Waters*, Part 332, "Compensatory Mitigation for Losses of Aquatic Resources." Washington, D.C. TN1472.

36 CFR Part 800. *Code of Federal Regulations*, Title 36, *Parks, Forests, and Public Property*, Part 800, "Protection of Historic Properties." Washington, D.C. TN513.

40 CFR Part 50. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 50, "National Primary and Secondary Ambient Air Quality Standards." Washington, D.C. TN1089.

40 CFR Part 51. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 51, "Requirements for Preparation, Adoption, and Submittal of Implementation Plans." Washington, D.C. TN1090.

40 CFR Part 60. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 60, "Standards of Performance for New Stationary Sources." Washington, D.C. TN1020.

40 CFR Part 61. *Code of Federal Regulations,* Title 40, *Protection of Environment,* Part 61, "National Emission Standards for Hazardous Air Pollutants." Washington, D.C. TN3289.

40 CFR Part 63. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 63, "National Emission Standards for Hazardous Air Pollutants for Source Categories." Washington, D.C. TN1403.

40 CFR Part 81. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 81, "Designation of Areas for Air Quality Planning Purposes." Washington, D.C. TN255.

40 CFR Part 93. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 93, "Determining Conformity of Federal Actions to State or Federal Implementation Plans." Washington, D.C. TN2495.

40 CFR Part 98. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 98, "Mandatory Greenhouse Gas Reporting." Washington, D.C. TN2170.

40 CFR Part 112. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 112, "Oil Pollution Prevention." Washington, D.C. TN1041.

40 CFR Part 190. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations." Washington, D.C. TN739.

40 CFR Part 204. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 204, "Noise Emission Standards for Construction Equipment." Washington, D.C. TN653.

40 CFR Part 230. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 230, "Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material." Washington, D.C. TN427.

40 CFR Part 423. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 423, "Steam Electric Power Generating Point Source Category." Washington, D.C. TN253.

40 CFR Part 1502. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 1502, "Environmental Impact Statement." Washington, D.C. TN2123.

40 CFR Part 1508. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 1508, "Terminology and Index." Washington, D.C. TN428.

50 CFR Part 17. *Code of Federal Re*gulations, Title 50, *Wildlife and Fisheries*, Part 17, "Endangered and Threatened Wildlife and Plants; Partial 90–Day Finding on a Petition to List 404 Species in the Southeastern United States as Endangered or Threatened With Critical Habitat." Washington, D.C. TN1648.

50 CFR Part 402. *Code of Federal Regulations,* Title 50, *Wildlife and Fisheries*, Part 402, "Interagency Cooperation—Endangered Species Act of 1973, as Amended." Washington, D.C. TN4312.

51 FR 30028. August 21, 1986. "Safety Goals for the Operation of Nuclear Power Plants; Policy Statement; Correction and Republication." *Federal Register*, Nuclear Regulatory Commission, Washington, D.C. TN594.

59 FR 7629. February 16, 1994. "Executive Order 12898: Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations." *Federal Register*, Office of the President, Washington, D.C. TN1450.

61 FR 65120. December 10, 1996. "Resolution of Dual Regulation of Airborne Effluents of Radioactive Materials; Clean Air Act." *Federal Register,* Nuclear Regulatory Commission, Washington, D.C. TN294.

64 FR 36454. July 6, 1999. "Endangered and Threatened Wildlife and Plants; Proposed Rule to Remove the Bald Eagle in the Lower 48 States from the List of Endangered and Threatened Wildlife." *Federal Register,* Department of the Interior, Washington, D.C. TN1848.

65 FR 79825. December 20, 2000. "Regulatory Finding on the Emissions of Hazardous Air Pollutants from Electric Utility Steam Generating Units." *Federal Register,* Environmental Protection Agency, Washington, D.C. TN2536.

66 FR 65256. December 18, 2001. "National Pollutant Discharge Elimination System: Regulations Addressing Cooling Water Intake Structures for New Facilities." *Federal Register,* Environmental Protection Agency, Washington, D.C. TN243.

68 FR 55905. September 29, 2003. "Nuclear Energy Institute; Denial of Petition for Rulemaking." *Federal Register,* Nuclear Regulatory Commission, Washington, D.C. TN733.

69 FR 52040. August 24, 2004. "Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions." *Federal Register*, Nuclear Regulatory Commission, Washington, D.C. TN1009.

72 FR 37346. July 9, 2007. "Endangered and Threatened Wildlife and Plants; Removing the Bald Eagle in the Lower 48 States from the List of Endangered and Threatened Wildlife—Final Rule." *Federal Register*, Fish and Wildlife Service, Washington, D.C. TN918.

72 FR 57416. October 9, 2007. "Limited Work Authorizations for Nuclear Power Plants." *Federal Register,* Nuclear Regulatory Commission, Washington, D.C. TN260.

72 FR 64948. November 19, 2007. "Approval and Promulgation of Air Quality Implementation Plans; Pennsylvania; Redesignation of the Scranton/Wilkes-Barre 8–Hour Ozone Nonattainment Area to Attainment and Approval of the Area's Maintenance Plan and 2002 Base Year Inventory." *Federal Register,* Environmental Protection Agency, Washington, D.C. TN2084.

72 FR 68598. December 5, 2007. "PPL Susquehanna, LLC; Susquehanna Steam Electric Station, Units 1 and 2; Draft Environmental Assessment and Finding of No Significant Impact Related to the Proposed License Amendment to Increase the Maximum Reactor Power Level." *Federal Register,* Nuclear Regulatory Commission, Washington, D.C. TN1706.

74 FR 470. January 6, 2009. "PPL Bell Bend, LLC; Bell Bend Nuclear Power Plant Combined License Application; Notice of Intent To Prepare an Environmental Impact Statement and Conduct Scoping Process." *Federal Register*, Nuclear Regulatory Commission, Washington, D.C. TN1785.

74 FR 56260. October 30, 2009. "Mandatory Reporting of Greenhouse Gases." *Federal Register,* Environmental Protection Agency, Washington, D.C. TN1024.

74 FR 66496. December 15, 2009. "Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act." *Federal Register*, Environmental Protection Agency, Washington, D.C. TN245.

75 FR 31514. June 3, 2010. "Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule." *Federal Register*, Environmental Protection Agency, Washington, D.C. TN1404.

76 FR 38095. June 29, 2011. "Endangered and Threatened Wildlife and Plants; 90-Day Finding on a Petition to List the Eastern Small-Footed Myotis and the Northern Long-Eared Bat as Threatened or Endangered." *Federal Register*, U.S. Fish and Wildlife Service, Washington, D.C. TN1798.

76 FR 52656. August 23, 2011. "Lock + Hydro Friends Fund VII: Notice of Preliminary Permit Application Accepted for Filing and Soliciting Comments, Motions to Intervene, and Competing Applications." *Federal Register*, Federal Energy Regulatory Commission, Washington, D.C. TN1218.

76 FR 73619. November 29, 2011. "Francis Walter Hydro, LLC; Notice of Preliminary Permit Application Accepted for Filing and Soliciting Comments, Motions to Intervene, and Competing Applications." *Federal Register,* Department of Energy, Washington, D.C. TN3621.

77 FR 14759. June 15, 2012. "PPL Bell Bend, LLC; Bell Bend Nuclear Power Plant Combined License Application; Notice of Intent to Conduct a Supplemental Scoping Process on the Revised Site Layout." *Federal Register*, Nuclear Regulatory Commission, Washington, D.C. TN1786.

77 FR 16082. March 19, 2012. "In the Matter of All Power Reactor Licensees and Holders of Construction Permits in Active or Deferred Status: Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Effective Immediately)." *Federal Register,* Nuclear Regulatory Commission, Washington, D.C. TN1424.

77 FR 16091. March 19, 2012. "Order Modifying Licenses With Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events (Effective Immediately)." *Federal Register,* Nuclear Regulatory Commission, Washington, D.C. TN2476.

77 FR 16098. March 19, 2012. "In the Matter of All Operating Boiling Water Reactor Licensees With Mark I and Mark II Containments; Order Modifying Licenses With Regard to Reliable Hardened Containment Vents (Effective Immediately)." *Federal Register,* Nuclear Regulatory Commission, Washington, D.C. TN2477.

78 FR 24073. April 24, 2013. "Reconsideration of Certain New Source Issues: National Emission Standards for Hazardous Air Pollutants from Coal- and Oil-Fired Electric Utility Steam Generating Units and Standards of Performance for Fossil-Fuel-Fired Electric Utility, Industrial-Commercial-Institutional, and Small Industrial-Commercial-Institutional Steam Generating Units." *Federal Register*, Environmental Protection Agency, Washington, D.C. TN3051.

78 FR 61046. October 2, 2013. "Endangered and Threatened Wildlife and Plants; 12–Month Finding on a Petition To List the Eastern Small-Footed Bat and the Northern Long-Eared Bat as Endangered or Threatened Species; Listing the Northern Long-Eared Bat as an Endangered Species." *Federal Register*, Fish and Wildlife Service, Washington, D.C. TN3207.

80 FR 17974. April 2, 2015. "Endangered and Threatened Wildlife and Plants; Threatened Species Status for the Northern Long-Eared Bat With 4(d) Rule—Final Rule and Interim Rule with Request for Comments." *Federal Register*, Fish and Wildlife Service, Washington, D.C. TN4216.

80 FR 21301. April 17, 2015. "Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities." *Federal Register*, Environmental Protection Agency, Washington, D.C. TN4230.

80 FR 22992. April 24, 2015. "Environmental Impact Statements; Notice of Availability." *Federal Register*, Environmental Protection Agency, Washington, D.C. TN4403.

80 FR 34063. June 15, 2015. "Approval and Promulgation of Air Quality Implementation Plans; Pennsylvania; Update of the Motor Vehicle Emissions Budgets and General Conformity Budgets for the Scranton/Wilkes-Barre 1997 8-Hour Ozone National Ambient Air Quality Standard Maintenance Area." *Federal Register*, Environmental Protection Agency, Washington, D.C. TN4500.

80 FR 64509. October 23, 2015. "Standards of Performance for Greenhouse Gas Emissions from New, Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units; Final Rule." *Federal Register*, Environmental Protection Agency, Washington, D.C. TN4388.

3 P.S. § 255.1–255.11. Title 3 Pennsylvania Statute, *Agriculture*, "Noxious Weed Control Law." Commonwealth of Pennsylvania, Harrisburg, Pennsylvania. TN4445.

30 Pa. C.S. (Pennsylvania Consolidated Statutes Title 30). "Fish." Commonwealth of Pennsylvania, Harrisburg, Pennsylvania. TN3824.

34 Pa. C.S. (Pennsylvania Consolidated Statutes Title 34). "Game." Commonwealth of Pennsylvania, Harrisburg, Pennsylvania. TN3825.

121 Stat. 1844. Consolidated Appropriations Act, 2008. TN1485.

7 U.S.C. § 4201 et seq. Farmland Protection Policy Act of 1981. TN708.

16 U.S.C. § 461 et seq. Historic Sites Act of 1935. TN1808.

16 U.S.C. § 668-668d et seq. Bald and Golden Eagle Protection Act. TN1447.

16 U.S.C. § 703 et seq. Migratory Bird Treaty Act of 1918. TN3331.

16 U.S.C. § 1131 et seq. Wilderness Act of 1964. TN1807.

16 U.S.C. § 1132 et seq. Eastern Wilderness Areas Act of 1975. TN3826.

16 U.S.C. § 1271 et seq. Wild and Scenic Rivers Act. TN1811.

16 U.S.C. § 1451 et seq. Coastal Zone Management Act of 1972. TN1243.

16 U.S.C. § 1531 et seq. Endangered Species Act of 1973. TN1010.

22 U.S.C. § 3201 et seq. Nuclear Non-Proliferation Act of 1978. TN737.

26 U.S.C. § 1. American Recovery and Reinvestment Act (ARRA) of 2009. TN1250.

33 U.S.C. § 403 et seq. Rivers and Harbors Appropriation Act of 1899, as amended. TN660.

33 U.S.C. § 1251 et seq. Federal Water Pollution Control Act of 1972 [also referred to as Clean Water Act]. TN662.

33 U.S.C. § 1344 et seq. Federal Water Pollution Control Act [also referred to as Clean Water Act]. "Permits for Dredged or Fill Material." TN1019.

42 U.S.C. § 82 et seq. Solid Waste Disposal Act of 1965. TN1032.

42 U.S.C. § 2011 et seq. Atomic Energy Act of 1954. TN663.

42 U.S.C. § 4321 et seq. National Environmental Policy Act (NEPA) of 1969, as amended. TN661.

42 U.S.C. § 6901 et seq. Resource Conservation and Recovery Act (RCRA). TN1281.

42 U.S.C. § 6921 et seq. Hazardous and Solid Waste Amendments of 1984. TN1033.

42 U.S.C. § 7401 et seq. Clean Air Act. TN1141.

42 U.S.C. § 7491 et seq. "Visibility Protection for Federal Class I Areas." Section 169A of the Clean Air Act. TN4418.

42 U.S.C. § 10101 et seq. Nuclear Waste Policy Act of 1982. TN740.

42 U.S.C. § 15801 et seq. Energy Policy Act of 2005. TN738.

54 U.S.C. § 300101 et seq. National Historic Preservation Act. TN4157.

Aarts, J. 2012. "Bell Bend Nuclear Power Plant Site Audit Notes Documentation." Portland, Oregon. Accession No. ML14308A107. TN3987.

ACHP (Advisory Council on Historic Preservation). 2009. Letter from C.D. Vaughn to W. Burton, dated February 17, 2009, regarding "Notification and Request for Consultation and Participation in the Scoping Process for the Combined License Application Review for the Bell Bend Nuclear Power Plant Near Berwick, Pennsylvania." Washington, D.C. Accession No. ML090500261. TN1881.

AEC (U.S. Atomic Energy Commission). 1972. *Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants*. WASH–1238, Washington, D.C. Accession No. ML14092A626. TN22.

AEC (U.S. Atomic Energy Commission). 1974. *Environmental Survey of the Uranium Fuel Cycle*. WASH–1248, Washington, D.C. Accession No. ML14092A628. TN23.

AECOM. 2011. *Sediment Characterization Report Bell Bend Nuclear Power Plant, Susquehanna River, Berwick, Pennsylvania*. Piscataway, New Jersey. Accession Nos. ML12208A395, ML12208A396. TN504.

AGNIR (Advisory Group on Non-Ionising Radiation). 2006. *Power Frequency Electromagnetic Fields, Melatonin and Risk of Breast Cancer: Report of an Independent Advisory Group on Non-Ionising Radiation*. Documents of the Health Protection Agency, Series B: Radiation, Chemical and Environmental Hazards, RCE–1, Health Protection Agency, Didcot, United Kingdom. Accession No. ML093210326. TN3906.

AMEC (AMEC Americas Limited). 2005. *Mackenzie Gas Project: Effects of Noise on Wildlife*. Imperial Oil Resources Ventures Limited, Calgary, Alberta, Canada. Accession No. ML14308A108. TN901.

Anderson, J. 2010. "The Gravity Model." Working Paper 16576, Natural Bureau of Economic Research, Cambridge, Massachusetts. Available at http://www.nber.org/papers/w16576. TN1947.

APLIC (Avian Power Line Interaction Committee). 2006. *Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006.* Edison Electric Institute, Washington, D.C. TN794.

Ardani, K. and R. Margolis. 2011. *2010 Solar Technologies Market Report Energy.* U.S. Department of Energy Office of Energy Efficiency and Renewable Energy, Washington, D.C. Accession No. ML13225A126. TN2522.

AREVA (AREVA NP Inc.). 2007. *AREVA NP Environmental Report Standard Design Certification.* ANP–10290, Revision 0, Lynchburg, Virginia. Accession No. ML073530589. TN1921.

AREVA (AREVA NP Inc.). 2009. *AREVA NP Environmental Report Standard Design Certification*. ANP–10290, Revision 1, Bethesda, Maryland. Accession No. ML092650775. TN576.

AREVA (AREVA NP Inc.). 2011. *U.S. EPR Final Safety Analysis Report.* Revision 3, Lynchburg, Virginia. Available at the NRC Legacy Library. TN1419.

AREVA (AREVA NP Inc.). 2012. Email from D. Williford to A. Snyder, dated October 25, 2012, regarding "Response to U.S. EPR Design Certification Application RAI No. 550 (6501), FSAR Ch. 9—NEW PHASE 4 RAI—Fukushima, Supplement 1." Washington, D.C. Accession No. ML12299A836. TN3795.

AREVA (AREVA NP Inc.). 2013. Email from D. Williford to A. Snyder, dated May 4, 2013, regarding "Submittal of ANP–10329, 'U.S. EPR Mitigation Strategies for Extended Loss of AC Power Event Technical Report.'" Lynchburg, Virginia. Accession No. ML13126A328. TN3723.

AREVA (AREVA Inc.). 2014. *U.S. EPR Final Safety Analysis Report.* Revision 6, Lynchburg, Virginia. Accession No. ML14308A111. TN3574.

AREVA (AREVA Inc.). 2014. *U.S. EPR Final Safety Analysis Report.* Revision 7, Lynchburg, Virginia. Accession No. ML14209A843. TN3722.

AREVA (AREVA Inc.). 2014. Letter from P. Salas to NRC, dated July 17, 2014, regarding "Submittal of Revision 7 of the U.S. EPR Final Safety Analysis Report for Design Certification." Lynchburg, Virginia. Accession No. ML14209A053. TN3798.

AREVA (AREVA Inc.). 2015. Letter from P. Salas to NRC, dated February 25, 2015, regarding "Request to Suspend Review of U.S. EPR Design Certification Application." NRC:15:010, Lynchburg, Virginia. Accession No. ML15061A130. TN4381.

Army, Air Force, and Navy (U.S. Department of the Army, U.S. Department of the Air Force, and U.S. Department of the Navy). 1983. "Dewatering and Groundwater Control." Chapter 6, Technical Manual TM 5–818–5; AFM 88–5; NAVFAC P–418. Accession No. ML14310A617. TN3650.

Arway, J.A. and G. Smith. 2013. "The Susquehanna River—A Fishery in Decline." *Fisheries* 38(5):235–236, Philadelphia, Pennsylvania. TN2914.

Associated Press. 2013. "Marcellus Shale Gas Growing Faster than Expected." *Pennsylvania Independent Oil and Gas Association*, October 23, 2013, Wexford, Pennsylvania. Accessed November 20, 2015, at http://www.pioga.org/marcellus-shale-gas-growing-faster-than-expected/. TN3707.

Audubon (National Audubon Society). 2014. "Important Bird Areas: Pennsylvania's Important Bird Area Program." New York, New York. Available at http://netapp.audubon.org/IBA/State/US-PA. TN3581.

Audubon and Cornell (National Audubon Society and Cornell Lab of Ornithology). 2014. "eBird: Bird Observations for Susquehanna Riverlands, Pennsylvania." Ithaca, New York. Accessed June 11, 2014, at http://ebird.org/ebird/GuideMe?step=saveChoices&getLocations=ibas&parentState=US-PA&bMonth=01&bYear=1900&eMonth=12&eYear=2014&reportType=location&ibas=US-PA_1156&continue.x=68&continue.y=8. TN3582.

Austen, D.J. 2009. Pennsylvania Fish and Boat Commission Notice: "Classification of Wild Trout Streams, Addition of Walker Run, Luzerne County." Pennsylvania Fish and Boat Commission, Harrisburg, Pennsylvania. Available at http://www.pabulletin.com/secure/data/vol39/39-51/2344.html. TN1573.

AWEA (American Wind Energy Association). 2009. "What is 'Capacity Factor'?" Washington, D.C. Accessed April 29, 2009, at http://archive.awea.org/faq/wwt_basics.html#What%20is%20capacity%20factor. TN2074.

AWEA (American Wind Energy Association). 2009. "Wind Energy and the Environment." Washington D.C. Accessed April 29, 2009, at http://archive.awea.org/faq/wwt_environment.html. TN2075.

AWWI (American Wind Wildlife Institute). 2014. *Wind Turbine Interactions with Wildlife and Their Habitats: A Summary of Research Results and Priority Questions.* Washington, D.C. Available at http://awwi.org/wp-content/uploads/2014/05/AWWI-Wind-Wildlife-Interactions-Factsheet-05-27-14.pdf. TN3777.

Balducci, P. 2009. "Site Audit Trip Report—Socioeconomic Field Notes for April 28–30, 2009 Visits to Bell Bend Nuclear Power Plant Site and Surrounding Communities." Washington, D.C. Accession No. ML14308A408. TN4027.

Baltimore Gas and Electric Co. v. Natural Resources Defense Council, Inc., et al. 462 U.S. 87 (1983). United States Supreme Court Decision June 6, 1983. *United States Reports* 462:87. Accession No. ML14091A199. TN1054.

Bayne, E.M., L. Habib, and S. Boutin. 2008. "Impacts of Chronic Anthropogenic Noise from Energy-Sector Activity on Abundance of Songbirds in the Boreal Forest." *Conservation Biology* 22(5):1186–1193, Washington, D.C. TN898.

BEA (U.S. Bureau of Economic Analysis). 2014. "RIMS II Multipliers (2010/2010), Table 2.5 Total Multipliers for Output, Earnings, Employment, and Value Added by Industry Aggregation, Bell Bend Economic Impact Area (Type II)." Regional Input-Output Modeling Systems (RIMS II) Regional Product Division, Bureau of Economic Analysis, Washington, D.C. Accession No. ML14308A112. TN3624.

Beaudry-Losique, J., T. Boling, J. Brown-Saracino, P. Gilman, M. Hahn, C. Hart, J. Johnson, M. McCluer, L. Morton, B. Naughton, G. Norton, B. Ram, T. Redding, and W. Wallace. 2011. *A National Offshore Wind Strategy: Creating an Offshore Wind Energy Industry in the United States.* U.S. Department of Energy, Washington, D.C. Accession No. ML13276A033. TN1844.

Berg, T.M. 1999. "Devonian-Mississippian Transition." Chapter 8 in *The Geology of Pennsylvania*, C.H. Shultz (editor). Pennsylvania Bureau of Topographic and Geologic Survey Special Publication 1, Pittsburg Geological Society and Pennsylvania Geological Survey, Pittsburgh, Pennsylvania. Accession No. ML093340271. TN2861.

Berg, T.M., W.E. Edmunds, A.R. Geyer, and others. 1980. "Geologic Map of Pennsylvania." 2nd edition, Pennsylvania Geological Survey, Pittsburg, Pennsylvania. Available at http://www.dcnr.state.pa.us/topogeo/publications/pgspub/map/map1/index.htm. TN3709.

Berwick Area School District. 2011. "PDE–2028—Final General Fund Budget: Fiscal Year 07/01/2011–06/30/2012." Berwick, Pennsylvania. Available at http://www.berwicksd.org/cms/lib07/PA01000861/Centricity/Domain/44/2011-12_Budget.pdf. TN1676.

Berwick Borough. 2013. "Berwick Police Department." Berwick, Pennsylvania. Accessed February 4, 2013, at http://www.berwickborough.org/police/indexpd.php. TN2004.

Berwick Borough. 2013. "Berwick Fire Department." Berwick, Pennsylvania. Accessed February 4, 2013, at http://www.berwickborough.org/fire/indexfd.php. TN2008.

Bezdek, R.H. and R.M. Wendling. 2006. "The Impacts of Nuclear Facilities on Property Values and Other Factors in the Surrounding Communities." *International Journal of Nuclear Governance, Economy and Ecology* 1(1):122–144, Geneva, Switzerland. TN2748.

Biomass Magazine. 2014. "GDF Suez Energy North America, Inc. Viking Energy—Northumberland." Grand Forks, North Dakota. Available at http://biomassmagazine.com/plants/view/1267. TN3923.

Bird and Nature. 2014. "North American Migration Flyways [Map]." Available at http://www.birdnature.com/allflyways.html. TN3872.

Bleech, M. 1999. "Fishing Patterns for Flathead and Channel Catfish." *Pennsylvania Angler and Boater Magazine* 68(4), Harrisburg, Pennsylvania. Available at http://fishandboat.com/anglerboater/1999/julaug99/fcatfish.htm. TN3425.

Blower, D. and A. Matteson. 2003. *Evaluation of the Motor Carrier Management Information System Crash File, Phase One.* UMTRI–2003–06, University of Michigan Transportation Research Institute, Ann Arbor, Michigan. Accession No. ML112650033. TN410.

BLS (U.S. Bureau of Labor Statistics). 2012. "Incidence Rates of Nonfatal Occupational Injuries and Illnesses by Industry and Case Types, 2001 through 2011." Washington, D.C. Accession No. ML14286A089. TN3908.

Bobeldyk, A.M. and G.A. Lamberti. 2010. "Stream Food Web Responses to a Large Omnivorous Invader, *Orconectes rusticus* (Decapoda, Camaridae)." *Crustaceana* 83(6):641–657, New Milford, Connecticut. TN1802.

Booth, M.S. 2012. *Biomass Energy in Pennsylvania: Implications for Air Quality, Carbon Emissions, and Forests*. Partnership for Public Integrity, Pittsburgh, Pennsylvania. Available at http://www.pfpi.net/wp-content/uploads/2012/12/PFPI-PA-Biomass-Energy-Report_12_18_12.pdf. TN3508.

Bott, T.L., J.K. Jackson, M.E. McTammany, J.D. Newbold, S.T. Rier, B.W. Sweeney, and J.M. Battle. 2012. "Abandoned Coal Mine Drainage and its Remediation: Impacts on Stream Ecosystem Structure and Function." *Ecological Applications* 22(8):2144–2163, Ithaca, New York. TN2915.

Bradsby, H.C. (editor). 1893. *History of Luzerne County, Pennsylvania, with Biographical Sections.* S.B. Nelson & Company, Chicago, Illinois. Available at https://archive.org/stream/historyofluzerne00brad. TN2891.

Bramble, W.C., R.H. Yahner, and W.R. Byrnes. 1992. "Breeding Bird Population Changes Following Right-of-Way Maintenance Treatments." *Journal of Arboriculture* 18(1):23–32, Champaign, Illinois. TN3889.

Bramble, W.C., R.H. Yahner, and W.R. Byrnes. 1997. "Effects of Herbicides on Butterfly Populations of an Electric Transmission Right-of-Way." *Journal of Arboriculture* 23(5):196–206, Champaign, Illinois. TN3888.

Brattle Group. 2006. *An Evaluation of PJM's Peak Demand Forecasting Process.* Washington, D.C. Available at https://www.pseg.com/family/pseandg/powerline/pdf/exhibits/JMR-3.pdf. TN1557.

Brauning, D. 2007. "The Year of the Peregrine." *The PSO Pileated* 18(2), Pennsylvania Society for Ornithology, Narvon, Pennsylvania. Available at http://www.pabirds.org/Newsletter/PSO_Newsletter_2007_02.pdf. TN3861.

Brightbill, R.A. and M.D. Bilger. 1999. *Fish-Community Composition in Cowanesque River Upstream of the Cowanesque Dam, Tioga County, Pennsylvania, 1998*. USGS Open File Report 99–208, Lemoyne, Pennsylvania. Accession No. ML14265A526. TN3379.

Brown, J.J., J. Perillo, T.J. Kwak, and R.J. Horwitz. 2005. "Implications of *Pylodictis olivaris* (Flathead Catfish) Introduction into the Delaware and Susquehanna Drainages." *Northeastern Naturalist* 12(4):473–484, Steuben, Maine. TN1804.

Bucknell University. 2014. "Cogeneration Plant." Lewisburg, Pennsylvania. Available at http://www.bucknell.edu/facilities/utilities/power-plant.html. TN3737.

Buda, S. 2009. *Middle Susquehanna Subbasin Survey: A Water Quality and Biological Assessment, June–October 2008*. Publication 263, Susquehanna River Basin Commission, Harrisburg, Pennsylvania. Accession No. ML14282A752. TN623.

Butchkoski, E. 2010. "Indiana Bat (*Myotis sodalis*)." Pennsylvania Game Commission, Harrisburg, Pennsylvania. Available at http://www.portal.state.pa.us/portal/server.pt/document/775661/indiana_bat_pdf. TN4165.

Butchkoski, C. 2013. *Pennsylvania Game Commission Bureau of Wildlife Management Project Annual Job Report: Indiana Bat (*Myotis sodalis*) Summer Roost Investigations, 1 January 2011 to 31 December 2012.* Pennsylvania Game Commission, Harrisburg, Pennsylvania. Available at http://www.portal.state.pa.us/portal/server.pt/document/1373296/71402-12z_pdf?qid=90725365&rank=1. TN4173.

Butler Township (Butler Township, Pennsylvania). 2014. "Wastewater Treatment." Drums, Pennsylvania. Accession No. ML14286A069. TN3463.

Cameron, P. 2012. "Luzerne County Man Dies from West Nile Virus." *The Scranton Times Tribune*, Scranton, Pennsylvania. Available at http://thetimes-tribune.com/news/luzerne-county-man-dies-from-west-nile-virus-1.1364402. TN1995.

Caselina, M.J. 2006. *Management Plan for Wild Turkeys in Pennsylvania 2006–2015*. Pennsylvania Game Commission, Harrisburg, Pennsylvania. Available at http://www.portal.state.pa.us/portal/server.pt/document/711862/turkey_plan_pdf. TN3817.

CCEMA (Columbia County Emergency Management Agency). 2013. "Emergency Management Awareness." Bloomsburg, Pennsylvania. Accession No. ML14286A009. TN2216.

CDC (Centers for Disease Control and Prevention). 2002. "Surveillance for Waterborne-Disease Outbreaks—United States, 1999–2000." *Morbidity and Mortality Weekly Report* 51(SS-08):1–28, Atlanta, Georgia. Accession No. ML12221A280. TN2444.

CDC (Centers for Disease Control and Prevention). 2004. "Surveillance for Waterborne Disease and Outbreaks Associated with Drinking Water—United States, 2001–2002" and "Surveillance for Waterborne-Disease and Outbreaks Associated with Recreational Water—United States, 2001–2002." *Morbidity and Mortality Weekly Report* 53(SS-8):23–45, Atlanta, Georgia. Accession No. ML12221A288. TN2435.

CDC (Centers for Disease Control and Prevention). 2006. "Surveillance for Waterborne Disease and Outbreaks Associated with Recreational Water—United States, 2003–2004" and "Surveillance for Waterborne Disease and Outbreaks Associated with Drinking Water and Water not Intended for Drinking—United States, 2003–2004." *Morbidity and Mortality Weekly Report* 55(SS-12):1–24, Atlanta, Georgia. Accession No. ML12221A294. TN2445.

CDC (Centers for Disease Control and Prevention). 2008. "Surveillance for Waterborne Disease and Outbreaks Associated with Recreational Water Use and Other Aquatic Facility-Associated Health Events—United States, 2005–2006" and "Surveillance for Waterborne Disease and Outbreaks Associated with Drinking Water and Water not Intended for Drinking—United States, 2005–2006." *Morbidity and Mortality Weekly Report* 57(SS-9):1–70, Atlanta, Georgia. Accession No. ML12207A497. TN557.

CDC (Centers for Disease Control and Prevention). 2011. "Surveillance for Waterborne Disease Outbreaks and Other Health Events Associated with Recreational Water—United States, 2007–2008" and "Surveillance for Waterborne Disease Outbreaks Associated with Drinking Water—United States, 2007–2008." *Morbidity and Mortality Weekly Report* 60(12):1–75, Atlanta, Georgia. Accession No. ML12207A494. TN558.

CDC (Centers for Disease Control and Prevention). 2014. "Recreational Water-Associated Disease Outbreaks—United States, 2009–2010." *Morbidity and Mortality Weekly Report* 63(01):6–10, Atlanta, Georgia. Available at http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6301a2.htm?s_cid=mm6301a2_w. TN4025.

CEAP (Clean Energy Action Project). 2012. "Alta Wind Energy Center." Denver, Colorado. Available at http://www.cleanenergyactionproject.com/CleanEnergyActionProject/Wind_Power_Case_Studies_files/Alta%20Wind%20Energy%20Center%20.pdf. TN2077.

CED (Con Edison Development, Inc.). 2015. "Projects: PA Solar Park—Nesquehoning, PA." Valhalla, New York. Available at http://www.coneddev.com/projects/pa.asp. TN4355.

Celebi, M., F. Grave, and C. Russell. 2012. *Potential Coal Plant Retirements: 2012 Update.* The Brattle Group, Inc., Washington, D.C. Available at http://www.brattle.com/system/publications/pdfs/000/004/678/original/Potential_Coal_Plant_Retirements_-_2012_Update.pdf?1378772119. TN1556.

CEQ (Council on Environmental Quality). 1997. *Environmental Justice Guidance under the National Environmental Policy Act*. Washington D.C. Accession No. ML103430030. TN452.

CEQ (Council on Environmental Quality). 2005. *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act.* Executive Office of the President, Washington, D.C. Accession No. ML16075A235. TN1394.

Chamberlain, T.T. 2012. "Sheriff's Message." Sheriff of Columbia County, Bloomsburg, Pennsylvania. Available at http://www.sheriffofcolumbiacounty.com/message.html. TN2005.

Chanin, D. and M.L. Young. 1998. *Code Manual for MACCS2: Volume 1*, *User's Guide*. NUREG/CR–6613, Sandia National Laboratories, Albuquerque, New Mexico. Accession No. ML110600923. TN66.

Chanin, D.I., J.L. Sprung, L.T. Ritchie, and H-N Jow. 1990. *MELCOR Accident Consequence Code System (MACCS) User's Guide.* NUREG/CR–4691, Volume 1, U.S. Nuclear Regulatory Commission, Washington, D.C. Accession No. ML063560409. TN2056.

Chaplin, J.J., J.K. Crawford, and R.A. Brightbill. 2011. *Water-Quality Monitoring in Response to Young-of-the-Year Smallmouth Bass (Micropterus dolomieu) Mortality in the Susquehanna River and Major Tributaries, Pennsylvania: 2008.* USGS Open File Report 2009–1216, Reston, Virginia. Accession No. ML13274A180. TN1818.

Clark, D.E., L. Michelbrink, T. Allison, and W.C. Metz. 1997. "Nuclear Power Plants and Residential Housing Prices." *Growth and Change* 28:496–519, Lexington, Kentucky. TN3000.

Clean Air Council. 2015. "Resource Page: Proposed Pipelines in Delaware River Watershed and Surrounding Region." Philadelphia, Pennsylvania. Accession No. ML16075A236. TN4367.

Clearfield (Clearfield Pennsylvania Chamber of Commerce). 2015. "NRG Energy: Shawville Station." Clearfield Pennsylvania. Available at http://clearfieldchamber.com/nrg.html. TN4393.

Columbia County (Columbia County, Pennsylvania). 2013. "Columbia County Millage Sheet 2013." Bloomsburg, Pennsylvania. Accessed February 6, 2013, at http://www.columbiapa.org/assessment/docs/MILLAGE_SHEET_2013.pdf. TN2027.

Columbia County (Columbia County, Pennsylvania). 2013. "Columbia County 2013 Approved Budget." Bloomsburg, Pennsylvania. Accessed February 6, 2013, at http://www.columbiapa.org/commissioners/approved_Budget_2013_2_Mill_Increase.pdf. TN2029.

Community Energy. 2015. "Bear Creek Wind Farm." Radnor, Pennsylvania. Available at https://www.communityenergyinc.com/wind-solar/wind/bear-creek-wind-farm/ . TN1195.

Connelly, N.A., C.R. O'Neill Jr., B.A. Knuth, and T.L. Brown. 2007. "Economic Impacts of Zebra Mussels on Drinking Water Treatment and Electric Power Generation Facilities." *Environmental Management* 40:105–112, Heidelberg, Germany. TN1712.

Cormany, T.C. 2012. *Professional Planning Analysis for PPL Bell Bend Nuclear Power Plant Conditional Use Application.* PPA-001, Revision 0, Martin and Martin, Incorporated, Chambersburg, Pennsylvania. Accession Nos. ML12158A409, ML12158A411. TN1172.

Cornell (The Cornell Lab of Ornithology). 2015. "All About Birds." Ithaca, New York. Available at http://www.allaboutbirds.org/guide/search. TN4433.

Cowen, J.P. 1994. *Handbook of Environmental Acoustics*. John Wiley & Sons, Inc., New York, New York. TN3905.

Cravotta, C.A., III and C.S. Kirby. 2004. *Effects of Abandoned Coal-Mine Drainage on Streamflow and Water Quality in the Shamokin Creek Basin, Northumberland and Columbia Counties, Pennsylvania, 1999–2001.* U.S. Geological Survey Water-Resources Investigations Report 03-4311, New Cumberland, Pennsylvania. Accession No. ML14282A751. TN609.

Crawford, K. 2009. "Susquehanna River Smallmouth Bass: Background, Theories, Actions." Presentation to Susquehanna Smallmouth Bass Public Meeting, January 31, 2009. USGS, New Cumberland, Pennsylvania. Accession No. ML13274A167. TN1819.

Davidson College (Davidson College Herpetology Laboratory). 2014. "The Eastern Box Turtle (*Terrapene carolina*)." Davidson, North Carolina. Available at http://www.bio.davidson.edu/people/midorcas/research/contribute/box%20turtle/boxinfo.htm. TN3863.

DePhilip, M. and T. Moberg. 2010. *Ecosystem Flow Recommendations for the Susquehanna River Basin.* The Nature Conservancy, Harrisburg, Pennsylvania. Available at http://www.srbc.net/policies/docs/TNCFinalSusquehannaRiverEcosystemFlowsStudyReport_Nov10_20120327_fs135148v1.PDF. TN1652.

DOE (U.S. Department of Energy). 2002. *A Resource Handbook on DOE Transportation Risk Assessment*. DOE/EM/NTP/HB-01, Washington, D.C. Accession No. ML12192A286. TN418.

DOE (U.S. Department of Energy). 2002. *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada*. DOE/EIS-0250, Office of Civilian Radioactive Waste Management, Washington, D.C. Accession No. ML14024A327. TN1236.

DOE (U.S. Department of Energy). 2004. "Application of Advanced Construction Technologies to New Nuclear Power Plants." In *NP2010 Improved Construction Technologies, O&M Staffing and Cost, Decommissioning Costs, and Funding Requirements Study.* MPR-2610, Revision 2, Washington, D.C. Accession No. ML093160836. TN2240.

DOE (U.S. Department of Energy). 2005. *DOE Standard Radiation Control.* DOE-STD-1098-99, Change Notice No. 1, Washington, D.C. Accession No. ML053330383. TN1235.

DOE (U.S. Department of Energy). 2008. *Final Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada*. DOE/EIS-0250F-S1, Washington, D.C. Accession No. ML14024A329. TN1237.

DOE (U.S. Department of Energy). 2008. *Geothermal Technologies Program—Geothermal Resource Maps.* Energy Efficiency and Renewable Energy, Washington, D.C. Accession No. ML102070308. TN1409.

DOE (U.S. Department of Energy). 2008. *State Energy Alternatives: Biomass Energy*. Energy Efficiency and Renewable Energy, Washington, D.C. Accession No. ML100490483. TN1416.

DOE (U.S. Department of Energy). 2008. *Fuel Cell Technology Challenges.* Energy Efficiency and Renewable Energy, Washington, D.C. Accession No. ML102070314. TN1417.

DOE (U.S. Department of Energy). 2009. *DOE Standard Radiological Control*. DOE-STD-1098-2008, Change Notice 1, Washington, D.C. Accession No. ML14287A421. TN1426.

DOE (U.S. Department of Energy). 2010. "Wind Powering America: Pennsylvania 80-Meter Wind Map and Wind Resource Potential." Washington, D.C. Accession No. ML13276A027. TN1837.

DOE (U.S. Department of Energy). 2010. "Wind Powering America: New Jersey Offshore 90-Meter Wind Map and Wind Resource Potential." Washington, D.C. Accession No. ML13276A030. TN1838.

DOE (U.S. Department of Energy). 2010. "Wind Powering America: Delaware Offshore 90-Meter Wind Map and Wind Resource Potential." Washington, D.C. Accession No. ML13276A031. TN1839.

DOE (U.S. Department of Energy). 2010. "Wind Powering America: Virginia Offshore 90-Meter Wind Map and Wind Resource Potential." Washington, D.C. Accession No. ML13276A036. TN1840.

DOE (U.S. Department of Energy). 2010. "Wind Powering America: Maryland Offshore 90-Meter Wind Map and Wind Resource Potential." Washington, D.C. Accession No. ML13276A037. TN1841.

DOE (U.S. Department of Energy). 2011. "Solid State Energy Conversion Alliance (SECA)." Office of Fossil Energy, Washington, D.C. Accession No. ML14093A257. TN2083.

DOE (U.S. Department of Energy). 2014. "WINDExchange: Installed Wind Capacity." Office of Energy Efficiency and Renewable Energy, Washington, D.C. Accession No. ML14286A053. TN3716.

DOE/EERE (U.S. Department of Energy/Energy Efficiency and Renewable Energy). 2014. "Clean Energy in My State: Renewable Energy Resource Maps for Pennsylvania, Maryland, Delaware, New Jersey, California, Colorado, and Arizona—Solar Photovoltaic, 2007." Washington, D.C. Accession No. ML14286A055. TN3783.

DOE/EIA (U.S. Department of Energy/Energy Information Administration). 1995. *Electricity Generation and Environmental Externalities: Case Studies*. Washington, D.C. Accession No. ML14029A023. TN2996.

DOE/EIA (U.S. Department of Energy/Energy Information Administration). 2001. *Renewable Energy 2000: Issues and Trends*. DOE/EIA-0628(2000), Washington, D.C. Accession No. ML14265A523. TN26.

DOE/EIA (U.S. Department of Energy/Energy Information Administration). 2009. *Electric Power Annual—Receipts and Quality of Coal Delivered for the Electric Power Industry.* Washington, D.C. Accession No. ML102030434. TN1415.

DOE/EIA (U.S. Department of Energy/Energy Information Administration). 2013. *Electric Power Annual 2011.* Washington, D.C. Accession No. ML14252A906. TN1951.

DOE/EIA (U.S. Department of Energy/Energy Information Administration). 2014. *Annual Energy Outlook 2014 with Projections to 2040*. DOE/EIA-0383(2014), Washington, D.C. Accession No. ML14308A128. TN3585.

DOE/EIA (U.S. Department of Energy/Energy Information Administration). 2014. "Today in Energy: Marcellus Region Production Continues Growth." Washington, D.C. Accession No. ML14286A054. TN3779.

DOE/EIA (U.S. Department of Energy/Energy Information Administration). 2014. "Marcellus Region, Drilling Productivity Report, September 2014. Washington, D.C. Accession No. ML16075A217. TN3780.

DOE/EIA (U.S. Department of Energy/Energy Information Administration). 2014. "Renewable Energy Generation by Fuel." Table 99 in *Annual Energy Outlook 2014*, Washington, D.C. Accession No. ML14310A620. TN3823.

DOI (U.S. Department of the Interior). 2009. *Cape Wind Energy Project Final Environmental Impact Statement.* MMS EIS-EA, OCS Publication No. 2008-040, Minerals Management Service, Herndon, Virginia. Accession No. ML13226A144. TN2527.

DOI (U.S. Department of the Interior). 2009. *Range-Wide Indiana Bat Protection and Enhancement Plan Guidelines*. Washington, D.C. Accession No. ML112650059. TN4177.

DOT (U.S. Department of Transportation). 2003. "From Home to Work, the Average Commute is 26.4 Minutes." *OmniStats* 3(4), Washington, D.C. Accession No. ML100621425. TN297.

DOT (U.S. Department of Transportation). 2011. *2009 National Household Travel Survey: Summary of Travel Trends*. Washington, D.C. Accession No. ML14308A121. TN3942.

DOT (U.S. Department of Transportation). 2013. *National Transportation Statistics 2013.* Bureau of Transportation Statistics, Washington, D.C. Accession No. ML14308A122. TN3930.

DRBC (Delaware River Basin Commission). 2013. "DRBC Approves Docket for Exelon's Limerick Generating Station." West Trenton, New Jersey. Available at http://www.state.nj.us/drbc/home/newsroom/news/approved/20130510_exelon-docket-approval.html. TN3345.

Duke (Duke Energy Corporation). 2013. "Project Overview: Edwardsport Generating Station." Charlotte, North Carolina. Available at http://www.duke-energy.com/about-us/edwardsport-overview.asp. TN2662.

Duke (Duke Energy Corporation). 2014. "Laurel Hill Windpower." Charlotte, North Carolina. Available at http://www.duke-energy.com/commercial-renewables/laurel_hill.asp. TN3338.

EA (EA Engineering, Science, and Technology). 2012. *Optimizing Use of Commission-Owned Water Storage at Cowanesque Lake, Pennsylvania*. Sparks, Maryland. Accession No. ML15043A629. TN3371.

Eckerman, K.F. and J.C. Ryman. 1993. *External Exposures to Radionuclides in Air, Water, and Soil*. EPA-402-R-93-081, U.S. Environmental Protection Agency, Washington, D.C. Accession No. ML101590169. TN8.

Eckerman, K.F., A.B. Wolbarst, and A.C.B. Richardson. 1988. *Limiting Values of Radionuclide Intake and Air Concentrations and Dose Conversion Factors for Inhalation, Submersion, and Ingestion.* EPA-520/1-88-020, U.S. Environmental Protection Agency, Washington, D.C. Accession No. ML111990404. TN68.

Ecology III (Ecology III, Inc.). 1995. *Environmental Studies in the Vicinity of the Susquehanna Steam Electric Station, 1994 Annual Report.* Berwick, Pennsylvania. Accession No. ML071800080. TN1782.

Ecology III (Ecology III, Inc.) 2008. *Environmental Studies in the Vicinity of the Susquehanna Steam Electric Station, 2007 Water Quality, Benthic Macroinvertebrates, Fishes.* Berwick, Pennsylvania. Accession No. ML14282A748. TN391.

Ecology III (Ecology III, Inc.) 2009. *Environmental Studies in the Vicinity of the Susquehanna Steam Electric Station, 2008 Water Quality, Benthic Macroinvertebrates, and Fishes.* Berwick, Pennsylvania. Accession No. ML14302A671. TN1572.

Ecology III (Ecology III, Inc.). 2010. *Environmental Studies in the Vicinity of the Susquehanna Steam Electric Station, 2009 Water Quality, Fishes.* Berwick, Pennsylvania. Accession No. ML12187A054. TN1174.

Ecology III (Ecology III, Inc.). 2011. *Environmental Studies in the Vicinity of the Susquehanna Steam Electric Station, 2010 Water Quality, Fishes.* Berwick, Pennsylvania. Accession No. ML12187A052. TN1175.

Ecology III (Ecology III, Inc.). 2012. *Analysis of Submerged Aquatic Vegetation in the Susquehanna River in the Vicinity of the Proposed Bell Bend Nuclear Power Plant*. Berwick, Pennsylvania. Accession No. ML12256A004. TN1645.

Ecology III (Ecology III, Inc.). 2012. *Environmental Studies in the Vicinity of the Susquehanna Steam Electric Station, 2011 Water Quality, Fishes*. Berwick, Pennsylvania. Accession No. ML13056A021. TN2236.

ECONW (ECONorthwest). 2013. *Highway Cost Allocation Study: 2013–2015 Biennium.* Portland, Oregon. Accession No. ML14308A129. TN3943.

EDF (EDF Renewable Energy). 2012. "Pocono Raceway Solar Project—Project Profile." San Diego, California. Available at http://www.edf-re.com/files/uploads/Pocono_Profile_9-2012.pdf. TN4356.

Ehlke, M.H. and L.A. Reed. 1999. *Comparison of Methods for Computing Streamflow Statistics for Pennsylvania Streams*. Water-Resources Investigations Report 99-4068, U.S. Geological Survey, Denver, Colorado. Accession No. ML14308A131. TN3705.

Eichelberger, B. 2011. "Pennsylvania Natural Heritage Program. Red Maple—Black Gum Palustrine Forest Factsheet." Middletown, Pennsylvania. Available at http://www.naturalheritage.state.pa.us/Community.aspx?=16023. TN3862.

Enel (Enel Green Power). 2012. "Goodyear Lake (Colliersville) Hydroelectric Project." Rome, Italy. Available at http://www.enelgreenpower.com/en-GB/ena/power_plants/ne/goodyear_lake/. TN1603.

EPA (U.S. Environmental Protection Agency). Undated. "Species Profile: Water Shrew (*Sorex palustris*)." Washington, D.C. Accession No. ML14282A847. TN3859.

EPA (U.S. Environmental Protection Agency). Undated. "Species Profile: Northern Leopard Frog (*Rana pipiens*)." Washington, D.C. Accession No. ML14282A848. TN3860.

EPA (U.S. Environmental Protection Agency). 1974. *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*. Washington, D.C. Accession No. ML12241A393. TN3941.

EPA (U.S. Environmental Protection Agency). 2007. *Biomass Combined Heat and Power Catalog of Technologies*. Combined Heat and Power Partnership, Washington, D.C. Accession No. ML14097A248. TN2660.

EPA (U.S. Environmental Protection Agency). 2007. "Region 3 Water Protection Division Sole Source Aquifer Program." Washington, D.C. Accession No. ML093280652. TN3552.

EPA (U.S. Environmental Protection Agency). 2008. *Clean Energy—Municipal Solid Waste.* Washington, D.C. Accession No. ML093280400. TN1413.

EPA (U.S. Environmental Protection Agency). 2009. *Non-Hazardous Waste—Combustion.* Washington, D.C. Accession No. ML100280908. TN1412.

EPA (U.S. Environmental Protection Agency). 2010. Letter from K. Magerr to NRC, dated August 26, 2010, regarding "Proposed Alternative Site Analysis Exclusionary Criteria." Philadelphia, Pennsylvania. Accession No. ML102640782. TN1797.

EPA (U.S. Environmental Protection Agency). 2011. *AP-42, Compilation of Air Pollutant Emission Factors, Volume I*. Fifth Edition, Research Triangle Park, North Carolina. Accession No. ML13072A613. TN1088.

EPA (U.S. Environmental Protection Agency). 2012. "Envirofacts Air Facility System (AFS) Plant Information: Wheelabrator Frackville/Morea Plt." Washington, D.C. Accession No. ML13168A487. TN1192.

EPA (U.S. Environmental Protection Agency). 2012. "Envirofacts Toxic Release Inventory (TRI) Report: Mount Carmel Cogen Facility." Washington, D.C. Accession No. ML13168A497. TN1193.

EPA (U.S. Environmental Protection Agency). 2012. "Envirofacts Air Facility System (AFS) Plant Information: Bear Gap Stone/Quarry." Washington, D.C. Accession No. ML13169A003. TN1197.

EPA (U.S. Environmental Protection Agency). 2012. "Envirofacts Air Facility System (AFS) Plant Information: UAE Coal Corp/Harmony Mine." Washington, D.C. Accession No. ML13169A010. TN1198.

EPA (U.S. Environmental Protection Agency). 2012. "Facility Detail Report: The Proctor & Gamble Paper Products Co." Washington, D.C. Accession No. ML13192A221. TN1212.

EPA (U.S. Environmental Protection Agency). 2012. "Facility Detail Report: Cherokee Pharmaceuticals LLC." Washington, D.C. Accession No. ML13025A189. TN1214.

EPA (U.S. Environmental Protection Agency). 2012. "Envirofacts Air Facility System (AFS) Plant Information: Benton Foundry." Washington, D.C. Accession No. ML13210A017. TN1215.

EPA (U.S. Environmental Protection Agency). 2012. "Envirofacts Air Facility System (AFS) Plant Information: Foam Fabricators Inc./Bloomsburg PLT." Washington, D.C. Accession No. ML13210A027. TN1216.

EPA (U.S. Environmental Protection Agency). 2012. "Envirofacts: KYDEX LLC." Washington, D.C. Accession No. ML13210A024. TN1217.

EPA (U.S. Environmental Protection Agency). 2012. "Envirofacts: Hanson Aggregates PA—Milton Quarry." Washington, D.C. Accession No. ML13228A379. TN1289.

EPA (U.S. Environmental Protection Agency). 2012. "Envirofacts: Knorr Cont Inc.—Montour TWP Plant." Washington, D.C. Accession No. ML13238A076. TN1290.

EPA (U.S. Environmental Protection Agency). 2012. "Envirofacts: Jersey Shore Steel Company." Washington, D.C. Accession No. ML13238A380. TN1291.

EPA (U.S. Environmental Protection Agency). 2012. "Envirofacts: Hershey Foods Corp—Hershey Plant." Washington, D.C. Accession No. ML13233A440. TN1293.

EPA (U.S. Environmental Protection Agency). 2012. "Envirofacts Air Facility System (AFS) Plant Information: Weatherly Casting & Weatherly Plant." Washington, D.C. Accession No. ML13238A097. TN1300.

EPA (U.S. Environmental Protection Agency). 2012. "Envirofacts Integrated Compliance Information System (ICIS) Detailed Reports: Aerospace Operations." Washington, D.C. Accession No. ML13238A129. TN1588.

EPA (U.S. Environmental Protection Agency). 2012. "Envirofacts Integrated Compliance Information System (ICIS) Detailed Reports: Armstrong World Industries." Washington, D.C. Accession No. ML13238A124. TN1589.

EPA (U.S. Environmental Protection Agency). 2012. "Envirofacts Integrated Compliance Information System (ICIS) Detailed Reports: Corixa Corporation." Washington, D.C. Accession No. ML13238A106. TN1590.

EPA (U.S. Environmental Protection Agency). 2012. "Envirofacts Integrated Compliance Information System (ICIS) Detailed Reports: Lockheed Martin Systems Integration—Owego." Washington, D.C. Accession No. ML13129A154. TN1591.

EPA (U.S. Environmental Protection Agency). 2012. "Envirofacts Integrated Compliance Information System (ICIS) Detailed Reports: Ocean Steel Corporation." Washington, D.C. Accession No. ML13129A144. TN1592.

EPA (U.S. Environmental Protection Agency). 2012. "Facility Detail Report: Hazleton Generation Facility." Washington, D.C. Accession No. ML13129A136. TN1593.

EPA (U.S. Environmental Protection Agency). 2013. "Clean Energy: Calculations and References." Washington, D.C. Accession No. ML13205A377. TN2505.

EPA (U.S. Environmental Protection Agency). 2013. "Regulatory Actions—Final Mercury and Air Toxics Standards (MATS) for Power Plants." Washington, D.C. Accession No. ML15211A629. TN2537.

EPA (U.S. Environmental Protection Agency). 2013. "2012 Greenhouse Gas Emissions from Large Facilities, Pennsylvania." Facility Level Information on Greenhouse Gases Tool (FLIGHT), Washington, D.C. Accession No. ML14282A845. TN3784.

EPA (U.S. Environmental Protection Agency). 2013. "2012 Greenhouse Gas Emissions from Large Facilities, United States." Facility Level Information on Greenhouse Gases Tool (FLIGHT), Washington, D.C. Accession No. ML14282A846. TN3785.

EPA (U.S. Environmental Protection Agency). 2014. "Envirofacts FRS Facility Detail Report: Romark PA Solar." Washington, D.C. Accession No. ML14265A529. TN3339.

EPA (U.S. Environmental Protection Agency). 2014. "Foster Wheeler Energy Corporation/Church Road TCE." Mid-Atlantic Superfund, Philadelphia, Pennsylvania. Accession No. ML14286A043. TN3341.

EPA (U.S. Environmental Protection Agency). 2014. "Envirofacts Air Facility System (AFS) Plant Information: Transcontinental Gas/Bear Creek Station 515." Washington, D.C. Accession No. ML14286A044. TN3489.

EPA (U.S. Environmental Protection Agency). 2014. "Envirofacts FRS Facility Detail Report: Bemis." Washington, D.C. Accession No. ML14286A045. TN3490.

EPA (U.S. Environmental Protection Agency). 2014. "Facility Detail Report: Silgan Closures LLC." Washington, D.C. Accession No. ML14286A046. TN3491.

EPA (U.S. Environmental Protection Agency). 2014. "Envirofacts AFS Plant Information: US Gypsum Company/Washingtonville Plant." Washington, D.C. Accession No. ML14286A047. TN3499.

EPA (U.S. Environmental Protection Agency). 2014. "Envirofacts AFS Plant Information: Northeastern Power Company/McAdoo Cogeneration." Washington, D.C. Accession No. ML14286A048. TN3500.

EPA (U.S. Environmental Protection Agency). 2014. "Envirofacts AFS Plant Information: UGI Development Company/Hunlock Creek Energy." Washington, D.C. Accession No. ML14286A050. TN3506.

EPA (U.S. Environmental Protection Agency). 2014. "Envirofacts FRS Facility Detail Report: Sunbury Generation LP." Washington, D.C. Accession No. ML14286A051. TN3507.

EPA (U.S. Environmental Protection Agency). 2014. "Detailed Facility Report: Watsontown Brick Company." Washington, D.C. Accession No. ML14286A038. TN3521.

EPA (U.S. Environmental Protection Agency). 2014. "Envirofacts: ACF Industries LLC." Washington, D.C. Accession No. ML14286A039. TN3522.

EPA (U.S. Environmental Protection Agency). 2014. "Envirofacts Facility Registry Service (FRS) Facility Detail Report: Conagra Foods Inc." Washington, D.C. Accession No. ML14282A775. TN3523.

EPA (U.S. Environmental Protection Agency). 2014. "Envirofacts: Jeraco Enterprises." Washington, D.C. Accession No. ML14282A776. TN3524.

EPA (U.S. Environmental Protection Agency). 2014. "Envirofacts: Truck Accessories Group LLC (DBA Leer East)." Washington, D.C. Accession No. ML14282A777. TN3525.

EPA (U.S. Environmental Protection Agency). 2014. "Envirofacts: Resilite Sports Products Inc." Washington, D.C. Accession No. ML14282A778. TN3526.

EPA (U.S. Environmental Protection Agency). 2014. "Enforcement and Compliance History Online (ECHO) Detail Facility Report: Masonite Corporation." Washington, D.C. Accession No. ML14282A780. TN3527.

EPA (U.S. Environmental Protection Agency). 2014. "Envirofacts: PPL Brunner Island Power Station." Washington, D.C. Accession No. ML14286A040. TN3531.

EPA (U.S. Environmental Protection Agency). 2014. "Envirofacts Multisystem Report: Saint Nicholas Cogeneration Project." Washington, D.C. Accession No. ML14282A781. TN3735.

EPA (U.S. Environmental Protection Agency). 2014. "Envirofacts Multisystem Report: Gilberton Power Co." Washington, D.C. Accession No. ML14282A782. TN3736.

EPA (U.S. Environmental Protection Agency). 2014. "Envirofacts Facility Detail Report: Viking Energy Northumberland LLC/Cogen P." Washington, D.C. Accession No. ML14282A783. TN3738.

EPA (U.S. Environmental Protection Agency). 2014. "Envirofacts Integrated Compliance Information System (ICIS) Report: Corning Fall Brook Plant." Washington, D.C. Accession No. ML14282A838. TN3739.

EPA (U.S. Environmental Protection Agency). 2014. "Envirofacts Integrated Compliance Information System (ICIS) Report: Corning Refractories Plant." Washington, D.C. Accession No. ML14282A839. TN3740.

EPA (U.S. Environmental Protection Agency). 2014. "Envirofacts Multisystem Report: NRG REMA LLC/Blossburg Generating Station." Washington, D.C. Accession No. ML14282A843. TN3744.

EPA (U.S. Environmental Protection Agency). 2014. "Envirofacts Facility Detail Report: Koppers Inc. (Susquehanna, PA)." Washington, D.C. Accession No. ML14282A844. TN3745.

EPA (U.S. Environmental Protection Agency). 2014. "Envirofacts: Kline Township Cogen Facility." Washington, D.C. Accession No. ML14302A596. TN3928.

EPA (U.S. Environmental Protection Agency). 2014. "Envirofacts: Panther Creek Partners." Washington, D.C. Accession No. ML14302A597. TN3929.

EPA (U.S. Environmental Protection Agency). 2014. "Cross-State Air Pollution Rule (CSAPR)." Washington, D.C. Accession No. ML14302A595. TN3962.

EPA (U.S. Environmental Protection Agency). 2014. *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2012*. EPA 430-R-14-003, Washington, D.C. Accession No. ML14308A134. TN4008.

EPA (U.S. Environmental Protection Agency). 2014. "Emissions Factors & AP 42, *Compilation of Air Pollutant Emission Factors*." Includes older editions and updates, Washington, D.C. Accession No. ML16075A216. TN4033.

EPA (U.S. Environmental Protection Agency). 2015. "Cross-State Air Pollution Rule (CSAPR)." Washington, D.C. Accession No. ML15239A598. TN4307.

EPA (U.S. Environmental Protection Agency). 2015. "Envirofacts Multisystem Report: Waymart Wind." Washington, D.C. Accession No. ML16075A237. TN4354.

EPA (U.S. Environmental Protection Agency). 2015. "Envirofacts FRS Facility Detail Report: Taylor Energy Partners LP." Washington, D.C. Accession No. ML16075A231. TN4357.

EPA (U.S. Environmental Protection Agency). 2015. "Envirofacts Multisystem Report: Archibald Power Station." Washington, D.C. Accession No. ML16075A232. TN4360.

EPRI (Electric Power Research Institute). 2002. *Siting Guide: Site Selection and Evaluation Criteria for an Early Site Permit Application.* Available at http://www.epri.com/abstracts/Pages/ProductAbstract.aspx?ProductId=000000000001006878. TN1799.

EPRI (Electric Power Research Institute). 2004. *Extrapolating Impingement and Entrainment Losses to Equivalent Adults and Production Foregone*. Report 1008471, Palo Alto, California. Accession No. ML16075A233. TN4378.

ERG (Eastern Research Group, Inc.). 1994. *List of Industrial Waste Landfills and Construction and Demolition Waste Landfills*. Lexington, Massachusetts. Accessed October 31, 2014, at http://www.epa.gov/osw/hazard/generation/sqg/list/lfillpdf.pdf. TN4021.

ERM (Environmental Resources Management). 2008. *Susquehanna River Thermal Plume and Dilution Modeling, Bell Bend Nuclear Power Plant.* Exton, Pennsylvania. Accession No. ML092330706. TN3677.

ERM and Ecology III (Environmental Resources Management and Ecology III, Inc.). 2012. *Potential Effects of the Bell Bend Project on Water Quality of Backwater Areas Used by Fry and Young-Of-The-Year Smallmouth Bass for the Year 2012*. Mt. Pleasant, South Carolina and Berwick, Pennsylvania. Accession No. ML12297A048. TN1606.

ESRI (Environmental Systems Research Institute, Inc.). 2008. "Data and Maps for ArcGIS: Base Data for Federal Lands and State Parks." ESRI ArcView 10, Redlands, California. Accession No. ML14308A135. TN2227.

Eureka (Eureka Resources). 2013. "Standing Stone Facility, Gas Well Wastewater Treatment." Williamsport, Pennsylvania. Available at http://www.eureka-resources.com/facilities/standing-stone-plant/. TN2615.

Eureka (Eureka Resources). 2014. "About Us—Oil and Gas Wastewater Recycling for Reuse." Williamsport, Pennsylvania. Available at http://www.eureka-resources.com/about-us/. TN3673.

Exelon (Exelon Corporation). 2012. "Conowingo Hydroelectric Generating Station." Darlington, Maryland. Available at http://www.exeloncorp.com/powerplants/conowingo/Pages/profile.aspx. TN1595.

Exelon (Exelon Corporation). 2012. "Muddy Run Pumped Storage Facility." Darlington, Maryland. Available at http://www.exeloncorp.com/powerplants/muddyrun/Pages/profile.aspx. TN1596.

FAA (Federal Aviation Administration). 2012. "Air Carrier Activity Information System: Enplanements at Primary Airports (by Rank), Calendar Year 2011 Primary Airports." Washington, D.C. Accession No. ML14265A500. TN2036.

Fairchild, G.W., D.A. Horwitz, D.A. Nieman, M.R. Boyer, and D.F. Knorr. 1998. "Spatial Variation and Historical Change in Fish Communities of the Schuylkill River Drainage, Southeast Pennsylvania." *The American Midland Naturalist* 139(2):282–295, Notre Dame, Indiana. TN1611.

Farber, S. 1998. "Undesirable Facilities and Property Values: A Summary of Empirical Studies." *Ecological Economics* 24:1–14, Amsterdam, Netherlands. TN2857.

FCPS (Fairfax County Public Schools). 2014. "Eastern Newt (*Notophthalmus viridescens*)." Falls Church, Virginia. Available at http://www.fcps.edu/islandcreekes/ecology/eastern_newt.htm. TN3838.

Fenneman, N.M. and D.W. Johnson. 1946. *Physiographic Divisions of the Conterminous U.S.* U.S. Geological Survey, Reston, Virginia. Available at http://water.usgs.gov/lookup/getspatial?physio. TN2882.

FERC (Federal Energy Regulatory Commission). 2011. *PJM Electric Market: Overview and Focal Points*. Washington, D.C. Accession No. ML13274A045. TN1546.

FERC (Federal Energy Regulatory Commission). 2013. "Notice of Preliminary Permit Application Accepted for File and Soliciting Comments, Motions to Intervene, and Competing Applications." Project No. 14560-000, Borough of Weatherly, December 19, 2013, Washington, D.C. Accession No. ML14308A136. TN3622.

FERC (Federal Energy Regulatory Commission). 2015. "FERC Online eLibrary Results: Transcontinental Gas Pipeline Company, LLC Leidy Southeast Expansion Project." Washington, D.C. Accession No. ML16075A234. TN4348.

FERC (Federal Energy Regulatory Commission). 2015. "FERC Online eLibrary Results: UGI Energy Services, LLC Sunbury Pipeline Project." Washington, D.C. Accession No. ML16075A229. TN4349.

Fergus, C. Undated. "Bats." Pennsylvania Game Commission Wildlife Note 35, LDR0103, Harrisburg, Pennsylvania. Available at http://www.portal.state.pa.us/portal/server.pt/document/706611/bats_pdf. TN3844.

Fike, J. 1999. *Terrestrial and Palustrine Plant Communities of Pennsylvania.* Pennsylvania Natural Diversity Inventory, Harrisburg, Pennsylvania. Accession No. ML14286A096. TN3816.

FirstEnergy (FirstEnergy Corporation). 2009. "FirstEnergy Acquires Rights to Norton Energy Storage Project." November 23 News Release, Akron, Ohio. Accession No. ML103620057. TN2102.

Flora of North America Editorial Committee, eds. 1993+. "Flora of North America North of Mexico." 16+ Volumes, New York, New York and Oxford, United Kingdom. Available at http://floranorthamerica.org/volumes. TN3960.

Forman, R.T.T. and L.E. Alexander. 1998. "Roads and their Major Ecological Effects." *Annual Review of Ecology, Evolution and Systematics* 29:207–231, Palo Alto, California. TN2250.

FWS (U.S. Fish and Wildlife Service). 1982. *Habitat Suitability Index Models: Beaver.* FWS/OBS-82/10.30, Washington, D.C. Accession No. ML14286A004. TN3835.

FWS (U.S. Fish and Wildlife Service). 1984. *Habitat Suitability Index Models: Muskrat.* FWS/OBS-82/10.46, Washington, D.C. Accession No. ML14286A005. TN3836.

FWS (U.S. Fish and Wildlife Service). 1993. *Ecology of Red Maple Swamps in the Glaciated Northeast: A Community Profile*. Biological Report 12, Washington, D.C. Available at http://www.nwrc.usgs.gov/techrpt/93-12.pdf. TN4019.

FWS (U.S. Fish and Wildlife Service). 2004. *Deer Hunting in the United States—An Analysis of Hunter Demographics. Addendum to the 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation.* Report 2001-6, Arlington, Virginia. Accession No. ML14302A611. TN1794.

FWS (U.S. Fish and Wildlife Service). 2006. "Northeastern Bulrush (*Scirpus ancistrochaetus*)." Hadley, Massachusetts. Accession No. ML14286A007. TN3896.

FWS (U.S. Fish and Wildlife Service). 2006. "Threatened and Endangered Species: Indiana Bat (*Myotis sodalis*)." Fort Snelling, Minnesota. Accession No. ML15043A589. TN4167.

FWS (U.S. Fish and Wildlife Service). 2007. *National Bald Eagle Management Guidelines*. Washington, D.C. Accession No. ML101960349. TN780.

FWS (U.S. Fish and Wildlife Service). 2007. *Indiana Bat (*Myotis sodalis*) Draft Recovery Plan: First Revision*. Great Lakes-Big Rivers Region, Fort Snelling, Minnesota. Accession No. ML14302A612. TN934.

FWS (U.S. Fish and Wildlife Service). 2007. *Biological Opinion on the Ohio Department of Transportation's Statewide Transportation Program for the Federally-Listed Endangered Indiana Bat* (Myotis sodalis). Reynoldsburg, Ohio. Accession No. ML15043A591. TN4172.

FWS (U.S. Fish and Wildlife Service). 2009. Letter from D. Densmore to NRC, dated July 10, 2009, regarding "Federally Listed, Proposed, and Candidate Species in Pennsylvania." State College, Pennsylvania. Accession No. ML13120A445. TN3868.

FWS (U.S. Fish and Wildlife Service). 2011. *Guidance on Developing and Implementing an Indiana Bat Conservation Plan.* Washington, D.C. Accession No. ML15043A593. TN4178.

FWS (U.S. Fish and Wildlife Service). 2012. "Cherry Valley National Wildlife Refuge." Washington, D.C. Accession No. ML13169A012. TN1208.

FWS (U.S. Fish and Wildlife Service). 2012. "White-Nose Syndrome, the Devastating Disease of Hibernating Bats in North America." Washington, D.C. Accession No. ML14252A907. TN1993.

FWS (U.S. Fish and Wildlife Service). 2013. Letter from S. Gannon-Nagle to NRC, dated March 14, 2013, regarding "Federally-Listed, Proposed, and Candidate Species, and Critical Habitat in the Vicinity of the Proposed Bell Bend Nuclear Power Plant and Three Alternative Sites." State College, Pennsylvania. Accession No. ML13116A228. TN3847.

FWS (U.S. Fish and Wildlife Service). 2013. "2013 Rangewide Population Estimate for the Indiana Bat (*Myotis sodalis*) by USFWS Region." Washington, D.C. Accession No. ML14286A006. TN3848.

FWS (U.S. Fish and Wildlife Service). 2014. Letter from L.L. Zimmerman to NRC, dated May 23, 2014, regarding "USFWS Project #209-0501—Species Protected under the Bald and Golden Eagle Protection Act located in Pennsylvania Counties Affected by PPL's Consumptive Water Use Mitigation Plan for Bell Bend Nuclear Power Plant." State College, Pennsylvania. Accession No. ML14253A417. TN3967.

FWS (U.S. Fish and Wildlife Service). 2014. Email from J. Siani to PNNL, dated February 25, 2014, regarding "T&E List Federally Listed Species Located in Pennsylvania Counties Affected by PPL's Consumptive Water Use Mitigation Plan for Bell Bend Nuclear Power Plant." State College, Pennsylvania. Accession No. ML14302A615. TN3968.

FWS (U.S. Fish and Wildlife Service). 2014. "Find Endangered Species." Falls Church, Virginia. Accession No. ML14302A616. TN3996.

FWS (U.S. Fish and Wildlife Service). 2014. *Northern Long-Eared Bat Interim Conference and Planning Guidance, USFWS Regions 2, 3, 4, 5, & 6*. Bloomington, Minnesota. Accession No. ML15043A596. TN4162.

FWS (U.S. Fish and Wildlife Service). 2014. "Pennsylvania Bald Eagle Nest Locations and Buffer Zones." Pennsylvania Field Office, State College, Pennsylvania. Accession No. ML16075A230. TN4397.

FWS (U.S. Fish and Wildlife Service). 2015. Letter from L.L. Zimmerman to NRC, dated August 5, 2015, regarding "USFWS Project #2009-0501, the Bell Bend Draft Environmental Impact Statement and Biological Assessment for the Proposed Construction and Operation of the Bell Bend Nuclear Power Plant." State College, Pennsylvania. Accession No. ML15225A426. TN4400.

FWS (U.S. Fish and Wildlife Service). 2015. *Biological Opinion: Effects to the Indiana Bat (*Myotis sodalis*) and Northern Long-Eared Bat (*Myotis septentrionalis*) from the Construction and Operation of the Bell Bend Nuclear Power Plant, Luzerne County, Pennsylvania*. State College, Pennsylvania. Accession No. ML15345A142. TN4436.

Gabbard, A. 1993. "Coal Combustion: Nuclear Resource or Danger." *ORNL Review* 26(3&4), Oak Ridge, Tennessee. Accession No. ML093280447. TN1144.

GAI Consultants. 2008. Bell Bend Nuclear Power Plant Combined License Application Part 11I, Revision 0: *Final Letter Report Phase IA Cultural Resources Reconnaissance of PPL Lands in the Vicinity of Susquehanna Steam Electric Station, Luzerne County, Pennsylvania for UniStar Nuclear Development, LLC*. Homestead, Pennsylvania. Accession No. ML083010191. TN479.

GAI Consultants. 2009. Letter from H.L. Cole to the Pennsylvania Historical and Museum Commission, dated November 16, 2009, regarding "ER# 81-0658-079, NRC: Bell Bend Nuclear Power Plant, *Management Summary Phase IB Cultural Resource Investigation*, Luzerne County, Conyngham, Nescopeck, Salem Townships." Homestead, Pennsylvania. Accession No. ML14308A176. TN3706.

Gargas, A., M.T. Trest, M. Christiansen, T.J. Volk, and D.S. Blehert. 2009. "*Geomyces destructans* sp. *nov*. Associated With Bat White-Nose Syndrome." *Mycotaxon* 108:147–154, Ithaca, New York. TN1996.

GCRP (U.S. Global Change Research Program). 2009. *Global Climate Change Impacts in the United States*. T.R. Karl, J.M. Melillo, and T.C. Peterson (editors). Cambridge University Press, New York, New York. Available at http://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf. TN18.

GCRP (U.S. Global Change Research Program). 2014. *Climate Change Impacts in the United States: The Third National Climate Assessment*. J.M. Melillo, T.C. Richmond, and G.W. Yohe (editors). U.S. Government Printing Office, Washington, D.C. Accession No. ML14129A233. TN3472.

GEO (Global Energy Observatory). 2014. "Paxton Creek Cogeneration Oil Plant PA USA." Available at http://globalenergyobservatory.org/geoid/4727. TN3513.

GKDEC (Green Knight Economic Development Corporation). 2005. "Green Knight Energy Center." Pen Argyl, Pennsylvania. Available at http://www.gkedc.com/energy/index.html. TN4362.

Golden, J., R.P. Ouellette, S. Saari, and P.N. Cheremisinoff. 1979. *Environmental Impact Data Book*. Ann Arbor Science Publishers, Ann Arbor, Michigan. TN3873.

Great Dane. 2014. "Contact Us—Great Dane Corporate Offices and Manufacturers." Chicago, Illinois. Available at http://www.greatdanetrailers.com/web/guest/contact-us. TN3514.

Griego, N.R., J.D. Smith, and K.S. Neuhauser. 1996. *Investigation of RADTRAN Stop Model Input Parameters for Truck Stops*. Sandia National Laboratories, Albuquerque, New Mexico. Accession No. ML14111A188. TN69.

Gross, D. 2004. *Pennsylvania Important Bird Area #50, Susquehanna Riverlands Phase I Conservation Plan*. Pennsylvania Audubon, Audubon, Pennsylvania. Accession No. ML14308A178. TN3982.

Hall, D.G., K.S. Reeves, J. Brizzee, R.D. Lee, G.R. Carroll, and G.L. Sommers. 2006. *Feasibility Assessment of the Water Energy Resources for the United States for New Low Power and Small Hydro Classes of Hydroelectric Plants*. DOE-ID-11263, Office of Energy Efficiency and Renewable Energy, Wind and Hydropower Technologies, Washington, D.C. Accession No. ML14093A275. TN2092.

Hardisky, T. 2013. *River Otter Management in Pennsylvania (2013–2022)*. Draft, Pennsylvania Game Commission, Harrisburg, Pennsylvania. Available at http://www.portal.state.pa.us/portal/server.pt/document/1368760/pa_otter_management_plan_draft_pdf. TN3386.

Harper, J.A. 1999. "Devonian." Chapter 7 in *The Geology of Pennsylvania.* Pennsylvania Bureau of Topographic and Geologic Survey Special Publication 1, Pittsburgh Geological Society, Pittsburgh and Pennsylvania Geological Survey, Harrisburg, Pennsylvania. Accession No. ML093340277. TN2865.

Hayes Large (Hayes Large Architects, LLP). 2012. "Berwick Area School District Facilities Master Plan." State College, Pennsylvania. Available at http://www.berwicksd.org/cms/lib07/PA01000861/Centricity/Domain/1/Facilities_Master_Plan.pdf. TN2152.

Hazleton Public Transit. 2013. "Services: Hazleton Bus Routes." Hazelton, Pennsylvania. Available at http://www.ridehpt.com/Hazleton-bus-services.htm. TN2057.

Heinlen, K. 2008. "A Glacier Runs Through It: Effects of Late Wisconsinan Glaciation on Stream Drainage Near the Terminal Moraine Boundary in North Central Pennsylvania." University of Pennsylvania, Scholarly Commons, Philadelphia, Pennsylvania. Available at http://repository.upenn.edu/mes_capstones/21/. TN2871.

Hendricks, M.L. 2009. *Abundance and Distribution of American Shad in the Susquehanna River, 2009*. Pennsylvania Fish and Boat Commission, State College, Pennsylvania. Available at http://fishandboat.com/pafish/shad/reports_technical/2009shadtech/juvenile2009.pdf. TN632.

Henning, A.M. 2012. *Assessment of Interstate Streams in the Susquehanna River Basin, Monitoring Report No. 25, January 1, 2011 through December 31, 2011*. Publication No. 281, Susquehanna River Basin Commission, Harrisburg, Pennsylvania. Accession No. ML14286A015. TN3387.

Hessler Associates. 2008. Bell Bend Nuclear Power Plant Combined License Application Part 11L, Revision 0*: Baseline Environmental Noise Survey—Leaf-on Season, Bell Bend Nuclear Power Plant (BBNPP) Project*. Report 062608-1, Haymarket, Virginia. Accession No. ML082890769. TN485.

Hessler Associates. 2008. Bell Bend Nuclear Power Plant Combined License Application Part 11L, Revision 0*: Baseline Environmental Noise Survey—Leaf-off Season, Bell Bend Nuclear Power Plant (BBNPP) Project*. Report 041808-1, Haymarket, Virginia. Accession No. ML082890768. TN486.

Hessler Associates. 2010. Bell Bend Nuclear Power Plant Combined License Application Part 11L, Revision 3: *Baseline Environmental Noise Survey, Supplement to HAI Reports 041808-1 and 062608-1, Bell Bend Nuclear Power Plant (NNNPP).* Technical Memo TM-072710-1, Haymarket, Virginia. Accession No. ML12145A459. TN1227.

Hessler Associates. 2010. *Estimated Cooling Tower Sound Emissions for the Bell Bend Nuclear Power Plant (BBNPP) Expansion Project*. Report 080108-1, Revision A, Haymarket, Virginia. Accession No. ML12145A458. TN3893.

Higgins, S.N. and M.J. Vander Zanden. 2010. "What a Difference a Species Makes: A Meta-Analysis of Dreissenid Mussel Impacts on Freshwater Ecosystems." *Ecological Monographs* 80(2):179–196, Ithaca, New York. TN1711.

HRG (Herbert, Rowland & Grubic, Inc.). 2010. *Montour County Act 167 County-Wide Stormwater Management Plan, Phase II*. Draft for Public Review, Lewisburg, Pennsylvania. Accession No. ML14286A061. TN633.

IAEA (International Atomic Energy Agency). 1992. *Effects of Ionizing Radiation on Plants and Animals at Levels Implied by Current Radiation Protection Standards*. Technical Report Series 332, Vienna, Austria. TN712.

Iberdrola Renewables. 2012. "Locust Ridge I and II Wind Power Projects." Portland, Oregon. Available at http://www.iberdrolarenewables.us/cs_locustridge.html. TN1194.

ICRP (International Commission on Radiological Protection). 1977. *Recommendations of the International Commission on Radiological Protection*. ICRP Publication 26, Pergamon Press, New York, New York. TN713.

ICRP (International Commission on Radiological Protection). 2007. *The 2007 Recommendations of the International Commission on Radiological Protection*. ICRP Publication 103, Elsevier, Maryland Heights, Missouri. Available at http://www.sciencedirect.com/science/journal/01466453/37/2-4. TN422.

In re Aiken County v. Nevada (In re Aiken County, et al. v. State of Nevada), 725 F.3d 255 (D.C. Cir. 2013). Accession No. ML13234A460. TN3953.

INEEL (Idaho National Engineering and Environmental Laboratory). 2003. *Early Site Permit Environmental Report Sections and Supporting Documentation*. EDF-3747, Idaho Falls, Idaho. Accession No. ML14098A017. TN71.

Infoplease. 2012. "Susquehanna." *The Columbia Electronic Encyclopedia,* 6th Edition, Columbia University Press, New York, New York. Available at http://www.infoplease.com/ce6/us/A0847316.html. TN3183.

Inners, J.D. 1978. *Geology and Mineral Resources of the Berwick Quadrangle, Luzerne and Columbia Counties, Pennsylvania*. Atlas 174c, Pennsylvania Geological Survey, Harrisburg, Pennsylvania. Accession No. ML093280383. TN3497.

IntelliWatt (IntelliWatt Renewable Energy). 2014. "IntelliWatt Renewable Energy: Providing Sustainable Renewable Energy Systems." Villanova, Pennsylvania. Available at http://www.intellibioenergy.com/index.htm. TN4037.

Isett (Barry Isett & Associates, Inc.). 2003. "Wetlands Location Plan [Map]." Trexlertown, Pennsylvania. Accession No. ML14286A057. TN3808.

Itron, Inc. 2010. *Review of PJM Models. Phase I: Load Forecast Model Evaluation.* San Diego, California. Available at http://www.pjm.com/~/media/committees-groups/committees/pc/20101006/20101006-item-09-load-forecasting-recommendations-phase-1-findings.ashx. TN1558.

Jablon, S., Z. Hrubec, J.D. Boice, Jr., and B.J. Stone. 1990. *Cancer in Populations Living Near Nuclear Facilities, Volume 1—Report and Summary; Volume 2—Individual Facilities: Cancer Before and After Start-up; and Volume 3—Individual Facilities: Cancer by 5-Year Time Intervals*. NIH Publication No. 90-874, National Institutes of Health, Washington, D.C. TN1257.

Jacobsen, T.V. 2009. *Thermal Plume Surveys in the Susquehanna River at the Susquehanna Steam Electric Station Discharge Diffuser Summer 2008 Revision 2*. Ecology III, Inc., Berwick, Pennsylvania. Accession No. ML092230251. TN3679.

Johnson, J.H. and D.S. Dropkin. 1993. "Diel Variation in Diet Composition of a Riverine Fish Community." *Hydrobiologia* 271:149–158, New York, New York. TN2924.

Johnson, P.E. and R.D. Michelhaugh. 2003. *Transportation Routing Analysis Geographic Information System (TRAGIS) User's Manual*. ORNL/NTRC–006, Revision 0, Oak Ridge National Laboratory, Oak Ridge, Tennessee. Accession No. ML113260107. TN1234.

Johnson, J.B., J.W. Edwards, and W.M. Ford. 2011. "Nocturnal Activity Patterns of Northern Myotis (*Myotis septentrionalis*) During the Maternity Season in West Virginia (USA)." *Acta Chiropterologica* 13(2):391–397, Warsaw, Poland. TN1852.

Jones Lang Laselle. 2012. "Seedco Industrial Park—Coal Township and Mount Carmel Township, Northumberland County, Pennsylvania." Chicago, Illinois. Available at http://seedcoindustrialpark.com/siteplans.html. TN1292.

Jow, H.N., J.L. Sprung, J.A. Rollstin, L.T. Ritchie, and D.I. Chanin. 1990. *MELCOR Accident Consequence Code System (MACCS), Model Description*. NUREG/CR–4691, Volume 2, Sandia National Laboratories, Albuquerque, New Mexico. Accession No. ML063560409. TN526.

Karter, M. and G. Stein. 2012. *U.S. Fire Department Profile through 2011.* National Fire Protection Association, Quincy, Massachusetts. Accessed January 19, 2013, at http://www.nfpa.org/assets/files/pdf/os.fdprofile.pdf. TN1871.

Kauffman, M.E. 1999. "Eocambrian, Cambrian, and Transition to Ordovician." Chapter 4 in *The Geology of Pennsylvania.* Pennsylvania Bureau of Topographic and Geologic Survey Special Publication 1, Pittsburgh Geological Society, Pittsburgh and Pennsylvania Geological Survey, Harrisburg, Pennsylvania. Accession No. ML093340293. TN2866.

Kaufman, K. 2000. *Birds of North America*. Houghton Mifflin Company, New York, New York. TN3832.

Kaushal, S.S., G.E. Likens, N.A. Jaworski, M.L. Pace, A.M. Sides, D. Seekell, K.T. Belt, D.H. Secor, and R.L. Wingate. 2010. "Rising Stream and River Temperatures in the United States." *Frontiers in Ecology and the Environment* 8(9):461–466, Washington, D.C. TN1571.

Kenney, G. and C. Stearns. 2013. *Recovery Plan for New York State Populations of the Northern Cricket Frog* (Acris crepitans). New York Department of Environmental Conservation, Albany, New York. Available at http://www.dec.ny.gov/docs/wildlife_pdf/ncfrrpdraft.pdf. TN3853.

Kerlinger, P. 2004. "Wind Turbines and Avian Risk: Lessons from Communication Towers." In S.S. Schwartz (ed.), *Proceedings of the Wind Energy and Birds/Bats Workshop: Understanding and Resolving Bird and Bat Impacts.* May 18–19, 2004, Washington, D.C. American Wind Energy Association (AWEA), Washington, D.C. Available at http://www.ewashtenaw.org/government/departments/planning_environment/planning/wind_power/Wind%20Energy%20Birds%20and%20Bats%20Workshop. TN3871.

Kerlinger, P., J. Guarnaccia, A. Hasch, R.C.E. Culver, R.C. Curry, L. Tran, M.J. Stewart, and D. Riser-Espinoza. 2012. "Avian Collision Mortality at 50- and 60-M Guyed Towers in Central California." *The Condor* 114(3):462–469, Washington, D.C. TN4401.

KLD (KLD Engineering, P.C.). 2011. Bell Bend Nuclear Power Plant Combined License Application Part 11M, Revision 3: *Traffic Impact Study Related to the Proposed Construction and Operation of the Bell Bend Nuclear Power Plant*. TR-439, Revision 5, Hauppauge, New York. Accession No. ML12145A463. TN1228.

KLD (KLD Engineering, P.C.). 2013. *Supplemental Traffic Study for Salem Township—Impact Analysis Related to Proposed Construction and Operation of the Bell Bend Nuclear Power Plant.* TR-592.1–1, Revision 1, Hauppage, New York. Accession No. ML13206A261. TN2841.

Kleinschmidt, Biodrawversity, Alden, and Kapur & Associates. 2012. *Bell Bend Nuclear Power Plant Low Flow Impact Analysis—Mussels*. Accession No. ML123410050. TN1608.

Klemic, H. and R.C. Baker. 1954. *Occurrences of Uranium in Carbon County, Pennsylvania*. U.S. Geological Survey Circular 350, Washington, D.C. Accession No. ML14252A908. TN1998.

Kneeland, S.C. and J.M. Rhymer. 2008. "Determination of Fish Host Use by Wild Populations of Rare Freshwater Mussels Using a Molecular Identification Key to Identify Glochidia." *Journal of the North American Benthological Society* 27(1):150–160, Lawrence, Kansas. TN1658.

Kuhlmann, M.L. and P.D. Hazelton. 2007. "Invasion of the Upper Susquehanna River Watershed by Rusty Crayfish (*Orconectes rusticus*)." *Northeastern Naturalist* 14(4):507–518, Steuben, Maine. TN1716.

Lackawanna Energy. 2015. "Lackawanna Energy Center: Project Overview." Jessup, Pennsylvania. Available at http://lackawannaenergy.com/lackawanna-energy-center-overview/. TN4352.

Lake, P.S. 2003. "Ecological Effects of Perturbation by Drought in Flowing Waters." *Freshwater Biology* 48:1161–1172, Malden, Massachusetts. TN2926.

LandStudies. 2009. *Walker Run Geomorphic Assessment.* Lititz, Pennsylvania. Accession Nos. ML12208A136, ML12208A137. TN499.

LandStudies. 2009. *Walker Run Surveys: Wild Trout Habitat Assessment*. Lititz, Pennsylvania. Accession No. ML12208A138. TN500.

LandStudies. 2010. *Bell Bend Project Site: Supplemental Field Assessments for PPL Riverlands.* Lititz, Pennsylvania. Accession No. ML12205A281. TN497.

LandStudies. 2010. *Bell Bend Project Site: Supplemental Field Assessments for the Walker Run Watershed.* Revision 2, Lititz, Pennsylvania. Accession Nos. ML12208A132, ML12208A133, ML12208A134, ML12208A135. TN498.

LandStudies. 2010. *Bell Bend Nuclear Power Plant Stream and Wetland Mitigation Design Report Walker Run Site, Salem Township, Luzerne County, Pennsylvania.* Revision 0, Lititz, Pennsylvania. Accession No. ML12193A031. TN1901.

LandStudies. 2010. *Bell Bend Nuclear Power Plant Wetland Mitigation Design Report Riverlands Site, Salem Township, Luzerne County, PA*. Revision 0, Lititz, Pennsylvania. Accession No. ML12193A033. TN1908.

LandStudies. 2011. *Wetland Functions and Values Assessment*. Revision 3, Lititz, Pennsylvania. Accession Nos. ML12208A141, ML12208A142. TN502.

Larkin, R.P. 1996. *Effects of Military Noise on Wildlife: A Literature Review*. USACERL Technical Report 96/21, U.S. Army Corps of Engineers Research Laboratory, Champaign, Illinois. Accession No. ML051150109. TN772.

Latham, R.E., J. Beyea, M. Benner, C.A. Dunn, M.A. Fajvan, R.R. Freed, M. Grund, S.B. Horsley, A.F. Rhoads, and B.P. Shissler. 2005. *Managing White-tailed Deer in Forest Habitat From an Ecosystem Perspective: Pennsylvania Case Study*. Deer Management Forum for Audubon Pennsylvania and Pennsylvania Habitat Alliance, Harrisburg, Pennsylvania. Available at http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_005406.pdf. TN3843.

Laughrey, C.D. 1999. "Silurian and Transition to Devonian." Chapter 6 in *The Geology of Pennsylvania*. Pennsylvania Bureau of Topographic and Geologic Survey Special Publication 1, Pittsburgh Geological Society, Pittsburgh and Pennsylvania Geological Survey, Harrisburg, Pennsylvania. Accession No. ML093340294. TN2867.

LLIBS (Little League International Baseball and Softball). 2012. *2012 Baseball & Softball Media Guide*. Williamsport, Pennsylvania. Accessed December 28, 2012, at http://www.littleleague.org/AssetFactory.aspx?vid=168093. TN1717.

Lodge, D.M., C.A. Taylor, D.M. Holdich, and J. Skurdal. 2000. "Nonindigenous Crayfishes Threaten North American Freshwater Biodiversity: Lessons from Europe." *Fisheries* 25(8):7–20, Philadelphia, Pennsylvania. TN1714.

Longcore, T. and C. Rich. 2004. "Ecological Light Pollution." *Frontiers in Ecology and the Environment* 2(4):191–198, Washington, D.C. TN4404.

Longcore, T., C. Rich, and S.A. Gauthreaux, Jr. 2008. "Height, Guy Wires, and Steady-Burning Lights Increase Hazard of Communication Towers to Nocturnal Migrants: A Review and Meta-Analysis." *The Auk* 125(2):485–492, Chicago, Illinois. TN4398.

Longcore, T., C. Rich, P. Mineau, B. MacDonald, D.G. Bert, L.M. Sullivan, E. Mutrie, S.A. Gauthreaux, Jr., M.L. Avery, R.L. Crawford, A.M. Manville, II, E.R. Travis, and D. Drake. 2013. "Avian Mortality at Communication Towers in the United States and Canada: Which Species, How Many, and Where?" *Biological Conservation* 158:410–419, New York, New York. TN4399.

Lotts, K. and T. Naberhaus, coordinators. 2014. "Butterflies and Moths of North America." Available at http://www.butterfliesandmoths.org/. TN3857.

Lowenstein, J. 2013. "Construction of Frack Water Treatment Plant Starts in Standing Stone Twp." *The Daily Review.com*, April 10, 2013, Towanda, Pennsylvania. Accessed May 22, 2014, at http://thedailyreview.com/news/construction-of-frack-water-treatment-plant-starts-in-standing-stone-twp-1.1470655. TN3510.

Luzerne County (Luzerne County, Pennsylvania). 2012. "Agenda Submittal to Luzerne County Council: Receive the County Manager's FY2012 Midyear Financial Report." Wilkes-Barre, Pennsylvania. Available at http://www.luzernecounty.org/uploads/images/assets/county/county-manager/FY2012%20Midyear%20Financial%20Rpt.pdf. TN2028.

Luzerne County (Luzerne County, Pennsylvania). 2013. "2012 Millages." Wilkes-Barre, Pennsylvania. Accessed February 6, 2013, at http://www.luzernecounty.org/uploads/images/assets/county/departments_agencies/assessor/2012%20millages.pdf. TN2026.

Madigan, M.T., J.M. Martinko, and J. Parker. 2003. *Brock Biology of Microorganisms*. Tenth Edition, Pearson Education, Inc., Upper Saddle River, New Jersey. TN3904.

Mangan, B.P. 2000. *2000 Biological Survey of Lake Took-A-While—A Report on the Status of the Warm Water Sport and Forage Fisheries*. Ecology III, Inc., Berwick, Pennsylvania. Accession No. ML14302A674. TN392.

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(3):40–43, East Stroudsburg, Pennsylvania. TN1705.

Mangan, B.P. 2010. Letter to R.K. Kropp, dated June 22, 2010, regarding "Survey of the Crayfish of the Susquehanna River during the Summer of 2008." Berwick, Pennsylvania. Accession No. ML14302A676. TN635.

Mangan, B.P. 2012. *Significant Increasing Trend in Susquehanna River Water Temperature 1974–2010*. King's College Environmental Program, Wilkes-Barre, Pennsylvania. Accession No. ML12158A409. TN1352.

Mangan, B.P. and Bilger, M.D. 2012. "First Record of Phoresy Between Chironomid Larvae and Crayfish." *The American Midland Naturalist* 167(2):410–415, Notre Dame, Indiana. TN1568.

Manville, A.M., II. 2005. "Bird Strikes and Electrocutions at Power Lines, Communication Towers, and Wind Turbines: State of the Art and State of the Science–Next Steps Toward Mitigation." In *Proceedings 3rd International Partners in Flight Conference 2002*, U.S. Forest Service General Technical Report PSW–GTR–191, Albany, California. Available at http://www.fs.fed.us/psw/publications/documents/psw_gtr191/psw_gtr191_1051-1064_manville.pdf. TN893.

Masser (Sterman Masser Potato Farms). 2014. "Solar Farm." Sacramento, Pennsylvania. Available at http://stermanmasser.com/corporate-responsibility/environmental-stewardship. TN3340.

McCormack Taylor, Borton Lawson, and CECO Associates, Inc. 2011. *Lackawanna–Luzerne Regional Plan, Comprehensive Plan and Long Range Transportation Plan for Lackawanna & Luzerne Counties, PA.* Philadelphia, Pennsylvania. Available at http://www.luzernecounty.org/content/File/May%20Final%20Draft_2011.pdf. TN2226.

McDowell, B.K. 2014. Letter to NRC, dated April 17, 2014, regarding "Bell Bend Site Audit Trip Report for QPC04, Task 18, 'Bell Bend COL—Environmental Review.'" Pacific Northwest National Laboratory, Richland, Washington. Accession No. ML14286A071. TN3492.

McLean, R.G. 2006. "West Nile Virus in North American Birds." *Ornithological Monographs* 60:44–64, Berkeley, California. TN1994.

MCSS (Missouri Cooperative Soil Survey). 2014. "The Cooperative Soil Survey: Pennsylvania Soil Series Data." Columbia, Missouri. Accessed October 30, 2014, at http://soils.missouri.edu/soilseries.asp?x=ALL&sort=Series&st=PA. TN4012.

McWilliams, W.H., S.P. Cassell, C.L. Alerich, B.J. Butler, M.L. Hoppus, S.B. Horsley, A.J. Lister, T.W. Lister, R.S. Morin, C.H. Perry, J.A. Westfall, E.H. Wharton, and C.W. Woodall. 2007. *Pennsylvania's Forest 2004.* U.S. Department of Agriculture, Forest Service, Northern Research Station, Newtown Square, Pennsylvania. Accession No. ML13282A037. TN1893.

MDFW (Massachusetts Division of Fisheries and Wildlife). 2010. "Four-Toed Salamander (*Hemidactylium scutatum*)." Natural Heritage and Endangered Species Program, Westborough, Massachusetts. Available at http://www.mass.gov/eea/docs/dfg/nhesp/species-and-conservation/nhfacts/hemidactylium-scutatum.pdf. TN3894.

Menzel, J.M., M.A. Menzel, W.M. Ford, J.W. Edwards, S.R. Sheffield, J.C. Kilgo, and M.S. Bunch. 2003. "The Distribution of Bats of South Carolina." *Southeastern Naturalist* 2(1):121–152, Steuben, Maine. TN1783.

Meyer, P.D. 2016. *Evaluation of Hydrologic Alterations Associated with Consumptive Water Use for Bell Bend Nuclear Power Plant Operation*. PNNL–23306, Revision 1, Pacific Northwest National Laboratory, Richland, Washington. Accession No. ML16075A215. TN3566.

Michaels, T. 2014. *The 2014 ERC Directory of Waste-To-Energy Facilities*. Energy Recovery Council, Arlington, Virginia. Available at http://www.energyrecoverycouncil.org/userfiles/files/ERC_2014_Directory.pdf. TN3849.

Michigan DNR (Michigan Department of Natural Resources). 2014. "Gray Treefrog (*Hyla versicolor* and *H. chrysoscelis*)." Lansing, Michigan. Available at http://www.michigan.gov/dnr/0,4570,7-153-10370_12145_12201-60110--,00.html. TN3841.

Milici, R.C. and C.S. Swezey. 2006. "Assessment of Appalachian Basin Oil and Gas Resources: Devonian Shale—Middle and Upper Paleozoic Total Petroleum System." U.S. Geological Survey Open-File Report Series 2006–1237, Washington, D.C. Accession No. ML14265A520. TN2872.

Miller, R.H. 2007. *Integrated Vegetation Management*. International Society of Arboriculture, Champaign, Illinois. TN4006.

Miller, I. and W. Groot. 2011. *General Air Conformity Analysis, NOx and VOC Emissions from Construction Activities, Bell Bend Nuclear Power Plant.* AECOM, Chelmsford, Massachusetts. Accession No. ML11355A060. TN2124.

Minkkinen, S. and I. Park. 2011. *American Eel Sampling at Conowingo Dam 2010*. U.S. Fish and Wildlife Service, Maryland Fishery Resources Office, Annapolis, Maryland. Accession No. ML14308A183. TN1719.

Minnesota DNR (Minnesota Department of Natural Resources). 2014. "Species Profile: Spring Peepers and Winter Run-Off." St. Paul, Minnesota. Available at http://www.dnr.state.mn.us/minnaqua/speciesprofile/springpeeper.html. TN3840.

Monitoring Analytics (Monitoring Analytics LLC). 2012. *State of the Market Report for PJM 2011, Volume 2: Detailed Analysis.* Eagleville, Pennsylvania. Available at http://pjm.com/documents/reports/state-of-market-reports/2011-state-of-market-reports.aspx. TN1560.

Monitoring Analytics (Monitoring Analytics LLC). 2014. *PJM State of the Market—2013*. Eagleville, Pennsylvania. Available at http://www.monitoringanalytics.com/reports/pjm_state_of_the_market/2013.shtml. TN3336.

Morris Arboretum (Morris Arboretum of the University of Pennsylvania). 2012. "Botanical Research and Activities." Philadelphia, Pennsylvania. Available at http://www.business-services.upenn.edu/arboretum/botanical_research.shtml. TN1665.

Morris Arboretum (Morris Arboretum of the University of Pennsylvania). 2014. "The Pennsylvania Flora Project of Morris Arboretum." Philadelphia, Pennsylvania. Available at http://www.paflora.org/. TN3858.

Mowen, A., A. Graefe, N. Trauntvein, and D. Stynes. 2012. *The Economic Significance and Impact of Pennsylvania State Parks: An Updated Assessment of 2010 Park Visitor Spending on the State and Local Economy*. Available at http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_007019.pdf. TN2222.

MPC (Mississippi Power Company). 2015. "Kemper County Energy Facility." Meridian, Mississippi. Available at http://www.mississippipower.com/about-energy/plants/kemper-county-energy-facility/facts. TN4155.

MSAC (Marcellus Shale Advisory Commission). 2001. *Governor's Marcellus Shale Advisory Commission Final Report*. Harrisburg, Pennsylvania. Available at http://files.dep.state.pa.us/publicparticipation/marcellusshaleadvisorycommission/marcellusshaleadvisoryportalfiles/msac_final_report.pdf. TN3580.

Munford, B.A. 2008. *Management Summary—Supplemental Phase Ib Cultural Resources Investigation, Bell Bend Nuclear Power Plant, Luzerne County, Pennsylvania.* ER 81-06580079, GAI Consultants, Inc., Homestead, Pennsylvania. Accession No. ML083260411. TN1726.

Munford, B.A. 2010. *Addendum Report: Second Supplemental Phase Ib Cultural Resources Investigation Power Block Relocation. Bell Bend Nuclear Power Plant, Luzerne County, Pennsylvania ER 81–0658–079.* GAI Consultants, Inc., C100549.00, Homestead, Pennsylvania. Accession No. ML12145A416. TN1735.

Munford, B.A. 2011. *Management Summary: Phase II National Register Evaluation Site 36LU301. Bell Bend Nuclear Power Plant, Luzerne County, Pennsylvania ER 81–0658–079.* GAI Consultants, Inc., Homestead, Pennsylvania. Accession No. ML12145A433. TN1732.

Munford, B.A. 2011. *Addendum Report: Third Supplemental Phase I Cultural Resources Investigation. Bell Bend Nuclear Power Plant, Luzerne County, Pennsylvania ER 81–0658–079*. GAI Consultants, Inc., C110841.00, Homestead, Pennsylvania. Accession No. ML12145A411. TN1733.

Munford, B.A. and J.N. Tuk. 2008. Bell Bend Nuclear Power Plant Combined License Application Part 11I, Revision 0: *Phase IA Cultural Resources Reconnaissance, Berwick, PA, NNP–1 Areas 6, 7, 8 and Confers Lane Parcel, Luzerne County, Pennsylvania [Redacted]*. GAI Consultants, Inc., Homestead, Pennsylvania. Accession No. ML083010192. TN477.

Munford, B.A., L.A. Frye, J.N. Tuk, and M.G. Hyland. 2008. Bell Bend Nuclear Power Plant Combined License Application Part 11I, Revision 0: *Management Summary Phase Ib Cultural Resources Investigation Bell Bend Nuclear Power Plant, Luzerne County, Pennsylvania*. ER 81–06580079, GAI Consultants, Homestead, Pennsylvania. Accession No. ML082890759. TN478.

Munford, B.A., L.A. Frye, M.P. Kenneally, and R.T. Baublitz. 2010. *Technical Report: Phase I Cultural Resources Investigations and Phase II National Register Site Evaluations. Bell Bend Nuclear Power Plant, Luzerne County, Pennsylvania, ER 81–0658–079.* GAI Consultants, Inc., Homestead, Pennsylvania. Accession No. ML11210B468. TN1731.

Murdy, E.O., R.S. Birdsong, and J.A. Musick. 1997. *Fishes of Chesapeake Bay*. Smithsonian Institution, Washington, D.C. TN1938.

Musial, M. and B. Ram. 2010. *Large-Scale Offshore Wind Power in the United States—Assessment of Opportunities and Barriers.* NREL/TP–500–40745, National Renewable Energy Laboratory, Golden, Colorado. Accession No. ML103620039. TN1843.

NABCI (North American Bird Conservation Initiative). 2010. *The State of the Birds: 2010 Report on Climate Change, United States of America*. U.S. Department of the Interior, Washington, D.C. Accession No. ML14286A083. TN3874.

National Research Council. 2006. *Health Risks from Exposure to Low Levels of Ionizing Radiation BEIR VII Phase 2*. National Academies Press, Washington, D.C. Available at http://www.nap.edu/openbook.php?record_id=11340&page=1. TN296.

NatureServe. 2013. "*Najas gracillima* -(A.Braun ex Engelm.) Magnus, Thread-like Naiad." NatureServe Explorer, Arlington, Virginia. Available at http://www.natureserve.org/explorer/servlet/NatureServe?searchName=Najas+gracillima. TN2928.

NatureServe. 2014. "Comprehensive Report Species—*Alasmidonta varicosa*, Brook Floater." Arlington, Virginia. Available at http://explorer.natureserve.org/servlet/NatureServe?searchName=Alasmidonta+varicosa. TN3969.

NatureServe. 2014. "NatureServe Explorer: *Potamogeton gramineus*, Grassy Pondweed." Available at http://explorer.natureserve.org/servlet/NatureServe?searchName=Potamogeton+gramineus. TN3994.

NatureServe. 2014. "NatureServe Explorer: *Lythrurus umbratilis*, Redfin Shiner." Arlington, Virginia. Available at http://explorer.natureserve.org/servlet/NatureServe?searchName=Lythrurus+umbratilis. TN3995.

NatureServe. 2014. "NatureServe Explorer: *Pleurobema clava*, Clubshell." Arlington, Virginia. Available at http://explorer.natureserve.org/servlet/NatureServe?searchName=Pleurobema+clava. TN3997.

NatureServe. 2015. "NatureServe Explorer: An Online Encyclopedia of Life—Species Quick Search." Arlington, Virginia. Available at http://explorer.natureserve.org/index.htm. TN4432.

NatureWorks. 2014. "Spotted Salamander—*Ambystoma maculatum*." New Hampshire Public Television, Durham, New Hampshire. Available at http://www.nhptv.org/natureworks/spottedsalamander.htm. TN3895.

NCDC (National Climatic Data Center). 2012. *2011 Local Climatological Data Annual Summary with Comparative Data—Wilkes-Barre/Scranton, Pennsylvania (KAVP)*. Asheville, North Carolina. Accession No. ML14265A514. TN2091.

NCDC (National Climatic Data Center). 2012. *2011 Local Climatological Data Annual Summary with Comparative Data—Williamsport, Pennsylvania (KIPT)*. Asheville, North Carolina. Accession No. ML14265A513. TN2093.

NCDC (National Climatic Data Center). 2014. "Storm Events Database—Luzerne County, Pennsylvania." Asheville, North Carolina. Accession No. ML14308A184. TN3999.

NCES (National Center for Education Statistics). 2013. "Common Core Data for 2011–2012 School Year for Carbon County, Columbia County, Luzerne County, Lycoming County, Montour County, Northumberland County, and Schuylkill County (Pennsylvania)." Alexandria, Virginia. Accession No. ML14308A409. TN4026.

NCRP (National Council on Radiation Protection and Measurements). 1991. *Effects of Ionizing Radiation on Aquatic Organisms.* NCRP Report No. 109, Bethesda, Maryland. TN729.

NCRP (National Council on Radiation Protection and Measurements). 1995. *Principles and Applications of Collective Dose in Radiation Protection*. NCRP Report No. 121, Bethesda, Maryland. TN728.

NCRP (National Council on Radiation Protection and Measurements). 2009. *Ionizing Radiation Exposure of the Population of the United States*. NCRP Report No. 160, Bethesda, Maryland. Available at http://app.knovel.com/web/toc.v/cid:kpIREPUS05. TN420.

NECNP v. NRC (New England Coalition on Nuclear Pollution v. U.S. Nuclear Regulatory Commission). 582 F.2d 87 (1st Circuit 1978). U.S. Court of Appeals First Circuit Decision, August 22, 1978. TN2632.

NEI (Nuclear Energy Institute). 2007. *Industry Ground Water Protection Initiative—Final Guidance Document.* NEI 07–07, Washington, D.C. Accession No. ML091170588. TN1913.

NEI (Nuclear Energy Institute). 2009. *Generic FSAR Template Guidance for Life Cycle Minimization of Contamination.* NEI 08–08A, Washington, D.C. Accession No. ML093220530. TN1277.

NERC (North American Electric Reliability Corporation). 2008. "About NERC & Reliability Standards." Washington, D.C. Accessed November 15, 2012, at http://www.nerc.com/Pages/default.aspx. TN1542.

NERC (North American Electric Reliability Corporation). 2012. "NERC Regions Map." Washington, D.C. Accessed November 15, 2012, at http://www.nerc.com/fileUploads/File/AboutNERC/maps/NERC_Regions_Color_072512.jpg. TN1547.

NERC (North American Electric Reliability Corporation). 2012. *2012 Long-Term Reliability Assessment.* Atlanta, Georgia. Available at http://www.nerc.com/news/Headlines%20DL/2012%20Long%20Term%20Reliability%20Assessment.pdf. TN2039.

NERC (North American Electric Reliability Corporation). 2013. *2013 Long-Term Reliability Assessment*. Atlanta, Georgia. Available at http://www.nerc.com/pa/RAPA/ra/Reliability%20Assessments%20DL/2013_LTRA_FINAL.pdf. TN3106.

NETL (National Energy Technology Laboratory). 2010. *Cost and Performance Baseline for Fossil Energy Plants, Volume 1: Bituminous Coal and Natural Gas to Electricity.* Revision 2, DOE/NETL–2010/1397, Pittsburgh, Pennsylvania. Accession No. ML13274A052. TN1423.

New Jersey (State of New Jersey). 2011. *2011 New Jersey Energy Master Plan*. Trenton, New Jersey. Available at http://www.state.nj.us/emp/docs/pdf/2011_Final_Energy_Master_Plan.pdf. TN2115.

Nichols, B.L. and R.B. Domermuth. 1981. "Appearance of the Asiatic Clam, *Corbicula fluminea*, in the Susquehanna River." *Proceedings of the Pennsylvania Academy of Science* 55:181–182, Bradford, Pennsylvania. TN1950.

NIEHS (National Institute of Environmental Health Sciences). 1999. *NIEHS Report on Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields*. NIH Publication No 99–4493, National Institutes of Health, Research Triangle Park, North Carolina. Accession No. ML093240277. TN78.

NJBPU (New Jersey Board of Public Utilities). 2011. *New Jersey's Renewable Portfolio Standard Rules 2010 Annual Report.* Draft for Public Comment, Trenton, New Jersey. Accession No. ML13226A126. TN2526.

NJHC (New Jersey Highlands Water Protection and Planning Council). 2012. Letter from G.F. Feyl to NRC, dated November 8, 2012, regarding "Proposed Bell Bend Nuclear Power Plant Environmental Impact Statement Alternative Site Analysis White Township, New Jersey Tax Block 7; Lots 3, 4, 5, 11, and Part of 16." Chester, New Jersey. Accession No. ML12335A042. TN1795.

NJHC (New Jersey Highlands Water Protection and Planning Council). 2012. Letter from D.J. Van Abs to NRC, dated May 10, 2012, regarding "Proposed Bell Bend Nuclear Power Plant Environmental Impact Statement Alternative Site Analysis White Township, New Jersey Tax Block 7; Lots 3, 4, 5, 11 and Part of 16." Chester, New Jersey. Accession No. ML12135A234. TN1796.

NOAA (National Oceanic and Atmospheric Administration). 2014. "Historical Hurricane Tracks." Washington, D.C. Accession No. ML14302A626. TN4000.

Normandeau (Normandeau Associates, Inc.). 2010. *Impingement and Entrainment Sampling for the Proposed Bell Bend Nuclear Power Plant at the SSES Circulating Water Supply System Intake Structure, Luzerne County, Pennsylvania*. Revision 1, Stowe, Pennsylvania. Accession No. ML12205A260. TN491.

Normandeau (Normandeau Associates, Inc.). 2010. *Mussel Survey in the Susquehanna River in the Vicinity of the Proposed Bell Bend Nuclear Power Plant Site, Luzerne County, Pennsylvania.* Revision 2, Stowe, Pennsylvania. Accession No. ML110730381. TN492.

Normandeau (Normandeau Associates, Inc.). 2011. *A Field Survey of Fish and Aquatic Macroinvertebrates at the Proposed Bell Bend Nuclear Power Plant Site, Luzerne County, Pennsylvania*. Revision 4, Stowe, Pennsylvania. Accession No. ML12205A192. TN488.

Normandeau (Normandeau Associates, Inc.). 2011. *A Field Survey of Plant Communities at the Proposed Bell Bend Nuclear Power Plant Site, Luzerne County, Pennsylvania*. Revision 6, Stowe, Pennsylvania. Accession Nos. ML12205A198, ML12205A199, ML12205A200. TN489.

Normandeau (Normandeau Associates, Inc.). 2011. *A Field Survey of Terrestrial Fauna at the Proposed Bell Bend Nuclear Power Plant Site, Luzerne County, Pennsylvania*. Revision 5, Stowe, Pennsylvania. Accession No. ML12205A201. TN490.

Normandeau (Normandeau Associates, Inc.). 2011. *Indiana Bat (*Myotis sodalis*) Roost Tree Survey Report Proposed Bell Bend NPP Site, Luzerne County, Pennsylvania.* Stowe, Pennsylvania. Accession Nos. ML12205A259, ML12205A263. TN493.

Normandeau (Normandeau Associates, Inc.). 2011. Bell Bend Nuclear Power Plant Combined License Application Part 11H, Revision 3: *Wetlands Delineation and Exceptional Value Wetlands Analysis Report for the Proposed Bell Bend Nuclear Power Plant Site, Luzerne County, Pennsylvania*. Revision 7, Stowe, Pennsylvania. Accession No. ML12145A386. TN1224.

Normandeau (Normandeau Associates, Inc.). 2011. Bell Bend Nuclear Power Plant Combined License Application Part 11K, Revision 3: *A Field Survey of Fish and Aquatic Macroinvertebrates at the Proposed Bell Bend Nuclear Power Plant Site, Luzerne County, Pennsylvania*. Revision 4, Stowe, Pennsylvania. Accession No. ML12145A456. TN1226.

Normandeau (Normandeau Associates, Inc.). 2012. *Potential Effects of the Bell Bend Project on Aquatic Resources and Downstream Users*. Moncks Corner, South Carolina. Accession No. ML121930648. TN1605.

Normandeau (Normandeau Associates, Inc.). 2012. *Mussel Survey in the Susquehanna River near the proposed Bell Bend Project at Berwick, PA*. Stowe, Pennsylvania. Accession No. ML12262A004. TN1607.

Normandeau (Normandeau Associates, Inc.). 2012. *Indiana Bat Biological Evaluation Management Plan for the Bell Bend Nuclear Power Plant, Luzerne County, Pennsylvania.* NAI22932.000, Revision 0, Stowe, Pennsylvania. Accession No. ML122690324. TN1784.

Normandeau (Normandeau Associates, Inc.). 2013. *Indiana Bat Biological Evaluation and Management Plan for the Bell Bend Nuclear Power Plant, Luzerne County, Pennsylvania.* NAI22932.000, Revision 1, Stowe, Pennsylvania. Accession No. ML13288A219. TN4158.

Normandeau (Normandeau Associates, Inc.). 2014. *Indiana Bat Mist Net Survey of the Proposed Bell Bend Nuclear Power Plant, Luzerne County, Pennsylvania.* NAI 22932.001A, Revision 1, Stowe, Pennsylvania. Accession No. ML14122A329. TN3828.

Normandeau and Gomez and Sullivan (Normandeau Associates, Inc. and Gomez and Sullivan Engineers, P.C.). 2011. *Impact of Plant Operation on Migratory Fish Reproduction, RSP 3.21, Conowingo Hydroelectric Project, FERC Project Number 405*. Bedford, New Hampshire and Utica, New York. Available at http://www.exeloncorp.com/assets/energy/powerplants/docs/Conowingo/Conowingo_RSP_3.21_.pdf. TN3681.

Normandeau, ERM, and Thomas R. Payne and Associates (Normandeau Associates, Inc., Environmental Resources Management, and Thomas R. Payne and Associates). 2010. *Study Plan to Assess the Potential Effects of the Bell Bend Project on Aquatic Resources and Downstream Users.* Drumore, Pennsylvania, Exton, Pennsylvania, and Arcata, California. Accession No. ML101270165. TN1825.

Northumberland County (Northumberland County, Pennsylvania). 2012. "*History of Northumberland County*." Sunbury, Pennsylvania. Available at http://www.northumberlandco.org/index.php/exploring-the-county/history-of-northumberland-county. TN1762.

NPCC (Northwest Power and Conservation Council). 2005. *The Fifth Northwest Electric Power and Conservation Plan.* Portland, Oregon. Accession No. ML083260734. TN1406.

NPCC (Northwest Power and Conservation Council). 2010. *Sixth Northwest Conservation and Electric Power Plan*. Portland, Oregon. Accession No. ML14093A352. TN2107.

NRC (U.S. Nuclear Regulatory Commission). 1975. *Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants, Supplement 1.* NUREG–75/038, Washington, D.C. Accession No. ML14091A176. TN216.

NRC (U.S. Nuclear Regulatory Commission). 1976. *Preparation of Environmental Reports for Nuclear Power Stations*. Regulatory Guide 4.2, Revision 2, Washington, D.C. Accession No. ML003739519. TN89.

NRC (U.S. Nuclear Regulatory Commission). 1976. *Environmental Survey of the Reprocessing and Waste Management Portions of the LWR Fuel Cycle*. W.P. Bishop and F.J. Miraglia, Jr. (editors). NUREG–0116 (Supplement 1 to WASH–1248), Washington, D.C. Accession No. ML14098A013. TN292.

NRC (U.S. Nuclear Regulatory Commission). 1977. *Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I*. Regulatory Guide 1.109, Revision 1, Washington, D.C. Accession No. ML003740384. TN90.

NRC (U.S. Nuclear Regulatory Commission). 1977. *Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors.* Regulatory Guide 1.111, Revision 1, Washington, D.C. Accession No. ML003740354. TN91.

NRC (U.S. Nuclear Regulatory Commission). 1977. *Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes.* NUREG–0170, Volume 1, Washington, D.C. Accession No. ML12192A283. TN417.

NRC (U.S. Nuclear Regulatory Commission). 1977. *Public Comments and Task Force Responses Regarding the Environmental Survey of the Reprocessing and Waste Management Portions of the LWR Fuel Cycle.* NUREG–0216 (Supplement 2 to WASH–1248), Washington, D.C. Accession No. ML14091A203. TN1255.

NRC (U.S. Nuclear Regulatory Commission). 1977. "In the Matter of Public Service Company of New Hampshire (Seabrook Station Units 1 and 2), CLI–77–8." 5 NRC 503, Washington, D.C. Accession No. ML14286A093. TN3867.

NRC (U.S. Nuclear Regulatory Commission). 1978. "Atomic Safety and Licensing Appeal Board Order In the Matter of Rochester Gas and Electric Corporation, et al." ALAB–502, Washington, D.C. Accession No. ML13274A004. TN2636.

NRC (U.S. Nuclear Regulatory Commission). 1980. *Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants*. NUREG–0654/FEMA–REP–1, Revision 1, Washington, D.C. Accession No. ML040420012. TN512.

NRC (U.S. Nuclear Regulatory Commission). 1983. *Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants.* Regulatory Guide 1.145, Revision 1, Washington, D.C. Accession No. ML003740205. TN279.

NRC (U.S. Nuclear Regulatory Commission). 1990. *Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants*. NUREG–1150, Washington, D.C. Accession No. ML040140729. TN525.

NRC (U.S. Nuclear Regulatory Commission). 1996. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. Volumes 1 and 2, NUREG–1437, Washington, D.C. Accession Nos. ML040690705, ML040690738. TN288.

NRC (U.S. Nuclear Regulatory Commission). 1997. *Regulatory Analysis Technical Evaluation Handbook.* NUREG/BR–0184, Washington, D.C. Accession No. ML050190193. TN676.

NRC (U.S. Nuclear Regulatory Commission). 1998. *General Site Suitability Criteria for Nuclear Power Stations.* Regulatory Guide 4.7, Washington, D.C. Accession No. ML003739894. TN1008.

NRC (U.S. Nuclear Regulatory Commission). 1999. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants Addendum to Main Report*. NUREG–1437, Volume 1, Addendum 1, Washington, D.C. Accession No. ML040690720. TN289.

NRC (U.S. Nuclear Regulatory Commission). 1999. *Environmental Standard Review Plan, Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1: Operating License Renewal.* NUREG–1555, Supplement 1, Washington, D.C. Accession No. ML003702019. TN3548.

NRC (U.S. Nuclear Regulatory Commission). 2000. *Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Plants.* Regulatory Guide 1.183, Washington, D.C. Accession No. ML003716792. TN517.

NRC (U.S. Nuclear Regulatory Commission). 2000. *Environmental Standard Review* Plan—Standard *Review Plans for Environmental Reviews for Nuclear Power Plants*. NUREG–1555, Main Report and 2007 Revisions, Washington, D.C. Available at http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1555/toc/. TN614.

NRC (U.S. Nuclear Regulatory Commission). 2002. *Final Generic Environmental Impact Statement of Decommissioning of Nuclear Facilities: Regarding the Decommissioning of Nuclear Power Reactors*. NUREG–0586, Supplement 1, Volumes 1 and 2, Washington, D.C. Accession Nos. ML023470327, ML023500228. TN665.

NRC (U.S. Nuclear Regulatory Commission). 2003. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants; Supplement 10 Regarding Peach Bottom Atomic Power Station, Units 2 and 3 Final Report*. NUREG–1437, Supplement 10, Washington, D.C. Accession Nos. ML030270025, ML030270038, ML030270055. TN3685.

NRC (U.S. Nuclear Regulatory Commission). 2006. *Liquid Radioactive Release Lessons Learned Task Force Final Report*. Washington, D.C. Accession No. ML083220312. TN1000.

NRC (U.S. Nuclear Regulatory Commission). 2007. *Meteorological Monitoring Programs for Nuclear Power Plants*. Regulatory Guide 1.23, Revision 1, Washington, D.C. Accession No. ML070350028. TN278.

NRC (U.S. Nuclear Regulatory Commission). 2007. *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, LWR Edition.* NUREG–0800, Washington, D.C. Accession No. ML070660036. TN613.

NRC (U.S. Nuclear Regulatory Commission). 2008. *Interim Staff Guidance Probabilistic Risk Assessment Information to Support Design Certification and Combined License Applications*. DC/COL–ISG–3, Washington, D.C. Accession No. ML081430675. TN671.

NRC (U.S. Nuclear Regulatory Commission). 2008. Letter from M.A. Canova to T.L. Harpster, dated December 19, 2008, regarding "Combined License Application Acceptance Review for Bell Bend Nuclear Power Plant." Washington, D.C. Accession No. ML083460640. TN3615.

NRC (U.S. Nuclear Regulatory Commission). 2008. Letter from R.V. Guzman to PPL Susquehanna, LLC, dated January 30, 2008, regarding "Susquehanna Steam Electric Station, Units 1 and 2—Issuance of Amendment Regarding the 13-percent Extended Power Uprate (TAC Nos. MD3309 and MD3310)." Washington, D.C. Accession No. ML080020182. TN3683.

NRC (U.S. Nuclear Regulatory Commission). 2008. Letter from G. Tesfaye to AREVA NP Inc., dated February 25, 2008, regarding "AREVA NP INC.—Acceptance of the Application for Standard Design Certification of the U.S. EPR." Washington, D.C. Accession No. ML080380357. TN3793.

NRC (U.S. Nuclear Regulatory Commission). 2009. "Memorandum and Order in the Matter of Duke Energy Carolinas, LLC and Tennessee Valley Authority." CLI–09–21, Rockville, Maryland. Accession No. ML093070690. TN539.

NRC (U.S. Nuclear Regulatory Commission). 2009. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants—Supplement 35 Regarding Susquehanna Steam Electric Station Units 1 and 2. Final Report.* NUREG–1437, Supplement 35, Washington D.C. Accession No. ML090700454. TN1725.

NRC (U.S. Nuclear Regulatory Commission). 2009. Letter from W. Burton to the Pennsylvania Historical and Museum Commission, dated January 9, 2009, regarding "Notification and Request for Consultation and Participation in the Scoping Process for the Bell Bend Nuclear Power Plant Combined License Application Review." Washington, D.C. Accession No. ML083470653. TN1736.

NRC (U.S. Nuclear Regulatory Commission). 2009. *Environmental Impact Statement Scoping Process Summary Report—Bell Bend Nuclear Power Plant Combined License Luzerne County, Pennsylvania.* Rockville, Maryland. Accession No. ML091760096. TN1787.

NRC (U.S. Nuclear Regulatory Commission). 2009. Memorandum from T.L. Terry to R.G. Schaaf, dated October 29, 2009, regarding "Summary of the Environmental Site Audit Related to the Review of the Combined License Application for Bell Bend Nuclear Power Plant." Washington, D.C. Accession No. ML091940388. TN1889.

NRC (U.S. Nuclear Regulatory Commission). 2009. Letter from R.R. Sgarro to NRC, dated September 11, 2009, regarding "Bell Bend Nuclear Power Plant Response to Environmental Request for Additional Information, Third Submittal." BNP–2009–256, Berwick, Pennsylvania. Accession No. ML092640125. TN2862.

NRC (U.S. Nuclear Regulatory Commission). 2009. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants; Supplement 37 Regarding Three Mile Island Nuclear Station, Unit 1 Final Report*. NUREG–1437, Supplement 37, Washington, D.C. Accession No. ML091751063. TN3684.

NRC (U.S. Nuclear Regulatory Commission). 2010. Memorandum from S. Imboden to R.G. Schaaf, dated September 24, 2010, regarding "Summary of the Second Environmental Alternative Sites Audit Related to the Review of the Combined License Application for Bell Bend Nuclear Power Plant." Washington D.C. Accession No. ML102520378. TN1891.

NRC (U.S. Nuclear Regulatory Commission). 2011. *Recommendations for Enhancing Reactor Safety in the 21st Century: The Near-Term Task Force Review of Insights from the Fukushima Dai-Ichi Accident.* SECY–11–0093, NRC Task Force, Washington, D.C. Accession No. ML111861807. TN684.

NRC (U.S. Nuclear Regulatory Commission). 2011. *Environmental Impact Statement for Combined License (COL) for Calvert Cliffs Nuclear Power Plant Unit 3*. NUREG–1936, Volume 1, Final Report, Washington, D.C. Accession No. ML11129A167. TN1980.

NRC (U.S. Nuclear Regulatory Commission). 2012. "Limerick Nuclear Power Plant Unit 1." Washington, D.C. Accession No. ML13168A435. TN1180.

NRC (U.S. Nuclear Regulatory Commission). 2012. "Limerick Nuclear Power Plant Unit 2." Washington, D.C. Accession No. ML13168A442. TN1181.

NRC (U.S. Nuclear Regulatory Commission). 2012. "Safety Light Corporation (Commonwealth of Pennsylvania)." Washington, D.C. Accession No. ML13169A022. TN1211.

NRC (U.S. Nuclear Regulatory Commission). 2012. "Approved Applications for Power Uprates." Washington, D.C. Accession No. ML13282A052. TN1538.

NRC (U.S. Nuclear Regulatory Commission). 2012. Memo from L.M. Quinn-Willingham to A.H. Hsia, dated September 21, 2012, regarding "Trip Report: Interviews with the Public Regarding Socioeconomic and Environmental Justice Issues in Areas near the Bell Bend Nuclear Power Plant Site." Washington, D.C. ML12209A346. TN1694

NRC (U.S. Nuclear Regulatory Commission). 2012. Letter from A. Hsia to Pennsylvania Historical and Museum Commission, dated June 12, 2012, regarding "Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review." Washington, D.C. Accession No. ML12073A076. TN1738.

NRC (U.S. Nuclear Regulatory Commission). 2012. Letter from A. Hsia to the Advisory Council on Historic Preservation, dated June 12, 2012, regarding "Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review." Washington, D.C. Accession No. ML12073A074. TN1739.

NRC (U.S. Nuclear Regulatory Commission). 2012. Letter from A. Hsia to the Absentee-Shawnee Tribe of Oklahoma, dated June 12, 2012, regarding "Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review." Washington, D.C. Accession No. ML12073A130. TN1740.

NRC (U.S. Nuclear Regulatory Commission). 2012. Letter from A. Hsia to the Delaware Nation, dated June 12, 2012, regarding "Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review." Washington, D.C. Accession No. ML12073A124. TN1741.

NRC (U.S. Nuclear Regulatory Commission). 2012. Letter from A. Hsia to the Heron Clan, Cayuga Nation, dated June 12, 2012, regarding "Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review." Washington, D.C. Accession No. ML12073A308. TN1742.

NRC (U.S. Nuclear Regulatory Commission). 2012. Letter from A. Hsia to the Oneida Nation of Wisconsin, dated June 12, 2012, regarding "Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review." Washington, D.C. Accession No. ML12073A090. TN1743.

NRC (U.S. Nuclear Regulatory Commission). 2012. Letter from A. Hsia to the Onondaga Nation, dated June 12, 2012, regarding "Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review." Washington, D.C. Accession No. ML12073A270. TN1744.

NRC (U.S. Nuclear Regulatory Commission). 2012. Letter from A. Hsia to the St. Regis Mohawk Tribe, dated June 12, 2012, regarding "Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review." Washington, D.C. Accession No. ML12073A261. TN1745.

NRC (U.S. Nuclear Regulatory Commission). 2012. Letter from A. Hsia to the Berwick Historical Society, dated June 12, 2012, regarding "Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review." Washington, D.C. Accession No. ML121110280. TN1746.

NRC (U.S. Nuclear Regulatory Commission). 2012. Letter from A. Hsia to the Luzerne County Historical Society, dated June 12, 2012, regarding "Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review." Washington, D.C. Accession No. ML121110274. TN1747.

NRC (U.S. Nuclear Regulatory Commission). 2012. Letter from A. Hsia to the Society for Pennsylvania Archaeology, dated June 12, 2012, regarding "Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review." Washington, D.C. Accession No. ML121110281. TN1748.

NRC (U.S. Nuclear Regulatory Commission). 2012. Letter from A. Hsia to the Luzerne County Planning Commission, dated June 12, 2012, regarding "Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review." Washington, D.C. Accession No. ML121120005. TN1749.

NRC (U.S. Nuclear Regulatory Commission). 2012. Letter from A. Hsia to the Salem Township Board of Supervisors, dated June 12, 2012, regarding "Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review." Washington, D.C. Accession No. ML121110296. TN1750.

NRC (U.S. Nuclear Regulatory Commission). 2012. Letter from A. Hsia to K. Faull, Bucknell University, dated June 12, 2012, regarding "Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review." Washington, D.C. Accession No. ML121110291. TN1751.

NRC (U.S. Nuclear Regulatory Commission). 2012. Letter from A. Hsia to the Tonawanda Seneca Nation, dated June 12, 2012, regarding "Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review." Washington, D.C. Accession No. ML12073A316. TN1752.

NRC (U.S. Nuclear Regulatory Commission). 2012. Letter from A. Hsia to the Eastern Shawnee Tribe of Oklahoma, dated June 12, 2012, regarding "Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review." Washington, D.C. Accession No. ML12073A245. TN1882.

NRC (U.S. Nuclear Regulatory Commission). 2012. Letter from A.H. Hsia to the Seneca-Cayuga Tribe of Oklahoma, dated June 12, 2012, regarding "Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review." Washington, D.C. Accession No. ML12073A101. TN1883.

NRC (U.S. Nuclear Regulatory Commission). 2012. Letter from A.H. Hsia to the Seneca Nation of Indians, dated June 12, 2012, regarding "Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review." Washington, D.C. Accession No. ML12073A299. TN1884.

NRC (U.S. Nuclear Regulatory Commission). 2012. Letter from A.H. Hsia to the Shawnee Tribe, dated June 12, 2012, regarding "Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review." Washington, D.C. Accession No. ML12079A139. TN1885.

NRC (U.S. Nuclear Regulatory Commission). 2012. Letter from A.H. Hsia to the Stockbridge-Munsee Band of the Mohican Nation of Wisconsin, dated June 12, 2012, regarding "Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review." Washington, D.C. Accession No. ML12073A247. TN1886.

NRC (U.S. Nuclear Regulatory Commission). 2012. Letter from A.H. Hsia to the Tuscarora Nation Chiefs Council, dated June 12, 2012, regarding "Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review." Washington, D.C. Accession No. ML12073A149. TN1887.

NRC (U.S. Nuclear Regulatory Commission). 2012. Email from M. Purdie to D. Stapp, dated August 30, 2012, regarding "Bell Bend Cultural Trip with Army Corps of Engineers Archaeologist." Washington, D.C. Accession No. ML13002A363. TN1888.

NRC (U.S. Nuclear Regulatory Commission). 2012. Memorandum from L. Quinn-Willingham to W.F. Burton, dated October 31, 2012, regarding "Summary of the Environmental Site Audit Related to the Review of the Combined License Application for Bell Bend Nuclear Power Plant." Washington, D.C. Accession No. ML12265A725. TN1890.

NRC (U.S. Nuclear Regulatory Commission). 2012. Email from J. Whited to L. Quinn-Willingham, dated November 5, 2012, regarding "Question on Susquehanna Units 1 and 2." Washington, D.C. Accession No. ML12319A114. TN1900.

NRC (U.S. Nuclear Regulatory Commission). 2012. "NRC Regulatory Issue Summary 2012–09, Endorsement of Nuclear Energy Institute Guidance for Using an Alternative Method to Manage Cumulative Fatigue at Nuclear Power Reactor Sites." August 7, 2012, Washington, D.C. Accession No. ML11230A678. TN1914.

NRC (U.S. Nuclear Regulatory Commission). 2012. Letter from E. Leeds to All Power Reactor Licensees and Holders of Construction Permits in Active or Deferred Status, dated March 12, 2012, regarding "Request for Information Pursuant to Title 10 of the *Code of Federal Regulations* 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3, of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident." Washington, D.C. Accession No. ML12053A340. TN2198.

NRC (U.S. Nuclear Regulatory Commission). 2012. Letter from E. Leeds to All Power Reactor Licensees and Holders of Construction Permits in Active or Deferred Status, dated March 12, 2012, regarding "Request for Information Pursuant to Title 10 of the *Code of Federal Regulations* 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident; Enclosure 5: Recommendation 9.3: Emergency Preparedness." Washington, D.C. Accession No. ML12056A051. TN2903.

NRC (U.S. Nuclear Regulatory Commission). 2012. *Modeling Potential Reactor Accident Consequences*. NUREG/BR–0359, Revision 1, Washington, D.C. Accession No. ML12347A049. TN3089.

NRC (U.S. Nuclear Regulatory Commission). 2012. *State-of-the-Art Reactor Consequence Analyses (SOARCA) Report.* NUREG–1935, Washington, D.C. Accession No. ML12332A057. TN3092.

NRC (U.S. Nuclear Regulatory Commission). 2012. *Compliance with Order EA–12–049, Order Modifying Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events*. Interim Staff Guidance, JLD–ISG–2012–01, Revision 0, Washington, D.C. Accession No. ML12229A174. TN3163.

NRC (U.S. Nuclear Regulatory Commission). 2012. Letter from W.F. Burton to the Haudenosaunee Standing Committee on Burial Rules and Regulations, dated November 7, 2012, regarding "Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review." Washington, D.C. Accession No. ML12275A585. TN3703.

NRC (U.S. Nuclear Regulatory Commission). 2012. Email from A. Snyder to AREVA, dated November 30, 2012, regarding "U.S. EPR Design Certification Application RAI No. 563 (6890), FSAR Ch. 19—New Phase 4 RAI—Fukushima." Washington, D.C. Accession No. ML12335A108. TN3796.

NRC (U.S. Nuclear Regulatory Commission). 2012. Email from G. Tesfaye to AREVA, dated May 5, 2012, regarding "U.S. EPR Design Certification Application RAI No. 550 (6501), FSAR Ch. 9—NEW PHASE 4 RAI—Fukushima." Washington, D.C. Accession No. ML12147A003. TN3797.

NRC (U.S. Nuclear Regulatory Commission). 2012. Email from M. Canova to R. Sgarro, dated December 12, 2012, regarding "Bell Bend COLA—Final Request for Information No. 121 (RAI No. 121)—BPFP 6894." Washington, D.C. Accession No. ML13101A178. TN3799.

NRC (U.S. Nuclear Regulatory Commission). 2012. Email from M. Canova to R.R. Sgarro, dated June 21, 2012, regarding "Bell Bend COLA—Final Request for Information No. 118–6496, 6503, 6514." Washington, D.C. Accession No. ML12215A071. TN3803.

NRC (U.S. Nuclear Regulatory Commission). 2012. *Central and Eastern United States Seismic Source Characterization for Nuclear Facilities*. NUREG–2115, Washington, D.C. Accession No. ML12048A776. TN3810.

NRC (U.S. Nuclear Regulatory Commission). 2012. Letter from A.H. Hsia to U.S. Fish and Wildlife Service, dated June 12, 2012, regarding "Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review." Washington, D.C. Accession No. ML12079A176. TN3842.

NRC (U.S. Nuclear Regulatory Commission). 2013. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* [GEIS]. NUREG–1437, Revision 1, Washington, D.C. Accession No. ML13107A023. TN2654.

NRC (U.S. Nuclear Regulatory Commission). 2013. Email from M. Canova to R. Sgarro, dated July 18, 2013, regarding "Bell Bend COLA—Final Request for Information No. 126 (RAI No. 126)—SPRA 7061." Washington, D.C. Accession No. ML13199A294. TN3801.

NRC (U.S. Nuclear Regulatory Commission). 2013. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants.* NUREG–1437, Main Report, Appendices, Revision 1, and Supplements 1 through 53, Washington, D.C. Available at http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1437/. TN4007.

NRC (U.S. Nuclear Regulatory Commission). 2013. Memo from L.M. Quinn-Willingham to S.S. Lee, dated July 31, 2013, regarding "Summary Teleconference between the U.S. Nuclear Regulatory Commission, the U.S. Army Corps of Engineers, and the U.S. Environmental Protection Agency Regarding Viability of the Martins Creek Site as an Alternative Site for the Bell Bend Nuclear Power Plant Combined License Environmental Review." Washington, D.C. Accession No. ML13155A291. TN4042.

NRC (U.S. Nuclear Regulatory Commission). 2014. "Three Mile Island—Unit 2." Washington, D.C. Accession No. ML14265A530. TN3285.

NRC (U.S. Nuclear Regulatory Commission). 2014. "Peach Bottom—Unit 1." Washington, D.C. Accession No. ML14265A527. TN3346.

NRC (U.S. Nuclear Regulatory Commission). 2014. Memorandum from T.L. Terry to J.L. Dixon-Herrity, dated July 1, 2014, regarding "Site Audit Summary Related to the Environmental Review of the Proposed Bell Bend Nuclear Power Plant." Washington, D.C. Accession No. ML14128A542. TN3639.

NRC (U.S. Nuclear Regulatory Commission). 2014. Memorandum From T.L. Terry to J. Dixon-Herrity, dated April 21, 2014, regarding "Scoping Summary Report Related to the Environmental Scoping Process for the Bell Bend Nuclear Power Plant Combined License Application." Washington, D.C. Accession No. ML14024A659. TN3651.

NRC (U.S. Nuclear Regulatory Commission). 2014. *Interim Staff Guidance on Environmental Issues Associated with New Reactors, COL/ESP–ISG–026.* Washington, D.C. Accession No. ML14092A402. TN3767.

NRC (U.S. Nuclear Regulatory Commission). 2014. *2014–2015 Information Digest.* NUREG–1350, Volume 26, Washington, D.C. Accession No. ML14240A480. TN3964.

NRC (U.S. Nuclear Regulatory Commission). 2014. *Occupational Radiation Exposure at Commercial Nuclear Power Reactors and Other Facilities, 2012: Forty-Fifth Annual Report.* NUREG–0713, Volume 34, Washington, D.C. Accession No. ML14126A597. TN4030.

NRC (U.S. Nuclear Regulatory Commission). 2014. "NRC Renews Operating Licenses of Limerick Nuclear Plant for an Additional 20 Years." *NRC News*, No. 14-070, Washington, D.C. Accession No. ML14293A264. TN4050.

NRC (U.S. Nuclear Regulatory Commission). 2014. "Major Uranium Recovery Licensing Applications." Washington, D.C. Accession No. ML14338A558. TN4054.

NRC (U.S. Nuclear Regulatory Commission). 2014. *Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel.* Final Report, NUREG–2157, Washington, D.C. Accession No. ML14198A440. TN4117.

NRC (U.S. Nuclear Regulatory Commission). 2015. "In the Matter of PPL Susquehanna, LLC (Susquehanna Steam Electric Station, Units 1 and 2): Order Approving Transfer of Licenses and Conforming Amendments." Docket Nos. 50-387 and 50-388, 7590-01-P, Washington, D.C. Accession No. ML15058A073. TN4447.

NRC and USACE (U.S. Nuclear Regulatory Commission and U.S. Army Corps of Engineers). 2015. *Biological Assessment for the Indiana Bat (*Myotis sodalis*) and the Northern Long-Eared Bat (*Myotis septentrionalis*) for the Proposed Bell Bend Nuclear Power Plant Combined License Application, Luzerne County, Pennsylvania*. Rockville, Maryland (NRC) and Baltimore, Maryland (USACE). Accession No. ML15055A436. TN4435.

NREL (National Renewable Energy Laboratory). 1993. *Profiles in Renewable Energy*. Golden, Colorado. Accession No. ML14097A242. TN2661.

NREL (National Renewable Energy Laboratory). 2009. *United States—Wind Resource Map.* Golden, Colorado. Accession No. ML12026A744. TN1396.

NREL (National Renewable Energy Laboratory). 2009. "Geothermal Resource of the United States: Locations of Identified Hydrothermal Sites and Favorability of Deep Enhances Geothermal Systems (EGS) [Map]." Golden, Colorado. Accession No. ML14286A082. TN3781.

NREL (National Renewable Energy Laboratory). 2011. *A Review of Operational Water Consumption and Withdrawal Factors for Electricity Generating Technologies*. NREL/TP–6A20–50900, Golden, Colorado. Accession No. ML14286A088. TN3850.

NSC (National Safety Council). 2011. *Injury Facts®, 2011 Edition.* Itasca, Illinois. Accessed January 24, 2014, at http://www.nsc.org/Documents/Injury_Facts/Injury_Facts_2011_w.pdf. TN3008.

NYDEC (New York State Department of Environmental Conservation). 2014. "List of Endangered, Threatened, and Special Concern Fish and Wildlife Species of New York State." Albany, New York. Available at http://www.dec.ny.gov/animals/7494.html. TN3980.

NYDEC (New York State Department of Environmental Conservation). 2014. "Part 193: Trees and Plants." Albany, New York. Available at https://govt.westlaw.com/nycrr/Browse/Home/NewYork/NewYorkCodesRulesandRegulations?guid=Iaa4ef900b5a011dda0a4e17826ebc834&originationContext=documenttoc&transitionType=Default&contextData=(sc.Default). TN3981.

NYNHP (New York Natural Heritage Program). 2012. "New York Natural Heritage Program Animal Guides." Albany, New York. Available at http://www.acris.nynhp.org/animals.php. TN3909.

NYNHP (New York Natural Heritage Program). 2014. Letter from N. Conrad to PNNL, dated January 17, 2014, regarding "Species of the Tioga and Chemung Rivers Affected by the Increased Water Flows Under the Consumptive Use Mitigation Plan for Bell Bend Nuclear Power Plant." Albany, New York. Accession No. ML14308A192. TN3988.

ODNR (Ohio Department of Natural Resources). 2014. "Longtail Salamander (*Eurycea longicauda*)" Columbus, Ohio. Available at http://wildlife.ohiodnr.gov/species-and-habitats/species-guide-index/amphibians/longtail-salamander. TN3958.

ODOT (Oregon Department of Transportation). 2000. *Peregrine Falcon Management Plan 2002–2007.* Salem, Oregon. Accession No. ML14286A067. TN2231.

ODW (Ohio Division of Wildlife). 2010. "Longtail Salamander (*Eurycea longicauda*)." Columbus, Ohio. Available at http://www.ohioamphibians.com/salamanders/Longtail_Salamander.html. TN3897.

OECD/NEA and IAEA (Organisation for Economic Co-Operation and Development/Nuclear Energy Agency and International Atomic Energy Agency). 2008. *Uranium 2007: Resources, Production and Demand*. NEA No. 6345, Paris, France. Available at https://www.oecd-nea.org/ndd/pubs/2008/6345-uranium-2007.pdf. TN3992.

Olympus (Olympus Power, LLC). 2012. "York Haven Hydroelectric Project." Morristown, New Jersey. Available at http://www.olympuspower.com/portfolio. TM1600.

Oneida Tribe (Oneida Tribe of Indians of Wisconsin). 2012. Letter from C. Williams to NRC, dated June 21, 2012, regarding "Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application for Review." Oneida, Wisconsin. Accession No. ML12195A236. TN1753.

OPSB (Ohio Power Siting Board). 2011. "Case No. 99–1626–EL–BGN; Compressed Air Energy Storage." Columbus, Ohio. Accession No. ML14093A367. TN2111.

PA Bulletin (The Pennsylvania Bulletin). 2014. "Department of Environmental Protection Notices: Applications, Actions and Special Notices." Document No 14–127, 44 Pa.B. 332, Harrisburg, Pennsylvania. Accession No. ML14286A049. TN3501.

PA Code 25-102 (Pennsylvania Code 25, Chapter 102). 1972. "Erosion and Sediment Control." *Pennsylvania Code*, Harrisburg, Pennsylvania. TN3998.

PA Code 25-105 (Pennsylvania Code 25, Chapter 105). 1981. "Dam Safety and Waterway Management." *Pennsylvania Code*, Harrisburg, Pennsylvania. TN1835.

PA Code 25-109 (Pennsylvania Code 25, Chapter 109). 1971. "Safe Drinking Water." *Pennsylvania Code*, Harrisburg, Pennsylvania. TN3952.

PA Code 25-122 (Pennsylvania Code 25, Chapter 122). 1979. "National Standards of Performance for New Stationary Sources." *Pennsylvania Code*, Harrisburg, Pennsylvania. TN2128.

PA Code 25-127 (Pennsylvania Code 25, Chapter 127). 1929. "Construction, Modification, Reactivation and Operation of Sources." *Pennsylvania Code*, Harrisburg, Pennsylvania. TN2130.

PA Code 25-93 (Pennsylvania Code 25, Chapter 93). 2010. "Water Quality Standards." *Pennsylvania Code*, Harrisburg, Pennsylvania. TN611.

PA P.L. 1277, No. 283 as amended by No. 110, May 7, 1982. "Pennsylvania Scenic Rivers Act." *Commonwealth of Pennsylvania Public Law*, Harrisburg, Pennsylvania. TN1812.

PA P.L. 597, No. 170. 1982. "Wild Resource Conservation Act." *Commonwealth of Pennsylvania Public Law*, Harrisburg, Pennsylvania. TN1810.

PA P.L. 654, No. 174 as amended June 28, 1951 and July 13, 1953. "General Safety Law." *Commonwealth of Pennsylvania Public Law*, Harrisburg, Pennsylvania. TN3914.

PADEP (Pennsylvania Department of Environmental Protection). 2001. *Shamokin Creek Watershed TMDL*. Bureau of District Mining Operations, Greensburg, Pennsylvania. Accessed April 20, 2012, at http://www.dep.state.pa.us/watermanagement_apps/tmdl/. TN689.

PADEP (Pennsylvania Department of Environmental Protection). 2005. *Black Creek, Little Nescopeck Creek and Unt Little Nescopeck Creek Watershed TMDL, Luzerne County*. Harrisburg, Pennsylvania. Available at http://www.dep.state.pa.us/dep/deputate/watermgt/wqp/wqstandards/tmdl/LittleNescopeckBlack_TMDL.pdf. TN690.

PADEP (Pennsylvania Department of Environmental Protection). 2006. *Pennsylvania Stormwater Best Management Practices Manual.* Document No. 363–0300–002, Bureau of Watershed Management, Harrisburg, Pennsylvania. Available at http://www.elibrary.dep.state.pa.us/dsweb/View/Collection-8305. TN3948.

PADEP (Pennsylvania Department of Environmental Protection). 2009. *Pennsylvania Final Climate Change Action Plan.* Harrisburg, Pennsylvania. Available at http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-77736/ALL%20OF%20VOLUME%201%20AND%202.pdf. TN2228.

PADEP (Pennsylvania Department of Environmental Protection). 2012. "Residual Waste Program, Residual Waste Generators." Harrisburg, Pennsylvania. Accessed November 13, 2012, at http://www.portal.state.pa.us/portal/server.pt/community/residual_waste/14093. TN1536.

PADEP (Pennsylvania Department of Environmental Protection). 2012. Letter from M. Krancer to J. Arway, dated April 16, 2012, regarding "The Health of the Smallmouth Bass Population in the Susquehanna River." Harrisburg, Pennsylvania. Available at http://www.fish.state.pa.us/water/rivers/susquehanna/susq-impairment/2012_04_16_KrancerLetterToJohnArway.pdf. TN1626.

PADEP (Pennsylvania Department of Environmental Protection). 2012. *Pennsylvania Water Atlas of the State Water Plan*. Accessed December 12, 2012, at http://www.pawaterplan.dep.state.pa.us/statewaterplan/docroot/WaterAtlasLinks.aspx. TN1781.

PADEP (Pennsylvania Department of Environmental Protection). 2013. "Black Fly Biology and Life History." Accessed December 28, 2012, at http://www.depweb.state.pa.us/portal/server.pt/community/black_fly/13774/biology/590143. TN1707.

PADEP (Pennsylvania Department of Environmental Protection). 2013. "Black Fly: Welcome to Pennsylvania's Black Fly Suppression Program Web Site." Accessed December 28, 2012, at http://www.depweb.state.pa.us/blackfly/cwp/view.asp?a=3&Q=505536. TN1709.

PADEP (Pennsylvania Department of Environmental Protection). 2013. "Flood Protection." Harrisburg, Pennsylvania. Accessed February 4, 2013, at http://www.portal.state.pa.us/portal/server.pt/community/flood_protection/10502. TN2002.

PADEP (Pennsylvania Department of Environmental Protection). 2013. "Pennsylvania Drinking Water Reporting System: Survey Information, Water Supply Data for Luzerne and Columbia Counties." Harrisburg, Pennsylvania. Accessed February 19, 2013, at http://www.drinkingwater.state.pa.us/dwrs/HTM/Welcome.html. TN2218.

PADEP (Pennsylvania Department of Environmental Protection). 2013. Letter from M.J. Brunamonti to G. Petrewski (PPL Bell Bend, LLC) dated January 23, 2013, regarding "Bell Bend Nuclear Power Plant 401 Water Quality Certification, U.S. Army Corps of Engineers, Project No. NAB–OP–RPA–2008–01401–P13, Nuclear Regulatory Commission Docket No. 42-039." Accession No. ML13032A110. TN2275.

PADEP (Pennsylvania Department of Environmental Protection). 2013. Email from D. Fritz to P. Balducci, dated February 22, 2013, regarding "Chapter 94 Reporting Data." Wilkes-Barre, Pennsylvania. Accession No. ML14286A081. TN3464.

PADEP (Pennsylvania Department of Environmental Protection). 2013. Email from D. Swartzlander to P. Balducci, dated March 1, 2013, regarding "94 Information." Williamsport, Pennsylvania. Accession No. ML14308A193. TN3465.

PADEP (Pennsylvania Department of Environmental Protection). 2013. Letter from J. Buczynski to PPL Bell Bend, LLC, dated May 24, 2013, regarding "Water Obstruction and Encroachment Permit, DEP Application No. E40–720, APS No. 753143, Bell Bend Nuclear Power Plant, Salem Township, Luzerne County." Wilkes-Barre, Pennsylvania. Accession No. ML13161A023. TN3538.

PADEP (Pennsylvania Department of Environmental Protection). 2013. "Municipal Waste Landfills & Resource Recovery Facilities." Harrisburg, Pennsylvania. Accessed September 24, 2014, at http://www.portal.state.pa.us/portal/server.pt/community/permitting/14092/mw_landfills_and_resource_recovery_facilities/589660. TN3911.

PADEP (Pennsylvania Department of Environmental Protection). 2013. *County Waste Destinations in Tons (2000 lbs.) of Waste*. Harrisburg, Pennsylvania. Available at http://www.portal.state.pa.us/portal/server.pt/document/1396004/county_2013_pdf?qid=68027527&rank=2. TN3912.

PADEP (Pennsylvania Department of Environmental Protection). 2013. "DEP Office of Oil and Gas Management—Wells Inventory by County." Harrisburg, Pennsylvania. Available at http://www.depreportingservices.state.pa.us/ReportServer?%2fOil_Gas&rs:Command=ListChildren. TN3951.

PADEP (Pennsylvania Department of Environmental Protection). 2014. *2014 Pennsylvania Integrated Water Quality Monitoring and Assessment Report—Clean Water Act Section 305(b) Report and 303(d) List.* Harrisburg, Pennsylvania. Accessed April 29, 2014, at http://www.dep.pa.gov/Business/Water/PointNonPointMgmt/WaterQuality/Pages/Integrated-Water-Quality-Report-2014.aspx#.VI4O3LGIZaR. TN3450.

PADEP (Pennsylvania Department of Environmental Protection). 2014. "Community Water Systems in Columbia and Luzerne Counties, Pennsylvania [Map]." Harrisburg, Pennsylvania. TN3462.

PADEP (Pennsylvania Department of Environmental Protection). 2014. "Flood Protection Projects—Susquehanna River Basin." Harrisburg, Pennsylvania. Accessed May 27, 2014, at http://www.portal.state.pa.us/portal/server.pt/community/projects/10503/flood_protection_projects_-_susquehana_river_basin/553454. TN3502.

PADEP (Pennsylvania Department of Environmental Protection). 2014. "Abandoned Mine Reclamation County Maps: Columbia, Luzerne, and Lycoming Counties." Harrisburg, Pennsylvania. Accessed May 27, 2014, at http://www.portal.state.pa.us/portal/server.pt?open=514&objID=588925&mode=2. TN3503.

PADEP (Pennsylvania Department of Environmental Protection). 2014. "2014 Pennsylvania Integrated Water Quality Monitoring and Assessment Report—Stream, Category 5 Waterbodies, Pollutants Requiring a TMDL." Harrisburg, Pennsylvania. Available at http://files.dep.state.pa.us/Water/Drinking%20Water%20and%20Facility%20Regulation/WaterQualityPortalFiles/2014%20Integrated%20List/2014%20Streams%20Category%205.pdf. TN3504.

PADEP (Pennsylvania Department of Environmental Protection). 2014. "Hazardous Waste Generator Requirements for Small Quantity Generators." Harrisburg, Pennsylvania. Accessed September 24, 2014, at http://www.portal.state.pa.us/portal/server.pt/directory/generator_fact_sheets/198208?DirMode=1#. TN3913.

PADEP (Pennsylvania Department of Environmental Protection). 2014. "PA Oil and Gas Mapping." Harrisburg, Pennsylvania. Available at http://www.depgis.state.pa.us/PaOilAndGasMapping/. TN3970.

PADEP (Pennsylvania Department of Environmental Protection). 2014. Letter from M. Zaman to EN-TIRE Logistics of Milton PA, LLC, dated January 10, 2014, regarding "Termination of Plan Approval 60-00022A, White Deer Energy Project." Williamsport, Pennsylvania. Available at http://files.dep.state.pa.us/RegionalResources/NCRO/NCROPortalFiles/En-TireTerminationLetter.pdf. TN4366.

PADEP (Pennsylvania Department of Environmental Protection). 2015. "Site Details: Tenaska Lebanon Valley Generating Station." Harrisburg, Pennsylvania. Available at http://www.ahs.dep.pa.gov/eFACTSWeb/searchResults_singleSite.aspx?SiteID=764358. TN4346.

PADEP (Pennsylvania Department of Environmental Protection). 2015. "Site Details: Hummel Station." Harrisburg, Pennsylvania. Available at http://www.ahs.dep.pa.gov/eFACTSWeb/searchResults_singleSite.aspx?SiteID=786918. TN4350.

PADEP (Pennsylvania Department of Environmental Protection). 2015. "Authorization to Discharge under the National Pollutant Discharge Elimination System Discharge Requirements for Industrial Wastewater Facilities, NPDES Permit No. PA0232602." Harrisburg, Pennsylvania. Available at http://www.portal.state.pa.us/portal/server.pt/document/1543213/pa0232602_3_final_3-2-2015_76589_v5_pdf?qid=23739359&rank=2. TN4351.

PADEP (Pennsylvania Department of Environmental Protection). 2015. "DEP Grants Air Quality Plan Approval for Natural Gas-Fired Power Plant in Luzerne County." Harrisburg, Pennsylvania. Available at http://www.portal.state.pa.us/portal/server.pt/community/newsroom/14287?id=20838&typeid=1. TN4392.

PADOH (Pennsylvania Department of Health). 2012. *Pennsylvania EPI Notes*: "Outbreak of E. Coli Associated with Lake Swimming at a Pennsylvania State Park." Volume 2, Issue 1, Bureau of Epidemiology, Harrisburg, Pennsylvania. Accession No. ML12166A271. TN1350.

PADOH (Pennsylvania Department of Health). 2012. "2010–2011 Hospital Reports." Harrisburg, Pennsylvania. Accessed February 20, 2013, at http://www.portal.state.pa.us/portal/server.pt?open=514&objID=596752&mode=2. TN2224.

PASDA (Pennsylvania Spatial Data Access). 2009. "Explore PA Trails—Trails." University Park, Pennsylvania. Accession No. ML14302A636. TN2232.

PASDA (Pennsylvania Spatial Data Access). 2010. "NAIP Digital Ortho Photo Image 2010." University Park, Pennsylvania. Originator: USDA-FSA Aerial Photography Field Office, Salt Lake City, Utah. Available at http://www.pasda.psu.edu/uci/FullMetadataDisplay.aspx?file=NAIP_PA2010.xml. TN4011.

PASDA (Pennsylvania Spatial Data Access). 2011. "State Game Lands File (PGC_StateGameland201108.shp)." University Park, Pennsylvania. Accession No. ML14302A637. TN2230.

PASDA (Pennsylvania Spatial Data Access). 2012. "PA Water Trails." University Park, Pennsylvania. Accession No. ML14302A638. TN2233.

PASDA (Pennsylvania Spatial Data Access). 2013. "State Forests File DCNR_BOF_StatForests2013.shp." University Park, Pennsylvania. Accession No. ML14302A639. TN2234.

PASDC (Pennsylvania State Data Center). 2010. *Pennsylvania County Population Projections, 2000–2030.* Available at http://pasdc.hbg.psu.edu/sdc/pasdc_files/projections/County_Projections_Chart.xls. TN1895.

PASDC (Pennsylvania State Data Center). 2013. "Pennsylvania Counties Total Population 2000–2010." Harrisburg, Pennsylvania. Available at http://pasdc.hbg.psu.edu/Data/Census2010/tabid/1489/Default.aspx. TN2018.

PAWC (Pennsylvania American Water Company). 2014. Email from R. Wilkin to P. Balducci, dated April 8, 2014, regarding "10-Year Historic Data for Berwick." Berwick, Pennsylvania. Accession No. ML14286A079. TN3786.

PDA (Pennsylvania Department of Agriculture). Undated. *Pennsylvania Sports Fish Directory.* Pennsylvania Aquaculture, Harrisburg, Pennsylvania. Accessed April 20, 2012, at http://extension.psu.edu/natural-resources/water/sports-fish-directory. TN688.

PDCED (Pennsylvania Department of Community and Economic Development). 2011. *State Land Use and Growth Management Report 2010.* Harrisburg, Pennsylvania. Available at http://archive2012.newpa.com/webfm_send/1577. TN2225.

PDCED (Pennsylvania Department of Community and Economic Development). 2012. "2012 Municipal Annual Audit and Financial Reports for Coal, Derry, Hazle, and Salem Townships." Harrisburg, Pennsylvania. Accession No. ML14308A209. TN3916.

PDCED (Pennsylvania Department of Community and Economic Development). 2014. "Pennsylvania Statewide Report—Earned Income Tax, Local Services Tax, and Personal Income Tax Rates and Collectors." Harrisburg, Pennsylvania. Accession No. ML14308A210. TN3915.

PDCNR (Pennsylvania Department of Conservation and Natural Resources). 2012. "Ricketts Glen State Park." Harrisburg, Pennsylvania. Available at http://www.dcnr.state.pa.us/stateparks/findapark/rickettsglen/index.htm. TN1199.

PDCNR (Pennsylvania Department of Conservation and Natural Resources). 2012. "Nescopeck State Park." Harrisburg, Pennsylvania. Available at http://www.dcnr.state.pa.us/stateparks/findapark/nescopeck/index.htm. TN1200.

PDCNR (Pennsylvania Department of Conservation and Natural Resources). 2012. "Lehigh Gorge State Park." Harrisburg, Pennsylvania. Available at http://www.dcnr.state.pa.us/stateparks/findapark/lehighgorge/index.htm. TN1201.

PDCNR (Pennsylvania Department of Conservation and Natural Resources). 2012. "Hickory Run State Park." Harrisburg, Pennsylvania. Available at http://www.dcnr.state.pa.us/stateparks/findapark/hickoryrun/index.htm. TN1202.

PDCNR (Pennsylvania Department of Conservation and Natural Resources). 2012. "Locust Lake State Park." Harrisburg, Pennsylvania. Available at http://www.dcnr.state.pa.us/stateparks/findapark/locustlake/index.htm. TN1203.

PDCNR (Pennsylvania Department of Conservation and Natural Resources). 2012. "Tuscarora State Park." Harrisburg, Pennsylvania. Available at http://www.dcnr.state.pa.us/stateparks/findapark/tuscarora/index.htm. TN1204.

PDCNR (Pennsylvania Department of Conservation and Natural Resources). 2012. "Frances Slocum State Park." Harrisburg, Pennsylvania. Available at http://www.dcnr.state.pa.us/stateparks/findapark/francesslocum/index.htm. TN1205.

PDCNR (Pennsylvania Department of Conservation and Natural Resources). 2012. "Milton State Park." Harrisburg, Pennsylvania. Available at http://www.dcnr.state.pa.us/stateparks/findapark/milton/index.htm. TN1206.

PDCNR (Pennsylvania Department of Conservation and Natural Resources). 2012. "Shikellamy State Park." Harrisburg, Pennsylvania. Available at http://www.dcnr.state.pa.us/stateparks/findapark/shikellamy/index.htm?tab=Maps#Maps. TN1207.

PDCNR (Pennsylvania Department of Conservation and Natural Resources). 2012. "Sand Bridge State Park." Harrisburg, Pennsylvania. Available at http://www.dcnr.state.pa.us/stateparks/findapark/sandbridge/index.htm?tab=Maps#Maps. TN1287.

PDCNR (Pennsylvania Department of Conservation and Natural Resources). 2012. "Raymond B. Winter State Park." Harrisburg, Pennsylvania. Available at http://www.dcnr.state.pa.us/stateparks/findapark/raymondbwinter/index.htm?tab=Maps#Maps. TN1288.

PDCNR (Pennsylvania Department of Conservation and Natural Resources). 2012. "Pennsylvania Marcellus Wells—Permits Issued and Completion Reports Received as of March 9, 2012." Harrisburg, Pennsylvania. Available at http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_009755.pdf. TN3505.

PDCNR (Pennsylvania Department of Conservation and Natural Resources). 2012. Letter from E.C. Boyer and R.H. Bowen to NRC, dated July 16, 2012, regarding "Docket No. 52-039, Bell Bend Nuclear Power Plant and Alternative Sites: Bell Bend Site—Salem Township, Luzerne County, PA; Montour Site—Derry Township, Montour County, PA; Humboldt Site—City of Hazleton, Luzerne County, PA; and Seedco Site—Coal Township, Northumberland County, PA." PNDI Number 21898, Harrisburg, Pennsylvania. Accession No. ML12200A032. TN3910.

PDCNR (Pennsylvania Department of Conservation and Natural Resources). 2013. Letter from A. Rohrbaugh and R.H. Bowen to NRC, dated February 28, 2013, regarding "Docket No. 52-039, Bell Bend Nuclear Power Plant and Alternative Sites: Bell Bend Site—Salem Township, Luzerne County, PA; Montour Site—Derry Township, Montour County, PA; Humboldt Site—City of Hazleton, Luzerne County, PA; and Seedco Site—Coal Township, Northumberland County, PA." PNDI Number 22137, Harrisburg, Pennsylvania. Accession No. ML13063A336. TN3886.

PDCNR (Pennsylvania Department of Conservation and Natural Resources). 2014. "Invasive Plants in Pennsylvania—Shrub Honeysuckles (Amur, Morrow's, Bells, Standish, and Tartarian [*Lonicera maackii, L. morrowii, L. x bella, L. standishii,* and *L. tatarica*])." Harrisburg, Pennsylvania. Available at http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_010229.pdf. TN2049.

PDCNR (Pennsylvania Department of Conservation and Natural Resources). 2014. "Invasive Plants in Pennsylvania—Reed Canary Grass (*Phalaris arundinacea*)." Harrisburg, Pennsylvania. Available at http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_010232.pdf. TN2050.

PDCNR (Pennsylvania Department of Conservation and Natural Resources). 2014. "Invasive Plants in Pennsylvania—Common Reed (*Phragmites australis* ssp. *australis*)." Harrisburg, Pennsylvania. Available at http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_010286.pdf. TN2051.

PDCNR (Pennsylvania Department of Conservation and Natural Resources). 2014. "Invasive Plants in Pennsylvania—Purple Loosestrife (*Lythrum salicaria*)." Harrisburg, Pennsylvania. Available at http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_010234.pdf. TN2052.

PDCNR (Pennsylvania Department of Conservation and Natural Resources). 2014. "Invasive Plants in Pennsylvania—Garlic Mustard (*Alliaria petiolata*)." Harrisburg, Pennsylvania. Available at http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_010274.pdf. TN2053.

PDCNR (Pennsylvania Department of Conservation and Natural Resources). 2014. "Invasive Plants in Pennsylvania—Japanese Stilt Grass (*Microstegium vimineum*)." Harrisburg, Pennsylvania. Available at http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_010258.pdf. TN2054.

PDCNR (Pennsylvania Department of Conservation and Natural Resources). 2014. "Invasive Plants in Pennsylvania—Multiflora Rose (*Rosa multiflora*)." Harrisburg, Pennsylvania. Available at http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_010245.pdf. TN2055.

PDCNR (Pennsylvania Department of Conservation and Natural Resources). 2014. "Beltzville State Park." Harrisburg, Pennsylvania. Available at http://www.dcnr.state.pa.us/stateparks/findapark/beltzville/index.htm. TN3517.

PDCNR (Pennsylvania Department of Conservation and Natural Resources). 2014. "Swatara State Park." Harrisburg, Pennsylvania. Available at http://www.dcnr.state.pa.us/stateparks/findapark/swatara/index.htm. TN3518.

PDCNR (Pennsylvania Department of Conservation and Natural Resources). 2014. "Susquehanna State Park." Harrisburg, Pennsylvania. Available at http://www.dcnr.state.pa.us/stateparks/findapark/susquehanna/index.htm. TN3519.

PDCNR (Pennsylvania Department of Conservation and Natural Resources). 2014. "McCalls Dam State Park." Harrisburg, Pennsylvania. Available at http://www.dcnr.state.pa.us/stateparks/findapark/mccallsdam/index.htm. TN3520.

PDCNR (Pennsylvania Department of Conservation and Natural Resources). 2014. "Scenic Rivers." Harrisburg, Pennsylvania. Available at http://www.dcnr.state.pa.us/brc/conservation/rivers/scenicrivers/index.htm. TN3829.

PDCNR (Pennsylvania Department of Conservation and Natural Resources). 2014. "Invasive Plants in Pennsylvania—Mile-a-Minute (*Persicaria perfoliata*)." Harrisburg, Pennsylvania. Available at http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_010249.pdf. TN3957.

PDCNR (Pennsylvania Department of Conservation and Natural Resources). 2014. "List of Plants and Natural Communities Potentially Affected by the Consumptive Use Mitigation Plan for the Bell Bend Nuclear Power Plant Combined License Application, Dated March 17, 2014." Harrisburg, Pennsylvania. Accession No. ML14308A199. TN3985.

PDOC (Pennsylvania Department of Corrections). 2012. "2011 County Statistics." Camp Hill, Pennsylvania. Accessed February 4, 2013, at http://www.cor.state.pa.us/portal/server.pt/community/county_prisons/20863/statistics_and_general_info_/1170613. TN2007.

PDR (Pennsylvania Department of Revenue). 2012. *The Tax Compendium October 2012.* Harrisburg, Pennsylvania. Accessed February 6, 2013, at http://www.portal.state.pa.us/portal/server.pt/community/reports_and_statistics/17303/tax_compendium/602434. TN2020.

PDR (Pennsylvania Department of Revenue). 2012. *The Statistical Supplement for the Pennsylvania Tax Compendium: Fiscal Year 2011–2012*. Harrisburg, Pennsylvania. Accessed February 4, 2013, at http://www.portal.state.pa.us/portal/server.pt/document/1288794/2011-12_stat_supp_pdf. TN2021.

Pearson, P.R. 1975. "Arborescent Composition of Woodlands on Diabase in Bucks and Montgomery Counties, Pennsylvania." *Bartonia* 44:1–7, Philadelphia, Pennsylvania. TN3851.

PEC (Pennsylvania Environmental Council). 2004. *North Branch Susquehanna River Corridor Rivers Conservation Plan*. Luzerne, Pennsylvania. Available at http://www.dcnr.state.pa.us/cs/groups/public/documents/document/D_001524.pdf. TN3979.

PennDOT (Pennsylvania Department of Transportation). 2011. "2011–2022 Twelve Year Program." Harrisburg, Pennsylvania. Accessed June 27, 2012, at ftp://ftp.dot.state.pa.us/public/pdf/TYP.pdf. TN1221.

PennDOT (Pennsylvania Department of Transportation). 2012. "2011 Traffic Volume Maps: Luzerne County." Harrisburg, Pennsylvania. Accessed February 7, 2013, at ftp://ftp.dot.state.pa.us/public/pdf/BPR_pdf_files/MAPS/Traffic/Traffic_Volume/2011/luzerne_2011_tv.pdf. TN2040.

PennDOT (Pennsylvania Department of Transportation). 2012. "2011 Traffic Volume Map: Columbia County." Harrisburg, Pennsylvania. Accessed February 7, 2013, at ftp://ftp.dot.state.pa.us/public/pdf/BPR_pdf_files/MAPS/Traffic/Traffic_Volume/2011/columbia_2011_tv.pdf. TN2041.

PennDOT (Pennsylvania Department of Transportation). 2015. *State Transportation Commission 2015 Twelve Year Program*. Harrisburg, Pennsylvania. Available at http://northwestpa.org/wp-content/uploads/2015/05/2015-TYP_NorthwestPA.pdf. TN4359.

PennDOT (Pennsylvania Department of Transportation). 2015. *2014 Pennsylvania Crash Facts & Statistics*. Harrisburg, Pennsylvania. Accession No. ML16075A225. TN4422.

Pennsylvania American Water. 2013. Email from M.P. Cross to P. Balducci, dated February 20, 2013, regarding "Water Supply Data." Wilkes-Barre, Pennsylvania. Accession No. ML14286A066. TN2223.

Pennsylvania Bureau of Topographic and Geologic Survey. 2008. "Physiographic Sections." Pennsylvania Department of Conservation and Natural Resources, Harrisburg, Pennsylvania. Accessed December 27, 2013, athttp://www.pasda.psu.edu/uci/MetadataDisplay.aspx?entry=PASDA&file=pags_physsections2008.xml&dataset=1154. TN2881.

Pennsylvania State Police. 2010. "Pennsylvania Law Enforcement Employees by Common Human Service Region, Full-Time Law Enforcement Employees 2010." Harrisburg, Pennsylvania. Accessed January 8, 2013, at http://ucr.psp.state.pa.us/UCR/Reporting/Annual/pdf2010/a181r001.pdf. TN1868.

PennWell (PennWell Corporation). 2015. "Pennsylvania Agency Issues Permit for 1,000 MW Gas-Fired Moxie Freedom Project." *GenerationHub*, September 14, 2015, Tulsa, Oklahoma. Available at http://generationhub.com/2015/09/14/pennsylvania-agency-issues-permit-for-1000-mw-gas-. TN4353.

PFBC (Pennsylvania Fish and Boat Commission). 2007. *Migratory Fish Restoration and Passage on the Susquehanna River.* Harrisburg, Pennsylvania. ML072410556. TN1700.

PFBC (Pennsylvania Fish and Boat Commission). 2009. Memo from T. Shervinskie to G. Trowbridge, dated August 26, 2009, regarding "Walker Run Stream Survey Report." Bellefonte, Pennsylvania. Accession No. ML092460788. TN503.

PFBC (Pennsylvania Fish and Boat Commission). 2009. "PFBC to Host Public Meeting on Susquehanna Smallmouth." Harrisburg, Pennsylvania. Available at http://www.outdoorcentral.com/2009/01/05/pfbc-to-host-public-meeting-on-susquehanna-smallmouth/. TN1814.

PFBC (Pennsylvania Fish and Boat Commission). 2011. *A Plan for the Management of Pennsylvania's Inland Walleye Fisheries.* Harrisburg, Pennsylvania. Available at http://fishandboat.com/walleyeplan.htm. TN2930.

PFBC (Pennsylvania Fish and Boat Commission). 2011. *Susquehanna River Management Plan: A Management Plan Focusing on the Large River Habitats of the West Branch Susquehanna and Susquehanna Rivers of Pennsylvania.* Harrisburg, Pennsylvania. Available at http://www.fish.state.pa.us/water/rivers/susquehanna/SusquehannaRiverMgmtPlan.pdf. TN3834.

PFBC (Pennsylvania Fish and Boat Commission). 2012. Letter from J. Arway to M. Krancer, dated April 4, 2012, regarding "Disease Issues Plaguing Smallmouth Bass in the Susquehanna River and its Tributaries." Harrisburg, Pennsylvania. Available at http://www.fish.state.pa.us/water/rivers/susquehanna/susq-impairment/2012_04_04_Krancer.pdf. TN1625.

PFBC (Pennsylvania Fish and Boat Commission). 2012. "Class A Wild Trout Waters." Harrisburg, Pennsylvania. Available at http://fishandboat.com/waters_trout.htm. TN1910.

PFBC (Pennsylvania Fish and Boat Commission). 2012. "Warmwater/Coolwater (All Species) Stocking Events in Northumberland County from 1991 to 2010." Harrisburg, Pennsylvania. Accessed February 6, 2012, at http://pfbc.state.pa.us/pfbc_webgis/WWCWStockingDetails_historical.aspx. TN2433.

PFBC (Pennsylvania Fish and Boat Commission). 2013. "Susquehanna River American Shad." Harrisburg, Pennsylvania. Available at http://www.fish.state.pa.us/shad_susq.htm. TN2931.

PFBC (Pennsylvania Fish and Boat Commission). 2013. "Fish Habitat Improvement Plan for Cowanesque Lake, Tioga County [Map]." Harrisburg, Pennsylvania. Available at http://fishandboat.com/water/habitat/mgmt_plans/lake/cowanesque.pdf. TN3423.

PFBC (Pennsylvania Fish and Boat Commission). 2014. "Susquehanna River Trail." Harrisburg, Pennsylvania. Available at http://www.fishandboat.com/watertrails/susqmid/trailguide.htm. TN3184.

PFBC (Pennsylvania Fish and Boat Commission). 2014. *2014 Pennsylvania Fishing Summary—Summary of Fishing Regulations and Laws*. Harrisburg, Pennsylvania. Accessed April 16, 2014, at http://fishandboat.com/fishpub/summaryad/z2014complete.pdf. TN3403.

PFBC (Pennsylvania Fish and Boat Commission). 2014. "Historical WW/CW Species Stocking by County: Tioga County." Harrisburg, Pennsylvania. Available at http://fbweb.pa.gov/stocking/WWCWStockingDetailsHistorical_RFP.aspx. TN3421.

PFBC (Pennsylvania Fish and Boat Commission). 2014. *Fish Consumption Advisory: Commonwealth of Pennsylvania Public Health Advisory—2014 Fish Consumption.* Harrisburg, Pennsylvania. Available at http://fishandboat.com/fishpub/summary/sumconsumption.pdf. TN3422.

PFBC (Pennsylvania Fish and Boat Commission). 2014. "Historical WW/CW Species Stocking by County—Bradford, Centre, Clearfield, Clinton, Columbia, Cumberland, Dauphin, Lackawanna, Lancaster, Luzerne, Lycoming, Montour, Northumberland, Perry, Snyder, Tioga, Union, Wyoming, and York Counties, Pennsylvania." Harrisburg, Pennsylvania. Available at http://fbweb.pa.gov/stocking/WWCWStockingDetailsHistorical_RFP.aspx. TN3468.

PFBC (Pennsylvania Fish and Boat Commission). 2014. "Adult Trout Stocking by County—Centre, Clearfield, Columbia, Luzerne, Montour, Northumberland, and Tioga Counties." Harrisburg, Pennsylvania. Available at http://fbweb.pa.gov/stocking/TroutStockingDetails_GIS.aspx. TN3471.

PFBC (Pennsylvania Fish and Boat Commission). 2014. "Pennsylvania Stream Sections that support Natural Reproduction of Trout." Harrisburg, Pennsylvania. Available at http://fishandboat.com/trout_repro.htm. TN3827.

PFBC (Pennsylvania Fish and Boat Commission). 2014. "Pennsylvania Native Reptile and Amphibian Species." Harrisburg, Pennsylvania. Available at http://www.fish.state.pa.us/water/amprep/native.htm. TN3869.

PFBC (Pennsylvania Fish and Boat Commission). 2014. Letter From C.A. Urban to Pacific Northwest National Laboratory, dated October 8, 2014, regarding "Species Impact Review (SIR)—Rare, Candidate, Threatened, and Endangered Species, Bell Bend Nuclear Power Plant Project—Bell Bend, Humboldt, Seedco, and Montour Sites, Pennsylvania." SIR # 43172, Bellefonte, Pennsylvania. Accession No. ML16075A226. TN4430.

PFBC (Pennsylvania Fish and Boat Commission). 2015. Email from M. Hartle to NRC, dated July 7, 2015, regarding "Draft EIS for Combined License at the Bell Bend Nuclear Power Plant—Pennsylvania Fish and Boat Commission Comments." Bellefonte, Pennsylvania. Accession No. ML15204A772. TN4396.

PGC (Pennsylvania Game Commission). 2009. *2009–2014 Strategic Plan*. Harrisburg, Pennsylvania. Accessed February 16, 2014, at http://www.portal.state.pa.us/portal/server.pt/document/737229/2009-2014_strategic_plan_pdf. TN3185.

PGC (Pennsylvania Game Commission). 2012. "State Game Lands." Harrisburg, Pennsylvania. Available at http://www.portal.state.pa.us/portal/server.pt/community/state_game_lands/. TN1223.

PGC (Pennsylvania Game Commission). 2012. Letter from O.A. Mowery to NRC, dated October 18, 2012, regarding "Bell Bend Nuclear Power Plant (BBNPP) Project—Request for Consultation and Participation in the Supplemental Scoping Process and Preliminary Screening of Alternate Locations: BBNPP Site—Salem Township, Luzerne County, Pennsylvania." Harrisburg, Pennsylvania. Accession No. ML12311A157. TN3864.

PGC (Pennsylvania Game Commission). 2012. Letter from O.A. Mowery to NRC, dated October 18, 2012, regarding "Bell Bend Nuclear Power Plant (BBNPP) Project—Request for Consultation and Participation in the Supplemental Scoping Process and Preliminary Screening of Alternate Locations: Montour Site, Derry Township, Montour County, Pennsylvania." Harrisburg, Pennsylvania. Accession No. ML12311A158. TN3901.

PGC (Pennsylvania Game Commission). 2013. "Threatened and Endangered Species." Harrisburg, Pennsylvania. Accessed September 17, 2014, at https://www.portal.state.pa.us/portal/server.pt?open=514&objID=621014&mode=2. TN3845.

PGC (Pennsylvania Game Commission). 2014. Letter from J. Taucher to NRC, dated March 18, 2014, regarding "Bell Bend Nuclear Power Plant Water Consumptive Use Mitigation—Nuclear Energy Clearfield, Centre, Clinton, Lycoming, Northumberland, Dauphin, Lancaster, Montour, Columbia, Luzerne, Lackawanna, Wyoming, Bradford and Tioga Counties, PA." Harrisburg, Pennsylvania. Accession No. ML14125A170. TN4180.

PGC and PFBC (Pennsylvania Game Commission and Pennsylvania Fish and Boat Commission). 2005. *Pennsylvania Comprehensive Wildlife Conservation Strategy*. Version 1.0, Harrisburg, Pennsylvania. Available at https://www.fish.state.pa.us/promo/grants/swg/nongame_plan/pa_wap_complete.pdf. TN3815.

PHMC (Pennsylvania Historical and Museum Commission). 2009. Letter from D.C. McLearen to UniStar Nuclear Energy, dated March 2, 2009, regarding "ER# 81–0658–079–N, Management Summary, Phase Ib Cultural Resources Investigation, Bell Bend Nuclear Power Plant, Salem Township, Luzerne County, Pennsylvania." Harrisburg, Pennsylvania. Accession No. ML090720932. TN2892.

PHMC (Pennsylvania Historical and Museum Commission). 2010. Letter from A.L. MacDonald to GAI Consultants, Inc., dated March 17, 2012, regarding "ER 81–0658–079–U, NRC: Bell Bend Power Plant Phase 1B Investigation Management Summary: Historic Resources Conyngham, Nescopeck, Salem Townships, Luzerne County." Harrisburg, Pennsylvania. Accession No. ML14308A203. TN3702.

PHMC (Pennsylvania Historical and Museum Commission). 2011. Letter from A.L. MacDonald to PPL Bell Bend, LLC, dated August 23, 2011, regarding "ER# 81–0658–079–BB, NRC: Phase I Cultural Resources Investigation and Phase II National Register Site Evaluations, Bell Bend Nuclear Power Plant, Salem Township, Luzerne County, Pennsylvania." Harrisburg, Pennsylvania. Accession No. ML11256A035. TN1728.

PHMC (Pennsylvania Historical and Museum Commission). 2011. Letter from A.L. MacDonald to GAI Consultants, Inc., dated October 5, 2011, regarding "ER#81–0658–079–GG, NRC: Bell Bend Nuclear Power Plant Expansion Project, Wapwallopen Field View, Conyngham Township, Luzerne County." Harrisburg, Pennsylvania. Accession No. ML11298A113. TN1756.

PHMC (Pennsylvania Historical and Museum Commission). 2011. Letter from D.C. McLearen to PPL Bell Bend, LLC, dated May 20, 2011, regarding "ER# 81–0658–079–CC, Addendum Report, Second Supplemental Phase IB Cultural Resource Investigation, Power Block Relocation, Bell Bend Nuclear Power Plant, Salem Township, Luzerne County, Pennsylvania." Harrisburg, Pennsylvania. Accession No. ML11174A200. TN3704.

PHMC (Pennsylvania Historical and Museum Commission). 2012. Letter from D.C. McLearen to PPL Bell Bend, LLC, dated August 20, 2012, regarding "ER# 81–0658–079–HH Addendum Report, Third Supplemental Phase I Archaeological Survey, Salem Township, Luzerne County, Pennsylvania." Harrisburg, Pennsylvania. Accession No. ML12243A347. TN1729.

PHMC (Pennsylvania Historical and Museum Commission). 2012. Letter from D.C. McLearen to PPL Bell Bend, LLC, dated September 6, 2012, regarding "ER# 81–0658–079–II, Phase II Archaeological Investigation of Site 36Lu301. Bell Bend Nuclear Power Plant, Salem Township, Luzerne County, Pennsylvania." Harrisburg, Pennsylvania. Accession No. ML122510205. TN1730.

PHMC (Pennsylvania Historical and Museum Commission). 2013. Letter from D.C. McClearen to U.S. Army Corps of Engineers, dated February 13, 2013, regarding "ER# 81–0658–079–TT, Bell Bend Nuclear Power Plant, Salem Township, Luzerne County, Pennsylvania." Harrisburg, Pennsylvania. Accession No. ML13056A020. TN2237.

PHMC (Pennsylvania Historical and Museum Commission). 2014. "Overview of Pennsylvania History." Harrisburg, Pennsylvania. Accessed October 10, 2014, at http://www.portal.state.pa.us/portal/server.pt/community/overview_of_pennsylvania_history/4281. TN3938.

PJM (PJM Interconnection). 2007. *PJM Load Forecast Report—January 2007*. Norristown, Pennsylvania. Available at http://www.pjm.com/planning/resource-adequacy-planning/load-forecast-dev-process/prev-load-reports.aspx. TN1554.

PJM (PJM Interconnection). 2012. "Company Overview." Norristown, Pennsylvania. Available at http://www.pjm.com/about-pjm.aspx. TN1541.

PJM (PJM Interconnection). 2012. *PJM Load Forecast Report—January 2012*. Norristown, Pennsylvania. Available at http://www.pjm.com/planning/resource-adequacy-planning/~/media/documents/reports/2012-pjm-load-report.ashx. TN1549.

PJM (PJM Interconnection). 2014. *PJM Load Forecast Report—January 2014*. Norristown, Pennsylvania. Available at http://www.pjm.com/planning/resource-adequacy-planning/load-forecast-dev-process.aspx. TN3105.

PJM (PJM Interconnection). 2014. "Generator Deactivation Summary Sheets." Norristown, Pennsylvania. Available at http://www.pjm.com/planning/generation-deactivation/gd-summaries.aspx. TN3961.

PLTA (Pennsylvania Land Trust Association). 2014. "Important Bird Areas." Harrisburg, Pennsylvania. Available at http://conservationtools.org/guides/show/32-Important-Bird-Areas. TN3977.

PNHP (Pennsylvania Natural Heritage Program). 2006. *A Natural Areas Inventory Luzerne County, Pennsylvania, Update—2006.* Western Pennsylvania Conservancy, Middletown, Pennsylvania. Available at http://www.naturalheritage.state.pa.us/CNAI_PDFs/Luzerne%20County%20NAI%202006%20WEB.pdf. TN1570.

PNHP (Pennsylvania Natural Heritage Program). 2007. "Brook Stickleback (*Culaea inconstans*)—Freshwater Fish Species of Concern Fact Sheet." Harrisburg, Pennsylvania. Accession No. ML14308A204. TN1619.

PNHP (Pennsylvania Natural Heritage Program). 2012. *Freshwater Mussel Species of Concern Facts Sheets*. Harrisburg, Pennsylvania. Accession No. ML14286A062. TN647.

PNHP (Pennsylvania Natural Heritage Program). 2012. *Eastern Mudminnow (Umbra pygmaea).* Harrisburg, Pennsylvania. Accession No. ML14286A063. TN694.

PNHP (Pennsylvania Natural Heritage Program). 2013. "Species of Special Concern Lists: Reptiles and Amphibians, Fish, Mammals, Insects and Spiders, Mussels and Snails, and Plants for Luzerne, Columbia, Montour and Northumberland Counties." Harrisburg, Pennsylvania. Accession No. ML15043A631. TN1777.

PNHP (Pennsylvania Natural Heritage Program). 2013. Email from N. Dewar to NRC, dated May 20, 2013, regarding "Request for Species for the Bell Bend DEIS." Harrisburg, Pennsylvania. Accession No. ML13225A356. TN3900.

PNHP (Pennsylvania Natural Heritage Program). 2014. "Brook Floater (*Alasmidonta varicose*)—Freshwater Mussel Species of Concern Factsheet." Harrisburg, Pennsylvania. Available at http://www.naturalheritage.state.pa.us/factsheets/12195.pdf. TN3950.

PNHP (Pennsylvania Natural Heritage Program). 2014. "PHNP Species Lists: Centre County Plants." Harrisburg, Pennsylvania. Available at http://www.naturalheritage.state.pa.us/Species.aspx. TN3972.

PNHP (Pennsylvania Natural Heritage Program). 2014. "PNHP Species Lists: Luzerne County Reptiles and Amphibians." Harrisburg, Pennsylvania. Available at http://www.naturalheritage.state.pa.us/Species.aspx. TN3974.

PNHP (Pennsylvania Natural Heritage Program). 2014. "Rank and Status Definitions." Harrisburg, Pennsylvania. Available at http://www.naturalheritage.state.pa.us/RankStatusDef.aspx. TN3975.

PNHP (Pennsylvania Natural Heritage Program). 2014. "PNHP Species Lists: Pennsylvania Birds." Harrisburg, Pennsylvania. Available at http://www.naturalheritage.state.pa.us/Species.aspx. TN3978.

PHNP (Pennsylvania Natural Heritage Program). 2014. "County Natural Heritage Inventories." Harrisburg, Pennsylvania. Available at http://www.naturalheritage.state.pa.us/CNHI.aspx. TN4013.

PNHP (Pennsylvania Natural Heritage Program). 2015. "PNHP Species Lists: Luzerne County Plants." Harrisburg, Pennsylvania. Available at http://www.naturalheritage.state.pa.us/Species.aspx. TN4410.

PNHP (Pennsylvania Natural Heritage Program). 2015. "PNHP Species Lists: Tioga County Plants." Harrisburg, Pennsylvania. Available at http://www.naturalheritage.state.pa.us/Species.aspx. TN4411.

PNHP (Pennsylvania Natural Heritage Program). 2015. "PNHP Species Lists." Harrisburg, Pennsylvania. Available at http://www.naturalheritage.state.pa.us/species.aspx. TN4431.

PNNL (Pacific Northwest National Laboratory). 2009. *Bell Bend Alternative Sites Trip Report March 30–April 3, 2009*. Richland, Washington. Accession No. ML14286A086. TN3667.

PNNL (Pacific Northwest National Laboratory). 2013. Letter from J. Becker to New York Natural Heritage Program, dated December 19, 2013, regarding "Request for Federally Listed Species and Critical Habitats, State-Listed Species, and State-Ranked Species and Communities for the Environmental Review of the Consumptive Use Mitigation Plan for the Bell Bend Nuclear Power Plant Combined License Application." Richland, Washington. Accession No. ML14302A662. TN3984.

PNNL (Pacific Northwest National Laboratory). 2014. Letter from J. Becker to Pennsylvania Department of Conservation and Natural Resources, dated January 29, 2014, regarding "PNDI Review Request for the Consumptive Use Mitigation Plan for the Bell Bend Nuclear Power Plant Combined License Application." Richland, Washington. Accession No. ML14302A663. TN3983.

Pocono Raceway. 2012. *Pocono Raceway 2012 Fan Guide.* Long Pond, Pennsylvania. Accessed January 29, 2013, at http://www.poconoraceway.com/wp-content/uploads/2012/01/PoconoRaceway-Fan-Guide-2012.pdf. TN1896.

Power Technology. 2010. "Roscoe Wind Farm, United States of America." London, United Kingdom. Available at http://www.power-technology.com/projects/roscoe-wind-farm. TN2112.

PPF (Panda Power Funds). 2013. "Panda Liberty Power Project." Dallas Texas. Available at http://www.pandafunds.com/invest/liberty/. TN3373.

PPF (Panda Power Funds). 2013. "Panda Power Funds Finances Second Pennsylvania Power Project." Dallas, Texas. Available at http://pandafunds.newshq.businesswire.com/press-release/panda-power-funds-finances-second-pennsylvania-power-project. TN3374.

PPL (Pennsylvania Power & Light Company). 1971. *Susquehanna Steam Electric Station Units 1 and 2: Applicant's Environmental Report—Construction Permit Stage*. Allentown, Pennsylvania. Available at the NRC Public Legacy Library. TN4038.

PPL (Pennsylvania Power & Light Company). 1978. *Susquehanna Steam Electric Station Environmental Report Operating License Stage*. Allentown, Pennsylvania. Available at the NRC Legacy Library. TN4036.

PPL (PPL Electric Utilities). 2015. "*PPL Electric Utilities Completes Susquehanna-Roseland Transmission Line*." Allentown, Pennsylvania. Accessed November 4, 2015, at http://pplweb.mediaroom.com/index.php?s=12270&item=137149. TN4263.

PPL Bell Bend (PPL Bell Bend, LLC). 2008. Letter from T.L. Harpster to NRC, dated October 10, 2008, regarding "Application for Combined License for the Bell Bend Nuclear Power Plant." BNP–2008–002, Berwick, Pennsylvania. Accession No. ML082880580. TN393.

PPL Bell Bend (PPL Bell Bend, LLC). 2008. *Bell Bend Nuclear Power Plant Combined License Application Part 2: Final Safety Analysis Report*. Revision 0, UniStar Nuclear Services, LLC, Baltimore, Maryland. Accession No. ML082890663. TN395.

PPL Bell Bend (PPL Bell Bend, LLC). 2008. *Bell Bend Nuclear Power Plant Combined License Application Part 3: Environmental Report*. Revision 0, UniStar Nuclear Services, LLC, Baltimore, Maryland. Accession No. ML082890680. TN396.

PPL Bell Bend (PPL Bell Bend, LLC). 2008. *Bell Bend Nuclear Power Plant Combined License Application Part 5: Emergency Plan*. Revision 0, UniStar Nuclear Services, LLC, Baltimore, Maryland. Accession No. ML082890723. TN398.

PPL Bell Bend (PPL Bell Bend, LLC). 2009. Letter from R.R. Sgarro to NRC, dated February 27, 2009, regarding "Bell Bend Nuclear Power Plant, Submittal of Bell Bend COLA, Revision 1." BNP–2009–035, Berwick, Pennsylvania. Accession No. ML090710441. TN432.

PPL Bell Bend (PPL Bell Bend, LLC). 2009. Letter from R.R. Sgarro to NRC, dated August 10, 2009, regarding "Bell Bend Nuclear Power Plant Response to Environmental Requests for Additional Information, Second Submittal." BNP–2009–217, Berwick, Pennsylvania. Accession No. ML09225656. TN1563.

PPL Bell Bend (PPL Bell Bend, LLC). 2009. Letter from R.R. Sgarro to NRC, dated October 19, 2009, regarding "Bell Bend Nuclear Power Plant Response to Environmental Requests for Additional Information, Sixth Submittal." BNP–2009–313, Berwick, Pennsylvania. Accession No. ML093270270. TN1872.

PPL Bell Bend (PPL Bell Bend, LCC). 2009. Letter from R.R. Sgarro to NRC, dated June, 4, 2009, regarding "Bell Bend Nuclear Power Plant Response to RAI Set No. 3." BNP–2009–097, Docket No. 52-039, Berwick, Pennsylvania. Accession No. ML091620642. TN2103.

PPL Bell Bend (PPL Bell Bend, LLC). 2010. Letter from R.R. Sgarro to NRC, dated February 12, 2010, regarding "Bell Bend Nuclear Power Plant Submittal of Bell Bend COLA, Revision 2." BNP–2010–040, Berwick, Pennsylvania. Accession No. ML101880709. TN3616.

PPL Bell Bend (PPL Bell Bend, LLC). 2010. Letter from R.R. Sgarro to NRC, dated October 7, 2010, regarding "Bell Bend Nuclear Power Plant Partial Response to Environmental Requests for Additional Information 5022, 5024, and 5043 and Schedule Information." BNP–2010–251, Berwick, Pennsylvania. Accession No. ML102880145. TN3642.

PPL Bell Bend (PPL Bell Bend, LLC). 2010. Letter from R.R. Sgarro to NRC, dated July 9, 2010, regarding "Bell Bend Nuclear Power Plant Response to Environmental Information Needs, First Submittal." BNP–2010–167, Berwick, Pennsylvania. Accession No. ML101930519. TN3643.

PPL Bell Bend (PPL Bell Bend, LLC). 2010. *Bell Bend Nuclear Power Plant Stream and Wetland Mitigation Design Report, Walker Run Site, Salem Township, Luzerne County, Pennsylvania*. Revision 0, Berwick, Pennsylvania. Accession No. ML12193A031. TN3884.

PPL Bell Bend (PPL Bell Bend, LLC). 2011. Letter from T.L. Harper to Susquehanna River Basin Commission, dated January 14, 2011, regarding "Bell Bend Nuclear Power Plant Application for Surface Water Withdrawal, Application for Consumptive Water Use." BNP–2011–005, Berwick, Pennsylvania. Accession No. ML110410619. TN3627.

PPL Bell Bend (PPL Bell Bend, LLC). 2011. Letter from T.L. Harpster to U.S. Army Corps of Engineers Baltimore District, dated October 25, 2011, regarding "Bell Bend Nuclear Power Plant, Additional Wetlands Within the Revised Project Boundary." Third Preliminary Jurisdictional Determination, BNP–2011–179, Berwick, Pennsylvania. Accession No. ML12192A258. TN3818.

PPL Bell Bend (PPL Bell Bend, LLC). 2011. Letter from R.R. Sgarro to NRC, dated September 23, 2011, regarding "Bell Bend Nuclear Power Plant Final Response to Environmental Requests for Additional Information 5022, 5026, 5033, 5034, 5035, 5036, 5042, and 5043." BNP–2011–177, Berwick, Pennsylvania. Accession No. ML11286A242. TN4010.

PPL Bell Bend (PPL Bell Bend, LLC). 2012. *Bell Bend Nuclear Power Plant Combined License Application Part 3: Environmental Report*. Revision 3, UniStar Nuclear Services, LLC, Baltimore, Maryland. Accession No. ML12145A242. TN1169.

PPL Bell Bend (PPL Bell Bend, LLC). 2012. Letter from R.R. Sgarro to NRC, dated June 7, 2012, regarding "Bell Bend Nuclear Power Plant Environmental Audit Need for Informational Responses: Second Submittal." BNP–2012–139, Allentown, Pennsylvania. Accession No. ML12166A271. TN1171.

PPL Bell Bend (PPL Bell Bend, LLC). 2012. Letter from R.R. Sgarro to NRC, dated May 31, 2012, regarding "Bell Bend Nuclear Power Plant Environmental Audit Need for Informational Responses: First Submittal." BNP–2012–131, Allentown, Pennsylvania. Accession No. ML121580599. TN1173.

PPL Bell Bend (PPL Bell Bend, LLC). 2012. Letter from R.R. Sgarro to NRC, dated July 12, 2012, regarding "Bell Bend Nuclear Power Plant Environmental Audit Need for Informational Responses: Sixth Submittal." BNP–2012–167, Allentown, Pennsylvania. Accession No. ML12214A589. TN1346.

PPL Bell Bend (PPL Bell Bend, LLC). 2012. Letter from R.R. Sgarro to NRC, dated June 28, 2012, regarding "Bell Bend Nuclear Power Plant Environmental Audit Need for Informational Responses: Fifth Submittal." BNP–2012–159, Allentown, Pennsylvania. Accession No. ML12193A153. TN1347.

PPL Bell Bend (PPL Bell Bend, LLC). 2012. Letter from R.R. Sgarro to NRC, dated June 21, 2012, regarding "Bell Bend Nuclear Power Plant Environmental Audit Need for Informational Responses: Fourth Submittal." BNP–2012–151, Allentown, Pennsylvania. Accession No. ML12187A026. TN1348.

PPL Bell Bend (PPL Bell Bend, LLC). 2012. Letter from R.R. Sgarro to NRC, dated September 24, 2012, regarding "Bell Bend Nuclear Power Plant Response to RAI No. 115, Questions 09.02.05-18 Through 09.02.05-26, 09.02.05-30, and 09.02.05-31." BNP–2012–247, Docket No. 52-039. Allentown, Pennsylvania. Accession No. ML12278A007. TN1529.

PPL Bell Bend (PPL Bell Bend, LLC). 2012. Letter from R.R. Sgarro to NRC, dated August 29, 2012, regarding "Bell Bend Nuclear Power Plant Response to Draft ER RAIs: Third Submittal." BNP–2012–208, Allentown, Pennsylvania. Accession No. ML12261A478. TN1532.

PPL Bell Bend (PPL Bell Bend, LLC). 2012. Letter from R.R. Sgarro to NRC, dated August 31, 2012, regarding "Bell Bend Nuclear Power Plant Response to Draft ER RAIs: Fourth Submittal." BNP–2012–211, Allentown, Pennsylvania. Accession No. ML12256A004. TN1533.

PPL Bell Bend (PPL Bell Bend, LLC). 2012. Email from R.R. Sgarro to NRC, dated September 14, 2012, regarding "Dodson Marker." Allentown, Pennsylvania. Accession No. ML12262A003. TN1737.

PPL Bell Bend (PPL Bell Bend, LLC). 2012. *Cultural Resources Protection Plan*. PPL Bell Bend Procedure RA-0106, Revision 0, Allentown, Pennsylvania. Accession No. ML12179A369. TN1757.

PPL Bell Bend (PPL Bell Bend, LLC). 2012. Letter from R.R. Sgarro to NRC, dated January 20, 2012, regarding "Revised Response to Environmental Request for Additional Information MET 2.7-1." BNP–2012–025, Allentown, Pennsylvania. Accession No. ML120310490. TN2838.

PPL Bell Bend (PPL Bell Bend, LLC). 2012. Letter from R.R. Sgarro to NRC, dated March 14, 2012, regarding "Revised Response to Environmental Request for Additional Information MET 2.7-1: Air Conformity Report, Revision 2." BNP–2012–050, Allentown, Pennsylvania. Accession No. ML120820274. TN2839.

PPL Bell Bend (PPL Bell Bend, LLC). 2012. Letter from R.R. Sgarro to NRC, dated March 30, 2012, regarding "Bell Bend Nuclear Power Plant Submittal of Bell Bend COLA, Revision 3." BNP–2012–089, Allentown, Pennsylvania. Accession No. ML12118A360. TN3617.

PPL Bell Bend (PPL Bell Bend, LLC). 2012. Letter from R. Sgarro to NRC, dated November 15, 2012, regarding "Bell Bend Nuclear Power Plant Response to RAI 118 Question 02.05.02-1." BNP–2012–270, Allentown, Pennsylvania. Accession No. ML12333A043. TN3794.

PPL Bell Bend (PPL Bell Bend, LLC). 2013. Letter from R.R. Sgarro to NRC, dated April 12, 2013, regarding "Bell Bend Nuclear Power Plant, Submittal of Bell Bend COLA Revision 4." BNP–2013–050, Allentown, Pennsylvania. Accession No. ML13120A306. TN2625.

PPL Bell Bend (PPL Bell Bend, LLC). 2013. *Bell Bend Nuclear Power Plant Combined License Application Part 3: Environmental Report*. Revision 4, UniStar Nuclear Services, LLC, Baltimore, Maryland. Accession No. ML13120A411. TN3377.

PPL Bell Bend (PPL Bell Bend, LLC). 2013. *Bell Bend Nuclear Power Plant Combined License Application Part 2: Final Safety Analysis Report*. Revision 4, UniStar Nuclear Services, LLC, Baltimore, Maryland. Accession No. ML13120A374. TN3447.

PPL Bell Bend (PPL Bell Bend, LLC). 2013. Letter from R.R. Sgarro to NRC, dated October 21, 2013, regarding "Bell Bend Nuclear Power Plant Revised Redacted Response to RAI ENV-19." BNP–2013–142, Allentown, Pennsylvania. Accession No. ML13304B419. TN3541.

PPL Bell Bend (PPL Bell Bend, LLC). 2013. Letter from R.R. Sgarro to NRC, dated February 1, 2013, regarding "Bell Bend Nuclear Power Plant Response to ER RAIs ENV-22 and ENV-23." BNP–2013–016, Allentown, Pennsylvania. Accession No. ML13045A420. TN3545.

PPL Bell Bend (PPL Bell Bend, LLC). 2014. Letter from R.R. Sgarro to NRC, dated March 4, 2014, regarding "Bell Bend Nuclear Power Plant Response to RAIs ENV-28 and ENV-29." BNP–2014–022, Allentown, Pennsylvania. Accession No. ML14105A030. TN3494.

PPL Bell Bend (PPL Bell Bend, LLC). 2014. Letter from R.R. Sgarro to NRC, dated February 27, 2014, regarding "Bell Bend Nuclear Power Plant Response to RAI ENV-27." BNP–2014–020, Allentown, Pennsylvania. Accession No. ML14073A505. TN3536.

PPL Bell Bend (PPL Bell Bend, LLC). 2014. Letter from R.R. Sgarro to NRC, dated April 10, 2014, regarding "Bell Bend Nuclear Power Plant Responses to March 2014 Environmental Audit Questions." BNP–2014–030, Allentown, Pennsylvania. Accession No. ML14118A041. TN3537.

PPL Bell Bend (PPL Bell Bend, LLC). 2014. Letter from R.R. Sgarro to NRC, dated May 29, 2014, regarding "Bell Bend Nuclear Power Plant Supplemental Environmental Information." BNP–2014–079, Allentown, Pennsylvania. Accession No. ML14188B429. TN3539.

PPL Bell Bend (PPL Bell Bend, LLC). 2014. Letter from R.R. Sgarro to NRC, dated May 2, 2014, regarding "Bell Bend Nuclear Power Plant Response to NRC Questions on BBNPP Schedule Milestones and Self-Scheduling." BNP–2014–070, Allentown, Pennsylvania. Accession No. ML14308A206. TN3625.

PPL Bell Bend (PPL Bell Bend, LLC). 2014. Letter from R.R. Sgarro to NRC, dated January 27, 2014, regarding "Bell Bend Nuclear Power Plant Initial Response to RAIs ENV-24 and ENV-25." BNP–2014–009, Allentown, Pennsylvania. Accession No. ML14052A083. TN3644.

PPL Bell Bend (PPL Bell Bend, LLC). 2014. Letter from R.R. Sgarro to NRC, dated April 17, 2014, regarding "Bell Bend Nuclear Power Plant Supplemental Response to RAI ENV-28, Question 7318." BNP–2014–065, Allentown, Pennsylvania. Accession No. ML14119A241. TN3652.

PPL Bell Bend (PPL Bell Bend, LLC). 2014. Letter from R. Sgarro to NRC, dated March 25, 2014, regarding "Bell Bend Nuclear Power Plant Response to ER RAI ENV-26 and Revised Schedule Information." BNP–2014–002, Allentown, Pennsylvania. Accession No. ML14098A246. TN3724.

PPL Bell Bend (PPL Bell Bend, LLC). 2014. Letter from R.R. Sgarro to NRC, dated August 14, 2014, regarding "Bell Bend Nuclear Power Plant Correction of Surface Water Data." BNP–2014–101, Allentown, Pennsylvania. Accession No. ML14241A468. TN3748.

PPL Bell Bend (PPL Bell Bend, LLC). 2014. Letter from R.R. Sgarro to Pennsylvania Department of Environmental Protection and U.S. Army Corps of Engineers Baltimore District, dated March 4, 2014, regarding "Bell Bend Nuclear Power Plant Joint Permit Application and Request for Water Quality Certification, Rev 1, Erratum." BNP–2014–023, Allentown, Pennsylvania. Accession No. ML14091A330. TN3865.

PPL Bell Bend (PPL Bell Bend, LLC). 2014. Letter from R.R. Sgarro to NRC, dated January 9, 2014, regarding "Bell Bend Nuclear Power Plant Interim Safety Review Guidance." BNP–2014–005, Docket No 52-039, Allentown, Pennsylvania. Accession No. ML14030A074. TN4380.

PPL Bell Bend (PPL Bell Bend, LLC). 2015. Letter from R.R. Sgarro to NRC, dated May 12, 2015, regarding "Bell Bend Nuclear Power Plant Name Changes Due to Spinoff Transaction." BNP–2015–028, Docket No. 52-039, Allentown, Pennsylvania. Accession No. ML15146A095. TN4379.

PPL Corporation. 2004. "PPL Preserves—Susquehanna Riverlands." Allentown, Pennsylvania. Accession No. ML080220456. TN3976.

PPL Corporation. 2010. "Recreation Area: Lake Took-A-While." Berwick, Pennsylvania. Accessed May 5, 2010, at http://www.pplweb.com/susquehanna+riverlands/things+to+do/lake+took+a+while.htm. TN1916.

PPL Corporation Environmental Preserves. 2012. *Stocking Lake Took-A-While.* Allentown, Pennsylvania. Accession No. ML14286A064. TN695.

PPL Generation. 2014. "PPL Montour, At a Glance." Allentown, Pennsylvania. Accessed February 17, 2014, at http://www.pplweb.com/ppl-generation/ppl-montour/ppl-montour-plant-fact-sheet.aspx. TN3194.

PPL Nuclear Development (PPL Nuclear Development, LLC). 2011. *PPL Bell Bend Nuclear Power Plant, Salem Township, Luzerne County, Pennsylvania, Joint Permit Application, Revision 1, Binder 1B, Section J—Environmental Assessment Part 1—Resource Identification, Enclosure C—Description of Aquatic Habitat.* Allentown, Pennsylvania. Accession No. ML12192A262. TN1824.

PPL Nuclear Development (PPL Nuclear Development, LLC). 2011. *Bell Bend Nuclear Power Plant, Salem Township, Luzerne County, Pennsylvania, Joint Permit Application, Revision 1, Binder 2, Appendix A—Item 20, ACOE Information Requirement Response.* Revision 1, Allentown, Pennsylvania. Accession No. ML12194A100. TN1905.

PPL Nuclear Development (PPL Nuclear Development, LLC). 2011. *PPL Bell Bend Nuclear Power Plant, Salem Township, Luzerne County, Pennsylvania, Joint Permit Application, Revision 1, Binder 1B, Section J—Environmental Assessment Part 2—Project Description, Enclosure D—Project Impacts*. Allentown, Pennsylvania. Accession Nos. ML12192A263, ML12192A264, ML12192A265. TN1906.

PPL Nuclear Development (PPL Nuclear Development, LLC). 2011. *Bell Bend Nuclear Power Plant Salem Township, Luzerne County, Pennsylvania, Joint Permit Application, Revision 1, Binder 1C, Section R—Construction Dewatering Mitigation Plan*. Allentown, Pennsylvania. Accession No. ML121930038. TN1952.

PPL Nuclear Development (PPL Nuclear Development, LLC). 2011. *Bell Bend Nuclear Power Plant Salem Township, Luzerne County, Pennsylvania, Joint Permit Application, Revision 1, Binder 1C, Section R.1—Mitigation Narrative.* Allentown, Pennsylvania. Accession No. ML12193A029. TN2238.

PPL Nuclear Development (PPL Nuclear Development, LLC). 2011. *PPL Bell Bend Nuclear Power Plant, Salem Township, Luzerne County, Pennsylvania, Joint Permit Application, Revision 1, Section M—Stormwater Management Analysis.* Allentown, Pennsylvania. Accession No. ML12213A264. TN2254.

PPL Nuclear Development (PPL Nuclear Development, LLC). 2011. *PPL Bell Bend Nuclear Power Plant, Luzerne County, Salem Township, Pennsylvania, Joint Permit Application, Revision 1.* Allentown, Pennsylvania. Accession No. ML13057A754. TN2274.

PPL Nuclear Development (PPL Nuclear Development, LLC). 2011. *Bell Bend Nuclear Power Plant Joint Permit Application, Appendix A—Item 2*. Allentown, Pennsylvania. Accession No. ML12194A077. TN3866.

PPL Nuclear Development (PPL Nuclear Development, LLC). 2011. *PPL Bell Bend Nuclear Power Plant, Salem Township, Luzerne County, Pennsylvania, Joint Permit Application, Revision 1, Binder 1, Section H—Project Description.* Allentown, Pennsylvania. Accession No. ML12213A285. TN3870.

PPL Nuclear Development (PPL Nuclear Development, LLC). 2011. *Bell Bend Nuclear Power Plant Joint Permit Application, Appendix A—Item 32*. Allentown, Pennsylvania. Accession No. ML12194A095. TN3887.

PPL Nuclear Development (PPL Nuclear Development, LLC). 2013. Letter from G. Petrewski to U.S. Army Corps of Engineers Baltimore District, dated August 19, 2013, regarding "Bell Bend Nuclear Power Plant Supplemental Information, Walker Run Mitigation Plan." BNP–2013–114, Allentown, Pennsylvania. Accession No. ML13240A159. TN3540.

PPL Nuclear Development (PPL Nuclear Development, LLC). 2013. Letter from G. Petrewski to U.S. Army Corps of Engineers Baltimore District, dated June 10, 2013, regarding "Bell Bend Nuclear Power Plant Air Conformity Analysis for Emissions Related to ACOE Activities." BNP–2013–067, Allentown, Pennsylvania. Accession No. ML13165A073. TN3902.

PPL Susquehanna (PPL Susquehanna, LLC). 2007. *Susquehanna Steam Electric Station Units 1 and 2 Radioactive Effluent Release Report—2006 Annual Report.* Berwick, Pennsylvania. Accession No. ML071290153. TN753.

PPL Susquehanna (PPL Susquehanna, LLC). 2009. *Susquehanna Steam Electric Station Units 1 and 2, 2008 Annual Report—Annual Radiological Environmental Operating Report.* Berwick, Pennsylvania. Accession No. ML091671765. TN742.

PPL Susquehanna (PPL Susquehanna, LLC). 2010. *Susquehanna Steam Electric Station Units 1 and 2, 2009 Annual Report—Annual Radiological Environmental Operating Report.* Berwick, Pennsylvania. Accession No. ML101450320. TN748.

PPL Susquehanna (PPL Susquehanna, LLC). 2011. *Susquehanna Steam Electric Station Units 1 and 2 Radioactive Effluent Release Report—2010 Annual Report.* Berwick, Pennsylvania. Accession No. ML11130A140. TN714.

PPL Susquehanna (PPL Susquehanna, LLC). 2011. *Susquehanna Steam Electric Station Units 1 and 2, 2010 Annual Report—Annual Radiological Environmental Operating Report.* Berwick, Pennsylvania. Accession No. ML11144A294. TN716.

PPL Susquehanna (PPL Susquehanna, LLC). 2012. *Susquehanna Steam Electric Station Units 1 and 2, 2011 Annual Report—Annual Radiological Environmental Operating Report.* Berwick, Pennsylvania. Accession No. ML12145A350. TN1911.

PPL Susquehanna (PPL Susquehanna, LLC). 2013. *Susquehanna Steam Electric Station Units 1 and 2, 2012 Annual Report—Annual Radiological Environmental Operating Report.* Berwick, Pennsylvania. Accession No. ML131090071. TN3757.

PPL Susquehanna (PPL Susquehanna, LLC). 2014. *Susquehanna Steam Electric Station Units 1 and 2, 2013 Annual Report—Annual Radiological Environmental Operating Report.* Berwick, Pennsylvania. Accession No. ML14134A248. TN3746.

PPL Susquehanna (PPL Susquehanna, LLC). 2014. *Susquehanna Steam Electric Station Units 1 and 2 Radioactive Effluent Release Report—2013 Annual Report*. Berwick, Pennsylvania. Accession No. ML14126A454. TN3747.

PPL Susquehanna (PPL Susquehanna, LLC). 2014. Letter from T.S. Rausch to NRC, dated July 11, 2014 regarding "Susquehanna Steam Electric Station Request for Order Approving Indirect Transfer of Control and Conforming License Amendments PLA-7191." Berwick, Pennsylvania. Accession No. ML14195A115. TN4211.

PPL Susquehanna (PPL Susquehanna, LLC). 2014. *Appendix A—SSES [Susquehanna Steam Electric Station] ODCM [Offsite Dose Calculation Manual]/TRM [Technical Requirements Manual] Radioactive Effluent Release Report—2013 Annual Report.* Berwick, Pennsylvania. Accession No. ML14126A455. TN4385.

PPL Susquehanna (PPL Susquehanna, LLC). 2015. *Susquehanna Steam Electric Station Units 1 and 2, 2014 Annual Report—Annual Radiological Environmental Operating Report.* Berwick, Pennsylvania. Accession No. ML15134A005. TN4391.

PPUC (Pennsylvania Public Utilities Commission). 2013. *Electric Power Outlook for Pennsylvania, 2012–2017.* Harrisburg, Pennsylvania. Available at http://www.puc.state.pa.us/utility_industry/electricity/electric_reports.aspx. TN3107.

PPUC (Pennsylvania Public Utilities Commission). 2015. *Electric Power Outlook for Pennsylvania, 2014–20*19. Harrisburg, Pennsylvania. Available at http://www.puc.state.pa.us/General/publications_reports/pdf/EPO_2015.pdf. TN4419.

PRNewswire (PR Newswire Association LLC). 2015. "PPL Electric Utilities Seeks Approval for First Segment of Proposed New Transmission Line." October 28, 2015, New York, New York. Available at http://www.prnewswire.com/news-releases/ppl-electric-utilities-seeks-approval-for-first-segment-of-proposed-new-transmission-line-300168197.html. TN4421.

PSU (Pennsylvania State University). 2008. *Pond Facts #19: Eurasian Water Milfoil*. University Park, Pennsylvania. Available at http://pubs.cas.psu.edu/FreePubs/pdfs/XH0027.pdf. TN1815.

PSU (Pennsylvania State University). 2009. *A Field Guide to Common Aquatic Plants of Pennsylvania*. AGRS-110, College of Agricultural Sciences, State College, Pennsylvania. Available at http://pubs.cas.psu.edu/FreePubs/pdfs/agrs110.pdf. TN696.

Ramsdell, J.V. and J.P. Rishel. 2007. *Tornado Climatography of the Contiguous United States.* NUREG/CR–4461, Revision 2, Pacific Northwest National Laboratory, Richland, Washington. Accession No. ML070810400. TN277.

Red Rock (Red Rock Power Partners LLC). 2012. "Most Recent Acquisitions: Binghamton Energy Center, Dupont Louisville Boiler, 67 MW Capitol District Energy Center Cogeneration Associates (CDECCA) Power Plant, and Pawtucket Power Plant." New York, New York. Accessed December 11, 2012, at http://www.rrpower.com/html/acquisitions.html#Binghamton. TN1602.

Reed, E. 2007. *Preventing and Controlling Cancer, The Nation's Second Leading Cause of Death.* Center for Disease Control and Prevention, Atlanta, Georgia. Accession No. ML14282A749. TN523.

RFC (ReliabilityFirst Corporation). 2012. "About Us." Akron, Ohio. Accessed November 15, 2012, at https://www.rfirst.org/Pages/AboutUs.aspx. TN1543.

RFC (ReliabilityFirst Corporation). 2013. *Long Term Resource Assessment 2014–2023*. Akron, Ohio. Available at https://rfirst.org/reliability/Documents/RFC%202013%20Assessment-Long%20Term%20Resource.pdf. TN3108.

Rohde, F.C., R.G. Arndt, D.G. Lindquist, and J.F. Parnell. 1994. *Freshwater Fishes of the Carolinas, Virginia, Maryland, and Delaware*. University of North Carolina Press, Chapel Hill, North Carolina. TN2208.

Rosenberg, K.V., R.W. Rohrbaugh, Jr., S.E. Barker, J.D. Lowe, R.S. Hames, and A.A. Dhondt. 1999. *A Land Managers Guide to Improving Habitat for Scarlet Tanagers and Other Forest-Interior Birds.* Cornell Lab of Ornithology, Ithaca, New York. Available at http://www.birds.cornell.edu/conservation/tanager/tanager.pdf. TN2045.

Rosenberg, K.V., J.D. Lowe, and A.A. Dhondt. 1999. "Effects of Forest Fragmentation on Breeding Tanagers: A Continental Perspective." *Conservation Biology* 13(3):568–583, Washington, D.C. TN2046.

Rosgen, D.L. 2011. "Natural Channel Design: Fundamental Concepts, Assumptions, and Methods." In *Stream Restoration in Dynamic Fluvial Systems: Scientific Approaches, Analyses, and Tools, Geophysical Monograph Series* 194:69–93, Washington, D.C. TN2267.

Ross, A., C. Benson, D. Abler, D. Wardrop, J. Shortle, M. McDill, M. Rydzik, R. Najjar, R. Ready, S. Blumsack, and T. Wagener. 2013. *Pennsylvania Climate Impacts Assessment Update.* University Park, Pennsylvania. Available at http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-97037/PA%20DEP%20Climate%20Impact%20Assessment%20Update.pdf. TN3485.

S&L (Sargent and Lundy). 2014. *Construction Dewatering Design, Bell Bend Nuclear Power Plant, Non-Safety-Related*. SL-009655, Revision 4, Chicago, Illinois. Accession No. ML14114A660. TN3544.

Safe Harbor (Safe Harbor Water Power Corporation). 2012. "About Safe Harbor Water Power Corporation." Conestoga, Pennsylvania. Accession No. ML14308A219. TN1604.

Saricks, C.L. and M.M. Tompkins. 1999. *State-Level Accident Rates of Surface Freight Transportation: A Reexamination*. ANL/ESD/TM-150, Argonne National Laboratory, Argonne, Illinois. Accession No. ML091060020. TN81.

Sauer, J.R., J.E. Hines, J.E. Fallon, K.L. Pardieck, D.J. Ziolkowski, Jr., and W.A. Link. 2011. *The North American Breeding Bird Survey, Results and Analysis 1966–2010.* Version 12.07.2011, USGS Patuxent Wildlife Research Center, Laurel, Maryland. Accession No. ML14286A077. TN3830.

Schasse, H.W., D.B. MacLachlan, and J.D. Inners. 2012. *Bedrock Geology and Coal Resources of the Conyngham Quadrangle, Luzerne and Schuylkill Counties, Pennsylvania*. Pennsylvania Geological Survey, 4th Series, Atlas 175b, Harrisburg, Pennsylvania. Accession No. ML14308A221. TN3699.

Sea Grant Pennsylvania. 2012. "Rusty Crayfish (*Orconectes rusticus*)." Erie, Pennsylvania. Accession No. ML14308A222. TN1715.

Sea Grant Pennsylvania. 2012. "Flathead Catfish (*Pylodictis olivaris*)." Erie, Pennsylvania. Accession No. ML14265A517. TN1813.

Sea Grant Pennsylvania. 2013. "Didymo: *Didymosphenia geminata*." Erie, Pennsylvania. Accession No. ML14286A070. TN2938.

Sempra (Sempra U.S. Gas and Power, LLC). 2013. "Mehoopany Wind." San Diego, California. Available at http://www.semprausgp.com/_/downloads/pdfs/FactSht_MehoopanyWind.pdf. TN3343.

Sevon, W.D. 1989. "Surficial Materials of Pennsylvania." Map 64, Pennsylvania Department of Conservation and Natural Resources, Harrisburg, Pennsylvania. Accession No. ML14308A224. TN3700.

Sevon, W.D. and D.D. Braun. 2000. "Glacial Deposits of Pennsylvania." Map 59, Pennsylvania Department of Conservation and Natural Resources, Harrisburg, Pennsylvania. Accession No. ML14308A223. TN3701.

Shenk, T. 2011. *2010 Susquehanna Large River Assessment Project*. Publication 276, Susquehanna River Basin Commission, Harrisburg, Pennsylvania. Accession No. ML14286A065. TN698.

Shields, M. 2010. *Economic Contribution and Impact of Angling on the Middle and Lower Susquehanna, and Lower Juniata Rivers.* Pennsylvania Fish and Boat Commission. Harrisburg, Pennsylvania. TN3362.

Shiels, A.L. 2007. "Pennsylvania Amphibians and Reptiles: The Snapping Turtle." Pennsylvania Angler and Boater Magazine July–August:46–47, Harrisburg, Pennsylvania. Available at http://www.fish.state.pa.us/anglerboater/2007/04julyaug/46snapping.pdf. TN3990.

Shultz, C.H. (editor). 1999. *The Geology of Pennsylvania.* Bureau of Topographic and Geologic Survey, Special Publication 1, Pittsburgh Geological Society, Pittsburgh, Pennsylvania, and Pennsylvania Geological Survey, Harrisburg, Pennsylvania. TN2873.

Smith, R.N., S.L. Cain, S.H. Anderson, J.R. Dunk, and E.S. Williams. 1998. "Blackfly-Induced Mortality of Nestling Red-Tailed Hawks. *The Auk* 115(2):368–375, Albuquerque, New Mexico. TN1708.

Snyder, B.D. 2005. "The Susquehanna River Fish Assemblage: Surveys, Composition, and Changes." *American Fisheries Society Symposium* 45:451–470, Bethesda, Maryland. TN2934.

Soldat, J.K., N.M. Robinson, and D.A. Baker. 1974. *Models and Computer Codes for Evaluating Environmental Radiation Doses*. BNWL-1754, Battelle, Pacific Northwest Laboratories, Richland, Washington. Accession No. ML12223A187. TN710.

Sprung, J.L., D.J. Ammerman, N.L. Breivik, R.J. Dukart, F.L. Kanipe, J.A. Koski, G.S. Mills, K.S. Neuhauser, H.D. Radloff, R.F. Weiner, and H.R. Yoshimura. 2000. *Reexamination of Spent Fuel Shipment Risk Estimates*. NUREG/CR–6672, Sandia National Laboratories, Albuquerque, New Mexico. Accession No. ML003698324. TN222.

SRAFRC (Susquehanna River Anadromous Fish Restoration Cooperative). 2010. *Migratory Fish Management and Restoration Plan for the Susquehanna River Basin*. Harrisburg, Pennsylvania. Available at http://www.fish.state.pa.us/pafish/shad/susq/SRAFRC-RestorationPlan.pdf. Accession No. ML13274A047. TN1701.

SRBC (Susquehanna River Basin Commission). 2005. "Information Sheet: Curwensville Lake Water Storage Project." Harrisburg, Pennsylvania. Accession No. ML14301A212. TN3583.

SRBC (Susquehanna River Basin Commission). 2005. "Groundwater Management Plan for the Susquehanna River Basin." Publication No. 236, Harrisburg, Pennsylvania. Accession Nos. ML093280639, ML093280641, ML093280644. TN3590.

SRBC (Susquehanna River Basin Commission). 2006. "PPL Montour, LLC—Montour Steam Electric Station Surface Water Withdrawal and Consumptive Water Use for Power Plant Operation and Flue Gas Desulfurization." Docket No. 19940901–2, Harrisburg, Pennsylvania. Accession No. ML14301A210. TN3573.

SRBC (Susquehanna River Basin Commission). 2007. "PPL Susquehanna, LLC—Susquehanna Steam Electric Station Surface Water Withdrawal, Groundwater Withdrawal, and Consumptive Water Use for Power Plant Operation." Docket No. 19950301, Harrisburg, Pennsylvania. Accession No. ML073090043. TN2073.

SRBC (Susquehanna River Basin Commission). 2007. "Approval: PPL Brunner Island, LLC—Brunner Island Steam Electric Station: Surface Water Withdrawal of up to 835.000 mgd from the Susquehanna River, and Consumptive Water Use of up to 23.100 mgd (Peak Day) for Power Plant Operation, East Manchester Township, York County, Pennsylvania." Docket No. 20070908, Harrisburg, Pennsylvania. Accession No. ML14310A012. TN3687.

SRBC (Susquehanna River Basin Commission). 2008. *Consumptive Use Mitigation Plan.* Publication 253, Harrisburg, Pennsylvania. Accession No. ML14286A013. TN699.

SRBC (Susquehanna River Basin Commission). 2011. *Anthracite Region Mine Drainage Remediation Strategy*. Publication 279, Harrisburg, Pennsylvania. Accession No. ML14308A225. TN1646.

SRBC (Susquehanna River Basin Commission). 2011. "Exelon Generating Company, LLC Three Mile Island Generating Station, Unit 1, Surface Water Withdrawal, Groundwater Withdrawal, and Consumptive Water Use for Power Plant Operations and Electric Power Generation." Docket No. 20110610, Harrisburg, Pennsylvania. Accession No. ML14310A013. TN3572.

SRBC (Susquehanna River Basin Commission). 2012. "Project Details: Spike Island Operation." Harrisburg, Pennsylvania. Accession No. ML14252A891. TN1196.

SRBC (Susquehanna River Basin Commission). 2012. "Subbasin Information for Upper Susquehanna, Chemung, Middle Susquehanna, West Branch, Juniata, and Lower Susquehanna Subbasins." Harrisburg, Pennsylvania. Accession No. ML14301A208. TN2443.

SRBC (Susquehanna River Basin Commission). 2012. *Low Flow Protection Policy Related to Withdrawal Approvals*. Policy No. 2012-01, December 14, 2012, Harrisburg, Pennsylvania. Accession No. ML14265A522. TN2453.

SRBC (Susquehanna River Basin Commission). 2012. "Frequently Asked Questions: SRBC's Role in Regulating Natural Gas Development." Harrisburg, Pennsylvania. Accession No. ML14286A022. TN3498.

SRBC (Susquehanna River Basin Commission). 2012. Letter from P.O. Swartz to PPL Bell Bend, LLC, dated December 28, 2012, regarding "Requirements for Consumptive Use Mitigation and Passby Flows for PPL Bell Bend, LLC—Bell Bend Nuclear Power Plant; Salem Township, Luzerne County, Pennsylvania; Commission Pending Nos. 2009-079 (SW) and 2009-080 (CU)." Harrisburg, Pennsylvania. Accession No. ML13008A468. TN3565.

SRBC (Susquehanna River Basin Commission). 2013. "The Flood-Prone Watershed." Harrisburg, Pennsylvania. Accession No. ML14252A895. TN1791.

SRBC (Susquehanna River Basin Commission). 2013. "Approved Water Sources for Natural Gas Development." Harrisburg, Pennsylvania. Accession No. ML14265A496. TN1999.

SRBC (Susquehanna River Basin Commission). 2013. "Information Sheet: Natural Gas Well Development in the Susquehanna River Basin." Harrisburg, Pennsylvania. Accession No. ML14265A521. TN2449.

SRBC (Susquehanna River Basin Commission). 2013. *State of the Susquehanna 2013 Report*. Harrisburg, Pennsylvania. Accession No. ML14265A535. TN2942.

SRBC (Susquehanna River Basin Commission). 2013. *SRBC Monitoring Staff Confirm Second Occurrence of Invasive Diatom* Didymosphenia geminata *in the Pine Creek Watershed*. SRBC Press Release, Harrisburg, Pennsylvania. Accession No. ML14265A533. TN2944.

SRBC (Susquehanna River Basin Commission). 2013. *Comprehensive Plan for the Water Resources of the Susquehanna River Basin.* Harrisburg, Pennsylvania. Accession No. ML14310A014. TN3568.

SRBC (Susquehanna River Basin Commission). 2013. Letter from J.L. Richenderfer to PPL Bell Bend, LLC, dated March 26, 2013, regarding "Status of Commission Review of Applications for PPL Bell Bend, LLC—Bell Bend Nuclear Power Plant; Salem Township, Luzerne County, Pennsylvania; Commission Pending Nos. 2009-079 (SW), 2009-080 (CU), and 2012-007 (GW)" Harrisburg, Pennsylvania. Accession No. ML13093A021. TN4428.

SRBC (Susquehanna River Basin Commission). 2013. Letter from J.L. Richenderfer to NRC, dated August 12, 2013, regarding "Consumptive Water Use Mitigation for PPL Bell Bend, LLC; Bell Bend Nuclear Power Plant; Salem Township, Luzerne County, Pennsylvania; Commission Pending Nos. 2009-079 (SW), 2009-080 (CU), and 2012-007 (GW). Harrisburg, Pennsylvania. Accession No. ML13228A282. TN4429.

SRBC (Susquehanna River Basin Commission). 2014. "Water Quality Portal Water Chemistry Data for Station IDs SUSQ174.0-4176 and SUSQ149.0-4076." Harrisburg, Pennsylvania. Accession No. ML14301A214. TN3604.

SRBC (Susquehanna River Basin Commission). 2014. "Water Quality Portal—Water Chemistry Data for Station ID WBSR015.0-4176." Harrisburg, Pennsylvania. Accession No. ML14301A204. TN3708.

SRBC (Susquehanna River Basin Commission). 2015. "SRBC Water Resource Portal." Harrisburg, Pennsylvania. Accession No. ML16075A227. TN4358.

SREL (Savannah River Ecology Laboratory). 2014. "Herpetology at SREL." Aiken, South Carolina. Available at http://srelherp.uga.edu/. TN3839.

SSI (Solar Southwest Initiative). 2010. "Baseload and Dispatchable Power." Tampa, Florida. Accession No. ML14107A328. TN1405.

Starwood (Starwood Energy Group). 2015. "Investments: Renewables—Northeast Natural Gas Portfolio." Greenwich, Connecticut. Accession No. ML16075A228. TN4394.

Steffy, L. 2013. *Lower Susquehanna River Subbasin Year-2 Focused Watershed Study—A Water Quality and Biological Assessment of the Lower Reservoirs of the Susquehanna River*. Publication 288, Susquehanna River Basin Commission, Harrisburg, Pennsylvania. Accession No. ML14286A018. TN3418.

Steiner, L. 2000. *Pennsylvania Fishes*. Pennsylvania Fish and Boat Commission, Harrisburg, Pennsylvania. TN1918.

Stranahan, S.Q. 1995. *Susquehanna, River of Dreams*. John Hopkins University Press, Baltimore, Maryland. TN3682.

Strawser, J. 2010. "Intelliwatt Receives $5 Million State Loan; Could be Final Piece to Make Mount Carmel Twp. Project Reality." The News-Item, Shamokin, Pennsylvania. Accessed December 16, 2012, at http://newsitem.com/news/intelliwatt-receives-5m-state-loan-could-be-final-piece-to-make-mount-carmel-twp-project-reality-1.563384. TN1877.

Strayer, D.L. 2009. "Twenty Years of Zebra Mussels: Lessons From the Mollusk that Made Headlines." *Frontiers in Ecology and the Environment* 7(3):135–141, Washington, D.C. TN1710.

Strenge, D.L., R.A. Peloquin, and G. Whelan. 1986. *LADTAP II—Technical Reference and User Guide*. NUREG/CR–4013, Pacific Northwest Laboratory, Richland, Washington. Accession No. ML14098A069. TN82.

Strenge, D.L., T.J. Bander, and J.K. Soldat. 1987. *GASPAR II—Technical Reference and User Guide*. NUREG/CR–4653, Pacific Northwest Laboratory, Richland, Washington. Accession No. ML14098A066. TN83.

Stuckey, M.H. and M.A. Roland. 2011. *Selected Streamflow Statistics for Streamgage Locations in and near Pennsylvania*. Open File Report 2011-1070, U.S. Geological Survey, Washington, D.C. Accession No. ML13282A160. TN1902.

Succar, S. and R.H. Williams. 2008. *Compressed Air Energy Storage: Theory, Resources, and Applications For Wind Power*. Princeton Environmental Institute, Princeton University, Princeton, New Jersey. Accession No. ML12016A701. TN2122.

Sumi, L. 2008. *Shale Gas: Focus on the Marcellus Shale*. Durango, Colorado. Accession No. ML14308A229. TN1628.

Sunbury (City of Sunbury, Pennsylvania). 2014. "The Adam T. Bower Dam." Sunbury, Pennsylvania. Accession No. ML14286A074. TN3516.

Talen (Talen Energy). 2015. "Ironwood Power Plant." Allentown, Pennsylvania. Available at https://www.talenenergy.com/generation/fossil-fuels/ironwood. TN4363.

Talen (Talen Energy). 2015. "Lower Mount Bethel Power Plant." Allentown, Pennsylvania. Available at https://www.talenenergy.com/generation/fossil-fuels/lower-mount-bethel. TN4364.

Talen (Talen Energy). 2015. "Montour Power Plant, Washingtonville, Pennsylvania." Allentown, Pennsylvania. Available at https://www.talenenergy.com/generation/fossil-fuels/montour. TN4412.

Talen (Talen Energy). 2015. "Brunner Island Power Plant, York Haven, Pennsylvania." Allentown, Pennsylvania. Available at https://www.talenenergy.com/generation/fossil-fuels/brunner-island. TN4413.

Talen (Talen Energy). 2015. "Hydro and Renewables: Holtwood." Allentown, Pennsylvania. Available at https://www.talenenergy.com/generation/hydro-and-renewables/holtwood. TN4414.

Talen (Talen Energy). 2015. Letter from R.R. Sgarro to NRC, dated November 6, 2015, regarding "Bell Bend Nuclear Power Plant Response to RAI ENV-30." BNP–2015–069, Allentown, Pennsylvania. Accession No. ML15331A001. TN4424.

Tenaska (Tenaska, Inc.). 2014. "Tenaska Lebanon Valley Generating Station (Lebanon, Pennsylvania)." Omaha, Nebraska. Available at http://tenaskaprojects.com/tenaskalebanonproject/wp-content/uploads/sites/8/2013/08/LebanonCountyFactSheet.pdf. TN3533.

Ternent, M.A. 2006. *Management and Biology of Black Bears in Pennsylvania. Ten Year Plan (2006–2015).* Pennsylvania Game Commission, Harrisburg, Pennsylvania. Available at http://www.portal.state.pa.us/portal/server.pt/document/712136/bear_plan_2006_pdf?qid=02506429&rank=8. TN1879.

Tex. Admin Code 31-675.23. "Importation of Waste from a Non-Compact Generator for Disposal." *Texas Administrative Code.* TN731.

TGP (Terra-Gen Power, LLC). 2012. "Terra-Gen Power Announces Closing of $650 Million Construction Financing for Alta Wind VII & IX to Continue Build-Out of Nation's Largest Wind Energy Facility." New York, New York. Available at http://www.terra-genpower.com/News/Terra-Gen-Power-Announces-Closing-of-$650-Million-.aspx. TN2117.

Therres, G.D. 1993. "Integrating Management of Forest Interior Migratory Birds with Game in the Northeast." In *Status and Management of Neotropical Migratory Birds*; *1992 September 21–25; Estes Park, CO*. D.M. Finch and P.W. Stangel (editors). General Technical Report RM-229, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado. Accession No. ML14308A230. TN1790.

Thompson, A.M. 1999. "Ordovician." Chapter 5 in *The Geology of Pennsylvania*. Pennsylvania Bureau of Topographic and Geologic Survey Special Publication 1, Pittsburgh Geological Society, Pittsburgh and Pennsylvania Geological Survey, Harrisburg, Pennsylvania. Accession No. ML093340298. TN2868.

Thomson, C.E. 1982. "*Myotis sodalis*." *Mammalian Species* 13:1–5, Lawrence, Kansas. TN4179.

Times Leader. 2015. "Panda Power Funds' Liberty Power Plant, Set for a Spring Opening, Will Bring 70 Jobs to Region." Wilkes-Barre, Pennsylvania. Available at http://timesleader.com/news/local/381697/panda-power-funds-liberty-power-plant-set-for-a-spring-opening-will-bring-70-jobs-to-region. TN4345.

Tiner, R.W. 1990. *Pennsylvania's Wetlands: Current Status and Recent Trends*. National Wetlands Inventory, U.S. Fish and Wildlife Service, Newton Corner, Massachusetts. Accession No. ML14286A091. TN3820.

Tipler, P.A. and G. Mosca. 2008. *Physics for Scientists and Engineers.* Sixth Edition, W.H. Freeman and Company, New York, New York. TN1467.

Trapp, H., Jr. and M.A. Horn. 1997. *Ground Water Atlas of the United States—Delaware, Maryland, New Jersey, North Carolina, Pennsylvania, Virginia, West Virginia*. HA 730-L, U.S. Geological Survey, Reston, Virginia. Accession No. ML093280441. TN1865.

Turner, G. 2012. *Pennsylvania Game Commission Bureau of Wildlife Management Project Annual Job Report: Indiana Bat Hibernacula Surveys, 1 July 2011 to 30 June 2012*. Pennsylvania Game Commission, Harrisburg, Pennsylvania. Available at http://www.portal.state.pa.us/portal/server.pt/document/1328710/71401-11z_pdf. TN4168.

Turner, G. 2014. Email to J. Taucher and J. Becker, dated November 26, 2014, regarding "Bat Information for the Bell Bend Nuclear Power Plant Project." Pennsylvania Game Commission, Harrisburg, Pennsylvania. Accession No. ML15043A634. TN4183.

Tyr Energy. 2015. "Projects: Good Spring." Overland Park, Kansas. Available at http://www.tyrenergy.com/projects/. TN4361.

UC Berkeley (University of California, Berkeley). 2012. "The Jepson Herbarium—Jepson eFlora." Berkeley, California. Accessed December 14, 2012, at http://ucjeps.berkeley.edu/IJM.html. TN1663.

UniStar (UniStar Nuclear Services). 2009. *Bell Bend Nuclear Power Plant Alternative Site Evaluation.* Revision 1, Baltimore, Maryland. Accession No. ML093631042. TN506.

UniStar (UniStar Nuclear Services). 2011. *Bell Bend Nuclear Power Plant Alternative Site Evaluation.* Revision 2, Baltimore, Maryland. Accession No. ML11158A200. TN505.

USACE (U.S. Army Corps of Engineers). 1987. *Corps of Engineers Wetlands Delineation Manual*. Wetlands Research Program Technical Report Y-87-1, Environmental Laboratory, Vicksburg, Mississippi. Accession No. ML042790476. TN2066.

USACE (U.S. Army Corps of Engineers). 1989. Memorandum from P.J. Kelly to USACE New Orleans District, dated April 21, 1989, regarding "Permit Elevation, Plantation Landing Resort, Inc." Washington, D.C. Accession No. ML13080A201. TN2365.

USACE (U.S. Army Corps of Engineers). 1999. *The Highway Methodology Workbook Supplement: Wetland Functions and Values, A Descriptive Approach*. NAEEP-360-1-30a, Concord, Massachusetts. Accession No. ML13274A145. TN1793.

USACE (U.S. Army Corps of Engineers). 2002. Excerpts from the *Tioga, Hammond & Cowanesque Lakes Master Plan: 2001 Update Programmatic Environmental Assessment*. Baltimore, Maryland. Accession No. ML14302A651. TN3966.

USACE (U.S. Army Corps of Engineers). 2005. *Technical Standard for Water-Table Monitoring of Potential Wetland Sites*. TN-WRAP-05-2, Wetlands Regulatory Assistance Program, Vicksburg, Mississippi. Accession No. ML13276A040. TN1863.

USACE (U.S. Army Corps of Engineers). 2011. "Tioga-Hammond and Cowanesque Lakes (USACE) Fish Stocking Report." Baltimore, Maryland. Accession No. ML14286A060. TN3424.

USACE (U.S. Army Corps of Engineers). 2011. *Fish and Wildlife Mitigation Plan—Cowanesque Lake Project*. Baltimore, Maryland. Accession No. ML14302A652. TN3965.

USACE (U.S. Army Corps of Engineers). 2012. *Public Notice In Reply to Application Number NAB-2008-01401-P13 (Bell Bend Nuclear Power Plant (BBNPP)).* PN-12-07, Baltimore District, Baltimore, Maryland. Accession No. ML12132A041. TN265.

USACE (U.S. Army Corps of Engineers). 2012. "Sandy Run, Bedford County, PA." Baltimore, Maryland. Accession No. ML1321A149. TN1222.

USACE (U.S. Army Corps of Engineers). 2012. "Emergency Operations: Reservoirs." Fact Sheets for Almond Lake, Arkport Dam, Aylesworth Creek Lake, Cowanesque Lake, East Sidney Lake, Stillwater Lake, Tioga-Hammond Lakes, and Whitney Point Lake. U.S. Army Corps of Engineers, Baltimore, Maryland. Accession No. ML13129A128. TN1599.

USACE (U.S. Army Corps of Engineers). 2012. Letter from W.B. Chandler to CAN DO, Incorporated, dated June 22, 2012, regarding "PASPGP-4 Verification and Terms and Conditions for Application for Humboldt Industrial Park Northwest." Baltimore, Maryland. Accession No. ML14286A056. TN3807.

USACE (U.S. Army Corps of Engineers). 2012. *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region.* Version 2.0, ERDC/EL TR-12-1, Vicksburg, Mississippi. Accession No. ML14286A058. TN3809.

USACE (U.S. Army Corps of Engineers). 2013. Letter from W.D. Chandler to Pennsylvania Historical and Museum Commission, dated January 7, 2013, requesting Concurrence on No Adverse Effects for the Bell Bend Project. Baltimore, Maryland. Accession No. ML13010A299. TN2243.

USACE (U.S. Army Corps of Engineers). 2013. *Final Environmental Assessment: Cowanesque Lake Water Supply Releases to Cowanesque, Tioga, Chemung, and Susquehanna Rivers Pennsylvania and New York.* Baltimore, Maryland. Accession No. ML14286A059. TN3383.

USACE (U.S. Army Corps of Engineers). 2014. "Curwensville Lake, PA." Baltimore, Maryland. Accession No. ML14286A052. TN3509.

USACE (U.S. Army Corps of Engineers). 2014. Email from A. Elliott to PNNL and NRC, dated September 23, 2014, regarding "Bell Bend Wetland Impacts Table." State College, Pennsylvania. Accession No. ML14302A653. TN4009.

USACE (U.S. Army Corps of Engineers). 2014. Email from A. Elliott to N.P. Kohn, dated October 30, 2014, regarding "Bell Bend Chapter 3 EIS Reference." State College, Pennsylvania. Accession No. ML14308A410. TN4024.

USACE (U.S. Army Corps of Engineers). 2015. Public Notice in Reply to Application Number CENAB-OPR-P-2008-01401-P13 (PPL Bell Bend, LLC/Bell Bend Nuclear Power Plant) to Announce the Release and Availability of the Draft Environmental Impact Statement (DEIS), Prepared by the Nuclear Regulatory Commission (NRC) and the U.S. Army Corps of Engineers (Corps), and Notice of a Public Meeting/Public Hearing by the NRC and the Corps. PN 15-27, Baltimore District, Baltimore, Maryland. Accession No. ML16075A220. TN4389.

USACE (U.S. Army Corps of Engineers). 2015. Email from A.H. Elliott to J.M. Becker, dated October 26, 2015, regarding "Bell Bend Impact Table." State College, Pennsylvania. Accession No. ML16075A221. TN4434.

USACE (U.S. Army Corps of Engineers). 2016. Letter from W. Seib to NRC, dated February 23, 2016, regarding Application for a Department of the Army Permit to Impact Waters of the United States, Including Jurisdictional Wetlands, in Association with the Construction of the Bell Bend Nuclear Power Plant. State College, Pennsylvania. Accession No. ML16055A537. TN4503.

USACE (U.S. Army Corps of Engineers) and NRC (U.S. Nuclear Regulatory Commission). 2008. "Memorandum of Understanding Between U.S. Army Corps of Engineers and U.S. Nuclear Regulatory Commission on Environmental Reviews Related to the Issuance of Authorizations to Construct and Operate Nuclear Power Plants." Washington, D.C. Accession No. ML082540354. TN637.

USCB (U.S. Census Bureau). 1990. *1990 Census of Population and Housing, Population and Housing Unit Counts: United States.* CPH-2-1, Washington, D.C. Accession No. ML102030409. TN1869.

USCB (U.S. Census Bureau). 2001. "Profile of General Demographic Characteristics, Census 2000 Summary File 1 (SF 1) 100-Percent Data for Carbon County, Columbia County, Luzerne County, Lycoming County, Montour County, Northumberland County, and Schuylkill County (Pennsylvania)." Table DP-1, Washington, D.C. Accession No. ML13282A101. TN1873.

USCB (U.S. Census Bureau). 2010. "American FactFinder: 2010 American Community Survey 1–Year Estimates, Table DP-03—Selected Economic Characteristics." Washington, D.C. Accession No. ML13274A094. TN1718.

USCB (U.S. Census Bureau). 2011. "Selected Economic Characteristics, 2010 American Community Survey 1–Year Estimates for Carbon County, Columbia County, Luzerne County, Lycoming County, Montour County, Northumberland County, and Schuylkill County (Pennsylvania)." Table DP-3, Washington, D.C. Accession No. ML13282A110. TN1874.

USCB (U.S. Census Bureau). 2011. "ACS Demographic and Housing Estimates, 2006–2010 American Community Survey 5–Year Estimates for Carbon County, Columbia County, Luzerne County, Lycoming County, Montour County, Northumberland County, and Schuylkill County (Pennsylvania)." Table DP-5, Washington, D.C. Accession No. ML13282A116. TN1875.

USCB (U.S. Census Bureau). 2011. "Selected Economic Characteristics, 2006–2010 American Community Survey 5–Year Estimates for Carbon County, Columbia County, Luzerne County, Lycoming County, Montour County, Northumberland County, and Schuylkill County (Pennsylvania)." Table DP-3, Washington, D.C. Accession No. ML13282A125. TN1876.

USCB (U.S. Census Bureau). 2011. *The 2006–2010 ACS 5–Year Summary File Technical Documentation.* Version 2, Washington, D.C. Accession No. ML14265A499. TN2009.

USCB (U.S. Census Bureau). 2011. "Sex by Age. 2006–2010 American Community Survey 5–Year Estimates: United States; Pennsylvania; Columbia County, Pennsylvania; and Luzerne County, Pennsylvania." Washington, D.C. Accession No. ML14265A507. TN2068.

USCB (U.S. Census Bureau). 2011. "ACS Demographic and Housing Estimates, 2006–2010 American Community Survey 5–year Estimates for the U.S.; Pennsylvania; Columbia County, Pennsylvania; and Luzerne County, Pennsylvania." Washington, D.C. Accession No. ML14265A508. TN2070.

USCB (U.S. Census Bureau). 2011. "Selected Economic Characteristics, 2006–2010 American Community Survey 5–Year Estimates for the U.S.; Pennsylvania; Columbia County, Pennsylvania; and Luzerne County, Pennsylvania." Washington, D.C. Accession No. ML14265A516. TN2071.

USCB (U.S. Census Bureau). 2011. "Selected Housing Characteristics, 2006–2010 American Community Survey 5–Year Estimates for Columbia County, Luzerne County, Northumberland County, and Schuylkill County, and the Cities/Boroughs of Berwick, Bloomsburg, Wilkes-Barre, Nanticoke, and Hazleton (Pennsylvania)." Washington, D.C. Accession No. ML14265A508. TN2072.

USCB (U.S. Census Bureau). 2011. "2006–2010 American Community Survey 5–Year Estimates: Select Social Characteristics in the United States: Pennsylvania." Washington, D.C. Accession No. ML14308A231. TN3623.

USDA (U.S. Department of Agriculture). 2007. *2007 Census of Agriculture, Pennsylvania State and County Data, Table 7,* "Hired Farm Labor—Workers and Payroll: 2007." National Agricultural Statistics Service, Washington, D.C. Accession No. ML13239A107. TN1697.

USDA (U.S. Department of Agriculture). 2009. *2007 Census of Agriculture, Pennsylvania State and County Data, Volume 1, Geographic Area Series, Part 38.* AC-07-A-38, Washington, D.C. Accession No. ML14302A680. TN3186.

USDA (U.S. Department of Agriculture). 2014. *2012 Census of Agriculture*, Pennsylvania State and County Data, Table 1, "County Summary Highlights: 2012." National Agricultural Statistics Service, Washington, D.C. Accession No. ML14302A681. TN3634.

USDA (U.S. Department of Agriculture). 2014. *2012 Census of Agriculture*, Pennsylvania State and County Data, Table 7, "Hired Farm Labor—Workers and Payroll: 2007." National Agricultural Statistics Service, Washington, D.C. Accession No. ML14302A682. TN3620.

USEC (U.S. Enrichment Corporation). 2013. Letter from S. Toelle to C. Haney, dated June 3, 2013, regarding "Paducah Gaseous Diffusion Plant, Docket No. 70-7001, Certificate No. GDP-1, Notification of Termination of Uranium Enrichment." Bethesda, Maryland. Accession No. ML13176A151. TN2765.

USFA (U.S. Fire Administration). 2013. "National Fire Department Census Database, Pennsylvania." Emmitsburg, Maryland. Accession No. ML13276A044. TN1867.

USGS (U.S. Geological Survey). 1998. *New Hope for Acid Streams*. Reston, Virginia. Available at http://www.lsc.usgs.gov/files/amdpub.pdf. Accession No. ML13239A099. TN1644.

USGS (U.S. Geological Survey). 2002. "Physiographic Divisions of the Conterminous U.S." Water Resources NSDI Node, Reston, Virginia. Available at http://water.usgs.gov/lookup/getspatial?physio. TN2880.

USGS (U.S. Geological Survey). 2010. "The National Map, US Topo, Berwick Quadrangle, Pennsylvania, 7.5 Minute Series." Reston, Virginia. Accession No. ML14308A233. TN3495.

USGS (U.S. Geological Survey). 2012. "National Water Information System: Site Inventory for the Nation." Washington, D.C. Accession No. ML13129A134. TN1598.

USGS (U.S. Geological Survey). 2012. "Land Cover Trends Project: Ridge and Valley." Denver, Colorado. Accession No. ML16075A222. TN1800.

USGS (U.S. Geological Survey). 2013. "Migration of Birds: Routes of Migration." Washington, D.C. Accession No. ML14286A011. TN3831.

USGS (U.S. Geological Survey). 2014. "NAS—Nonindigenous Aquatic Species: *Dreissena polymorpha* (Zebra Mussel)." Reston, Virginia. Accession No. ML14286A010. TN3410.

USGS (U.S. Geological Survey). 2014. "Water-Resources Data for the United States, Water Year 2013: Site 01536500 Susquehanna River at Wilkes-Barre, PA." WDR-US-2013, Site 01536500, Reston, Virginia. Accession No. ML16075A223. TN4409.

USGS (U.S. Geological Survey). 2014. "Water-Data Report 2013: Site 01540500 Susquehanna River at Danville, Pennsylvania. USGS Water-Data Report WDR-US-2013, Reston, Virginia. Accession No. ML16075A224. TN4426.

USGS (U.S. Geological Survey). 2014. "Water-Data Report 2013: Site 01553500 West Branch Susquehanna River at Lewisburg, Pennsylvania." USGS Water-Data Report WDR-US-2013, Reston, Virginia. Accession No. ML16075A219. TN4427.

Van Auken, R. 2012. "The Heritage Trail." Williamsport, Pennsylvania. Accessed October 22, 2014, at https://robinvanauken.wordpress.com/2012/02/24/stroll-the-heritage-trail/. TN3986.

VDGIF (Virginia Department of Game and Inland Fisheries). 2014. "Midland Painted Turtle (*Chrysemys picta marginata*)." Richmond, Virginia. Available at http://www.dgif.virginia.gov/wildlife/information/?s=030054. TN3989.

Venesky, T. 2009. "Mussels Pose Threat to River." *The Times Leader*, Wilkes-Barre, Pennsylvania. Accession No. ML100540798. TN650.

Wagner, C.R., S.A. Fitzgerald, R.D. Sherrell, D.A. Harned, E.L. Staub, B.H. Pointer, and L.L. Wehmeyer. 2011. *Characterization of Stormwater Runoff from Bridges in North Carolina and the Effects of Bridge Deck Runoff on Receiving Streams*. U.S. Geological Survey Report 2011–5180, Reston, Virginia. Accession No. ML13274A416. TN1831.

Walbridge. 2012. "United States Gypsum Company, Wall Board Manufacturing Facility." Detroit, Michigan. Available at http://www.walbridge.com/projects/united-states-gypsum-company-wall-board-manufacturing-facility#. TN1213.

Walsh, M.C., J. Deeds, and B. Nightingale. 2007. *User's Manual and Data Guide to the Pennsylvania Aquatic Community Classification*. Pennsylvania Natural Heritage Program, Middletown, Pennsylvania, and Western Pennsylvania Conservancy, Pittsburgh, Pennsylvania. Accession No. ML14308A235. TN1612.

Wang, G. and T.R. Carr. 2013. "Organic-rich Marcellus Shale Lithofacies Modeling and Distribution Pattern Analysis in the Appalachian Basin." *AAPG Bulletin* 97(12):2173–2205, Tulsa, Oklahoma. Available at http://pages.geo.wvu.edu/~tcarr/Wang_Manuscripts/The%20fourth%20paper.pdf. TN3782.

WBCNC (Weaver Boos Consultants North Central, LLC). 2011. *Evaluation of Temporary Construction Dewatering Strategies, Proposed Bell Bend Nuclear Power Plant Berwick, Pennsylvania—Non-Safety Related*. Project No. 2524301-01-03, Revision 1, South Bend, Indiana. TN1833.

WDNR (Wisconsin Department of Natural Resources). 2013. *Wisconsin Blanchard's Cricket Frog* (Acris blanchardi) *Species Guidance*. PUB-ER-666, Bureau of Natural Heritage Conservation, Madison, Wisconsin. Available at http://dnr.wi.gov/files/PDF/pubs/er/ER0666.pdf. TN3956.

Weiner, R.F., D.M. Osborn, D. Hinojosa, T.J. Heames, J. Penisten, and D. Orcutt. 2008. *RADCAT 2.3 User Guide*. SAND2006–6315, Sandia National Laboratories, Albuquerque, New Mexico. Accession No. ML12192A238. TN302.

Weiner, R.F., D. Hinojosa, T.J. Heames, C. Ottinger Farnum, and E.A. Kalinina. 2013. *RADTRAN 6/RadCat 6 User Guide.* SAND2013–8095, Sandia National Laboratories, Albuquerque, New Mexico. Accession No. ML14286A092. TN3390.

Weldy, T., D. Werier, and A. Nelson. 2014. "New York Flora Atlas." Florida Center for Community Design and Research, University of South Florida, New York Flora Association, Albany, New York. Available at http://newyork.plantatlas.usf.edu/. TN3959.

Wells, J.V., D.K. Niven, and J. Cecil. 2005. "The Important Bird Areas Program in the United States: Building a Network of Sites for Conservation, State by State." In *Bird Conservation Implementation and Integration in the Americas: Proceedings of the Third International Partners in Flight Conference, March 20–24, 2002, Asilomar, California*. USDA Forest Service, PSW-GTR-191, Albany, California. Accession No. ML14265A511. TN133.

White Deer Energy. 2012. "Update on Plan Approval Application: March 23, 2012." News Archives, White Deer Township, Pennsylvania. Accessed June 27, 2012, at http://www.whitedeerproject.com/News_3-29-12.html. TN1188.

White Deer Energy. 2013. "DEP Announces May 2 Public Meeting, Hearing on Union County Tire-Derived Fuel Steam and Power Generation Plant." News Archives, White Deer Township, Pennsylvania. Accessed November 5, 2014, at http://www.whitedeerproject.com/newsarchives_5-1-13.html. TN4035.

WHO (World Health Organization). 2007. *Extremely Low Frequency Fields*. Environmental Health Criteria 238, Geneva, Switzerland. Available at http://www.who.int/peh-emf/publications/elf_ehc/en/. TN1272.

Wilkes-Barre/Scranton International Airport. 2013. "Flight Schedule Departures: February 2013." Avoca, Pennsylvania. Accessed February 7, 2013, at http://www.flyavp.com/flightschedules.html. TN2035.

Williams, J. 2013. "Eureka Resources Holds Open House." Northeastdriller.com, Towanda, Pennsylvania. Available at http://northeastdriller.com/eureka-resources-holds-open-house-1.1587504. TN3613.

Williams (Williams Transco Pipeline). 2014. "Atlantic Sunrise Project." Wilkes Barre, Pennsylvania. Available at http://atlanticsun.wpengine.com/. TN3614.

Wilson, A.M., D.W. Brauning, and R.S. Mulvihill, eds. 2012. *Second Atlas of Breeding Birds in Pennsylvania*. Penn State Press, University Park, Pennsylvania. Available at http://www.pabirdatlas.psu.edu/. TN3833.

Wise, B.A. 2012. *PPL Bell Bend LLC Cultural Resources Avoidance/Mitigation Plan Archaeological Site 36LU288.* SHPA-MIT-001, Revision 0, Allentown, Pennsylvania. Accession No. ML12179A368. TN1755.

WNA (World Nuclear Association). 2010. *The Economics of Nuclear Power.* London, United Kingdom. Available at http://www.world-nuclear.org/info/inf02.html. TN717.

WNA (World Nuclear Association). 2013. "The Economics of Nuclear Power." London, England. Available at http://www.world-nuclear.org/info/Economic-Aspects/Economics-of-Nuclear-Power/. TN2689.

Wnuk, R. 2010. "Biologist Reports: Cowanesque Lake, Tioga County." Pennsylvania Fish and Boat Commission, Harrisburg, Pennsylvania. Available at http://fishandboat.com/images/reports/2010bio/4x06_15cowa.htm. TN3417.

Woods, A.J., J.M. Omernik, and D.D. Brown. 1999. *Level III and Level IV Ecoregions of Delaware, Maryland, Pennsylvania, Virginia, and West Virginia*. U.S. Environmental Protection Agency, Corvallis, Oregon. Accession No. ML083220457. TN1805.

Woods, A.J., J.M. Omernik, and D.D. Brown. 2003. "Map of Level III and Level IV Ecoregions of EPA Region 3." U.S. Environmental Protection Agency, Corvallis, Oregon. Accession No. ML14252A897. TN1806.

Wright, J. and G.L. Kirkland, Jr. 1998. "Mammals: Review of Status in Pennsylvania." Pennsylvania Biological Survey, Harrisburg, Pennsylvania. Available at http://academic.keystone.edu/JSkinner/WildlifeFisheries/Mammals-Review%20of%20Status%20in%20PA.pdf. TN3852.

Yahner, R.H. and R.J. Hutnik. 2005. "Integrated Vegetation Management on an Electric Transmission Right-of-Way in Southeastern Pennsylvania." *U.S. Journal of Arboriculture* 31(5):263–268, Champaign, Illinois. TN3891.

Yahner, R.H. and R.T. Yahner. 2007. "Populations of Small Mammals on an Electric Transmission Line Area in Southeastern Pennsylvania, U.S." *Arboriculture and Urban Forestry* 33(6):433–434, Champaign, Illinois. TN3892.

Yahner, R.H., W.C. Bramble, and W.R. Byrnes. 2001. "Response of Amphibian and Reptile Populations to Vegetation Maintenance of an Electric Transmission Line Right-of-Way." *Journal of Arboriculture* 27(4):215–221, Champaign, Illinois. TN3890.

Zedler, P.H. 2003. "Vernal Pools and the Concept of 'Isolated Wetlands'." *Wetlands* 23(3):597–607, Madison, Wisconsin. Available at http://users.ipfw.edu/isiorho/wetvernalisolatedwetlands2003.pdf. TN3821.

12.0 INDEX

A

B

C

D

E

F

G

H

N

O

P

R

S

T

U

V

W

Y

Z

APPENDIX A

CONTRIBUTORS TO THE ENVIRONMENTAL IMPACT STATEMENT

APPENDIX A

CONTRIBUTORS TO THE ENVIRONMENTAL IMPACT STATEMENT

The overall responsibility for the preparation of this environmental impact statement was assigned to the Office of New Reactors, U.S. Nuclear Regulatory Commission (NRC). The statement was prepared by members of the Office of New Reactors with assistance from other NRC organizations, the U.S. Army Corps of Engineers, Pacific Northwest National Laboratory, and Numark Associates, Inc.

Name	Education/Expertise	Contribution
Nuclear Regulatory Commission		
Tomeka Terry	B.S., M.S., Civil Engineering; 12 years of relevant experience	Project Manager
Patricia Vokoun	B.S., Civil Engineering; 21 years of relevant experience	Project Manager
Laura Quinn-Willingham	B.S., Environmental Sciences; 10 years of relevant experience	Project Manager
Stacey Imboden	B.S., Meteorology; M.S., Environmental Engineering and Science; 13 years of relevant experience	Project Manager, Energy and Site Alternatives, Air Quality
Jessica Voveris	B.S., Meteorology; 3 years of relevant experience	Meteorology and Air Quality
Seshargiri (Rao) Tammara	M.S., Chemical and Environmental Engineering; 40 years of relevant experience	Demography, Transportation, Accidents
Donald Palmrose	B.S., Nuclear Engineering; M.S., Nuclear Engineering; Ph.D., Nuclear Engineering; 30 years of relevant experience	Radiological Health, Accidents, Transportation
Zachary Gran	B.S., Physics; M.S., Radiological Health Physics; 5 years of relevant experience	Radiological Health
Ed Stutzcage	B.S., Health Physics; 5 years of relevant experience	Radiological Health
Mohammad Haque	M.S., Civil Engineering; 35 years of relevant experience	Hydrology, Plant System Alternatives
Joseph Giacinto	B.S., Geology (Geophysics); M.S., Hydrology, 25 years of relevant experience	Geology
Dan Mussatti	B.A., Economics; M.S., Natural Resource and Environmental Economics; M.A., Environmental Economics; 26 years of relevant experience	Socioeconomics, Environmental Justice, Cost-Benefit Balance, Need for Power
Nancy Kuntzleman	B.S., Biology; M.S., Education; M.S., Biology; 39 years of relevant experience	Aquatic Ecology

Name	Education/Expertise	Contribution
Jack Cushing	B.S., Marine Engineering; 30 years of relevant experience	Archaeologist Historic and Cultural, Nonradiological Health and Waste, Site Layout and Design, Cumulative Impacts
Robert Schaaf	B.S., Mechanical Engineering; 24 years of relevant experience	Fuel Cycle and Decommissioning
Peyton Doub	B.S., Plant Sciences; M.S., Plant Physiology; Professional Wetland Scientist; 27 years of relevant experience	Land Use, Transmission Lines, Terrestrial Ecology
Hanh Phan	B.S., M.S., Electrical Engineering; 25 years of relevant experience	Severe Accidents
Michelle Hart	B.S., Physics; M.S., Nuclear Engineering; 18 years of relevant experience	Design Basis Accidents
Anne-Marie Grady	B.S., M.S., Nuclear Engineering; 18 years of relevant experience	Severe Accidents
Maria Brown	10 years of relevant experience	Reference Coordinator
Eben Allen	B.S., Nuclear Engineering; M.S., Nuclear Engineering; 10 years of relevant experience	Transportation
Stephen Giebel	B.S., Health Physics; 31 years of relevant experience	Decommissioning
U.S. Army Corps Of Engineers		
Amy Elliott	B.S., Marine Biology; 24 years of relevant experience	Biologist
Pacific Northwest National Laboratory[(a)]		
Bruce McDowell	B.A., Land Use Planning; M.S., Resource Economics; M.S., Atmospheric Science; 34 years of relevant experience	Task Leader
Kimberly Leigh	B.S., Environmental Science; 15 years of relevant experience	Deputy Task Leader
James Becker	B.S., Botany and Range Science; M.S., Wildlife Science; 21 years of relevant experience	Terrestrial Ecology
Lara Aston	B.S. and M.S., Environmental Science; 15 years of relevant experience	Nonradiological Health, Nonradiological Waste, Terrestrial Ecology
Jeremy Rishel	B.S. and M.S., Meteorology; 17 years of relevant experience	Meteorology and Air Quality, Air Conformity, Accidents Mentor
Patrick Balducci	B.S., Economics; M.S.C. Applied Environmental Economics; 19 years of relevant experience	Socioeconomics, Environmental Justice, Benefit-Cost Balance
Dave Anderson	B.S., Forest Resources; M.S., Forest Economics; 25 years of relevant experience	Need for Power, Land Use Mentor
Roy Kropp	B.S., Zoology; M.S., Biology; Ph.D., Zoology; 21 years of relevant experience	Aquatic Ecology

Name	Education/Expertise	Contribution
Ann Miracle	B.A., Biology; M.S., Molecular Genetics; Ph.D., Molecular Immunology, 12 years of relevant experience	Aquatic Ecology
Tom Anderson	B.S., Botany; 41 years of relevant experience	Energy and Site Alternatives
Joanne Duncan	B.A., Biology; 15 years of relevant experience	Cumulative Impacts, Reference Coordinator
Kate Hall	B.S., Environmental Science; 15 years of relevant experience	Reference Coordinator Assistant
Tara O'Neil	B.A., Anthropology; M.B.A., Business Management; 22 years of relevant experience	Historic and Cultural Resource Mentor
Eva Eckert Hickey	B.S., Biology; M.S., Health Physics; 35 years of relevant experience	Radiological Health, Fuel Cycle, Decommissioning
Nancy Kohn	B.S., Freshwater Studies; 6 years of relevant experience	Site Layout and Design
Steve Breithaupt	B.S., Aquatic Biology; M.S., Environmental Science; Ph.D., Water Resource Engineering; 34 years of relevant experience	Surface Water Hydrology
Philip Meyer	B.S., Physics; M.S., Civil Engineering; Ph.D., Civil Engineering; 20 years of relevant experience	Hydrology
Lance Vail	B.S., Environmental Systems Engineering; M.S., Civil Engineering; 35 years of relevant experience	System Alternatives
Jerry Tagestad	B.S., Biology; M.S., Geography; 15 years of relevant experience	Mapping and Spatial Analysis
Kristine Hand	B.S., Wildlife Biology; 21 years of relevant experience	Mapping and Spatial Analysis
Michael Parker	B.A., English; 16 years of relevant experience	Technical Editing and Text Processing
Cary Counts	B.S., Ceramic Engineering; M.S., Environmental Systems Engineering; 42 years of relevant experience	Technical Editing and Text Processing
Susan Ennor	B.A., Journalism; 35 years of relevant experience	Technical Editing and Text Processing
Heather Culley	B.S., Biology and Philosophy; M.A. Medical History and Ethics; 8 years of relevant experience	Technical Editing and Text Processing
Numark Associates, Inc.		
Tom Grant	B.S., Accounting; J.D., Law; 38 years of relevant experience	Task Leader
Jan Aarts	B.A. and M.A., Urban Planning; 25 years of relevant experience	Land Use, Transmission Lines
Darby Stapp	B.A. and M.A., Anthropology; Ph.D., Historical Archaeology; 30 years of relevant experience	Historic and Cultural Resources

Name	Education/Expertise	Contribution
Andrew Marchese	B.S. and M.S., Aerospace Engineering; 48 years of relevant experience	Design Basis Accidents, Severe Accidents
William Dornsife	B.S., General Engineering; M.S., Nuclear Engineering; 48 years of relevant experience	Transportation
Jim Scherrer	B.S., Geological Science; M.S., Energy Systems and Policy; M.B.A., Finance; 12 years of relevant experience	Geology

(a) Pacific Northwest National Laboratory is operated by Battelle Memorial Institute for the U.S. Department of Energy.

APPENDIX B

ORGANIZATIONS CONTACTED

APPENDIX B

ORGANIZATIONS CONTACTED

The following Federal, State, regional, Tribal, and local organizations were contacted during the course of the U.S. Nuclear Regulatory Commission staff's review of potential environmental impacts from the construction and operation of a new nuclear unit at the Bell Bend Nuclear Power Plant in Luzerne County, Pennsylvania:

Absentee-Shawnee Tribe of Oklahoma, Shawnee, Oklahoma

Advisory Council on Historic Preservation, Washington, D.C.

Berwick Area School District, Berwick, Pennsylvania

Berwick Emergency Management, Berwick, Pennsylvania

Berwick Historical Society, Berwick, Pennsylvania

Berwick Hospital Center, Berwick, Pennsylvania

Berwick Industrial Development Association, Berwick, Pennsylvania

Borough of Berwick, Berwick, Pennsylvania

Bucknell University, Lewisburg, Pennsylvania

Chesapeake Energy, Oklahoma City, Oklahoma

Columbia County Housing and Redevelopment Authority, Bloomsburg, Pennsylvania

Columbia County Planning Commission, Bloomsburg, Pennsylvania

Columbia County Sheriff's Office, Bloomsburg, Pennsylvania

Columbia Montour Chamber of Commerce, Bloomsburg, Pennsylvania

Delaware Nation, Anadarko, Oklahoma

Delaware River Basin Commission, West Trenton, New Jersey

Eastern Shawnee Tribe of Oklahoma, Seneca, Missouri

Heron Clan Representative for the Cayuga Nation, Versailles, New York

Luzerne Conservation District, Shavertown, Pennsylvania

Luzerne County Commission on Economic Opportunity, Wilkes-Barre, Pennsylvania

Luzerne County Emergency Management Agency, Wilkes-Barre, Pennsylvania

Luzerne County Engineer's Office, Wilkes-Barre, Pennsylvania

Luzerne County Historical Society, Wilkes-Barre, Pennsylvania

Luzerne County Planning Commission, Wilkes-Barre, Pennsylvania

Luzerne County Sheriff's Office, Wilkes-Barre, Pennsylvania

National Marine Fisheries Service, Gloucester, Massachusetts

New Jersey Highlands Council, Chester, New Jersey

New Jersey National Heritage Program, Trenton, New Jersey

Oneida Indian Nation, Verona, New York

Oneida Nation of Wisconsin, Oneida, Wisconsin

Onondaga Nation, Nedrow, New York

Pennsylvania American Water, Berwick, Pennsylvania

Pennsylvania Department of Conservation and Natural Resources, Harrisburg, Pennsylvania

Pennsylvania Department of Environmental Protection, Harrisburg, Pennsylvania

Pennsylvania Fish and Boat Commission, Bellefonte, Pennsylvania

Pennsylvania Game Commission, Harrisburg, Pennsylvania

Pennsylvania Historical and Museum Commission, Harrisburg, Pennsylvania

St. Regis Mohawk Tribe, Akwesasne, New York

Salem Township Board of Supervisors, Salem Township, Pennsylvania

Salem Township Zoning Office, Salem Township, Pennsylvania

Seneca-Cayuga Tribe of Oklahoma, Miami, Oklahoma

Seneca Nation of Indians, Salamanca, New York

Shawnee Tribe, Miami, Oklahoma

Society of Pennsylvania Archaeology, Covington Township, Pennsylvania

Stockbridge-Munsee Band of the Mohican Nation of Wisconsin, Bowler, Wisconsin

Susquehanna River Basin Commission, Harrisburg, Pennsylvania

Tonawanda Seneca Nation, Basom, New York

Tuscarora Nation, Lewiston, New York

U.S. Army Corps of Engineers – Baltimore District, Baltimore, Maryland

U.S. Environmental Protection Agency – Region III, Philadelphia, Pennsylvania

U.S. Federal Emergency Management Agency, Hanover, Maryland

U.S. Fish and Wildlife Service, Pleasantville, New Jersey

U.S. Fish and Wildlife Service, State College, Pennsylvania

APPENDIX C

NRC AND USACE ENVIRONMENTAL REVIEW CORRESPONDENCE

APPENDIX C

NRC AND USACE ENVIRONMENTAL REVIEW CORRESPONDENCE

This appendix contains a chronological listing of correspondence between the U.S. Nuclear Regulatory Commission (NRC) or the U.S. Army Corps of Engineers (USACE) and PPL Bell Bend, LLC (PPL), and other correspondence related to the NRC staff's environmental review, under Title 10 of the *Code of Federal Regulations* (CFR) Part 51 (TN250), for PPL's application for a combined construction permit and operating license (COL or combined license) for the Bell Bend Nuclear Power Plant (BBNPP) near Berwick, Pennsylvania. PPL notified the NRC of changes in its power generation business by letter dated May 12, 2015 (PPL Bell Bend 2015-TN4379). PPL Bell Bend, LLC was renamed Bell Bend, LLC, and Bell Bend, LLC became a generation affiliate of Talen Energy Corporation (Talen Energy). The transaction became official on June 1, 2015. For purposes of this review, the abbreviation "PPL" will still be used to indicate the applicant. Bell Bend, LLC, under Talen Energy, is the applicant.

All documents, with the exception of those containing proprietary information, have been placed in the Commission's Public Document Room, at One White Flint North, 11555 Rockville Pike (first floor), Rockville, Maryland, and are available electronically from the Public Electronic Reading Room found on the Internet at the following web address: http://www.nrc.gov/reading-rm.html. From this site, the public can gain access to the NRC's Agencywide Documents Access and Management System (ADAMS), which provides text and image files of NRC's public documents in the component of ADAMS. The ADAMS accession numbers for each document are included below.

May 2, 2008	Trip Report for Readiness Assessment (C-1) Visit for a Future Combined License Application at Bell Bend Nuclear Power Plant Site (Accession No. ML081010333).
July 7, 2008	Letter from Ms. Margaret E. Gaffney-Smith, U.S. Army Corps of Engineers, to NRC, regarding Cooperating Status on the BBNPP EIS (Accession No. ML081980548).
September 23, 2008	Trip Report for Readiness Assessment (C-3) Visit for a Future Combined License Application at Bell Bend Nuclear Power Plant Site (Accession No. ML082480448).
October 10, 2008	Letter from Mr. Terry L. Harpster, PPL Bell Bend, LLC, to NRC regarding Application for Combined License Environmental Report for the Bell Bend Nuclear Power Plant, Revision 0 (Package Accession No. ML082890759).
November 13, 2008	Federal Register Notice of Receipt and Availability of Application for a Combined License for the Bell Bend Nuclear Power Plant (73 FR 67214).

November 18, 2008	Letter from Mr. Terry L. Harpster, PPL Bell Bend, LLC, to NRC, regarding Supplemental Information for the Combined License Application for the Bell Bend Nuclear Power Plant (Accession No. ML083250485).
December 19, 2008	Letter from NRC, to Mr. Clifford Farides, Mill Memorial Public Library, regarding Maintenance of Reference Materials for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML083500303).
December 19, 2008	Letter from NRC, to Mr. Rich Miller, McBride Memorial Library, regarding Maintenance of Reference Materials for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML083500320).
December 29, 2008	Letter from NRC, to Ms. Margaret E. Gaffney-Smith, U.S. Army Corps of Engineers, regarding Acceptance of Cooperating Agency Request (Accession No. ML082320446).
December 29, 2008	Letter from NRC, to Mr. Terry L. Harpster, PPL Bell Bend, LLC, regarding Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Related to a Combined License for Bell Bend Nuclear Power Plant (Accession No. ML083400428).
January 6, 2009	Federal Register Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process for Bell Bend Nuclear Power Plant Combined License Application (74 FR 470).
January 7, 2009	Notice of Public Meeting to Discuss Environmental Scoping Process for the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML090070243).
January 8, 2009	Press Release No. 09-004: NRC Meeting with Public January 29 on Environmental Issues for Bell Bend New Reactor Application (Accession No. ML090080406).
January 8, 2009	Letter from NRC, to Mr. Herb Lord, New Jersey Natural Heritage Program, regarding Request for Participation in the Scoping Process for the Environmental Review for the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML083500509).
January 8, 2009	Letter from NRC, to Mr. Eric Davis, New Jersey Field Office of the U.S. Fish and Wildlife Service, regarding Request for Participation in the Scoping Process for the Environmental Review for the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML083500530).

January 9, 2009	Letter from NRC, to Mr. Robert Chicks, Stockbridge-Munsee Band of the Mohican Nation of Wisconsin, regarding Notification and Request for Consultation and Participation in the Scoping Process for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML083520544).
January 9, 2009	Letter from NRC, to Mr. Tony Gonyea, Onondaga Nation, regarding Notification and Request for Consultation and Participation in the Scoping Process for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML083510898).
January 9, 2009	Letter from NRC, to The Honorable Raymond Halbritter, Oneida Indian Nation, regarding Notification and Request for Consultation and Participation in the Scoping Process for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML083510897).
January 9, 2009	Letter from NRC, to Mr. Clint Halftown, Heron Clan Representative for the Cayuga Nation, regarding Notification and Request for Consultation and Participation in the Scoping Process for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML083510880).
January 9, 2009	Letter from NRC, to The Honorable Leo Henry, Tuscarora Nation, regarding Notification and Request for Consultation and Participation in the Scoping Process for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML083520477).
January 9, 2009	Letter from NRC, to The Honorable Rick Hill, Oneida Nation of Wisconsin, regarding Notification and Request for Consultation and Participation in the Scoping Process for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML083510895).
January 9, 2009	Letter from NRC, to The Honorable Roger Hill, Tonawanda Seneca Nation, regarding Notification and Request for Consultation and Participation in the Scoping Process for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML083520483).
January 9, 2009	Letter from NRC, to The Honorable LeRoy Howard, Seneca-Cayuga Tribe of Oklahoma, regarding Notification and Request for Consultation and Participation in the Scoping Process for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML083520552).

January 9, 2009	Letter from NRC, to Mr. Kerry Holton, Delaware Nation, regarding Notification and Request for Consultation and Participation in the Scoping Process for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML083510888).
January 9, 2009	Letter from NRC, to Mr. Maurice John, Seneca Nation of Indians, regarding Notification and Request for Consultation and Participation in the Scoping Process for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML083520472).
January 9, 2009	Letter from NRC, to Ms. Karen Kaniatobe, Absentee-Shawnee Tribe of Oklahoma, regarding Notification and Request for Consultation and Participation in the Scoping Process for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML083510872).
January 9, 2009	Letter from NRC, to Mr. Don Klima, Advisory Council on Historic Preservation, regarding Request for Participation in the Scoping Process for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML083470501).
January 9, 2009	Letter from NRC, to Ms. Patricia Kurkul, NOAA National Marine Fisheries Service, regarding Request for Participation in Environmental Scoping Process and a List of Protected Species Within the Area under Evaluation for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML083500532).
January 9, 2009	Letter from NRC, to Mr. James Leigey, Pennsylvania Game Commission, regarding Request for Participation in the Scoping Process and List of State Listed Protected Species for the Environmental Review for the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML083500555).
January 9, 2009	Letter from NRC, to Mr. Douglas McLearen, Pennsylvania Historical and Museum Commission, regarding Notification and Request for Consultation and Participation in the Scoping Process for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML083470653).
January 9, 2009	Letter from NRC, to The Honorable James Ransom, St. Regis Mohawk Tribe, regarding Notification and Request for Consultation and Participation in the Scoping Process for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML083520468).

January 9, 2009	Letter from NRC, to Mr. Ron Sparkman, Chairman of Shawnee Tribe, regarding Notification and Request for Consultation and Participation in the Scoping Process for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML083510894).
January 9, 2009	Letter from NRC, to Mr. Chris Urban, Pennsylvania Fish and Boat Commission, regarding Request for Participation in the Scoping Process and List of State Listed Protected Species for the Environmental Review for the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML083510239).
January 9, 2009	Letter from NRC, to The Honorable Glenna Wallace, Eastern Shawnee Tribe of Oklahoma, regarding Notification and Request for Consultation and Participation in the Scoping Process for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML083520420).
January 12, 2009	Letter from NRC, to Mr. David Densmore, U.S. Fish and Wildlife Service, regarding Request for Participation in the Environmental Scoping Process and a List of Protected Species Within the Area Under Evaluation for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML083460637).
January 12, 2009	Letter from NRC, to Mr. Justin Newell, Pennsylvania Department of Conservation and Natural Resources, regarding Request for Participation in the Scoping Process and List of State Listed Protected Species for the Environmental Review for the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML083500498).
January 27, 2009	Letter from Mr. Herbert A. Lord, New Jersey Department of Environmental Protection Natural Heritage Program, to NRC, regarding Species and Habitat on Martin's Creek, New Jersey, Alternate Site (Accession No. ML090400936).
February 12, 2009	Letter from Ms. Joy VanDervort-Sneed, Pennsylvania Department of Conservation and Natural Resources, to NRC, regarding Species and Resources of Special Concern on the Bell Bend Site, and the Sandy Bend and Montour Alternate Sites (Accession No. ML090440181).
February 17, 2009	Letter from Ms. Charlene Dwin Vaughn, Advisory Council on Historic Preservation, to NRC, regarding the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML090500261).
February 24, 2009	Summary of the Public Scoping Meeting to Support the Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML090440489).

February 27, 2009	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Revision 1 of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML090710441).
March 2, 2009	Letter from Mr. Douglas McLearen, Pennsylvania Historical and Museum Commission, regarding Management Summary, Phase 1b Cultural Resource Investigation, Bell Bend Nuclear Power Plant, Salem Township, Luzerne County, Pennsylvania (Accession No. ML090720932).
March 5, 2009	Letter from Mr. Christopher A. Urban, Pennsylvania Fish and Boat Commission, to NRC, regarding Species Impact Review (SIR) – Rare, Candidate, Threatened and Endangered Species Bell Bend Nuclear Power Plant Project, Sandy Bend Alternative Site, Mifflin County, Pennsylvania (Accession No. ML090790548).
March 13, 2009	Letter from Mr. J. Eric Davis, Jr., U.S. Fish and Wildlife Service, to NRC, regarding the Martin's Creek Alternative Site (Accession No. ML091280435).
March 19, 2009	E-mail from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Bell Bend Information Needs (Accession No. ML092180356).
April 9, 2009	Letter from Mr. William P. Seib, U.S. Army Corps of Engineers, to NRC, regarding Corps Participation (Accession No. ML091050461).April 29, 2009 Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to Ms. Amy Elliot, U.S. Army Corps of Engineers, regarding Request for Preliminary Jurisdictional Determination, Bell Bend Nuclear Power Plant, Luzerne County, Pennsylvania (Accession No. ML093620088).
May 26, 2009	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to Mr. Douglas C. McLearen, Pennsylvania Historic Museum and Commission, regarding Bell Bend Nuclear Power Plant Submittal of Workscope for Phase II National Register Evaluations of Archaeological Sites (Accession No. ML091630187).
May 27, 2009	Letter from NRC to Mr. Terry L. Harpster, PPL Bell Bend, LLC, regarding Bell Bend Nuclear Power Plant Combined License Application Review Schedule (Accession No. ML091260419).
May 28, 2009	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding the Bell Bend Nuclear Power Plant April 2009 NRC Environmental Audit Response Status (Accession No. ML091620183).
May 29, 2009	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Supplemental Information for the Bell Bend COLA – Impingement and Entrainment Study (Package Accession No. ML091530131).

June 11, 2009	Letter from Mr. Douglas C. McLearen, Pennsylvania Historic and Museum Commission, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Scope of Work Proposal for Phase II Archaeological Evaluations and Assessments of Effects to Historic Resources, Bell Bend Nuclear Power Plant, Salem Township, Luzerne County, Pennsylvania (Accession No. ML091630211).
June 24, 2009	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding the BBNPP April 2009 NRC Environmental Audit Final Response Items (Accession No. ML092370535).
June 29, 2009	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC regarding the BBNPP April 2009 NRC Environmental Audit Final Response Items (Accession No. ML092370537).
July 2, 2009	Letter from NRC to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Bell Bend Nuclear Power Plant Combined License Application Online Reference Portal (Accession No. ML091460705).
July 7, 2009	Letter from NRC, to The Honorable Rick Hill, Oneida Nation of Wisconsin, regarding Request for Information for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML091560475).
July 7, 2009	Letter from NRC, to Mr. Kerry Holton, Delaware Nation, regarding Request for Information for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML091541273).
July 7, 2009	Letter from NRC, to the Honorable LeRoy Howard, Seneca-Cayuga Tribe of Oklahoma, regarding Request for Information for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML091560488).
July 7, 2009	Letter from NRC, to Mr. Maurice John, Seneca Nations of Indians, regarding Request for Information for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML091560513).
July 7, 2009	Letter from NRC, to Ms. Karen Kaniatobe, Absentee-Shawnee Tribe of Oklahoma, regarding Request for Information for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML091541164).

July 7, 2009	Letter from NRC, to the Honorable James Ransom, St. Regis Mohawk Tribe, regarding Request for Information for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML091560567).
July 7, 2009	Letter from NRC, to Mr. Jim Stout, Berwick Historical Society, regarding information Request for Information for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML091560490).
July 7, 2009	Letter from NRC, to the Honorable Glenna Wallace, Eastern Shawnee Tribe of Oklahoma, regarding Request for Information for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML091560458).
July 10, 2009	Letter from NRC, to Mr. David Densmore, U.S. Fish and Wildlife Service, regarding Request for Information for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML092020071).
July 10, 2009	Letter from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Requests for Additional Information Related to the Environmental Review for the Combined License Application for Bell Bend Nuclear Power Plant (Package Accession No. ML091620600).
July 17, 2009	E-mail from Mr. Bill Vezendy, Berwick Historical Society, to Ms. Stacey Imboden, NRC, regarding License Application of Bell Bend Nuclear Plant Environmental Study (Accession No. ML091980262).
July 22, 2009	Scoping Summary Report Related to the Environmental Scoping Process for the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML091760096).
July 23, 2009	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding ADAMS-Compliant Electronic Discs of BBNPP April 2009 NRC Environmental Audit Response Items (Accession No. ML092220661).
August 5, 2009	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Responses to Environmental Request for Additional Information, First Submittal (Accession No. ML092220151).
August 10, 2009	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Response to Environmental Requests for Additional Information, Second Submittal (Accession No. ML092250656).
August 18, 2009	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Online Reference Portal (Accession No. ML092360179).

September 2, 2009	Letter from NRC, to Mr. Robert Chicks, Stock-bridge-Munsee Band of the Mohican Nation of Wisconsin, regarding Request for Information for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML092470274).
September 2, 2009	Letter from NRC, to Mr. Tony Gonyea, Onondaga Nation, regarding Request for Information for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML092470231).
September 2, 2009	Letter from NRC, to the Honorable Raymond Halbritter, Oneida Indian Nation, regarding Request for Information for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML092460629).
September 2, 2009	Letter from NRC, to Mr. Clint Halftown, Heron Clan Representative for the Cayuga Nation, requesting Information for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML092460607).
September 2, 2009	Letter from NRC, to The Honorable Leo Henry, Tuscarora Nation, regarding Information for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML092470260).
September 2, 2009	Letter from NRC, to the Honorable Roger Hill, Tonawanda Seneca Nation, regarding Request for Information for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML092470301).
September 2, 2009	Letter from NRC, to Mr. Ron Sparkman, Chairman of the Shawnee Tribe, regarding Request for Information for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML092470285).
September 9, 2009	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Alternative Site Evaluation (Package Accession No. ML092570289).
September 11, 2009	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Response to Environmental Requests for Additional Information, Third Submittal (Package Accession No. ML092640143).
September 15, 2009	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Environmental Requests for Additional Information Extension Request (Accession No. ML092610372).

September 17, 2009	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Response to Environmental Requests for Additional Information, Fourth Submittal (Accession No. ML092810289).
September 25, 2009	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Response to Environmental Requests for Additional Information, Fifth Submittal (Accession No. ML092740184).
October 15, 2009	Letter from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Summary of Teleconference to Discuss Responses to Requests for Additional Information Regarding the Environmental Review of the Combined License Application For Bell Bend Nuclear Power Plant (Accession No. ML092580084).
October 16, 2009	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Extension Request for Environmental Requests for Additional Information (Accession No. ML092950159).
October 19, 2009	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Response to Environmental Requests for Additional Information, Sixth Submittal (Accession No. ML093270270).
October 29, 2009	Memorandum from Ms. Tomeka L. Terry, NRC, to Mr. Robert G. Schaaf, NRC, regarding Summary of the Environmental Site Audit Related to the Review of the Combined License Application for Bell Bend Nuclear Power Plant (Accession No. ML091940388).
November 9, 2009	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Update of Response to Environmental Request for Additional Information STO 1-1 (Package Accession No. ML093270273).
November 25, 2009	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Environmental Report Section 9.3, Alternative Sites (Accession No. ML093380312).
November 30, 2009	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Response to Environmental Requests for Additional Information, Seventh Submittal (Package Accession No. ML093420037).
December 8, 2009	Letter from Mr. Terry L. Harpster, PPL Bell Bend, LLC, to NRC regarding Bell Bend Nuclear Power Plant BBNPP Schedule Update (Accession No. ML093450345).
December 16, 2009	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant BBNPP COLA Preliminary Plot Plan (Package Accession No. ML093631617).

December 17, 2009	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Revision of Response to Environmental Request for Additional Information H 5.3-1 (Accession No. ML093580196).
December 17, 2009	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Alternative Site Evaluation Revision 1 (Package Accession No. ML093631045).
January 15, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Response to Environmental Request for Additional Information, Eighth Submittal (Accession No. ML100191531).
February 12, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Submittal of Bell Bend COLA, Revision 2 (Accession No. ML101880709).
February 17, 2010	Letter from NRC, to Mr. Terry L. Harpster, PPL Bell Bend, LLC, regarding Bell Bend Nuclear Power Plant Combined License Application Review Schedule Revision (Accession No. ML100110386).
February 26, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Response to Environmental Requests for Additional Information, Ninth Submittal (Accession No. ML100640163).
March 1, 2010	Letter from Mr. Terry L. Harpster, PPL Bell Bend, LLC, to Ms. Amy Elliott, U.S. Corps of Engineers, regarding Bell Bend Nuclear Power Plant Preliminary Jurisdiction Determination (Package Accession No. ML100890584).
March 31, 2010	Letter from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Summary of Teleconferences to Discuss Responses to Requests for Additional Information regarding the Environmental Review of the Combined License Application for Bell Bend Nuclear Power Plant (Accession No. ML093631218).
April 5, 2010	Letter from Mr. Joseph J. Scopelliti, PPL Bell Bend, LLC, to property owners, regarding Bell Bend Nuclear Power Plant Letter to Downstream Property Owners (Accession No. ML101040485).
April 20, 2010	E-mail from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Bell Bend 2nd Alternative Site Visit Information Needs (Accession No. ML101100516).
April 30, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Response to Environmental RAI's: Schedule Update (Accession No. ML101230615).

May 7, 2010	Letter from Mr. Terry L. Harpster, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant May 2010 BBNPP Schedule Update (Accession No. ML101340552).
May 14, 2010	Letter from Ms. Amy Elliot, U.S. Army Corps of Engineers, to NRC, regarding information needs in preparation for the alternative site audit (Accession No. ML101440130).
June 25, 2010	Letter from Ms. Amy Elliot, U.S. Army Corps of Engineers, to Mr. Geier, Unistar Nuclear Energy, regarding request for a jurisdictional determination (Accession No. ML101890694).
July 9, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Response to Environmental Information Needs, First Submittal (Accession No. ML101930519).
July 16, 2010	Letter from Mr. Terry L. Harpster, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant July 2012 BBNPP Schedule Update (Accession No. ML102030025).
July 21, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Response to Environmental Information Needs, Second Submittal (Accession No. ML102070070).
July 23, 2010	Letter from Mr. Terry L. Harpster, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Environmental Request for Additional Information MET 2.7-1 Extension Request (Accession No. ML102100205).
August 4, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Submittal of BBNPP RAI Schedule (Accession No. ML102230149).
August 12, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Environmental Requests for Additional Information TE 2.4-7 and TE 2.4-8 Extension Request (Accession No. ML102300074).
August 13, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Response to Environmental Information Needs, Third Submittal (Accession No. ML102310237).
August 19, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Response to Environmental Information Needs, Third Submittal (Accession No. ML102370780).
August 20, 2010	E-mail from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Bell Bend Environmental USACE RAIs (Accession No. ML102370117).

August 26, 2010	Letter from Mr. Kevin Magerr, U.S. Environmental Protection Agency, to Ms. Amy Elliott, U.S. Corps of Engineers, regarding the proposed alternative site analysis (Accession No. ML102640782).
August 27, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Response to Environmental Requests for Additional Information, Eleventh Submittal (Accession No. ML102440650).
August 27, 2010	Letter from Mr. William P. Seib, U.S. Army Corps of Engineers, to NRC, regarding the Bell Bend site audit (Accession No. ML102640781).
September 8, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant BBNPP Plot Plan Change COLA Supplement: Part 3 (ER) Section 4.5 Status: Part 3 (ER) Section 7.1 and Part 2 (FSAR) Section 6.4 (Accession No. ML102570071).
September 10, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Clarification of Schedule for COLA Part 11 Reports (Accession No. ML102580173).
September 15, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant BBNPP Plot Plan Change COLA Supplement: Part 3 (ER) Section 6.4 Status: Part 3 (ER) Section 2.1 (Accession No. ML102670161).
September 21, 2010	Letter from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Transmittal of U.S. Army Corps of Engineers Comments on Bell Bend Nuclear Power Plant Combined License Application Alternatives Analysis (Package Accession No. ML102430317).
September 22, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant BBNPP Plot Plan Change COLA Supplement Schedule Update (Accession No. ML102720191).
September 24, 2010	Memorandum from Ms. Stacey Imboden, NRC, to Mr. Robert G. Schaaf, NRC regarding Summary of the Second Environmental Alternative Sites Audit Related to the Review of the Combined License Application for Bell Bend Nuclear Power Plant (Package Accession No. ML102520378).
September 28, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant BBNPP Plot Plan Change COLA Supplement Schedule Update (Accession No. ML102780283).
October 6, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Environmental Request for Additional Information MET 2.7-1 Extension Request (Accession No. ML102861201).

October 7, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Partial Response to Environmental Requests for Additional Information 5022, 5025, 5033,& 5043 and Schedule Information (Accession No. ML102880145).
October 14, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC submitting Part 3 Section 7.2 of revised COL application and responses to requests for additional information (Accession No. ML102920368).
October 19, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC providing responses to second alternative sites audit requests for additional information (Accession No. ML102980024).
October 20, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC submitting Part 3 Section 3.7 of revised COL application (Accession No. ML102980023).
October 21, 2010	Letter from Mr. Terry L. Harpster, PPL Bell Bend, LLC to Mr. James Richenderfer, SRBC, Bell Bend Nuclear Power Plant Notice of application review response avoidance of consumptive use (Accession No. ML102990460).
October 27, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC submitting Part 3 Section 2.1 of revised COL application and revised responses to requests for additional information (Accession No. ML103070314).
October 27, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC providing schedule update for submittal of responses to RAI MET 2.7-1 and USACE-2f (Accession No. ML103060388).
October 28, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC submitting Part 3 Section 7.3 of revised COL application (Accession No. ML103070173).
November 1, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC submitting Part 3 Section 3.1 of revised COL application (Accession No. ML103090555).
November 3, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC submitting Part 3 Chapter 8 of revised COL application (Accession No. ML103130380).
November 5, 2010	Letter from Mr. Terry L. Harpster, PPL Bell Bend, LLC, to Ms. Amy Elliott, U.S. Army Corps of Engineers, transmitting Sampling and Analysis Plan for Dredge Management Support (Accession No. ML103560157).

November 8, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC providing schedule update for submittal of responses to requests for additional information (Accession No. ML103190456).
November 11, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC providing responses to second alternative sites audit requests for additional information (Accession No. ML103200415).
November 11, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC submitting Part 3 Section 2.2 of revised COL application and responses to requests for additional information (Accession No. ML103200240).
November 15, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC submitting revised Part 3 Section 7.3 of revised COL application (Accession No. ML103260237).
November 18, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC providing responses to second alternative sites audit requests for additional information (Accession No. ML103260482).
November 30, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC providing revised response to request for additional information AE 5.3-1 and schedule information (Accession No. ML103400358).
December 3, 2010	Letter from NRC to Mr. Terry L. Harpster, PPL Bell Bend, LLC, announcing environmental project manager change for the combined license application review for the Bell Bend Nuclear Power Plant (Accession No. ML103270346).
December 3, 2010	Letter from Mr. Terry L. Harpster, PPL Bell Bend, LLC, to Ms. Amy Elliott, U.S. Army Corps of Engineers Baltimore District, requesting second preliminary jurisdictional determination (Accession No. ML110410532).
December 6, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC submitting Part 3 Section 5.6 of revised COL application (Accession No. ML103490444).
December 10, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC submitting Part 3 Section 4.4 of revised COL application and revised responses to requests for additional information SE 4.4-1, SE 4.4-2, and SE 4.4-10 (Accession No. ML103490807).
December 13, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC submitting Part 3 Section 5.3 of revised COL application and responses to requests for additional information (Accession No. ML103550387).

December 15, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC providing schedule update for submittal of response to RAI MET 2.7-1 (Accession No. ML103550564).
December 16, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC submitting Part 3 Section 2.7.7 and Part 11L of revised COL application (Accession No. ML103570168).
December 20, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC submitting Part 3 Section 7.2 of revised COL application and responses to requests for additional information (Accession No. ML103620624).
December 21, 2010	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC submitting Part 3 Section 2.6 of revised COL application (Accession No. ML103620626).
December 23, 2010	Letter from Mr. Terry L. Harpster, PPL Bell Bend, LLC, to Ms. Amy Elliott, U.S. Army Corps of Engineers Baltimore District, providing materials in support of second preliminary jurisdictional determination (Accession No. ML110980716).
January 12, 2011	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC providing schedule update for submittal of response to RAI TE 2.4-6, TE 2.4-7, and STO 2.1-1 (Accession No. ML110190087).
January 20, 2011	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC providing schedule update for submittal of response to RAI H 4.2-1 (Accession No. ML110310456).
January 25, 2011	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC submitting Part 3 Section 6.1 of revised COL application (Accession No. ML110270161).
January 25, 2011	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC providing schedule update for submittal of responses to requests for additional information (Accession No. ML110270164).
January 28, 2011	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC submitting Part 3 Section 3.3 of revised COL application (Accession No. ML110350548).
January 28, 2011	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC submitting Part 3 Section 3.6 of revised COL application (Accession No. ML110350579).
February 11, 2011	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC providing schedule update for submittal of responses to requests for additional information (Accession No. ML110470344).

February 15, 2011	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC providing schedule update for submittal of responses to RAIs MET 2.7-1 and USACE-2f (Accession No. ML110480494).
February 25, 2011	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC providing schedule update for submittal of responses to RAIs USACE-2 and USACE-2a (Accession No. ML110660337).
February 28, 2011	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC providing schedule update for submittal of response to RAI H 4.2-1 (Accession No. ML110670355).
March 11, 2011	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC providing responses to requests for additional information and schedule update for submittal of response to RAI TE 2.4-6 (Accession No. ML110830902).
March 15, 2011	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC providing schedule update for submittal of responses to RAIs USACE-1a and USACE-1b (Accession No. ML110950354).
March 16, 2011	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC providing schedule update for submittal of responses to RAIs (Accession No. ML111020287).
March 28, 2011	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC submitting Part 3 Section 2.5 of revised COL application and responses to RAIs (Accession No. ML110910090).
March 30, 2011	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC providing schedule update for submittal of responses to RAIs (Accession No. ML110950674).
March 30, 2011	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC providing response to RAI H 4.2-1 (Accession No. ML111010131).
April 12, 2011	Letter from NRC to Mr. Terry L. Harpster, PPL Bell Bend, LLC, announcing environmental project manager change for the combined license application review for the Bell Bend Nuclear Power Plant (Accession No. ML110960330).
April 13, 2011	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC providing schedule update for submittal of response to RAI TE 2.4-6 (Accession No. ML11116A005).
April 19, 2011	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC submitting Part 3 Section 6.5 of revised COL application and responses to RAIs (Accession No. ML11119A079).

May 4, 2011	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC providing response to RAI TE 2.4-6 (Accession No. ML111890425).
May 6, 2011	Letter from Mr. Bradley A. Wise, PPL Bell Bend, LLC, to Ms. Amy Elliott, USACE, regarding second Preliminary Jurisdictional Determination (Accession No. ML11143A047).
May 9, 2011	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC submitting Part 3 Chapter 1 of revised COL application and response to RAI USACE-2f (Accession No. ML11140A037).
May 25, 2011	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC providing responses to requests for additional information and schedule update for submittal of responses to RAIs (Accession No. ML11153A125).
May 27, 2011	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC providing Alternative Site Evaluation Report Revision 2 (Accession No. ML111580443).
May 28, 2011	Letter from Mr. Gary Petrewski, PPL Bell Bend, LLC, to Mr. James Richenderfer, Susquehanna River Basin Commission, regarding Bell Bend Nuclear Power Plant Response to SRBC Comments on the BBNPP Water Monitoring Plan (Accession No. ML11192A144).
June 30, 2011	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC providing responses to requests for additional information and schedule update for submittal of responses to RAIs (Accession No. ML11187A301).
July 22, 2011	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding redacted versions of cultural resources reports (Accession No. ML112101650).
August 1, 2011	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Schedule Information For Environmental Requests for Additional Information 5022, 5026, 5033, 5034, 5035, 5036, 5042, and 5043 (Accession No. ML11220A304).
August 22, 2011	Letter from Mr. Andrew D. Dehoff, SRBC, to Mr. Terry Harpster, Bell Bend, LLC, regarding Bell Bend Nuclear Power Plant Avoidance of Consumptive Use (Accession No. ML11238A198).
August 26, 2011	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Schedule Update for ER 9.3 RAIs (Accession No. ML11249A094).

September 23, 2011	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Final Response to Environmental Requests for Additional Information 5022, 5026, 5033, 5034, 5035, 5036, 5042 and 5043 (Package Accession No. ML112860514).
September 23, 2011	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant COLA Schedule Information (Accession No. ML11277A067).
October 3, 2011	Letter from Mr. Terry L. Harpster, PPL Bell Bend, LLC, to Mr. Wade B. Chandler, U.S. Army Corps of Engineers, regarding Bell Bend Nuclear Power Plant Request for Deferral of Public Notice of Joint Permit Application (Accession No. ML11284A209).
October 6, 2011	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Data Sources Associated with Environmental Request for Additional Information 5035 EIS 9.3-27 (Accession No. ML11294A463).
November 18, 2011	Letter from NRC, to FEMA LOMC Clearinghouse, regarding U.S. Nuclear Regulatory Commission's Endangered Species Act Review for the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML113070296).
December 13, 2011	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Request for Withholding of Information from Joint Permit Application Pursuant to 10 CFR 2.390 (Package Accession No. ML13057A75).
December 13, 2011	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Final Response to Environmental Requests for Additional Information TE 4.3-1, TE 4.3-2, TE 4.3-7, TE 4.3-10, MET 2.7-1, LU 4.1-1, LU 5.1-1 and LU 5.1-2 (Package Accession No. ML113550181).
December 19, 2011	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant COLA Part 3 (Environmental Report) Update to Reflect Site Footprint Relocation (Accession No. ML12108A051).
December 21, 2011	Letter from Mr. James A. Richenderfer, Susquehanna River Board Commission, to Mr. Michael J. Caverly, PPL Bell Bend, LLC, regarding Bell Bend Nuclear Power Plant; BNP-2011-126; Project Response Status and Filing of Joint Permit Application; Salem Township, Luzerne County, Pennsylvania (Accession No. ML120170314).

January 16, 2012	Letter from Mr. Michael J. Caverly, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Project Notice of Application for Groundwater Withdrawal Salem Township, Luzerne County, Pennsylvania (Accession No. ML12107A339).
January 20, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to Mr. Douglas McLearen, Pennsylvania Historical and Museum Commission, regarding Bell Bend Nuclear Power Plant Addendum Report Third Supplemental Phase I Cultural Resources Investigation (Accession No. ML12053A050).
January 20, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Revised Response to Environmental Request for Additional Information MET 2.7-1 (Package Accession No. ML120310490).
January 23,2012	U.S. Army Corps of Engineers Public Notice in Reply to Application Number NAB-2008-01401-P13 Bell Bend Nuclear Power Plant BBNPP) (Accession No. ML12132A041).
January 24, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant COLA Part 3 (Environmental Report) Update to Reflect Site Footprint Relocation (Accession No. ML12054A746).
January 27, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant COLA Part 3 (Environmental Report) Environmental Noise Survey and Cooling Tower Sound Emissions (Accession No. ML12039A271).
January 29, 2012	Letter from Ronald and Elizabeth Samuels, to Ms. Amy Elliott, U.S. Army Corps of Engineers, regarding Application Number NAB 2008-01401-P13 BBNPP Bell Bend Nuclear Power Plant (Accession No. ML12107A341).
February 18, 2012	Letter from Ms. Tina Daly, to U.S. Army Corps of Engineers, regarding Comments on Public Notice NAB-2008-01401-P13 (Accession No. ML12107A342).
February 19, 2012	Letter from Dennis and Jill Shelper, to Ms. Amy Elliott, U.S. Army Corps of Engineers, regarding comments on Public Notice NAB-2008-01401-P13 (Accession No. ML12107A338).
February 21, 2012	Letter from Mr. Eric Epstein, Three Mile Island Alert, Inc., to Ms. Amy Elliott, U.S. Army Corps of Engineers, regarding Three Mile Island Alert Inc.'s Comments Re: PPL Bend Nuclear Power Plant's Application Number NAB-2008-01401-P13 (Bell Bend Nuclear Power Plant) Before the U.S. Army Corps of Engineers (Accession No. ML12107A343).

February 21, 2012	Letter from Mr. Eric Epstein, Three Mile Island Alert, Inc., to Ms. Amy Elliott, U.S. Army Corps of Engineers, regarding Three Mile Island Alert Inc.'s Comments Re: PPL Bend Nuclear Power Plant's Application Number NAB-2008-01401-P13 (Bell Bend Nuclear Power Plant) Before the U.S. Army Corps of Engineers (Accession No. ML12065A013).
February 22, 2012	E-mail from Ms. B.J. DeRonde, to Ms. Amy Elliott, U.S. Army Corps of Engineers, regarding Extension to Submit Concerns about Bell Bend Pond Project (Accession No. ML12107A340).
February 22, 2012	Letter from Mr. James L. Richenderfer, Susquehanna River Board Commission, to Ms. Amy Elliott, U.S. Army Corps of Engineers, regarding Public Notice in Reply to Application Number NAB-2008-01401-P13; Pennsylvania Power and Light (PPL); Bell Bend Nuclear Power Plant (BBNPP); U.S. Army Corps of Engineers, Baltimore District (Accession No. ML12107A337).
February 29, 2012	SRBC's response to USACE Public Notice in Reply to PPL's JPA, regarding Bell Bend Nuclear Power Plant (Accession No. ML12060A134).
March 14, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Revised Response to Environmental Request for Additional Information MET 2,7-1 – Air Conformity Report, Revision 2 (Package Accession No. ML120820274).
March 22, 2012	Letter from Mr. John R. Pomponio, U.S. Environmental Protection Agency, to Ms. Beth Bachur, U.S. Army Corps of Engineers, regarding Public Notice NAB-2008-01401-P13 Bell Bend Nuclear Power Plant (Accession No. ML12107A345).
March 22, 2012	Letter from Mr. Clinton Riley, U.S. Fish and Wildlife Service, to Ms. Amy Elliott, U.S. Army Corps of Engineers, regarding Bell Bend Nuclear Power Plant (PN-12-07) USFWS Project #2009-0501 (Accession No. ML12107A344).
March 28, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Closure of USACE Environmental Requests for Additional Information 1a, 1b, 2a, 2h, and 3 (Accession No. ML12101A076).
March 30, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Submittal of Bell Bend COLA, Revision 3 (Package Accession No. ML12145A187).
April 2, 2012	Bell Bend Nuclear Power Plant Information Needs for May 2012 Supplemental Audit (Accession No. ML12114A212).

April 16, 2012	Letter from Mr. Shawn M. Garvin, U.S. Environmental Protection Agency, to Colonel David E. Anderson, U.S. Army Corps of Engineers, regarding comments in response to Public Notice NAB-2008-01401-P13 (Accession No. ML12132A042).
April 18, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to Mr. Douglas McLearen, Pennsylvania Historical and Museum Commission, regarding Bell Bend Nuclear Power Plant Cultural Resources Avoidance/Mitigation Plan Archaeological Site 36LU288 (Accession No. ML12132A044).
April 26, 2012	E-mail from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to Ms. Laura Quinn-Willingham, NRC, and Ms. Amy Elliott, U.S. Army Corps of Engineers, regarding Bell Bend Nuclear Power Plant Cultural Resource Avoidance Mitigation Plan Archeological Site 36LU288 BNP-2012-075 Docket No. 52-039 (Accession No. ML12132A043).
April 26, 2012	Letter from Mr. Michael J. Caverly, PPL Bell Bend, LLC, to Ms. Glenda Miller, Susquehanna River Basin Commission, regarding Bell Bend Nuclear Power Plant Approval by Rule Application Certification of Public Notifications SRBC Pending No. NOI-2012-0104 (Accession No. ML12150A229).
April 27, 2012	Letter from Mr. Michael J. Caverly, PPL Bell Bend, LLC, to Mr. Robert Kretschmer, Pennsylvania Department of Transportation, regarding Bell Bend Nuclear Power Plant Bell Bend TIS File No. 2066 HOP APPL. No. TISNUC (Accession No. ML12132A046).
May 3, 2012	E-mail from NRC, to Ms. Kim Ball Kaiser, New Jersey Highlands Council, regarding Bell Bend Nuclear Power Plant (Accession No. ML12255A292).
May 7, 2012	Letter from Mr. Clinton Riley, U.S. Fish and Wildlife Service, to NRC, regarding Bell Bend Nuclear Power Plant USFWS Project #2009-0501 (Package Accession No. ML121450545).
May 9, 2012	E-mail from NRC, to Ms. Kim Ball Kaiser, New Jersey Highlands Council, regarding Martin's Creek New Jersey Alternative Site for the Bell Bend Nuclear Power Plant (Accession No. ML12257A355).
May 10, 2012	Letter from Mr. Daniel J. Van Abs, Highland Water Protection and Planning Council, to NRC, regarding Proposed Bell Bend Nuclear Power Plant Environmental Impact Statement Alternative Site Analysis White Township, New Jersey (Package Accession No. ML12135A234).
May 14, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Need for Information ACC-08 Data Files (Accession No. ML12146A027).

May 21, 2012	Letter from Mr. Wade B. Chandler, U.S. Army Corps of Engineers, to Mr. Michael J. Caverly, PPL Bell Bend, LLC, regarding application for Department of the Army permit identified as CENAB-OP-RPA-2008-01401-P13 (Package Accession No. ML12153A164).
May 22, 2012	E-mail from NRC, to Ms. Kim Ball Kaiser, New Jersey Highlands Council, regarding Bell Bend EIS Alternative Site Analysis (Accession No. ML12257A356).
May 22, 2012	E-mail from NRC, to Ms. Kim Ball Kaiser, New Jersey Highlands Council, regarding Bell Bend EIS Alternative Site Analysis (Accession No. ML12258A186).
May 31, 2012	Letter from NRC, to Mr. Troy Jordan, Chesapeake Energy Corporation, regarding Natural Gas "Fracking" Tour on Thursday, May 17, 2012 (Accession No. ML12150A193).
May 31, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Environmental Audit Need for Information Responses: First Submittal (Package Accession No. ML121580599).
June 7, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Environmental Audit Need for Information Responses: Second Submittal (Accession No. ML12166A271).
June 11, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Environmental Audit Need for Information Responses: Third Submittal (Accession No. ML12172A249).
June 11, 2012	Letter from NRC, to Mr. Michael J. Caverly, PPL Bell Bend, LLC, regarding Notice of Intent to Conduct a Supplemental Scoping Process for the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML12061A137).
June 11, 2012	Letter from NRC, to Mr. Clifford Farides, Mill Memorial Public Library, regarding Maintenance of Reference Materials at the Mill Memorial Public Library Related to the Environmental Review of the PPL Bell Bend, LLC Combined License Application at the Bell Bend Nuclear Power Plant Site (Accession No. ML12076A162).
June 11, 2012	Letter from NRC, to Ms. Lisette Ormsbee, McBride Memorial Library, regarding Maintenance of Reference Materials at the McBride Memorial Library Related to the Environmental Review of the PPL Bell Bend, LLC Combined License Application at the Bell Bend Nuclear Power Plant Site (Accession No. ML12076A174).

June 11, 2012	Letter from NRC, to Mr. James R. Leigey, Pennsylvania Game Commission, regarding Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML12074A168).
June 11, 2012	Letter from NRC, to Mr. James L. Richenderfer, Susquehanna River Basin Commission, regarding Request for Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML12076A111).
June 11, 2012	Letter from NRC, to Ms. Carol R. Collier, Delaware River Basin Commission, regarding Request for Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML12115A009).
June 12, 2012	Letter from NRC, to Mr. Justin Newell, Pennsylvania Department of Conservation and Natural Resources regarding Request for Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML12076A068).
June 12, 2012	Letter from NRC, to Mr. Herb Lord, Natural Heritage Program, regarding Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML12076A047).
June 12, 2012	Letter from NRC, to Mr. Clint Riley, U.S. Fish and Wildlife Service, Pennsylvania Field Office, regarding Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML12079A176).
June 12, 2012	Letter from NRC, to Mr. Chris Urban, Pennsylvania Fish and Boat Commission, regarding Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML12076A091).
June 12, 2012	Letter from NRC, to Ms. Patricia A. Kurkul, NOAA National Marine Fisheries Service, regarding Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML12076A053).

June 12, 2012	Letter from NRC, to Mr. Eric Davis, U.S. Fish and Wildlife Service, New Jersey Field Office, regarding Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML12076A037).
June 12, 2012	Letter from NRC, to The Honorable Kerry Holton, Delaware Nation, regarding Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML12073A124).
June 12, 2012	Letter from NRC, to Mr. Robert Odawi Porter, Seneca Nation of Indians, regarding Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML12073A299).
June 12, 2012	Letter from NRC, to The Honorable George Blanchard, Absentee-Shawnee Tribe of Oklahoma, regarding Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML12073A130).
June 12, 2012	Letter from NRC, to Dr. Katherine Faull, Bucknell University, regarding Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML121110291).
June 12, 2012	Letter from NRC, to Mr. Adrian Merolli, Luzerne County Planning Commission, regarding Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML121120005).
June 12, 2012	Letter from NRC, to The Honorable Genna Wallace, Eastern Shawnee Tribe of Oklahoma, regarding Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML12073A245).
June 12, 2012	Letter from NRC, to Mr. Douglas C. McLearen, Pennsylvania Historical and Museum Commission, regarding Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML12073A076).

June 12, 2012	Letter from NRC, to The Honorable Roger Hill, Tonawanda Seneca Nation, regarding Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML12073A316).
June 12, 2012	Letter from NRC, to The Honorable Clint Halftown, Heron Clan, regarding Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML12073A308).
June 12, 2012	Letter from NRC, to Mr. Tony Gonyea, Onondaga Nation, regarding Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML12073A270).
June 12, 2012	Letter from NRC, to The Honorable Ron Sparkman, Shawnee Tribe, regarding Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML12079A139).
June 12, 2012	Letter from NRC, to The Honorable Raymond Halbritter, Oneida Indian Nation, regarding Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML12073A137).
June 12, 2012	Letter from NRC, to The Honorable Leo Henry, Tuscarora Nation Chiefs Council, regarding Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML12073A149).
June 12, 2012	Letter from NRC, to Mr. Robert M. Pearse, Salem Township Board of Supervisors, regarding Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML121110296).
June 12, 2012	Letter from NRC, to Mr. Ted Baird, Society for Pennsylvania Archaeology, regarding Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML121110281).

June 12, 2012	Letter from NRC, to Mr. Anthony T.P. Brooks, Luzerne County Historical Society, regarding Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML121110274).
June 12, 2012	Letter from NRC, to The Honorable Mark H. Garrow, The Honorable Randy Hart, The Honorable Ron LaFrance, Jr., St. Regis Mohawk Tribe, regarding Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML12073A261).
June 12, 2012	Letter from NRC, to Mr. Robert Chicks, Stockbridge-Munsee Band of the Mohican Nation of Wisconsin, regarding Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML12073A247).
June 12, 2012	Letter from NRC, to Mr. Reid Nelson, Advisory Council on Historic Preservation, regarding Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML12073A074).
June 12, 2012	Letter from NRC, to The Honorable Ed Delgado, Oneida Nation of Wisconsin, regarding Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML12073A090).
June 12, 2012	Letter from NRC, to The Honorable LeRoy Howard, Seneca-Cayuga Tribe of Oklahoma, regarding Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML12073A101).
June 12, 2012	Letter from NRC, to Mr. Jim Stout, Berwick Historical Society, regarding Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML121110280).
June 15, 2012	Federal Register Notice of Intent to Conduct Supplemental Scoping Process on the Revised Site Layout for Bell Bend Nuclear Power Plant Combined License Application (77 FR 36012).

June 21, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Environmental Audit Need for Information Responses: Fourth Submittal (Accession No. ML12187A026).
June 27, 2012	Letter from Mr. James Richenderfer, Susquehanna River Basin Commission, to Mr. Michael Caverly, PPL Bell Bend, LLC, regarding Holtwood Hydroelectic Station; Letter from Dennis Murphy to Andrew D. Dehoff, dated March 9, 2012; Application to Provide Consumptive Water Use Mitigation (Accession No. ML12194A306)
June 28, 2012	E-mail from Ms. Karen Karchner, Salem Township, to Mr. Darby Stapp, Numark Associates, regarding Dodson Site at Bell Bend (Accession No. ML12181A216).
June 28, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Environmental Audit Need for Information Responses: Fifth Submittal (Accession No. ML12193A153).
June 28, 2012	E-mail from Mr. Larry Miller, Natural Heritage Program, to NRC, regarding Natural Heritage Data Request – Bell Bend Nuclear Power Plant (Accession No. ML12187A055).
June 28, 2012	E-mail from Mr. Darby Stapp, Numark Associates, to Ms. Karen Karchner, Salem Township, regarding Dodson Site at Bell Bend (Accession No. ML122510098).
June 28, 2012	E-mail from Ms. Karen Karchner, Salem Township, to Mr. Darby Stapp, Numark Associates, regarding Dodson Site at Bell Bend (Accession No. ML122510115).
July 3, 2012	Letter from NRC, to Ms. Carol Shull, National Park Services, regarding Archeologist, National Register of Historic Places (Accession No. ML12096A251).
July 12, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Environmental Audit Need for Information Responses: Sixth Submittal (Accession No. ML12214A589).
July 20, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Environmental Audit Need for Information Responses: Seventh Submittal (Accession No. ML12214A590).
August 7, 2012	E-mail from NRC, to Ms. Corina Williams, Oneida Nation, regarding Follow-Up to June 21 Letter (Accession No. ML122510139).
August 13, 2012	E-mail from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Draft RAIs for the Bell Bend Environmental Review (Accession No. ML12227A385).

August 13, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Environmental Audit Need for Information Responses: Eighth Submittal (Accession No. ML12235A287).
August 13, 2012	E-mail from Ms. Corina Williams, Oneida Nation, to NRC, regarding Follow-Up to June 21 Letter (Accession No. ML122510154).
August 15, 2012	E-mail from NRC, to Ms. Corina Williams, Oneida Nation, regarding Follow-Up to June 21 Letter (Accession No. ML122510162).
August 17, 2012	E-mail from NRC, to Ms. Karen Karchner, Salem Township, regarding Dodson Site at Bell Bend (Accession No. ML122510135).
August 23, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Response to Draft ER RAI ALT-8 (Accession No. ML12251A104).
August 27, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Response to Draft ER RAI (Accession No. ML12249A038).
August 27, 2012	E-mail from NRC, to Mr. Abrams, Haudenosaunee Council, regarding NHPA Section 106 Consultation Request from the U.S. Nuclear Regulatory Commission (Package Accession No. ML122500970).
August 29, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Response to Draft ER RAIs, Third Submittal (Accession No. ML12261A478).
August 30, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Indiana Bat Biological Evaluation and Management Plan (Package Accession No. ML122690324).
August 31, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Response to Draft ER RAIs, Fourth Submittal (Accession No. ML12256A004).
August 31, 2012	E-mail from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Draft RAIs for the Bell Bend Environmental Review (Accession No. ML12227A385).
August 31, 2012	E-mail from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Bell Bend Final RAIs for Alternatives (Accession No. ML12244A453).
August 31, 2012	E-mail from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Bell Bend Final RAIs for Aquatic Ecology (Accession No. ML12244A507).

August 31, 2012	E-mail from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Bell Bend Final RAIs for Cultural Resources (Accession No. ML12244A509).
September 5, 2012	E-mail from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Bell Bend Final RAIs for General Info Requests (1 of 2) (Accession No. ML12249A321).
September 5, 2012	E-mail from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Bell Bend Final RAIs for General Info Requests (2 of 2) (Accession No. ML12249A324).
September 5, 2012	E-mail from NRC, to Ms. Corina Williams, Oneida Nation, regarding Follow-Up to June 21 Letter (Accession No. ML12249A398).
September 5, 2012	E-mail from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Bell Bend Final RAIs for Land Use (Accession No. ML12249A646).
September 5, 2012	E-mail from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Bell Bend Final RAIs for Meteorology (Accession No. ML12249A647).
September 5, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to Mr. Douglas McLearen, Pennsylvania Historical and Museum Commission, regarding Bell Bend Nuclear Power Plant Addendum Report, Third Supplemental Phase 1 Cultural Resource Investigation Salem Township, Luzerne County, Pennsylvania (Accession No. ML12256A007).
September 6, 2012	E-mail from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Bell Bend Final RAIs for Radiological Health (1 of 2) (Accession No. ML12250A159).
September 6, 2012	E-mail from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Bell Bend Final RAIs for Radiological Health (2 of 2) (Accession No. ML12250A679).
September 6, 2012	E-mail from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Bell Bend Final RAIs for Socioeconomics and Environmental Justice (1 of 2) (Accession No. ML12250A805).
September 6, 2012	E-mail from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Bell Bend Final RAIs for Socioeconomics and Environmental Justice (2 of 2) (Accession No. ML12250A809).
September 6, 2012	E-mail from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Bell Bend Final RAIs for Terrestrial Ecology (1 of 4) (Accession No. ML12250A865).

September 6, 2012	E-mail from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Bell Bend Final RAIs for Terrestrial Ecology (2 of 4) (Accession No. ML12250A892).
September 6, 2012	E-mail from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Bell Bend Final RAIs for Terrestrial Ecology (3 of 4) (Accession No. ML12250B186).
September 6, 2012	E-mail from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Bell Bend Final RAIs for Terrestrial Ecology (4 of 4) (Accession No. ML12250B187).
September 7, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Status of ER RAI Responses (Accession No. ML12265A064).
September 14, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Submittal of ENV-09 Input/Output files Disc and Affidavit Supplied Supplemental to BNP-2012-199 (Accession No. ML12277A190).
September 14, 2012	E-mail from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Dodson Marker (Accession No. ML12262A003).
September 17, 2012	Letter from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Status of the Environmental Review for the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML12086A134).
September 17, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Response to ER RAI ENV-01 (Accession No. ML12313A482).
September 21, 2012	Letter from Mr. Gary Petrewski, PPL Bell Bend, LLC, to Mr. James Richenderfer, Susquehanna River Basin Commission, regarding Bell Bend Nuclear Power Plant 2012 Young-of-the-year (YOY) Smallmouth Bass (SMB) Survey Report (Accession No. ML12297A048).
September 21, 2012	Trip Report from Interviews with the Public Regarding Socioeconomics and Environmental Justice Issues in Areas Near the Bell Bend Nuclear Power Plant Site (Accession No. ML12209A346).
October 3, 2012	E-mail from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Bell Bend Final RAIs for Design Basis Accidents (Accession No. ML12277A418).

October 18, 2012	Letter from Ms. Olivia A. Mowrey, Pennsylvania Game Commission, to NRC, regarding Bell Bend Nuclear Power Plant (BBNPP) Project – Request for Consultation and Participation in the Supplemental Scoping Process and Preliminary Screening of Alternative Locations Humbolt Site-Hazle Township, Luzerne County, Pennsylvania (Accession No. ML12311A156).
October 18, 2012	Letter from Ms. Olivia A. Mowrey, Pennsylvania Game Commission, to NRC, regarding Bell Bend Nuclear Power Plant (BBNPP) Project – Request for Consultation and Participation in the Supplemental Scoping Process and Preliminary Screening of Alternative Locations – BBNPP Site- Salem Township, Luzerne County, Pennsylvania (Accession No. ML12311A157).
October 18, 2012	Letter from Ms. Olivia A. Mowrey, Pennsylvania Game Commission, to NRC, regarding Bell Bend Nuclear Power Plant (BBNPP) Project – Request for Consultation and Participation in the Supplemental Scoping Process and Preliminary Screening of Alternative Locations Seedco Site-Coal Township, Northumberland County, Pennsylvania (Accession No. ML12311A159).
October 18, 2012	Letter from Ms. Olivia A. Mowrey, Pennsylvania Game Commission, to NRC, regarding Bell Bend Nuclear Power Plant (BBNPP) Project – Request for Consultation and Participation in the Supplemental Scoping Process and Preliminary Screening of Alternative Locations Montour Site-Derry Township, Montour County, Pennsylvania (Accession No. ML12311A158).
October 19, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Supplemental RAI Response for ENV-10 and ENV-11 Optical Media Transmittal (Accession No. ML12356A091).
October 30, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC regarding Bell Bend Nuclear Power Plant Response to RAI 116 (Accession No. ML12318A165).
October 31, 2012	Summary of the Supplemental Environmental Site Audit Related to the Review of the Combined License Application for the Bell Bend Nuclear Power Plant (Accession No. ML12265A725).
November 6, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Response to RAI ENV-18 (Accession No. ML12321A036).

November 7, 2012	Letter from NRC, to Ms. Christine Abrams, Tonowanda Seneca Nation, regarding Request for Consultation and Participation in the Supplemental Scoping Process Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML12275A585).
November 7, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Supplemental RAI Response for ENV-11 Optical Storage Media Transmittal (Accession No. ML12339A260).
November 8, 2012	Letter from Mr. Gene F. Feyl, Highlands Water Protection and Planning Council, to NRC, regarding Proposed Bell Bend Nuclear Power Plant Environmental Impact Statement Alternative Site Analysis White Township, New Jersey Tax Block 7; Lots 3,4,5,11 and Part of 16 (Accession No. ML12335A042).
November 21, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant COLA Part 3 (Environmental Report) (Package Accession No. ML123400059).
December 4, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Response to RAI ENV-19 (Accession No. ML12349A006).
December 6, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to Ms. Amy Elliot, U.S. Army Corps of Engineers, regarding Bell Bend Nuclear Power Plant ACOE Copy of PPL Response to NRC RAI ENV-19 (Package Accession No. ML123450170).
December 10, 2012	Letter from Ms. Amy Elliot, U.S. Army Corps of Engineers, to Mr. Michael J. Caverly, PPL Bell Bend, LLC, regarding additional information needed (Accession No. ML12347A176).
December 11, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Response to RAIs ENV-20 and ENV-21 (Package Accession No. ML130030016).
December 11, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to Ms. Amy Elliot, U.S. Corps of Engineers, regarding Bell Bend Nuclear Power Plant ACOE Copy of PPL Response to NRC RAI ENV-20 and ENV-21 (Accession No. ML12354A511).
December 13, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Supplemental RAI Response for RAI ENV-11 (Accession No. ML12363A126).

December 20, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Supplemental Response for RAI ENV-01 (Accession No. ML13025A269).
December 21, 2012	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to Ms. Amy Elliot, U.S. Corps of Engineers, regarding Bell Bend Nuclear Power Plant Response to ACOE Comments on BBNPP CWA Section 404 Application (Accession No. ML13010A296).
December 28, 2012	Letter from Mr. Paul O. Swartz, Susquehanna River Board Commission, to Mr. Michael J. Caverly, PPL Benn Bend, LLC, regarding Requirements for Consumptive Water Use Mitigation and Passby Flows for PPL Bell Bend, LLC- Bell Bend Nuclear Power Plant; Salem Township, Luzerne County, Pennsylvania; Commission Pending Nos. 2009-079 (SW) and 2009-080 (CU) (Accession No. ML13008A468).
January 3, 2013	Letter from NRC, to Mr, Michael D. Bedrin, Pennsylvania Department of Environmental Protection, regarding Request for Consultation and Comments Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML12318A239).
January 7, 2013	Letter from Mr. Wade B. Chandler, U.S. Army Corps of Engineers, to Mr. Douglas McLearen, Pennsylvania Historical and Museum Commission, regarding Section 106 compliance (Accession No. ML13010A299).
January 8, 2013	Letter from NRC, to Mr. Michael J. Caverly, PPL Bell Bend, regarding Bell Bend Nuclear Power Plant Combined License Application – Exemption from the Requirements of Title 10 of the Code of Federal Regulations Section 50. 71(e)(3)(iii) (Accession No. ML12325A753).
January 11, 2013	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Withdrawal of Withholding Request for RAI ENV-09 (MET-05) (Accession No. ML13029A710).
January 16, 2013	Letter from NRC, to Mr. Nathan Dewar, Pennsylvania Department of Conservation and Natural Resources, regarding Request for Federally Listed Species, State-Listed Species, and State-Ranked Species and Communities for the Environmental Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML13007A202).
January 22, 2013	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Response regarding RAI No. 116 (Accession No. ML13032A172).

January 23, 2013	Letter from Mr. Michael J. Brunamonti, Pennsylvania Department of Environmental Protection, to Mr. Gary Petrewski, PPL Bell Bend, LLC, regarding PPL Nuclear Development Bell Bend Nuclear Power Plant 401 Water Quality Certification U.S. Army Corps of Engineers, Project No. NAB-OP-RPA-2008-01401-P13 Nuclear Regulatory Commission, Docket No. 52-039 Salem Township, Luzerne County Accession No. ML13032A110).
January 29, 2013	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Public Version of Supplemental Traffic Study for Hunlock Creek Township (Accession No. ML13032A111).
February 1, 2013	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Response to ER RAIs ENV-22 and ENV-23 (Accession No. ML13045A420).
February 1, 2013	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Supplemental Response to RAI ENV-19 (Accession No. ML13046A163).
February 4, 2013	Letter from Ms. Mary Colligan, National Marine Fisheries Service, to NRC, regarding Bell Bend (Accession No. ML13058A245).
February 5, 2013	Letter from Mr. Eric Epstein, to NRC, regarding Summary of the Supplemental Environmental Impact Site Audit Related to the Review of the Combined License Application for the Bell Bend Nuclear Power Plant (Package Accession No. ML130460140).
February 12, 2013	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant GIS Shapefiles for RAI ENV-22, Question EIS 4.2-4 and RAI ENV-23, Question EIS 3.2-1 (Accession No. ML13053A212).
February 13, 2013	Letter from Mr. Douglas C. McLearen, Pennsylvania Historical and Museum Commission, to Mr. Wade B. Chandler, U.S. Army Corps of Engineers, regarding ER#81-0658-079-TT Bell Bend Nuclear Power Plant, Salem Township, Luzerne County, Pennsylvania (Accession No. ML13056A020).
February 13, 2013	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Information on Landfill Closure (Accession No. ML13056A489).
February 15, 2013	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant COLA Markup of Supplemental Response to RAI-19 (Accession No. ML13071A083).

February 19, 2013	E-mail from Ms. Amy Elliott, U.S. Army Corps of Engineers, to Mr. Gary Petrewski, PPL Bell Bend, LLC, requesting information on wetland acreage discrepancies (Accession No. ML13070A418).
February 21, 2013	E-mail from Ms. Amy Elliott, U.S. Army Corps of Engineers, to NRC, forwarding information on wetland acreage discrepancies (Accession No. ML13070A420).
February 25, 2013	E-mail from Ms. Amy Elliott, U.S. Army Corps of Engineers, to Mr. Gary Petrewski, PPL Bell Bend, LLC, requesting information to Walker Run Mitigation (Accession No. ML13070A421).
February 26, 2013	E-mail from Mr. Gary Petrewski, PPL Bell Bend, LLC, to Ms. Amy Elliott, U.S. Army Corps of Engineers, regarding the Walker Run Mitigation (Accession No. ML13063A333).
February 28, 2013	Letter from Mr. Andrew Rohrbaugh and Ms. Rebecca Bowen, Pennsylvania Department of Conservation and Natural Resources, to NRC, regarding Bell Bend Nuclear Power Plant and Alternative Sites (Accession No. ML13063A336).
March 1, 2013	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Redaction of Response to RAI ENV-19 (Accession No. ML13073A149).
March 6, 2013	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Additional Information on Solid Waste Disposal Site #3 (Accession No. ML13079A129).
March 7, 2013	Letter from NRC to Mr. Chris Urban, Pennsylvania Fish and Boat Commissions regarding the Second Request for Consultation and Participation in the Supplemental Scoping Process (Accession No. ML13031A342).
March 14, 2013	Letter from Ms. Sarah Gannon-Nagle, U.S. Fish and Wildlife Service, to NRC, regarding USFWS Project #2009-0501List Request (Accession No. ML13116A228).
March 22, 2013	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Revision to Response to RAI 21 Question 02.01.02-2 (Accession No. ML13098A069).
March 29, 2013	Letter from Ms. Sarah Gannon-Nagle, U.S. Fish and Wildlife Service, to NRC, regarding Bell Bend Nuclear Power Plant USFWS Project #2009-0501 (Accession No. ML13101A284).

April 11, 2013	Letter from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Request for Withholding Information from Public Disclosure (Accession No. ML13086A602).
April 12, 2013	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Application for Combined License Final Safety Analysis Report for the Bell Bend Nuclear Power Plant, Revision 4 (Package Accession No. ML13120A374).
April 12, 2013	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Application for Combined License Final Environmental Report for the Bell Bend Nuclear Power Plant, Revision 4 (Package Accession No. ML13120A411).
April 17, 2013	Letter from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Request for Withholding Information from Public Disclosure (Accession No. ML13063A138).
April 24, 2013	Letter from NRC, to Ms. Carol Shull, National Park Service, regarding Request for Withholding of Cultural Resource Information Submitted in Support of the Bell Bend Combined License Application Review. (Accession No. ML13098A176).
April 25, 2013	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Redaction of Response to RAIs ENV-20 and ENV-21. (Accession No. ML13128A141).
May 20, 2013	E-mail from Mr. Nathan Dewar, Pennsylvania Natural Heritage Program, to NRC, regarding Request for Species Information for the Bell Bend DEIS (Accession No. ML13225A356).
May 20, 2013	Letter from NRC, to Mr. Eric Epstein, TMI-Alert, regarding Comments Regarding the Revised Site Layout for the Bell Bend Nuclear Power Plant Combined License Application Review (Accession No. ML13112A402).
May 20, 2013	Letter from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Request for Withholding Information from Public Disclosure for the Bell Bend Nuclear Power Plant Response to Request for Additional Information ENV-19 Water Availability (Accession No. ML13112A383).
May 29, 2013	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant COD (Commercial Operation Date) Sensitivity (Accession No. ML13182A239).
June 7, 2013	Letter from Mr. Gary Petrewski, PPL Bell Bend, LLC, to Mr. Robert Anderson, U.S Fish and Wildlife Service, regarding Bell Bend Nuclear Power Plant Indiana Bat Study Plan (Accession No. ML13171A040).

June 14, 2013	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Changes to ER Discussion of ROI and Purpose and Need (Accession No. ML13182A240).
July 18, 2013	Letter from NRC, to Mr. Michael J. Caverly, PPL Bell Bend, LLC, regarding Project Manager Change for the Combined License Application Safety Review for the Bell Bend Nuclear Power Plant (Accession No. ML13171A241).
July 25, 2013	Letter from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Request for Withholding Information from Public Disclosure for the Bell Bend Nuclear Power Plant Response to the Request for Additional Information Aquatic and Terrestrial Ecology and Water Availability (Accession No. ML13165A393).
July 31, 2013	Note to File: Summary Teleconference Between the NRC, the U.S Army Corps of Engineers, and the U.S. Environmental Protection Agency Regarding Viability of the Martins Creek Site as an Alternative Site for the Bell Bend Nuclear Power Plant Combined License Environmental Review (Accession No. ML13155A291).
August 12, 2013	Letter from Mr. James Richenderfer, Susquehanna River Basin Commission, to NRC, regarding Consumptive Water Use Mitigation for PPL Bell Bend, LLC; Bell Bend Nuclear Power Plant; Salem Township, Luzerne County, Pennsylvania; Commission Pending Nos. 2009-079 (SW), 2009-080 (CU), and 2012-007 (GW) (Accession No. ML13228A282).
August 12, 2013	E-mail from Mr. Gary Petrewski, PPL Bell Bend, LLC, to Ms. Jennifer Siani, U.S. Fish and Wildlife Service, transmitting the revisions to the Bell Bend Biological Evaluation and Management Plan Draft (Package Accession No. ML13240A061).
August 16, 2013	Letter from Mr. Gary Petrewski, PPL Bell Bend, LLC, to Ms. Amy Elliott, U.S. Army Corps of Engineers, regarding Bell Bend Nuclear Power Plant Supplemental Information Walker Run Mitigation Plan (Accession No. ML13240A159).
August 19, 2013	Letter from Mr. Gary Petrewski, PPL Bell Bend, LLC, to Ms. Amy Elliott, U.S. Army Corps of Engineers, regarding Bell Bend Nuclear Power Plant Supplemental Information Walker Run Mitigation Plan (Accession No. ML13240A159).
August 21, 2013	Memorandum to File: Trip Report: Site Visit Regarding the Indiana Bat Summer Survey Plan for the Proposed Bell Bend Nuclear Power Plant Site (Accession No. ML13169A150).

September 6, 2013	Letter from Mr. Gary Petrewski, PPL Bell Bend, LLC, to Ms. Amy Elliott, U.S. Army Corps of Engineers, regarding Bell Bend Nuclear Power Plant Project Mitigation Financial Assurance (Accession No. ML13268A161).
September 11, 2013	Letter from NRC, to Mr. Michael J. Caverly, PPL Bell Bend, LLC, regarding Project Manager Change for the Combined License Application Safety Review for the Bell Bend Nuclear Power Plant (Accession No. ML13211A172).
September 30, 2013	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Requested Information: ER Chapter 8 (Accession No. ML13288A018).
October 3, 2013	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Information in Support of a Biological Assessment Under Section 7 of the Endangered Species Act (Package Accession No. ML13288A217).
October 9, 2013	Letter from Mr. Gary Petrewski, PPL Bell Bend, LLC, to Ms. Tracey Librandi Mumma, Pennsylvania Game Commission, regarding Bell Bend Nuclear Power Plant Large Project Species of Special Concern Screen Update (Accession No. ML13309A467).
October 9, 2013	Letter from Mr. Gary Petrewski, PPL Bell Bend, LLC, to Pennsylvania Department of Conservation and Natural Resources, regarding Bell Bend Nuclear Power Plant Large Project Species of Special Concern Screen Update (Accession No. ML13309A468).
October 11, 2013	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Changes to COLA Part 3 from Revised Wind Direction Information (Accession No. ML13304A586).
October 18, 2013	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Request for Exemption from 10 CFR 50.71(e)(3)(iii) (Accession No. ML13304A574).
October 21, 2013	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Revised Withholding for RAI Responses ENV-20 and ENV-21 (Accession No. ML13304A573).
October 21, 2013	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Revised Redacted Response to RAI ENV-19 (Accession No. ML13304B419).
October 28, 2013	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Correction to the Response to ER RAI Nos. ACC 7.2-2 and 7.2-3 (Accession No. ML13312A067).

November 5, 2013	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Transmittal of Redacted Files for RAIs ENV-10 and ENV-11 (Package Accession No. ML13330A422).
November 15, 2013	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant COLA Part 3 Update and BEMP Errata (Accession No. ML13358A318).
December 3, 2013	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to Mr. Joseph Buczynski, Pennsylvania Department of Environmental Protection, regarding Bell Bend Nuclear Power Plant Joint Permit Application and Request for Water Quality Certification, Rev 1 Errata (Accession No. ML14028A220).
December 18, 2013	Letter from NRC, to Mr. Michael J. Caverly, PPL Bell Bend, LLC, regarding Bell Bend Nuclear Power Plant Combined License Application-Exemption from the Requirements of Title 10 of the Code of Federal Regulations Section 50.71(e)(3)(iii) (Accession No. ML13318A123).
January 9, 2014	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Interim Safety Review Guidance (Accession No. ML14030A074).
January 10, 2014	E-mail from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Final RAI ENV-24 (Accession No. ML14010A492).
January 10, 2014	E-mail from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Final RAI ENV-25 (Accession No. ML14010A497).
January 10, 2014	E-mail from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Final RAI ENV-26 (Accession No. ML14017A382).
January 27, 2014	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Initial Response to RAIs ENV-24 and ENV-25 (Accession No. ML14052A083).
January 28, 2014	E-mail from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Final RAIs (Accession No. ML14028A608).
February 7, 2014	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Final Response to RAIs ENV-24 and ENV-25 (Accession No. ML14056A245).
February 12, 2014	E-mail from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Bell Bend Final RAI (Accession No. ML14044A000).

February 18, 2014	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Initial Response for RAI ENV-26 (Accession No. ML14069A222).
February 19, 2014	E-mail from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Final RAI ENV-29 (Accession No. ML14051A000).
February 27, 2014	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Response to RAI ENV-27 (Accession No. ML14073A505).
March 4, 2014	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to Mr. Joseph Buczynski, Pennsylvania Department of Environmental Protection, regarding Bell Bend Nuclear Power Plant Joint Permit Application and Request for Water Quality Certification, Rev 1 Erratum (Accession No. ML14091A330).
March 4, 2014	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Responses to RAIs ENV-28 and ENV-29 (Accession No. ML14105A030).
March 12, 2014	NRC Environmental Water Audit Execution Plan for Bell Bend COL (Accession ML14072A278).
March 14, 2014	E-mail from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Additional Capacity at Tioga Hammond (Accession No. ML14125A172).
March 18, 2014	Letter from Mr. John Taucher, Pennsylvania Game Commission, to NRC, regarding Bell Bend Nuclear Power Plant - Water Consumptive Use Mitigation - Nuclear Energy Clearfield, Centre, Clinton, Lycoming, Northumberland, Dauphin, Lancaster, Montour, Columbia, Luzerne, Lackawanna, Wyoming, Bradford and Tioga Counties, PA (Accession No. ML14125A170).
March 25, 2014	Letter from Ms. Rebecca H. Bowen, Pennsylvania Department of Conservation and Natural Resources, to NRC, regarding NRC; Consumptive Use Mitigation Plan for the Bell Bend Nuclear Power Plant Salem Township, Luzerne Country, PA (Accession No. ML14125A171).
March 25, 2014	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Responses to ER RAI ENV-26 and Revised Schedule Information (Accession No. ML14098A246).
April 7, 2014	E-mail from NRC to Mr. Rocky R. Sgarro, PPL Bell Bend, LLC, regarding E-mailing: Tioga-Hammond Water Control Manual 191.pdf (Accession No. ML14125A169).

April 10, 2014	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Reponses to March 2014 Environmental Audit Questions (Accession No. ML14118A041).
April 16, 2014	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to Ms. Amy Elliott, U.S. Army Corps of Engineers, regarding Bell Bend Nuclear Power Plant Submittal of Revised Construction Dewatering Design Report (Accession No. ML14114A660).
April 17, 2014	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Supplemental Response to RAI ENV-28 Question 7318 (Accession No. ML14119A241).
April 21, 2014	Memorandum to File: Scoping Summary Report Related to the Environmental Scoping Process for the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML14024A659).
April 24, 2014	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Corrected Indiana Bat Mist Net Survey (Accession No. ML14122A329).
April 28, 2014	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Response to RAI ENV-26 Question ACC 7352 (Accession No. ML14122A367).
May 2, 2014	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding Bell Bend Nuclear Power Plant Schedule Milestones and Self-Scheduling (Accession No. ML14135A166).
May 6, 2014	E-mail from Mr. Rocco R. Sgarro, to NRC, regarding Supplemental Capacity Information on Borrow Pit Access for the Bell Bend Nuclear Power Plant (Accession No. ML14127A118).
May 23, 2014	Letter from Ms. Lora Zimmerman, U.S. Fish and Wildlife, to NRC, regarding Federally-listed and Proposed Endangered and Threatened Species Affected by the Consumptive Water Use Mitigation Plan (Accession No. ML14253A417).
May 29, 2014	Letter from Mr. Rocco R. Sgarro, to NRC, regarding Bell Bend Nuclear Power Plant Supplemental Environmental Information (Accession No. ML14188B429).
July 1, 2014	Memorandum to File: Site Audit Summary Related to the Environmental Review of the Proposed Bell Bend Nuclear Power Plant (Accession No. ML14128A542).

August 8, 2014	Letter from Mr. Rocco R. Sgarro, to NRC, regarding Bell Bend Nuclear Power Plant Environmental Report Supplemental Information (Accession No. ML14234A254).
August 14, 2014	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Bell Bend Nuclear Power Plant Correction of Surface Water Data (Accession No. ML14241A468).
September 16, 2014	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Bell Bend Nuclear Power Plant Schedule for SAMDA Update (Accession No. ML14280A539).
October 8, 2014	Letter from Mr. Christopher Urban, Pennsylvania Fish and Boat Commission, to Mr. Jim Becker, Pacific Northwest National Laboratory, regarding Species Impact Review (SIR) - Rare, Candidate, Threatened and Endangered Species Bell Bend Nuclear Power Plant Project- Bell Bend, Humboldt, Seedco, and Montour Sites Pennsylvania (Accession No. ML16075A226).
October 15, 2014	Letter from NRC, to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Bell Bend Nuclear Power Plant Combined License Application Environmental Review Schedule Revision (Accession No. ML14239A290).
October 22, 2014	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding the Bell Bend Nuclear Power Plant Supplemental Information Update Concerning the Construction and Preconstruction Workforce (Accession No. ML14310A416).
January 16, 2015	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding the Bell Bend Nuclear Power Plant Correction of Surface Water Data (Accession No. ML15034A498).
March 4, 2015	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding the Bell Bend Nuclear Power Plant Combined License Application Status (Accession No. ML15079A325).
March 19, 2015	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding the Bell Bend Nuclear Power Plant Severe Accident Mitigation Design Alternative RAI and ER Section 7.3 Update (Accession No. ML15091A389).
April 16, 2015	Letter from NRC to Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, regarding Notice of Availability of the Draft Environmental Impact Statement for Bell Bend Nuclear Power Plant Combined License (Accession No. ML15078A362).

April 17, 2015	Letter from NRC to Mr. Reid Nelson, Director, Advisory Council on Historic Preservation, regarding Notification Issuance and Requesting Comments on the Draft Environmental Impact Statement for Bell Bend Nuclear Power Plant Combined License (Accession No. ML15078A402).
April 17, 2015	Letter from NRC to Mr. Douglas C. McLearen, Chief, Pennsylvania Historical and Museum Commission, regarding Notification Issuance and Requesting Comments on the Draft Environmental Impact Statement for Bell Bend Nuclear Power Plant Combined License (Accession No. ML15078A373).
April 17, 2015	Letter from NRC to Ms. Pamela Schellenberger, U.S. Fish and Wildlife Service, Pennsylvania Field Office, regarding Notification Issuance and Requesting Comments on the Draft Environmental Impact Statement for Bell Bend Nuclear Power Plant Combined License (Accession No. ML15078A458).
April 17, 2015	Letter from NRC to Mr. Andrew Gavin, Deputy Executive Director, Susquehanna River Basin Commission, regarding Notification Issuance on the Draft Environmental Impact Statement for Bell Bend Nuclear Power Plant Combined License (Accession No. ML15082A185).
April 17, 2015	Letter from NRC to Mr. James R. Leigey, Pennsylvania Game Commission, regarding Notification Issuance on the Draft Environmental Impact Statement for Bell Bend Nuclear Power Plant Combined License (Accession No. ML15079A436).
April 17, 2015	Letter from NRC to Mr. Kevin Magerr, U.S. Environmental Protection Agency, regarding Notification Issuance on the Draft Environmental Impact Statement for Bell Bend Nuclear Power Plant Combined License (Accession No. ML15079A435).
April 17, 2015	Letter from NRC to Ms. Patricia A. Kurkul, NOAA National Marine Fisheries Service, regarding Notification Issuance on the Draft Environmental Impact Statement for Bell Bend Nuclear Power Plant Combined License (Accession No. ML15078A358).
April 17, 2015	Letter from NRC to Mr. Justin Newell, Pennsylvania Department of Conservation and Natural Resources, regarding Notification Issuance on the Draft Environmental Impact Statement for Bell Bend Nuclear Power Plant Combined License (Accession No. ML15082A299).
April 17, 2015	Letter from NRC to Mr. Chris Urban, Pennsylvania Fish and Boat Commission, regarding Notification Issuance on the Draft Environmental Impact Statement for Bell Bend Nuclear Power Plant Combined License (Accession No. ML15079A437).

April 17, 2015	Letter from NRC to Mr. Tony Gonyea, Faithkeeper, Onondaga Nation, regarding Notification Issuance and Requesting Comments on the Draft Environmental Impact Statement for Bell Bend Nuclear Power Plant Combined License (Accession No. ML15090A304).
April 17, 2015	Letter from NRC to Mr. Clint Halftown, Heron Clan Representative for the Cayuga Nation, regarding Notification Issuance and Requesting Comments on the Draft Environmental Impact Statement for Bell Bend Nuclear Power Plant Combined License (Accession No. ML15090A402).
April 17, 2015	Letter from NRC to Mr. Wallace A. Miller, Acting Chief, Stockbridge-Munsee Community of Wisconsin, regarding Notification Issuance and Requesting Comments on the Draft Environmental Impact Statement for Bell Bend Nuclear Power Plant Combined License (Accession No. ML15090A425).
April 17, 2015	Letter from NRC to The Honorable Leroy Howard, Chief, Seneca-Cayuga Tribe of Oklahoma, regarding Notification Issuance and Requesting Comments on the Draft Environmental Impact Statement for Bell Bend Nuclear Power Plant Combined License (Accession No. ML15090A416).
April 17, 2015	Letter from NRC to The Honorable Raymond Halbritter, Nation Representative, Oneida Nation of New York, regarding Notification Issuance and Requesting Comments on the Draft Environmental Impact Statement for Bell Bend Nuclear Power Plant Combined License (Accession No. ML15090A410).
April 17, 2015	Letter from NRC to The Honorable Glenna Wallace, Chief, Eastern Shawnee Tribe of Oklahoma, regarding Notification Issuance and Requesting Comments on the Draft Environmental Impact Statement for Bell Bend Nuclear Power Plant Combined License (Accession No. ML15078A413).
April 17, 2015	Letter from NRC to The Honorable Ed Delgado, Chairman, Oneida Tribe of Indians of Wisconsin, regarding Notification Issuance and Requesting Comments on the Draft Environmental Impact Statement for Bell Bend Nuclear Power Plant Combined License (Accession No. ML15090A412).
April 17, 2015	Letter from NRC to The Honorable Ron Sparkman, Chief, Shawnee Tribe, regarding Notification Issuance and Requesting Comments on the Draft Environmental Impact Statement for Bell Bend Nuclear Power Plant Combined License (Accession No. ML15090A396).
April 17, 2015	Letter from NRC to The Honorable Paul O. Thompson, Chief, St. Regis Mohawk Tribe, regarding Notification Issuance and Requesting Comments on the Draft Environmental Impact Statement for Bell Bend Nuclear Power Plant Combined License (Accession No. ML15090A389).

April 17, 2015	Letter from NRC to Mr. Barry E. Snyder Sr., President, Seneca Nation of Indians, regarding Notification Issuance and Requesting Comments on the Draft Environmental Impact Statement for Bell Bend Nuclear Power Plant Combined License (Accession No. ML15090A387).
April 17, 2015	Letter from NRC to The Honorable Roger Hill, Chief, Tonawanda Seneca Nation, regarding Notification Issuance and Requesting Comments on the Draft Environmental Impact Statement for Bell Bend Nuclear Power Plant Combined License (Accession No. ML15090A400).
April 17, 2015	Letter from NRC to The Honorable Leo R. Henry, Chief, Tuscarora Nation, regarding Notification Issuance and Requesting Comments on the Draft Environmental Impact Statement for Bell Bend Nuclear Power Plant Combined License (Accession No. ML15090A385).
April 17, 2015	Letter from NRC to Mr. George Blanchard, Governor, Absentee-Shawnee Tribe of Oklahoma, regarding Notification Issuance and Requesting Comments on the Draft Environmental Impact Statement for Bell Bend Nuclear Power Plant Combined License (Accession No. ML15090A380).
April 17, 2015	Letter from NRC to Mr. Clifford Peacock, President, Delaware Nation, Notifying Issuance and Requesting Comments on the Draft Environmental Impact Statement for Bell Bend Nuclear Power Plant Combined License (Accession No. ML15090A402).
April 21, 2015	Federal Register Notice of Draft Environmental Impact Statement; Public Meeting and Request for Comment (80 FR 22231).
April 21, 2015	Letter from NRC to Mr. Clifford Farides, Mill Memorial Public Library, regarding Maintenance of Reference Materials for the Environmental Review of the Draft Environmental Impact Statement for the Bell Bend Nuclear Power Plant Combined License (Accession No. ML15082A141).
April 21, 2015	Letter from NRC to Ms. Alice Zaikoski, McBride Memorial Library, regarding Maintenance of Reference Materials for the Environmental Review of the Draft Environmental Impact Statement for the Bell Bend Nuclear Power Plant Combined License (Accession No. ML15082A134).
April 21, 2015	Federal Register Notice Availability of Draft Environmental Impact Statement for the Combined License for the Bell Bend Nuclear Power Plant (FR).
May 12, 2015	Letter from Mr. Rocco R. Sgarro, PPL Bell Bend, LLC, to NRC, regarding the Bell Bend Nuclear Power Plant Name Changes Due to Spinoff Transaction (Accession No. ML15146A095).

June 18, 2015	Letter from Mr. Rocco R. Sgarro, Talen Energy, to NRC, regarding the Bell Bend Nuclear Power Plant Corrections to BBNPP Environmental Report (Accession No. ML15177A083).
June 25, 2015	Memorandum from Ms. Tomeka Terry, NRC, to Mrs. Jennifer Dixon-Herrity, NRC, regarding the Summary of the Public Meetings for the Draft Environmental Impact Statement to Support Review of the Bell Bend Nuclear Power Plant Combined License Application (Accession No. ML15175A461).
August 5, 2015	Letter from Ms. Lora L. Zimmerman, U.S. Fish and Wildlife Service, to NRC, regarding the Bell Bend Nuclear Power Plant Biological Assessment and Draft Environmental Impact Statement (Accession No. ML15225A426).
October 9, 2015	Letter from Mr. Rocco Sgarro, Talen Energy, to Pennsylvania Department of Conservation and Natural Resources, regarding Bell Bend Nuclear Power Plant Large Project Species of Special Concern Screen Update Salem Township, Luzerne County, PA (Accession No. ML15351A322).
October 9, 2015	Letter from Mr. Rocco Sgarro, Talen Energy, to Mr. Christoper Urban, Pennsylvania Fish and Boat Commission, regarding Bell Bend Nuclear Power Plant Large Project Species of Special Concern Screen Update Salem Township, Luzerne County, PA (Accession No. ML15351A478).
October 9, 2015	Letter from Mr. Rocco Sgarro, Talen Energy, to Ms. Tracey Librandi Mumma, Pennsylvania Game Commission, regarding Bell Bend Nuclear Power Plant Large Project Species of Special Concern Screen Update Salem Township, Luzerne County, PA (Accession No. ML15251A483).
October 19, 2015	Letter from Mr. John Taucher, Pennsylvania Game Commission to Mr. Rocco Sgarro, Talen Energy, regarding Bell Bend Nuclear Power Plant Project Update Salem Township, Luzerne County, Pennsylvania (Accession No. ML15292A453).
November 4, 2015	Letter from Mr. Greg Podniesinski, Pennsylvania Department of Conservation and Natural Resources to Mr. Rocco Sgarro, Talen Energy, regarding Potential Bell Bend Nuclear Power Plant (Accession No. ML16035A437).
November 5, 2015	E-mail from NRC, to Mr. Rocco Sgarro, Talen Energy, regarding Bell Bend Environmental Review Final RAI ENV-30 (Accession No. ML15310A509).
November 6, 2015	Letter from Mr. Rocco Sgarro, Talen Energy, to NRC, regarding the Bell Bend Nuclear Power Plant Response to Request for Additional Information (RAI) ENV-30 (Accession No. ML15331A001).

November 23, 2015	Letter from Mr. Christopher Urban, Pennsylvania Fish and Boat Commission, to Mr. Rocco Sgarro, Talen Energy, regarding Species Impact Review (SIR) - Rare, Candidate, Threatened and Endangered Species Bell Bend Nuclear Power Plant, Luzerne County: Salem Township (Accession No. ML16070A332.
November 30, 2015	Letter from Ms. Lora Zimmerman, U.S. Fish and Wildlife Service, to NRC, regarding Effects of the Proposed Construction and Operation of Bell Bend Nuclear Power Plant (Accession No. ML15345A152).
January 4, 2016	Letter from Mr. Rocco Sgarro, Talen Energy, to NRC, regarding Bell Bend Nuclear Power Plant Correction to ER Table 5.4-20 (Accession No. ML16022A109).
February 23, 2016	Letter from Mr. William Seib, USACE, to Mr. Rocco Sgarro, Talen Energy, regarding Application for a Department of the Army Permit to Impact Waters of the Unite States (Accession No. ML16055A537).

References

10 CFR Part 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions." Washington, D.C. TN250.

PPL Bell Bend (PPL Bell Bend, LLC). 2015. Letter from R.R. Sgarro to NRC, dated May 12, 2015, regarding "Bell Bend Nuclear Power Plant Name Changes Due to Spinoff Transaction." BNP-2015-028, Docket No. 52-039, Allentown, Pennsylvania. Accession No. ML15146A095. TN4379.

APPENDIX D

SCOPING COMMENTS AND RESPONSES

APPENDIX D

SCOPING COMMENTS AND RESPONSES

Two scoping processes were conducted for the environmental review of the Bell Bend Nuclear Power Plant (BBNPP) combined license (COL) application. The initial scoping process was conducted in response to the application for a new nuclear power reactor submitted by PPL Bell Bend, LLC, (PPL) by letter dated October 10, 2008. The supplemental scoping process was conducted following revision 3 of the application submitted by letter dated March 3, 2012, which described PPL's plans for the revised site layout of the BBNPP.

On January 6, 2009, the U.S. Nuclear Regulatory Commission (NRC) published a "Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process" in the *Federal Register* (74 FR 470-TN1785). The Notice of Intent notified the public of the NRC staff's intent to prepare an environmental impact statement (EIS) and conduct scoping for the application for COLs received from PPL. The NRC invited PPL; Federal, Tribal, State, and local government agencies; local organizations; and the public to participate in the initial scoping process by providing oral comments at the scheduled public meeting and/or submitting written comments no later than March 9, 2009.

On June 15, 2012, the NRC published a "Notice of Intent to Conduct a Supplemental Scoping Process for the Revised Site Layout" in the *Federal Register* (77 FR 36012-TN3907). The Notice of Intent notified the public that the NRC and the U.S. Army Corps of Engineers (USACE) were providing an additional opportunity to participate in the scoping process pertaining to the revised site layout relative to the proposed BBNPP project scope. Once again, the NRC invited PPL; Federal, Tribal, State, and local government agencies; local organizations; and the public to participate in the supplemental scoping process by providing oral comments at the scheduled public meeting and/or submitting written comments no later than July 16, 2012.

Preparation of the EIS accounted for relevant issues raised during the initial and supplemental scoping processes. The comments received and addressed in NRC's environmental review are included in this appendix. They were extracted from the July 2009 *Environmental Impact Statement Scoping Process Summary Report, Bell Bend Nuclear Power Plant Combined License* (ADAMS Accession No. ML091760096) (NRC 2009-TN1787) and the January 2014 *Environmental Impact Statement Scoping Process Summary Report, Bell Bend Nuclear Power Plant, Combined License* (ADAMS Accession No. ML14024A659) (NRC 2014-TN3651), and are provided for convenience of those interested specifically in the scoping comments applicable to this environmental review. Comment categories that are outside the scope of the environmental review for the proposed BBNPP are not included in this appendix—they are included in their entirety in the scoping process summary reports cited above. These out-of-scope categories include comments related to:

1. safety
2. emergency preparedness
3. NRC oversight for operating plants

4. security and terrorism
5. support for or opposition to the licensing action, licensing process, nuclear power, hearing process, or the applicant.

The scoping process provides an opportunity for public participants to identify issues to be addressed in the EIS and highlight public concerns and issues. This appendix provides the comments and the NRC and USACE responses for the two public scoping processes held to support the preparation of this EIS. The supplemental scoping process summary begins on page D-32.

D.1 The Initial Scoping Process

The initial public scoping meeting was held on January 29, 2009, at the Berwick Area Senior High School, in Berwick, Pennsylvania. The meeting summary and meeting transcript are available electronically in the NRC Public Document Room or from the Publicly Available Records component of NRC's Agencywide Documents Access and Management System (ADAMS), which is accessible from the NRC website at http://www.nrc.gov/reading-rm/adams/web-based.html (the Public Electronic Reading Room; note that the URL is case-sensitive). The ADAMS package accession number for the meeting summary and the meeting transcript is ML090440489.

D.1.1 Overview of the Scoping Processes

At the January 2009 Berwick meeting, 21 attendees provided oral or written comments that were recorded and transcribed by a certified court reporter. In addition to the oral comments and written statements submitted at the public meetings, during the scoping period the NRC received five emails and eight letters containing comments. At the conclusion of the initial scoping period, the NRC staff reviewed the scoping meeting transcript and all written material received during the comment period and identified individual comments. These comments were organized according to topic within the proposed EIS or according to the general topic, if outside the scope of the EIS. Once comments were grouped according to subject area, the staff determined the appropriate response for the comments.

The comments from the initial scoping period and their responses were published in the *Environmental Impact Statement Scoping Process Summary Report, Bell Bend Nuclear Power Plant Combined License, Luzerne County, Pennsylvania* (ML091760096). To maintain consistency with the Scoping Summary Report, the correspondence identification (ID) number along with the name of the commenter used in that report is retained in this appendix.

Table D-1 identifies in alphabetical order the individuals who provided comments during the initial scoping period, their affiliations, if given, and the ADAMS accession number that can be used to locate the correspondence. Although all commenters are listed, the comments presented in this appendix are limited to those within the scope of the environmental review.

Table D-1. Individuals Who Provided Comments During the Comment Period

Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #	Correspondence ID
Baker, Elisabeth (Lisa)	Senate of Pennsylvania	Letter (ML090440081)	0008
Belles, Donnie	Belles Signs & Designs	Letter (ML090440082)	0009
Bershline, Roy		Meeting Transcript (ML090440109)	0018
Bodnar, Steve		Meeting Transcript (ML090440109)	0012
Bogard, Deborah		Meeting Transcript (ML090440109)	0018
Cleary, Jim		Meeting Transcript (ML090440109)	0012
Creasy, David	EAM Mosca Corp	E-mail (ML090690086)	0014
Creasy, David		Meeting Transcript (ML090440109)	0012
Creasy, Mary		Meeting Transcript (ML090440109)	0012
Davenport, Bill		Meeting Transcript (ML090440109)	0012
Eachus, Todd	House of Representatives, PA	Letter (ML090290058)	0005
Epstein, Eric		Letter (ML090650459)	0015
Fatula, Ken		Meeting Transcript (ML090440109)	0012
Hartman, Cindy	Luzerne County Planning Commission	Meeting Transcript (ML090440109)	0012
Hess, Leroy		Letter (ML090500380)	0016
Hess, Leroy		Meeting Transcript (ML090440109)	0018
Janati, Rich	Department of Environmental Protection	E-mail (ML091030556)	0017
Kowalski, Daniel	Newport Township Fire Dept	Letter (ML090350113)	0007
McGinnis, Joy	Berwick Area United Way	Meeting Transcript (ML090440109)	0012
Metzger, Marvin		Meeting Transcript (ML090440109)	0012
Musto, Raphael	Senate of Pennsylvania	Letter (ML090290059)	0006
Pajovich, Nick	Berwick Area YMCA	Meeting Transcript (ML090440109)	0012
Phillips, Stephen	Berwick Industrial Development Association (BIDA)	Meeting Transcript (ML090440109)	0012

Table D-1. (contd)

Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #	Correspondence ID
Search, Ryan	Belles Signs Company	Meeting Transcript (ML090440109)	0012
Siecko, Joseph		Meeting Transcript (ML090440109)	0012
Snavely, Nate		E-mail (ML090410139)	0004
Soberick, Bill		Meeting Transcript (ML090440109)	0012
Stilp, Gene		E-mail (ML090680546)	0013
Stilp, Gene		Meeting Transcript (ML090440109)	0012
Superdock, Dave		Meeting Transcript (ML090440109)	0012
Walsh, Karen	PA Energy Alliance	E-mail (ML090330085)	0003
Walsh, Karen	PA Energy Alliance	Meeting Transcript (ML090440109)	0018
Yudichak, John	House of Representatives, PA	Letter (ML090440083)	0010

D.1.2 In-Scope Comments and Responses

The in-scope comment categories for the initial scoping process are listed in Table D-2 in the order that they are presented in this EIS. The comments and responses for the in-scope categories are included below the table. Parenthetical numbers shown after each comment refer to the comment ID number (correspondence number-comment number) and the commenter name.

Table D-2. Initial Scoping Comment Categories in Order as Presented in this Appendix

Section	Title
D.1.2.1	Comments Concerning the COL Process
D.1.2.2	Comments Concerning Land Use – Transmission Lines
D.1.2.3	Comments Concerning Meteorology and Air Quality
D.1.2.4	Comments Concerning Geology
D.1.2.5	Comments Concerning Hydrology – Surface Water
D.1.2.6	Comments Concerning Hydrology – Groundwater
D.1.2.7	Comments Concerning Ecology – Terrestrial
D.1.2.8	Comments Concerning Ecology – Aquatic
D.1.2.9	Comments Concerning Socioeconomics
D.1.2.10	Comments Concerning Environmental Justice

Table D-2. (contd)

Section	Title
D.1.2.11	Comments Concerning Health – Radiological
D.1.2.12	Comments Concerning Accidents – Severe
D.1.2.13	Comments Concerning the Uranium Fuel Cycle
D.1.2.14	Comments Concerning Transportation
D.1.2.15	Comments Concerning Decommissioning
D.1.2.16	Comments Concerning Cumulative Impacts
D.1.2.17	Comments Concerning the Need for Power
D.1.2.18	Comments Concerning Alternatives – Energy
D.1.2.19	Comments Concerning Benefit-Cost Analysis

D.1.2.1 Comments Concerning the COL Process

Comment: I don't think the hearing for increasing the output of the present reactor or the application for a permit to construct a third reactor were properly advertised. The hearing for the increased output was never in the local newspaper (Press Enterprise) and the meeting for the public input on the application for the third reactor was listed on the inside in a small notation. Most of the local citizens don't get a daily paper. It was never advertised on the TV or radio news. I mentioned it in church the following Sunday and no one knew about it. Something as important as this should have been well advertised so all the local population could have input in the decision. (**0016-1** [Hess, Leroy])

***Response**: The NRC staff used a number of methods to inform the public about the scoping meeting. The "Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process" was published in the Federal Register on January 6, 2009. In addition, public notice was provided through local newspaper ads and public service announcements, as well as on the NRC website. The staff appreciates the concern raised by the commenters and will continue to look for ways to improve public notification of these meetings.*

D.1.2.2 Comments Concerning Land Use – Transmission Lines

Comment: The scoping document must also include the environmental aspects associated with any and all new power lines that go to and from the plant including the current proposed line to New Jersey. (**0013-17** [Stilp, Gene])

***Response**: Environmental impacts associated with any planned new transmission lines and rights-of-way will be addressed in Chapters 4 and 5 of the EIS. The transmission lines associated with the proposed BBNPP are located entirely within the Bell Bend site. The NRC does not have any regulatory authority regarding the implementation of Federal, State, and local guidelines in the siting, construction, and maintenance of other proposed transmission corridors and lines. The proposed Susquehanna-Roseland line will be constructed regardless of whether the BBNPP is constructed and is not considered a connected action under NEPA.*

D.1.2.3 Comments Concerning Meteorology and Air Quality

Comment: I have reservations about adding another reactor and cooling tower. I already have enough problems with the present cooling towers from the steam vapor emited into the atmosphere. It is like having an irrigation system that you can't turn off. I have a farm approximately 3 miles east of the present plant. I have a lot of problems trying to dry any crops like corn, soy beans, hay and wheat. The house siding gets solid mildew. It was always bad but last summer (2008) was the worst after they increased the output of steam from cooling tower (No. 1). Now they want to increase the output from cooling tower (No.2). If they add a third reactor & cooling tower the situation will only get worse. If it were me emiting something into the atmosphere they would have me shut down immediately. A lot of days the vapor completely blocks out the sun all day. It probably was a poor location for this plant because of the mountain terrain. The steam clouds form over the valley that is like a box canyon and it [is] there all day. (**0016-2**, **0018-6** [Hess, Leroy])

Response*: The commenter expresses his concern that additional steam plume from the BBNPP cooling towers will compound an impact on his crops that he attributes to plumes from the Susquehanna Steam Electric Station (SSES) cooling towers. The NRC staff will evaluate impacts associated with the proposed cooling towers associated with BBNPP, including the cumulative impact of adding two additional cooling towers next to the existing SSES cooling towers. The evaluation will be summarized in Chapter 5 of the EIS. Cumulative Impacts will be discussed in Chapter 7 of the EIS.*

Comment: Environmentally, we have to look at the air (**0012-6** [Stilp, Gene])

Comment: [W]e think of the traditional items in the scoping document, the air, the water, the fauna and foliage, whatever that is, the animals and plants also have to be studied. Interestingly enough, I never saw any animals evacuated during a nuclear emergency. Anyhow, that whole aspect has to be studied also. (**0012-79** [Stilp, Gene])

Comment: The entire project can have a major impact on the air quality from the first reaction to the last half life of the waste products. This issue is bound up with all aspects of nuclear production from mine to transport to utilization to waste storage and the air aspect from normal operation to accident mode has to be addressed. (**0013-26** [Stilp, Gene])

Response*: The NRC staff will evaluate air-quality impacts from construction and operation of the BBNPP in Chapters 4 and 5, respectively, of the EIS.*

Comment: Your scoping documents shouldn't be limited to the Berwick area or across the river. Which way does the wind blow? Does it blow through Hazle or Mountain Top? All those communities have to be involved too in this scoping document if your prevailing winds are mostly that way. And what about your percentage of the time the winds are blowing some other way? So the scope should not be just left to the immediate area. (**0012-82** [Stilp, Gene])

Response*: The NRC staff will examine both onsite and regional meteorological averages and extremes, including severe weather phenomena and air-quality conditions. Results from the meteorological evaluation will be presented in Chapter 2 of the EIS.*

Comment: The one hundred yea[r]/five hundred year weather predictors must be considered. (**0013-6** [Stilp, Gene])

Response: *Following the Standard Review Plans for Environmental Reviews for Nuclear Power Plants (NUREG-1555), the NRC staff will include in the draft EIS a discussion of the severe weather phenomena (e.g., tornadoes, hurricanes, thunderstorms, atmospheric stagnation episodes) experienced in the region with expected frequencies of occurrence and measured extremes of parameters, such as temperature and precipitation. The information will be presented in Chapter 2 of the EIS.*

Comment: The scoping document must include long term weather and climate projections. What will the weather be like twenty, thirty years or fifty years out? I know: the NRC will just change the rules like it has in the past to accommodate the industry. (**0013-19** [Stilp, Gene])

Response: *The NRC staff will evaluate the implications of the local climatology on the proposed action during its evaluation of the COL application, and a discussion of the pertinent aspects of the local climatology will be presented in Chapter 2 of the EIS. Potential downwind impacts from construction and operation for the proposed site will be considered in Chapters 4 and 5 of the EIS.*

D.1.2.4 Comments Concerning Geology

Comment: The EIS scoping document must produce updated information on seismic activity for the area. The old studies done forty years ago with outdated methodology cannot be the main source of information for the new EIS. The NRC must employ the most updated methodologies to ascertain the seismic conditions that exist around the plant and the effects of seismic activity at relevant distances as they relate to shaking activity and its affect on the proposed plant and existing plants. These studies must also look into the future because the waste must be stored on site for who know how long and seismic activity can affect waste storage. What time frame should be used? Let us start with at least a century. After all, the region is still dealing with the coal strippings and abandoned mines from the middle of the nineteenth century. Why not look ahead. (**0013-34** [Stilp, Gene])

Response: *Seismic hazards are outside the scope of the environmental review. As part of the NRC's site safety review, the staff considers whether, taking into consideration the site criteria in 10 CFR Part 100 and information provided by the applicant, the proposed reactor can be constructed and operated without undue risk to the health and safety of the public.*

D.1.2.5 Comments Concerning Hydrology − Surface Water

Comment: Environmentally, we have to look at...the water (**0012-7** [Stilp, Gene])

Comment: [W]e think of the traditional items in the scoping document, the air, the water, the fauna and foliage, whatever that is, the animals and plants also have to be studied. Interestingly enough, I never saw any animals evacuated during a nuclear emergency**.** (**0012-78** [Stilp, Gene])

***Response**: The NRC staff will assess consumptive water use and water-quality impacts from operation of the proposed facility. The results will be described in Chapter 5 of the EIS.*

Comment: Also, the document must include a complete study of all other proposed power plants by all companies along the length of the Susquehanna River. Manufacturing facilities must also be studied for present and future demand on the river's resources. The study must include the entire watershed of the Susquehanna from the river inception to its conclusion. (**0013-3** [Stilp, Gene])

Comment: All river activities must be considered from drinking water use, to sewage use to fishing and boating use, to agricultural use, to tourism use, to industrial use, etc. Streams impacts must also be studied. Above ground and below ground stream and well implications must be studied. (**0013-9** [Stilp, Gene])

Comment: All water sources that the population with fifty miles of the plant depends on have to be considered. (**0013-13** [Stilp, Gene])

Comment: Water issues also have to consider the already impacted and dead streams that are the result of coal mining and acid mine drainage waste that already impact the entire region. (**0013-18** [Stilp, Gene])

***Response**: The NRC staff will consider present and known future surface-water uses (withdrawals, consumption, and returns) that are within the BBNPP site's hydrological system and that may affect or be affected by the plant. The NRC staff will also consider present and known future groundwater withdrawals on the site and for distances great enough to cover aquifers that may be adversely affected by the facility. Results of the cumulative impact analyses will be presented in Chapter 7 of the EIS.*

Comment: The Susquehanna River Basin Commission must be a full party to any scoping document. If the SRBC does not initiate comments, the NRC must approach and include the SRBC research and analysis of the future condition of the watershed in its decision making process and also the history of the actions by PPL in relation to the Susquehanna River and the SRBC. (**0013-7** [Stilp, Gene])

***Response**: The NRC held a site audit with the applicant the week of April 27, 2009, in Wilkes-Barre, Pennsylvania, to review the applicant's Environmental Report and to tour the site. The Susquehanna River Basin Commission (SRBC) staff attended the NRC audit. SRBC staff provided information to the NRC staff regarding the SRBC water withdrawal permit process and SRBC reports. Because the SRBC is the primary regulatory authority for water withdrawals from the Susquehanna River, the NRC staff will work closely with the SRBC during preparation of the EIS.*

Comment: All documents from NOAA must be considered as they relate to water and storm activity and water availability and quality. (**0013-16** [Stilp, Gene])

***Response**: The applicant's Final Safety Analysis Report (Part 2 of the application) and the NRC's Safety Evaluation Report will evaluate storm activity, precipitation depths/rates, and flooding potentials at the site. Water-use and water-quality impacts associated with construction* *and operation of the proposed BBNPP will be evaluated by the NRC staff, and results will be presented in Chapters 4 and 5 of the EIS. Chapter 2 of the EIS will provide a description of the environment potentially impacted by the proposed facility. Information to be used during the COL review will include documents obtained from NOAA and other State and Federal agencies to the extent necessary to characterize the BBNPP site.*

Comment: The proposed transmission line to transport sewage from the Bell Bend facility should be sized to handle flows from both the Susquehanna Steam Electric Station (SSES) and the Bell Bend facility, should SSES decide to terminate the existing Outfall 079 river discharge in the future. (**0017-1** [Janati, Rich])

Comment: Act 537 Planning approval for the facility's sewage is needed. Since Berwick is located in the North Central Region of DEP, that regional office will need to be contacted for that approval. (**0017-2** [Janati, Rich])

Response*: The NRC staff will assess nonradioactive waste systems resulting from operation of the proposed facility. This assessment includes sanitary system effluents. The results will be presented in Chapter 3 of the EIS.*

Comment: The application did not identify the need to obtain a Water Quality Management Permit for the industrial wastewater treatment facilities that will be constructed to treat the wastewater before it is discharged to the Susquehanna River. (**0017-3** [Janati, Rich])

Response*: Because the State of Pennsylvania is the primary regulatory authority over water quality, the NRC staff will work closely with Pennsylvania state agencies during the EIS review. In Section 1.3.2 of the Environmental Report, the applicant identified the need to obtain permits from the Pennsylvania Department of Environmental Protection for water quality, stormwater discharge, and industrial wastewater treatment and discharge. Table 1.3-1 of the applicant's Environmental Report identifies the various environmentally related authorizations from Federal, State, and local authorities for the proposed action. The NRC staff will review this list to ensure it is complete.*

Comment: A detailed evaluation of the combined thermal effects of both the SSES and the proposed Bell Bend discharge will need to be included in the NPDES application. (**0017-4** [Janati, Rich])

Response*: The NRC staff will consider water-quality impacts resulting from construction and operation of the proposed facility on the Susquehanna River, including temperature (thermal) effects. Results will be presented in Chapters 4 and 5 of the EIS. The staff will consider cumulative water-quality impacts from the proposed BBNPP and SSES, Units 1 and 2, including the effect described in the comment in Chapter 7 of the EIS.*

Comment: The application states that the closest impaired water body to the proposed project is the Little Nescopeck Creek. The closest 2008 Integrated Water Quality Monitoring and Assessment report listed impaired water body is the Susquehanna River. (**0017-6** [Janati, Rich])

***Response**: The comment is noted. Water-quality impacts of construction and operation of the plant will be evaluated by the NRC staff. Assessment results will be documented in Chapters 4, 5, and 7 of the EIS.*

Comment: The application does not include all of the detailed information that is required to determine if the project will conform to all Water Management Program requirements. (**0017-5** [Janati, Rich])

***Response**: This comment relates to approvals required for operating the BBNPP. The comment provides no information about environmental impacts of the proposed action and will not be evaluated further.*

D.1.2.6 Comments Concerning Hydrology – Groundwater

Comment: Another concern is when they were doing the test boring back at the site and I haven't been there, I only know this from people that were doing the boring and have talked, they've practically hit underground rivers which are just lots and lots of water, what's flowing our way. Water flows downhill. I'm concerned about building where our water table can be that disruptive. (**0012-17** [Davenport, Bill])

***Response**: The movement of groundwater under the BBNPP site, as well as the planned groundwater monitoring systems, will be described in Chapter 2 of the EIS. The effects of the construction and operation of the plant on the local and regional groundwater hydrology will be evaluated in Chapters 4 and 5.*

Comment: The application describes the pre-application hydrological monitoring program that will be implemented at the BBNPP site, including installations of groundwater (GW) monitoring wells. It is recommended that the applicant continue to maintain the existing wells, following the completion of the pre-construction phase, and for the purpose of future GW monitoring. The applicant should also make a commitment to develop and maintain a GW Monitoring and Protection Program, during plant operations, to comply with the industry's GW Protection Initiative. (**0017-11** [Janati, Rich])

***Response:** At this time, NRC regulations do not explicitly require the monitoring of onsite groundwater during plant operation. However, Section 6.2.7 of the applicant's Environmental Report, Revision 1, related to the Radiological Environmental Monitoring Program states that the program will include "The addition of eight new on-site well water sampling locations to monitor for potential leaks from plant facilities which could impact ground water." The Nuclear Energy Institute's "Groundwater Protection Initiative" (NEI 07-07) identifies actions to implement a groundwater protection program, but at the present time it is not an NRC requirement and compliance is voluntary. The applicant has stated in Section 6.5.2.3 of the ER that they will continue to follow development of the NEI initiative and address future requirements as applicable.*

D.1.2.7 Comments Concerning Ecology − Terrestrial

Comment: ...we think of the traditional items in the scoping document, the air, the water, the fauna and foliage, whatever that is, the animals and plants also have to be studied. (**0012-77** [Stilp, Gene])

***Response**: The impacts of construction and operation of the proposed BBNPP on the terrestrial environment will be discussed in Chapters 4 and 5, respectively, of the EIS.*

D.1.2.8 Comments Concerning Ecology − Aquatic

Comment: All PA Department of Conservation and Natural Resources documents must be consulted. The effect of the thermal aspects of the water returning to the river is a major consideration. The effects on the fish and water wildlife from a new reactor in addition to the operation of the old reactors must be studied. The U.S. Fish and Wildlife Service's existing water and stream knowledge and all documents available from that source must be considered. (**0013-15** [Stilp, Gene])

***Response**: The NRC staff is coordinating the review of impacts of the proposed BBNPP with numerous State and Federal agencies, including the U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, the Pennsylvania Department of Environmental Protection, the Pennsylvania Fish and Boat Commission, and the Pennsylvania Game Commission. This coordination includes periodic meetings with the NRC staff and the applicant. The impacts of the construction and operation will be considered in Chapters 4 and 5 of the EIS, respectively.*

Comment: There is an issue with Walker Run, with wild trout being found in a stream not on the Pennsylvania Fish and Boat Commission's wild trout list. If the stream is reclassified, there is the potential that we will have to deal with EV wetlands. Current project design calls for a section of this stream to be relocated and piped. (**0017-10** [Janati, Rich])

Comment: Stream habitat assessment should be included in the measurement of success for the comparison of the natural stream design sections to the reference stream sections. (**0017-7** [Janati, Rich])

***Response**: The EIS analysis will use the most recently available information about aquatic biota and water quality to characterize the existing conditions in the vicinity of the BBNPP site and to analyze potential impacts from the project on the aquatic ecosystem in Walker Run and in the Susquehanna River. Existing conditions will be described in Chapter 2 of the EIS. The impacts of construction and operation will be discussed in Chapters 4 and 5, respectively. The cumulative impacts of construction and operation will be presented in Chapter 7 of the EIS.*

Comment: There are issues related to filling the wetlands which may have a large impact on the project. Wetland replacement may be an issue. (**0017-9** [Janati, Rich])

***Response**: The U.S. Army Corps of Engineers, as part of its conduct of the 404 permitting program, and the NRC staff will evaluate the impact of the construction and operation of the BBNPP on wetlands located onsite and along the Susquehanna River. Wetlands will be described in Chapter 2 and impacts on wetlands due to construction will be described in*

Chapter 4. The NRC's responsibility under NEPA is to provide an analysis of potential impacts related to the proposed action, to evaluate alternatives, and to suggest mitigation if deemed necessary. Approval of other Federal and State permits associated with the proposed new nuclear unit and any requirements for mitigating actions will be the responsibility of the permitting agencies.

D.1.2.9 Comments Concerning Socioeconomics

Comment: I am very excited about the future economic benefits to my business and to my family directly relating to the Bell Bend project (**0004-1** [Snavely, Nate])

Comment: In addition the proposed Bell Bend nuclear unit would create thousands of construction jobs and hundreds of new permanent jobs, which would benefit the economic health of this area and the surrounding region. I have found that PPL and its employees support the community in many ways. A new nuclear unit would create a significant ripple effect throughout the local economy that will help the housing market, retail businesses and service providers such as restaurants and hotels. We need new sources of electric generation for northeastern Pennsylvania to grow and prosper. (**0006-3** [Musto, Raphael])

Comment: Ensuring the availability of abundant and affordable energy is vital to a healthy economy and to attracting and retaining new industry. This facility will address these needs directly and locally by creating thousands of new construction jobs in the near term and over time, hundreds of highly skilled, permanent jobs that will positively impact the local housing market, retail businesses, restaurants, and other establishments in Salem Township and the surrounding area. (**0008-3** [Baker, Elisabeth (Lisa)])

Comment: Belles Signs strongly feels that the proposed Bell Bend Unit would not only create much needed employment in this area, but it will attract more business to our local retail stores, restaurants, and boost the housing market in these dire of economic conditions that we are currently going through. (**0009-2** [Belles, Donnie])

Comment: In addition, the Bell Bend project would create over 4,000 construction jobs and 400 new permanent jobs, providing a significant economic boost to our region. (**0010-3** [Yudichak, John])

Comment: They [PPL] provide good jobs. And they're willing to expand and have a project that will bring in hundreds of jobs to the local area and the effect in the economy. So I just say let them do it. Let's go. We need the power and we need the jobs. (**0012-45** [Cleary, Jim])

Comment: BIDA [Berwick Industrial Development Association] is the premiere economic development agency serving the greater Berwick area. Historically, PPL and its predecessor companies have been strong allies of the economic development community. BIDA and its sister economic development organizations in the greater Berwick area have been recipients of assistance from PPL in numerous ways, including, but not limited to marketing aid, direct financial contributions to help underwrite the cost of administering a conference of economic and community development programs and construction of an industrial shell building. (**0012-12** [Phillips, Stephen])

Comment: Belles Signs strongly feels that the proposed Bell Bend unit would not only create much needed employment in this area, but it will attract more business to our local retail stores, restaurants, and boost the housing market in these dire of economic conditions that we are currently experiencing. (**0012-39** [Search, Ryan])

Comment: our Chambers of Commerce is out there trying to scrounge up employers coming in here who will bring in new businesses and maybe they're going to bring in 50 jobs or 100 jobs. And here we have an employer who has proven them to be good corporate citizens. (**0012-44** [Cleary, Jim])

Comment: I've worked for a lot of guys in the power plant and honestly, if it wasn't for the power plant, this community would be -- it would be here, but we'd be very short of jobs. One thing is when the new plant comes in; there will be a lot of jobs coming up. The people that work at the plant now, where will they be if this plant does get shut down? (**0012-51** [Bodnar, Steve])

Comment: PPL is an economic -- has an economic impact in our area. It employs over one thousand people and in an outage time, almost 1500. It is the largest payer of school taxes. It pays to the Berwick Area School District -- $2,769,000 is paid to the Berwick Area School District. If they were not there, calculating everything, our school taxes would be 20 percent higher. (**0012-62** [Siecko, Joseph])

Comment: And as I sit back and think about it, you know, it's easy to categorize PPL as this corporate entity, but you know, they're not. They're our neighbors, they're our friends, and I believe it was Mr. Fatula who said something that was really profound and really true. They don't want to die any more than we do. I believe and trust in them with my family's safety. I think they do a tremendous job up there. I have no reason to believe that if the third reactor went in, they wouldn't continue to do a tremendous job. I have no reason not to believe that there wouldn't be even more employees involved in our communities. The economic impact, too, it's easy to categorize that as money, and it's easy to say that money wins, but money is something that our community desperately needs. (**0012-64** [Pajovich, Nick])

Comment: It is true they are in business to make money. Well, you know, we all are. In the United States, we live under a capitalist society and capitalism is a reality. They shouldn't be faulted for that. They should be applauded for that, because again, the best way you can help a community, the best way you can contribute is to have the financial resources to do that. PPL has done that. They've proven it time and time again and I believe with all my heart the community will be a stronger, better community if Bell Bend becomes a reality. (**0012-66** [Pajovich, Nick])

Comment: As Nick [Pajovich, CEO of Berwick Area YMCA] said, there is not a nonprofit in this area that has not benefitted from the abilities that they bring to this community and to the time that they're willing to give to the nonprofits in this area. This community is made better and stronger because of PPL. (**0012-70** [McGinnis, Joy])

Comment: Furthermore, this facility will create an estimated 4,000 construction jobs and 400 permanent jobs to operate and maintain the plant, which is vital in the current economic climate. To that end, I am requesting your full support of their application. (**0005-2** [Eachus, Todd])

Comment: PPL's current workforce of approximately 1100 persons is a key component of the Berwick area's economic base. Those employees are among the highest compensated in the entire region. The payroll generated in the greater Berwick area would be the envy of many other locales. The proposed 400 to 500 positions expected to be created by the proposed third reactor will add substantial economic benefit to the greater Berwick area. (**0012-13** [Phillips, Stephen])

***Response**: These comments relate to socioeconomic issues and anticipated economic benefits that will accrue to the local community from future BBNPP construction and operation. Socioeconomic impacts of the proposed action will be discussed in Chapters 4 and 5 of the EIS.*

Comment: Lastly, the outdoor recreational opportunities of the area have been greatly enhanced with the Susquehanna Riverlands recreation area and Council Cup - both crown jewels of our region. (**0004-3** [Snavely, Nate])

***Response**: The comment is related to socioeconomic impacts, specifically tourism, recreation, or historic appeal. Public services involving tourism and recreation will be discussed in Chapter 2 of the EIS.*

Comment: The current facility underwrites approximately 20 percent of the tax revenue generated by the Berwick area school district. Construction of the anticipated new facility will certainly greatly increase the existing tax revenue. Without this tax revenue, the burden on other property owners would greatly increase. No one could dispute the fact that the utility has been a good corporate citizen. It's contributions in both the monetary and personnel sense to area municipalities have been well documented. (**0012-14** [Phillips, Stephen])

Comment: I am sure PP&L knows all about it but they choose to do nothing. PP&L bought a lot of property in Conyngham Twp. and bull-dozed all the buildings taking them off the local tax base. We are left to make up the taxes (loss) with no consideration locally. The power plant is in Salem Twp. (**0016-3** [Hess, Leroy])

Comment: When is PPL going to contribute their 'fair share' toward school taxes? (**0018-10** [Bogard, Deborah])

***Response**: The EIS will evaluate the expected economic impacts of construction and operation activities including any local purchasing of construction and production inputs, local and in-migrating labor, local spending of earnings, and tax revenues generated by local purchasing activities or from changes in real property assessments. The evaluation will include both Conyngham and Salem Townships. The information will be presented in Chapters 4 and 5 of the EIS.*

Comment: The population growth, density, and affiliated infrastructure must also be considered in the immediate radius of the plant and beyond. (**0013-5** [Stilp, Gene])

***Response**: These comments briefly identify potential socioeconomic impacts on the community and local municipalities of plant construction and operation, including the fiscal impact of monetary investments required to maintain the community infrastructure. These topics will be discussed in Chapters 4 and 5 of the EIS.*

D.1.2.10 Comments Concerning Environmental Justice

Comment: In my capacity to lead our YMCA, I see the poverty in our community. Four in ten kids in our school district live below the poverty level, folks, and that's real. That's not a made-up statistic. I see the kids we help at the Y. I see the kids that other agencies, I believe I've heard the Boy Scouts mentioned. But the fact is there's not one nonprofit in our community that isn't touched by PPL whether it's in terms of time, in terms of finances, in terms of expertise. And quite honestly, we couldn't operate without them. They are that important and that significant. (**0012-65** [Pajovich, Nick])

Comment: As CEO of Berwick Area United Way, we are seeing some real concerns about the economic conditions in this community. As Nick said, four out of every ten of the kids in the School District are eligible for the subsidized meal programs. Thirty-three percent of the people who live in Berwick have a disability. Over a third of the residents are tenants, they are not homeowners. The average salary in Berwick is $40,000 and that's for a family of four. Even the State of Pennsylvania says that the sustainability standard in Columbia County is $43,994. So even from the get-go, people in Berwick are at a disadvantage. (**0012-71** [McGinnis, Joy])

***Response**: NRC will consider disproportionate impacts on minorities and low income populations that result from the operation of the proposed BBNPP in Chapter 5 of the EIS.*

D.1.2.11 Comments Concerning Health − Radiological

Comment: Look at the whole aspect and how far out are you going to go? Usually, they say right next to the plant or five miles, ten miles. I don't know what the scope of your past scoping documents says has been, but I would study it not in concentric circles, but you have to study, I believe, which way the wind blows and the wind blows pretty far. (**0012-81** [Stilp, Gene])

Comment: The proximity of this plant to the metro NY and NJ areas which are in the extended keyhole of the prevailing winds...give this location elevated status as something we should protect and not contaminate with the wastes and potential irradiation. (**0014-2** [Creasy, David])

***Response**: These comments concern airborne radioactive effluents from the plant. The NRC staff will address the patterns of wind and weather in Chapter 2 of the EIS. Based on that information, the NRC staff will address the environmental impacts of airborne radioactive effluents of the plant and accidents in Chapter 5 of the EIS.*

Comment: The present radionuclides given off from the plant and those that have been put out for the past almost thirty years have to be studied for their impact via the water on the population that was present during the past years. (**0013-11** [Stilp, Gene])

Comment: The fact that the Susquehanna River is a water source for many communities downstream and the major source of the Chesapeake Bay's water give this location elevated status as something we should protect and not contaminate with the wastes and potential irradiation. (**0014-3** [Creasy, David])

Comment: In the Draft Environmental Assessment to increase Maximum Reactor Power Level taken from the Federal Register, Vol.72, No. 233, December 5, 2007, this plant in 2005 released 1,470,000 gallons of radioactive waste water into the river. The report states that increasing the power levels would raise the release levels directly. What would a new reactor emit? (**0014-4** [Creasy, David])

***Response**: These comments refer to health impacts of releases of radiological effluents to the Susquehanna River. The impact analysis for the BBNPP in Chapters 4 and 5 of the EIS will address health impacts of releases of radioactive effluents to the Susquehanna River. Cumulative impacts will be discussed in Chapter 7 of the EIS.*

Comment: Everybody in this room who has lived in Berwick all their lives, they have become of the key people, one of the key aspects of the scope of the environmental scoping for this new plant. Everybody should be looked at; the human health of all those people should be looked at. (**0012-2** [Stilp, Gene])

***Response**: Health impacts associated with plant operation will be discussed in Chapter 5 of the EIS.*

Comment: A study of all the people who come in from out of town to do the transition when they put the new fuel storage in there. (**0012-3** [Stilp, Gene])

***Response**: The NRC's regulatory limits for radiological protection are set to protect workers and the public from the harmful health effects of radiation on humans. These limits are presented in 10 CFR Part 20, Standards for Protection Against Radiation, and are based on recommendations of national and international standards-setting organizations and the National Research Council's committee reports on the Biological Effects of Ionizing Radiation (the BEIR reports). The effects on workers, including additional workers brought in to assist during outages from cumulative radiological releases from the proposed BBNPP unit and from SSES, Units 1 and 2, will be described in Chapter 7 of the EIS.*

Comment: ...are there any documented cases of death to radiation exposure as a result of a nuclear power plant? I'm asking the question. And the answer would be there's no study done on it. Okay. If there are, then that's something to look at. If there aren't, then that sounds like a lot of smoke. (**0012-31** [Fatula, Ken])

Comment: Does nuclear power generation release environmentally damaging gases or pollution? We've been told about picocuries. My question is how many picocuries kill? How many do you have to ingest? What is their decay rate? There are a lot of statements; I refer to them as alarmism, quite honestly. (**0012-32** [Fatula, Ken])

Comment: Now you say I feel fine, but at a genetic level, who knows? You're messing with your children's lives. You're messing with your future generations' lives. You do not know what constant low-level nuclear radiation does to you. (**0012-4** [Stilp, Gene])

Comment: Environmentally, we have to look at...the people's health, (**0012-8** [Stilp, Gene])

Comment: The primary concerns with nuclear power plants, of course, is radiation. And those concerns are true. Biological effects, that's basically cancer. What are the carcinogenic effects of radiation and what are the genetic effects? We can spend a great deal of time on this, but I'll just give you two pieces of information. For example, at TMI, there were over 12 studies done, National Cancer Institute, Columbia University, in other words, agencies and groups that are not a part of the industry. The result of those studies indicate that in a 50-mile radius involving 2 million people where the normal number of cancers would be 17 percent, in other words those people 2 million, 17 percent of them will die from cancer. That would be 340,000 people. For the exposures of radiation release from TMI, how many of that 340,000 could be credited to TMI? The answer is one. Genetic effects, one of the most interesting and we generally assume that they are present, but there were 840,000 survivors in Japan, Hiroshima, Nagasaki, that were exposed to very high levels of radiation, didn't die. Subsequently, they married, some of them to each other and gave birth to children. The studies that have been done on the children of those 84,000 exposed people shows no significant difference in terms of birth defects over what you would have normally for that population. No significant difference. (**0012-49** [Superdock, Dave])

Comment: Studies that follow present and former residents must be conducted. (**0013-12** [Stilp, Gene])

Comment: What is the distance of safe living from not only the reactor, but the storage facilities? (**0018-9** [Bogard, Deborah])

***Response**: Radiological health effects from routine operation of the proposed BBNPP unit will be addressed in Chapter 5 of the EIS.*

Comment: A little reference material. Half a liter of water. The tap water contains 1/100th picocuries per liter, twice this amount, 1/100th picocuries. A picocuries is one trillionth of a curie. From documents on the Federal Register, Wednesday, December 5, 2007, draft environmental assessment to increase maximum reactor power level. Currently, Susquehanna has 3439 megawatts per unit. In this environmental draft statement, they were asking or talking about increasing to 3952 megawatts per reactor, a 13 percent thermal power increase. What this means is that they would be generating more waste. In looking over the radioactive waste assessments for the history of the plant, the single year highest radioactive releases between 2000 and 2005. In 2005, 1,470,000 gallons of radioactive, liquid radioactive waste was released into the Susquehanna River. In 2003, they don't list the amount released, but it contained 70 curies of tritium and in 2000, contained 36.9 curies of fission and activation products. Now remember, twice this much, 1/100th of a picocurie which is one trillionth of a curie and they have released millions of gallons before the increase in megawattage. And now with the third reactor anticipated, that has to be potentially increased by at least 33 percent. I'm not math wizard, but if you've got two and you add one, that's a third. (**0012-26** [Creasy, David])

Comment: How many additional gallons of waste are to be put into the Susquehanna River each year? Who gets to drink what waste down stream? Yummy. (**0013-31** [Stilp, Gene])

Response*: These comments address the amount of liquid radioactive effluents projected to be released from the combined operation of the SSES units and the proposed BBNPP unit. Chapters 5 and 7 of the EIS will address the radiological environmental impact from the combined operations of the SSES units and the proposed BBNPP unit.*

D.1.2.12 Comments Concerning Accidents − Severe

Comment: Does the probability of a nuclear accident go up with a plants age? (**0013-22** [Stilp, Gene])

Response*: The issue raised in this comment is a safety issue and, as such, is outside the scope of the environmental review and will not be addressed in the EIS. A safety assessment for the proposed licensing action was provided as part of the application. The NRC is developing a Safety Evaluation Report that analyzes all aspects of reactor and operational safety for the BBNPP.*

Comment: The fact of the location of the plant. We are approximately 100 miles upwind of New York City metro area. We are approximately 100 miles upstream from Chesapeake, one of the largest ecosystems in North America, yet we're at the triangulation point where if something catastrophic were to occur, and God forbid that would ever happen for all of our sakes, we have the potential of losing some of the most valued property, resources, and population centers in North America. (**0012-30** [Creasy, David])

Comment: if you're looking at the economics of this whole thing, any kind of nuclear accident would also involve everybody involved in the dairy industry, the farming industry, and who knows how many billions of dollars that generates and how many jobs that creates in Pennsylvania. Isn't Pennsylvania the leading economic thing for jobs? Isn't it farming? (**0012-80** [Stilp, Gene])

Comment: The amount of radiation released via different accident scenarios and its environmental impact on populations whether they be human, animal or plant has to be considered. Why plant and animal? Because of the economic impact on Pennsylvania and on Pennsylvania's major source of revenue: agriculture. That is unless you are ready to utilize Pennsylvania's aging population as a source of "Solient Green." Bon Appetite. The total air movement in the Mid-Atlantic must be studied and one would conclude that any plant that is in a direct line with major eastern cities with mass populations should be shut immediately let alone the building of a new reactor that can put its radioactive product into the prevailing wind. There will be another accident at some point with aging plants. The aging plants at Berwick are right along the Route 80 line that goes directly to the New York City region by prevailing wind. Why put fifty million people at risk? Oh excuse me, that is the business of the NRC. (**0013-27** [Stilp, Gene])

Response*: These comments refer to nuclear accidents and their consequences. The environmental impacts of postulated accidents will be evaluated, and the results of this analysis will be presented in Chapter 5 of the EIS.*

D.1.2.13 Comments Concerning the Uranium Fuel Cycle

Comment: I have major concerns about living next to a nuclear waste dump. I'm not against nuclear power. It's far better than reading by candlelight. We have many of our citizens, especially in Salem Township living within a quarter mile of a nuclear waste dump. President Bush did sign legislation to open Yucca Mountain; however, Harry Reid has stopped it. It's up to you to get to your Congressmen and your Senators and your legislators to get Yucca Mountain opened for safe storage of nuclear waste or for reprocessing waste. (**0012-16** [Davenport, Bill])

Comment: The other part that I don't care for about this process is that we're talking about the plant. And it's just one little piece in the a la carte menu of the fuel cycle and the environmental impact. We're here to talk about environmental impact, but yet we can't speak about the mining and the milling process that takes place somewhere else. And they don't care about us. But the tailings, the tons, the acres of tailings that are emitting radiation because we only want the Uranium-235 which is 1 percent of what they take out of the ground. Ninety-nine percent is Uranium-238, but that's no good, so we just leave that here for those people that we have to process, that we have to reprocess it. Then we have to formulate it into the ceramic pellets. All along the chain, there's environmental impact. (**0012-28** [Creasy, David])

Comment: I am a lifelong resident of Salem Township. I write this as a concerned citizen but more as a father of two who thinks the impact of the power plant is far greater than the limited scope the owners and the NRC are presenting. If we are to talk about the scope of the environmental impact a new reactor would have on the surrounding area, I believe we must first recognize that there is a great impact from the moment the first shovel of dirt is removed from the Earth here at the site and also from the mining areas in the western US, Canada and now Eastern Europe and Russia. The impact is being created and is not just a disruption of soil and water. We are talking about elements which are toxic for hundreds of thousands of years. The notion that the mining, processing and transportation are outside the scope of this process is taking a tunnel vision approach and should be considered in any environmental impact assessment. (**0014-1** [Creasy, David])

***Response**: The impacts related to the uranium fuel cycle will be addressed in Chapter 6 of the EIS. The generic impacts of the fuel cycle are codified in 10 CFR 51.51(b), Table S-3, "Table of Uranium Fuel Cycle Environmental Data" and in 10 CFR 51. 52, Table S-4, "Environmental impact of Transportation of Fuel and Waste to and from One Light-water Cooled Nuclear Power Reactor."*

Comment: These nuclear power plants were built without a defined plan for safe waste disposal or transportation. This issue has never been solved. We now not only have a facility without a plan or money for decontaminating, we now have a high-level radioactive waste dump. And I might add it is being stored in temporary storage units. How temporary is 30 years? Who builds a home without a sewage system? (**0012-19** [Creasy, Mary])

Comment: If your neighbor were to dump his garbage in the yard and let it pile up for 20 years would he be a good neighbor? I don't think so. We're not talking about smelly garbage here. We're talking about radioactive waste. We're talking about a containment, a spent fuel pool that has been filled to capacity that has been over-filled, condensed to a point where it can't store any more so now the old rods are being encased in concrete and put into the back yard, the back 40. And this will continue and continue and continue. (**0012-27** [Creasy, David])

Comment: And people are complaining about the fact that well, we have on-site storage. This could have been addressed decades ago. The problem was that we have politicians that are more concerned about getting votes from environmentalists and their lobby than they are about doing what we know to be right. (**0012-34** [Fatula, Ken])

Comment: I was going to bring up an issue of the spent fuel rods that are up there. It's been brought up by several people before me. But I remember going to such meetings as this 35 years ago and I asked the -- one of the gentlemen conducting the meeting, Bill Begdin, his name was, what are you going to do about the spent waste? And he said we feel very comfortable that the Federal Government will find a place to put it. Well, now I'm in the twilight of my mediocre career and we still don't have a place to put the waste and I am concerned about that because the waste is my neighbor. Nothing makes me feel good about it. (**0012-47** [Hartman, Cindy])

Comment: I agree with the problem with high-level waste and I look forward to the point when the politicians will get together and solve that problem. Technologically, it's solved. Politically, it hasn't been solved. (**0012-50** [Superdock, Dave])

Comment: At what point does the cost benefit analysis include the fact that production of nuclear waste is of no benefit when it cannot be stored as originally conceptualized at a distant location and sold to the public as it was thirty years ago. The new "public confidence" effort as it relates to changing the way nuclear waste is considered by the NRC must be looked at in this cost/benefit analysis. What is the cost of the nuclear waste produced by the old reactors and the new reactor? The public was always told high level waste would go somewhere else when the original two plants were constructed at this site. (**0013-20** [Stilp, Gene])

Comment: When you build a nuclear plant you are actually building two structures: the plant itself and the waste storage facility. You actually need a separate EIS scoping document for the new type of facility needed for the type of waste generated from the new reactor design. (**0013-29** [Stilp, Gene])

Comment: The current reactors have filled and overfilled the spent fuel pools. The older fuel has been encased in concrete. How much capacity will ultimately be held? The answer is all the waste the reactors generate. With the recent cut-off of funding for the Yucca Mtn. disposal site, the current administration has finally realized that burial there is not a solution and that all waste will be held at the respective sites. The environmental impact of that reality is exponentially increased for the next millennia. Who will be responsible for this once PPL has squeezed every kilowatt out of the Uranium? (**0014-5** [Creasy, David])

Comment: My concern is about the safety of the existing and future 'temporary' storage of nuclear waste onsite. Can this be returned to the mine that it came from? Can it be recycled? (**0018-7** [Bogard, Deborah])

***Response**: The safety and environmental effects of long-term storage of spent fuel on site have been evaluated by the NRC and, as set forth in the Waste Confidence Rule at 10 CFR 51.23 (available at http://www.nrc.gov/reading-rm/doc-collections/cfr/part051/part051-0023.html), the NRC generically determined that "if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor at its spent fuel storage basin or at either onsite of offsite independent spent fuel installations. Further, the Commission believes there is reasonable assurance that at least one mined geologic repository will be available within the first quarter of the twenty-first century and sufficient repository capacity will be available within 30 years beyond the licensed life for operation of any reactor to dispose of the commercial high-level waste and spent fuel originating in any such reactor and generated up to that time." On October 9, 2008, the NRC published for public comment a proposal to amend its generic determination of no significant environmental impact for the temporary storage of spent fuel after cessation of reactor operation codified at 10 CFR 51.23(a) (73 FR 59547) and a related update and proposed revision of its 1990 Waste Confidence Decision (73 FR 59551). The impact of the uranium fuel cycle, including disposal of low-level radioactive waste and spent fuel, will be addressed in Chapter 6 of the EIS.*

Comment: There is radioactivity. It is in the ground. That's the only thing that we should really be worried about right now; if they could get that out, if they do have a place to store it or if they can find a place to store it. (**0012-57** [Bodnar, Steve])

Comment: Also, you have to look at during the mining process and all through it, what is emitted? Are there CFCs emitted by the nuclear mining and the nuclear development process? You have to look at everything that's attached to the reprocessing of nuclear --highly controversial aspects of reprocessing nuclear waste. (**0012-75** [Stilp, Gene])

***Response**: The impacts related to the uranium fuel cycle will be addressed in Chapter 6 of the EIS. The generic impacts of the fuel cycle are codified in 10 CFR 51.51(b), Table S-3, "Table of Uranium Fuel Cycle Environmental Data." In accordance with 10 CFR 51.51(a) and the guidance in Section 5.7 of NUREG-1555, the staff will use the Table S-3 data as the basis for evaluating the uranium fuel cycle impacts.*

Comment: One of the key impacts we've heard tonight from a lot of the anti-nuclear people is the high-level nuclear waste. There's also low-level nuclear waste that has to be looked at. Low-level nuclear waste -- well, it's all nuclear waste, but it emits different items. Now low-level nuclear waste should be looked at. (**0012-74** [Stilp, Gene])

Comment: The waste has to be the billion curie gorilla that cannot be solved. This entire exercise is pointless unless you solve the waste problem. No reactor construction can begin until the problem is solved. The reactor design proposed for this spot has to be analyzed for the amount and toxicity of the waste produced. Is the waste produced of a more intense nature than other reactor designs? Does this EPR design produce more intense wastes? Is the waste storage design now in place able to handle these increased aspects of the waste? By reference please address any and all other questions that have been directed to your office by groups and citizens concerned with the siting of this reactor design in or near their communities Do you need different types of storage facilities for waste produced from this reactor design? Will this site become a defacto long term storage site for other reactors' wastes? What is the waste streams' affects on the water, air and land? And yes, the waste at some point according to the NRC will be shipped cross country. Part of that country is right here. But the entire waste transport process must be part of the scoping process. The security aspects of waste transport are dealt with later. Again, the holistic approach must be used rather than a compartmentalized NRC whitewash. (**0013-28** [Stilp, Gene])

***Response**: The impact of the uranium fuel cycle and its transportation steps, including disposal of low-level radioactive waste and spent fuel, will be addressed in Chapter 6 of the EIS. The generic impacts of the fuel cycle are codified in 10 CFR 51.51(b), Table S-3, "Table of Uranium Fuel Cycle Environmental Data." In accordance with 10 CFR 51.51(a) and the guidance in Section 5.7 of NUREG-1555, the staff will use the Table S-3 data as the basis for evaluating the uranium fuel cycle impacts. The safety and environmental effects of long-term storage of spent fuel on site have been evaluated by the NRC and, as set forth in the Waste Confidence Rule at 10 CFR 51.23 (available at http://www.nrc.gov/reading-rm/doc-collections/cfr/part051/part051-0023.html), the NRC generically determined that "if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor at its spent fuel storage basin or at either onsite of offsite independent spent fuel installations. Further, the Commission believes there is reasonable assurance that at least one mined geologic repository will be available within the first quarter of the twenty-first century and sufficient repository capacity will be available within 30 years beyond the licensed life for operation of any reactor to dispose of the commercial high-level waste and spent fuel originating in any such reactor and generated up to that time." On October 9, 2008, the NRC published for public comment a proposal to amend its generic determination of no significant environmental impact for the temporary storage of spent fuel after cessation of reactor operation codified at 10 CFR 51.23(a) (73 FR 59547) and a related update and proposed revision of its 1990 Waste Confidence Decision (73 FR 59551). It should be noted that the EIS will not address specific low-level waste burial locations, existing or proposed. Site-specific data for these locations is developed as part of the NRC licensing process under 10 CFR Part 61. The impacts from the transportation of radioactive materials will be evaluated in accordance with the criteria in Table S-4 of 10 CFR 51.52(c) and the guidance in Section 3.8 of NUREG-1555.*

Comment: The application contains a discussion of potential actions or measures to reduce the amount of Class B and C wastes. It is expected that the applicant will develop and implement an effective waste minimization plan to minimize the generation of all types of waste including Class A and Greater-Than-Class C (GTCC) wastes. Additionally, the planned Radioactive Waste Processing Building at BBNPP may not have sufficient capacity for on-site storage of LLRW considering uncertainties associated with the future of LLRW and GTCC disposal. It is recommended that the applicant construct a separate temporary storage facility for LLRW and GTCC wastes, during the initial construction of the facility. (**0017-12** [Janati, Rich])

***Response**: The onsite storage of radioactive waste will be described in Chapter 3 and will be evaluated in Chapter 5 of the EIS. This evaluation will include the necessity for waste minimization efforts or the need for construction of a separate onsite storage facility for low-level radioactive waste and Greater than Class C waste.*

Comment: The Commonwealth has publicly expressed concerns regarding long-term storage of spent nuclear fuel (SNF) at reactor sites. Considering that there is currently no permanent repository for SNF, it is possible that there will be a need for an Independent Spent Fuel Storage Installation (ISFSI) at the proposed BBNPP site in the future. Therefore, the applicant should demonstrate that the proposed site is adequate for construction of an ISFSI and dry storage of SNF during normal and extended plant operations, as applicable. (**0017-13** [Janati, Rich])

***Response**: The safety and environmental effects of long-term storage of spent fuel on site have been evaluated by the NRC and, as set forth in the Waste Confidence Rule at 10 CFR 51.23, the NRC generically determined that "if necessary, spent fuel generated in any reactor can be stored safely and without significant environmental impacts for at least 30 years beyond the licensed life for operation (which may include the term of a revised or renewed license) of that reactor at its spent fuel storage basin or at either onsite of offsite independent spent fuel installations." The NRC staff will consider this in the EIS.*

D.1.2.14 Comments Concerning Transportation

Comment: These nuclear power plants were built without a defined plan for safe...transportation... And let's face it; you haven't come up with any kind of safe, radioactive honey trucks. (**0012-20** [Creasy, Mary])

Comment: Yucca Mountain, from what I understand, isn't that dangerous. We know that shipping this stuff, they've designed some containers that are very, very secure. (0012-35 [Fatula, Ken])

***Response**: The EIS will include an analysis of the radiological impacts of transportation involving spent nuclear fuel in Chapter 6 of the EIS. Spent fuel is transported in massive, heavily-shielded shipping casks, referred to in 10 CFR Part 71 as Type B containers, and are designed to withstand severe transportation accident environments.*

D.1.2.15 Comments Concerning Decommissioning

Comment: These reactors were built without a budget to decontaminate the facility when their ability to continue to generate financial gains for whoever may own them at that point in time. We cannot expect PPL to own this facility indefinitely since they were trying to sell it a few years ago. (**0012-18** [Creasy, Mary])

Comment: The bottom line is this plant spits out immense amounts of energy making incredible amounts of money for PPL, its stockholders and employees. The community has lost revenue from property taxes, school taxes, building permits, and will end up with the cost for decontamination when the cost usefulness has been met. (**0012-23** [Creasy, Mary])

Comment: It was created; it has created a high-waste dump, stress, and a target for terrorists and a questionable future. There are no requirements for PPL to deal with the high-waste dump, high waste which has accumulated over these 30 years. What is keeping them from selling the facility and walking away, leaving the burden on the government or the community? (**0012-24** [Creasy, Mary])

Comment: What does happen to the site if they have to abandon it in 10, 20, or 30 years? I do want to have an answer to that. Who is going to be responsible because certainly if it is the taxpayer, I don't like that answer. (**0012-37** [Fatula, Ken])

Comment: The bankruptcy of PPL , PPL Electric Utilities, or whatever related business entity that exists or will exist that has a stake in the plant must be looked at. How does bankruptcy effect environmental planning? At what point does the government own the waste? I am sure that is no benefit to anyone. Decommissioning of the new plant has to be considered in the scoping document's cost/benefit analysis. It will cost more to decommission this plant than it will cost to build it. What will the decommissioning costs of the other two plants do to the company who has to decommission them whether that is a PPL related company or some stupid purchaser of the two existing plants? What does French ownership of the reactor building aspects do to the project? Does the NRC have access to French company records to see the financial health or future financial projections of the company? (**0013-24** [Stilp, Gene])

Response*: Several nuclear power plants have successfully undergone decommissioning; in addition, 14 plants are currently undergoing decommissioning (see http://www.nrc.gov/info-finder/decommissioning/power-reactor/). Federal regulations (10 CFR 50.33(k) and 10 CFR 50.75(b)) require an applicant for a COL to certify that sufficient funds will be available to ensure radiological decommissioning at the end of power operations. Chapter 6 of the EIS will evaluate the applicant's plan for ensuring these funds are available.*

Comment: Added here should be the long term issue of decommissioning of the plant itself because that is a pile of waste itself. The decommissioning aspect must be fully addressed in the scoping document. (**0013-30** [Stilp, Gene])

Response*: Decommissioning the BBNPP upon its retirement will be discussed in Chapter 6 of the EIS. The environmental impact from decommissioning a permanently shut down commercial nuclear power reactor is also discussed in Supplement 1 to NUREG-0586, Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities, which was published in 2002. In Supplement 1, NRC staff found that for most environmental issues, the impact from decommissioning activities is considered small.*

D.1.2.16 Comments Concerning Cumulative Impacts

Comment: In addition, the increased operating power requests for the existing reactors into the future must be considered. (**0013-2** [Stilp, Gene])

Comment: The Chesapeake Bay impact from the flow of the Susquehanna River must also be considered and the other states affected by the river's flow into the Bay must be considered in depth. Increased nuclear activity associated with the Bay must also be considered overall. The effort to put another reactor at Calvert Cliffs is part of the whole picture that must be considered. (**0013-4** [Stilp, Gene])

Comment: The full impact of power generation increases at the existing plants on all aspects of water must be considered in addition to the impacts by a new reactor at this site. (**0013-10** [Stilp, Gene])

Comment: The effects of thermal discharges, chemical additives in discharges, impingement and entrainment issues of aquatic organisms from the existing SSES and the proposed Bell Bend facility intake and blowdown structures should continue being addressed together due to the close proximity of these intake structures to the Susquehanna River. (**0017-8** [Janati, M.S., Rich])

***Response**: Cumulative impacts result from the combined effects of the proposed action and past, present, and reasonably foreseeable actions, regardless of who takes the actions. The appropriate geographic area and time period for considering cumulative impacts depend on the resource being affected and will be determined for each resource as part of the staff's evaluation. The impacts of the construction and operation of the proposed BBNPP on the Susquehanna River and adjacent lands would be added to other known or reasonably foreseeable actions and stressors within the defined geographic area of interest, including known or planned upgrades of SSES Units 1 and 2, or other power plants, if appropriate. The results of the analysis of impacts of BBNPP operations on the aquatic environment will be presented in Chapter 5 of the EIS. The results of cumulative impact analyses will be presented in Chapter 7 of the EIS.*

D.1.2.17 Comments Concerning the Need for Power

Comment: As you know, Pennsylvania is the nation's second largest producer of nuclear energy. One-third of our electricity comes from this carbon-free source. Unfortunately, Pennsylvania also has the distinction of ranking 4th highest in the nation in carbon dioxide emissions, 2nd highest in sulfur dioxide emissions and 5th highest in nitrogen oxide emissions. Over the next 10 years, our electricity demand is expected to rise 1.5% a year. To meet our ever-increasing demand for electricity in a way that does not destroy our environment, we need a diverse energy mix that includes nuclear power, cleaner fossil fuels, renewable sources, and energy efficiency. However, conservation alone will not offset the expected growth in our electricity use and renewable sources like wind and solar are unreliable. (**0003-2, 0018-2** [Walsh, Karen])

Comment: Nuclear energy has served our community for the past 25 years, and with the ever increasing demand for electricity, Bell Bend will serve as a vital component to the future of our regional energy infrastructure. The construction of Bell Bend will help meet the increasing demand, along with providing enough power for more than one million homes. (**0010-2** [Yudichak, John])

Comment: We need power. I don't see anybody that goes home without turning on a light switch at night. What are we going to do? (**0012-54** [Bodnar, Steve])

***Response**: The NRC staff will review the analysis of need for power in Chapter 8 of the EIS.*

Comment: As a state representative from Luzerne County, I am extremely cognizant of the positive impacts this facility will have in area by greatly increasing the electricity infrastructure, which is essential in attracting economic development, and ensuring that the projected electricity demands are met. (**0005-1** [Eachus, Todd])

Comment: A new nuclear unit will provide much needed electricity in Pennsylvania without adding greenhouse gas emissions. (**0006-2** [Musto, Raphael])

Comment: As Pennsylvania continues its transition to a deregulated electric market, additional electric generating capacity is critical to keeping prices affordable for families in our region and throughout the Commonwealth. This project seeks to do this without increasing our dependence on foreign sources of energy and without an accompanying increase in greenhouse gases and pollutants that come with other electric generation technologies. (**0008-2** [Baker, Elisabeth (Lisa)])

Comment: The Bell Bend Nuclear Power Plant would significantly increase the percentage of electricity that PPL generates from non-carbon sources -currently at 40 percent -and provide a reliable source of electricity that does not contribute to global warming. (**0003-4**, [Walsh, Karen])

Response*: The comments express general support for additions to new electric generating capacity in eastern Pennsylvania such as the proposed BBNPP. The comments imply that nuclear plant emissions contain less carbon than other generation alternatives. Emissions from plant construction and operation will be evaluated in Chapters 4 and 5 of the EIS. Emissions from the uranium fuel cycle will be evaluated in Chapter 6. Emissions from power generation alternatives will be evaluated in Chapter 9 of the EIS.*

D.1.2.18 Comments Concerning Alternatives − Energy

Comment: I hear people talk about the fact that we shouldn't have nuclear energy at all. Does somebody have any other option? More birds are killed, and bats by wind generation than by a nuclear power plant. Talk to somebody who operates a site that tries to synchronize wind power with the grid. Have you ever seen a wind tower come down? Check it out. You can see it because it's on You Tube. Sometimes they virtually come apart and explode. Ask the people that work in coal mines if that's not dangerous and then the people who object to or complain about strip mining and yet we all want electricity. (**0012-33** [Fatula, Ken])

Comment: ...look at the alternatives, all the alternatives that are available instead of nuclear power and as an aside, those items also create many, many jobs. If you have $5 or $10 billion to invest, you can invest that into many job-producing things, but we're talking about the environment and what has to happen. So I'd like you to look at all the other processes that are involved. When you look at this, you have to compare them and also to either rule them out after studying them or -- well, you do have to study them. I'd like them studied in the environmental scoping document. And also look at the efficiencies that are involved. I think nuclear power is one of the least efficient processes. (**0012-76** [Stilp, Gene])

Response*: Decisions regarding which generation sources and alternatives to deploy are made by the applicant and regulatory bodies such as State energy planning agencies. The alternatives must be technically viable, feasible, and competitive. Alternative actions such as the no-action alternative, new generation alternatives, purchased electrical power, alternative technologies (including renewable energy such as wind and solar), and the combination of alternatives will be considered in Chapter 9 of the EIS.*

Comment: The Bell Bend Nuclear Power Plant would significantly increase the percentage of electricity that PPL generates from non-carbon sources - currently at 40 percent - and provide a reliable source of electricity that does not contribute to global warming. (**0018-4** [Walsh, Karen])

***Response**: Life-cycle carbon impacts will be considered in Chapters 4 and 5 (construction and operation) and Chapter 9 (alternatives) of the EIS.*

D.1.2.19 Comments Concerning Benefits-Cost Balance

Comment: I believe the scope of your environmental responsibility is far reaching and absolutely so large that the benefits do not outweigh the risks put on the surrounding population. Do your job but keep in mind the magnitude of your decisions. (**0014-6** [Creasy, David])

***Response**: The costs and benefits of construction and operation of the proposed BBNPP will be addressed in Chapter 10 of the EIS.*

Comment: I'm one of the closest homes. I see the towers every day. That's the only thing I don't like. They look like chimneys on my house. Besides that, this plant is going to be lower, so the effect won't be there as much. It still covers a lot of grounds. I used to work on the farm that this power plant is going to be on. There were a lot of kids raised on that farm. The guy that owned it employed a lot of kids. It will affect us in that way because it takes away some of the beauty, but like I said, jobs are the thing with the economics today, we have to get every job we can get. (**0012-58** [Bodnar, Steve])

***Response**: The NRC will carefully review the application against its regulations that are intended to protect public health and safety and the environment. An evaluation of the benefit-cost balance of constructing proposed BBNPP will be discussed in Chapter 10 of the EIS.*

Comment: Continuing. What has already been spent on the new reactor and what will be the cost? What is the present projected cost in 2009 dollars? Twelve billion dollars is the new estimate. What is the full analysis of what will be spent on this reactor? What will be the methodology utilized to project the future actual costs? Who will design the equations to figure this out? How will these studies be kept independent? What will the public actually be able to see from the utility? What will the NRC demand in the way of figures? All costs must be available publicly for the public and the NRC to ascertain the truth which is always presented in false fashion by the utility. No cost/benefit analysis can exist without these figures verified independently. Continuing. The cost/benefit analysis has to also say who will benefit by this plant. New Jersey and New York customers as the primary consumer of plant out put does not justify primary burdens on the non-using population that surround the plant. Would a Delaware River site be more beneficial for the intended end use of the electricity? I guess the cost of siting it there would be astronomical compared to a site where the population is beaten down for thirty years, forty if you consider construction time, and act like heroin addicted sheep for the mere chance to be human radiation sponges and the site of high level nuclear waste dump forever. The entire degradation of the coal regions of Pennsylvania is living proof that the environmental disasters and scars of the past live from century to century to century and populations are myopic as to the future consequences. Utilizing the cost/benefit analysis to ascertain the benefit of utilizing different forms of energy production to produce energy have to be considered. Emerging wind, solar, gas, and etc production must be considered in depth. Therefore the exact figures as to the plant costs must be presented by the utility. The financial stability of the company must also enter into the cost benefit analysis. Currently, a PPL 40 % rate increase that is due to take effect on January 1, 2010 is the subject of a major effort to overturn the increase and re-regulate the utility because of the major impact economic impact on jobs in Pennsylvania. The NRC can take note of this as it produces this scoping document and cannot ignore this major economic factor as to the overall cost/benefit. The exact standing and analysis to PPL's business health overall must be looked at in light of the current and projected market conditions. What does the market analysis show for this and for similar projects across the country, across the northeast, and what has been the experience of reactors of similar design overseas? These factors must be considered in the cost benefit analysis as these costs are compared with a more decentralized approach to energy needs for the future? Where do renewables fit in the NRC analysis? If they are not even considered, they should be. (**0013-21** [Stilp, Gene])

***Response**: The NRC staff will consider renewables in Chapter 9. The NRC does not have authority under its regulations to ensure that the proposed plant is the least costly alternative to provide energy services under any particular set of assumptions concerning future circumstances. This authority and responsibility is most often the role of State regulatory authorities such as public service commissions or, in the case of merchant plants, the competitive marketplace. The EIS will consider the potential for alternative non-nuclear technologies to provide the electricity that could be generated by the proposed plant and their environmental impacts in Chapter 9.*

D.2 The Supplemental Scoping Process

On June 15, 2012, in accordance with 10 CFR 51.26, the NRC and the USACE initiated an opportunity for the public to participate in the scoping process on the revised site layout, by publishing a "Notice of Intent to Conduct a Supplemental Scoping Process on the Revised Site Layout" in the *Federal Register* (77 FR 36012). Through the Notice of Intent, the NRC and USACE also invited PPL; Federal, Tribal, State, and local government agencies; local organizations; and the public to provide comments on the information regarding the revised site layout that was not available during the initial scoping process in 2009. The public participated in the scoping process by submitting written comments to the NRC by July 16, 2012. Comments received after July 16, 2012, were included.

D.2.1 Overview of the Supplemental Scoping Processes

Twelve comment letters were received during the supplemental scoping process. At the conclusion of the supplemental scoping period, the NRC staff reviewed all comment letters received during the comment period and identified individual comments. These comments were organized according to topics within the proposed EIS or according to the general topic, if outside the scope of the EIS. Once comments were grouped according to subject area, the staff determined the appropriate response for the comments.

The comments from the supplemental scoping period and their responses were published in the January 2014 *Environmental Impact Statement Scoping Process Summary Report, Bell Bend*

Nuclear Power Plant, Combined License (ADAMS Accession No. ML14024A659). To maintain consistency with the Scoping Summary Report, the correspondence ID number along with the name of the commenter used in that report is retained in this appendix.

Table D-3 identifies in alphabetical order the individuals who provided comments during the supplemental scoping period; their affiliations, if given; and the ADAMS accession number that can be used to locate the correspondence. Although all commenters are listed, the comments presented in this appendix are limited to those within the scope of the environmental review.

Table D-3. Individuals Who Provided Comments During the Supplemental Scoping Period

Commenter	Affiliation (if stated)	Comment Source (ADAMS Accession #)	Correspondence ID
Boyer, Emilee	Pennsylvania Natural Heritage Program	Letter (ML12200A032)	0006
Cartica, Robert	New Jersey Natural Heritage Program	E-mail (ML12187A055)	0001
DeRonde, Barbara and Robert		E-mail (ML12199A455 and ML12201A082)	0010
Epstein, Eric	TMI-Alert	E-mail (ML12200A220 and ML12205A059)	0009
Jumper, Kim	Shawnee Tribe	E-mail (ML12201B503)	0005
Martin, David	IBOEHA	E-mail (ML12198A636)	0003
Mowrey, Olivia	Pennsylvania Game Commission	E-mail (ML12311A156)	0011
Mowrey, Olivia	Pennsylvania Game Commission	E-mail (ML12311A157)	0012
Mowrey, Olivia	Pennsylvania Game Commission	E-mail (ML12311A158)	0013
Mowrey, Olivia	Pennsylvania Game Commission	E-mail (ML12311A159)	0014
Richenderfer, James	Susquehanna River Board Commission	E-mail (ML12199A454 and ML12209A052)	0004
Williams, Corina	Oneida Tribe of Indians of Wisconsin	Letter (ML12195A236)	0007

D.2.2 Supplemental Scoping In-Scope Comments and Responses

The in-scope comment categories for the supplemental scoping process are listed in Table D-4 in the order that they are presented in this EIS. The comments and responses for the in-scope categories are included below the table. Parenthetical numbers shown after each comment refer to the comment ID number (correspondence number-comment number) and the commenter name.

Table D-4. Supplemental Scoping Comments Categories in Order as Presented in this Appendix

Section	Title
D.2.2.1	Comments Concerning the COL Process
D.2.2.2	Comments Concerning the NEPA Process
D.2.2.3	Comments Concerning Hydrology – Surface Water
D.2.2.4	Comments Concerning Hydrology – Groundwater
D.2.2.5	Comments Concerning Ecology – Terrestrial
D.2.2.6	Comments Concerning Ecology – Aquatic
D.2.2.7	Comments Concerning Socioeconomics
D.2.2.8	Comments Concerning Cultural Resources
D.2.2.9	Comments Concerning Meteorology and Air Quality
D.2.2.10	Comments Concerning Health – Nonradiological
D.2.2.11	Comments Concerning Health – Radiological
D.2.2.12	Comments Concerning Alternatives – Energy
D.2.2.13	Comments Concerning Alternatives – System Design
D.2.2.14	Comments Concerning Benefit-Cost Analysis

D.2.2.1 Comments Concerning the COL Process

Comment: To date, based upon the attendance of community members at the NRC's last public assessment meeting in February, community participation appeared to be very poor - most likely because the NRC and the EPA do not do as good a job as needed try and engage the community and seek out their opinions. Has any one of the federal agencies ever conducted a survey, sent someone house to house to ask how they feel about another reactor being in their back yard? Has anyone ever informed the public about the risks associated with aging nuclear power plants and groundwater contamination, so that they can make an informed decision as to whether they want to risk living in Salem Twp. any more. It is the only ethical and professional thing to do, regardless of the public relations consequences. Has any one ever bothered to send all of the property owners and residents of the township notice about the massive amount of ground water PPL will take out of the ground to construct the foundation for their reactor? Again this should not be a matter of notifying people whose property lines are contiguous with PPL; the groundwater removal work will have a widespread impact on the entire community which the youthful members of the Federal government do not seen to either understand, appreciate, or care enough about the citizens to inform them. It is better to inform people up front so they can move instead of making them angry in the future, which only results in lawsuits. The people and property owners of Salem Twp. are children of God and deserve to be treated with respect. This is why meetings should be publicized by the NRC, EPA, the SRBC, and the EPA not just one newspaper, but in all papers that cover the entire region It should be a requirement of each project manger and a PPL employee to coordinate and notify the people well in advance. People don't read the Federal Register, let alone know about its existence. Again, this is an example of lack of communication between the government and people who live in the real world. Though PPL may not think that it is to their advantage to allow the people to become informed, the truth of the matter, partnerships last longer than fiefdoms and serfs. It is just our observation, the lack of communication between the government and the public, suggests to us that the public has no say, that our democracy has given way to an oligarchy.

Who is going to take the time to organize a meeting on this issue soon, as it not one that should wait or occur a year from now? The NRC and PPL need to be more transparent with the public and keep a majority of the people informed about his project as it affects human lives, personal property, and property values; this project is something that should be taken lightly by anyone. (**0010-8** [DeRonde, Barbara and Robert])

Response: *The public comment period for collecting scoping comments was from January 6, 2009 through March 9, 2009, and then again from June 15, 2012 through July 16, 2012. In addition, a public meeting was held in Berwick, Pennsylvania, on January 29, 2009. Multiple announcements were published in local newspapers, such as the Press-Enterprise, the Standard-Speaker, and the Times Leader, noting the availability of the January 29, 2009, meeting. In addition, announcements in the Federal Register were published on January 6, 2009, and June 15, 2012. Another meeting will be held after the draft is published to collect comments on the draft. That meeting will also be announced in the local newspapers and the Federal Register. The staff considers the public comment period sufficient time for public review and comment, and the method for public notice sufficient.*

Chapter 1 of the EIS will outline the U.S. Army Corps of Engineers (USACE) role in the EIS, its permit evaluation process, and regulations it must meet. PPL has submitted a Joint Permit Application to the USACE for Department of the Army approval to construct the project that proposes structures in and under navigable waters and to discharge dredged, excavated, and/or fill material into waters of the United States, including jurisdictional wetlands. The USACE released their first public notice (PN -12-07) on January 23, 2012, and the public was given the opportunity to respond, including requests for public hearings. This public notice was sent to all adjacent property owners within the vicinity of the proposed action and was also published on the USACE District website. A 30-day time frame was given to submit comments back to the USACE. The USACE considers this comment period sufficient time for public review and comment. Several comments were received in response to PN-12-07. All comments received will be considered by the USACE to determine whether to issue, modify, condition, or deny a permit for this action. Comments received will become part of the public record for this action and will determine the overall public interest of the proposed action. Upon the release of the draft EIS, the USACE will issue a second public notice, which will include notification for a public hearing. (BBNP-COL1-SS0024R)

D.2.2.2 Comments Concerning Process – NEPA

Comment: General Comments. In its ongoing review, SRBC has provided a number of comments on the applications to PPL. Detailed comments related to the technical review are documented in correspondence between PPL and the SRBC, copies of which are distributed to other interested agencies, including the NRC.

In addition to providing written comments, SRBC staff has regularly participated in conference calls and periodic meetings with PPL, and it is staff's understanding that PPL is actively working to resolve the comments and concerns raised in the letters. (**0004-8** [Richenderfer, James])

Response: *The review team appreciates the comment submitted by the Susquehanna River Board Commission (SRBC) and will work with the SRBC staff as it prepares the EIS. (BBNP-COL1-SS0016R)*

Comment: Considering the schedule that PPL will submit information required by SRBC's review process and the time necessary to coordinate with other agencies of our member jurisdictions, it is unlikely that the SRBC could act on the PPL applications during 2012. However, staff recommendations should be nearing completion before yearend, which would allow for SRBC commissioner action at its first 2013 quarterly meeting (March 2013). (**0004-10** [Richenderfer, James])

Response: *By letter dated March 26, 2013 (NRC Accession No. ML13093A021), the SRBC informed PPL that additional information will be needed to process the BBNPP application. Until this information is received, SRBC has suspended its review. (BBNP-COL1-SS0017R)*

Comment: PPL Bell Bend has not disclosed or quantified the how many fish (game and consumable), fish eggs, shellfish will be killed annually if this Application is approved. Is the Corps in possession of this data? Has it been made available to the public for review? Has the Corps established "acceptable levels" of fish kills? If so, where can that data be found? (**0009-16** [Epstein, Eric])

Comment: What will the Corp's compliance reporting requirements be in regard to onsite 316 (a) and 316 (b) monitoring? Where will the results be published? Has the Corps and EPA executed a MOU? What will the Corps compliance reporting requirements be in regard to offsite tritium monitoring? Where will the results be published? (**0009-18** [Epstein, Eric])

Comment: How will the Corps account for the loss of water? How will the Corps track the chemicals dispersion and maintain a "chain of custody?" How often will the Corps test for differential water temperatures? (**0009-21** [Epstein, Eric])

Comment: The U.S. Army Corps of Engineers should convene public hearings pursuant to PPL Bend Nuclear Power Plant's ("Bell Bend") Application ("PPL" or "the Applicant") number NAB 20008-01401-P13 to the U.S. Army Corps of Engineers ("the Corps), Re: PPL Bend Nuclear Power Plant's Application Number NAB 20008-01401-PI3. (**0009-25** [Epstein, Eric])

Response: *The USACE is a cooperating agency and is part of the review team on this proposed action. The USACE's independent Record of Decision regarding the proposed permit will reference the analyses in the EIS and will present any additional information required by the USACE to support its permit decision. One purpose of the EIS will be to adequately fulfill the requirement of the USACE regulations and the Clean Water Act Section 404(b)(1) Guidelines. As part of the USACE public comment process, a public notice was released on January 23, 2012, to solicit comments from the public; Federal, State, and local agencies and* *officials; Indian tribes; and other interested parties. Upon release of the draft EIS, the USACE will issue a second public notice, which will include notification for a public hearing. The review team will consider impacts resulting from operation of the proposed BBNPP on the aquatic environment, including fish kills, temperature (thermal) effects, and the release of radionuclides in Chapter 5 of the EIS. Compliance with Sections 316(a) and (b) of the Clean Water Act will also be discussed in Chapter 5 of the EIS. (BBNP-COL1-SS0025R)*

D.2.2.3 Comments Concerning Hydrology – Surface Water

Comment: Nuclear power plants require large amounts of water for cooling purposes. PPL's Susquehanna Electric Steam Station power plant already removes large amounts water from the Susquehanna River. Animals and people who depend on these aquatic resources will also be affected Refer to Charts A-1 and A-2). [Tables A-1 and A-2 can be found at ADAMS Accession No. ML12200A220.] (**0009-14** [Epstein, Eric])

Comment: The Applicant did not adequately consider the additional and aggregate impact another nuclear power plant will have on environment, habitat and ecosystem.

The magnitude of the amount of water used at nuclear power plants is readily evidence at PPL's Susquehanna Steam Electric Station located on the Susquehanna River in Luzerne County. (4) The plant draws 0.86 million gallons per day from the Susquehanna River. For each unit, 14.93 million gallons per day are lost as vapor out of the cooling tower stack while 11 million gallons per day are returned to the River as cooling tower basin blow down. On average, 29.86 million gallons per day are taken from the Susquehanna River and not returned. This data is public information, and can be easily referenced by reviewing PPL's Pennsylvania Environmental Permit Report. (**0009-4** [Epstein, Eric])

Response: *Cumulative impacts result from the combined effects of the proposed action and past, present, and reasonably foreseeable actions, regardless of who takes the actions that occur in the same geographical area of interest. The impacts of the construction and operation of the proposed BBNPP on the Susquehanna River and adjacent lands would be added to other known or reasonably foreseeable actions and stressors within the defined geographic area of interest for each affected resource. The results of the cumulative impact analysis will be presented in Chapter 7 of the EIS. (BBNP-COL1-SS0006R)*

Comment: Consumptive Water Use. Consumptive use is defined by SRBC as the loss of water withdrawn from the basin through a process by which the water is not returned to the waters of the basin undiminished in quantity including, but not limited to, evaporation, transpiration by vegetation, incorporation in products during their manufacture, injection into a subsurface formation, and diversion out of basin. In accordance with SRBC regulations, PPL must propose (and the SRBC commissioners must approve) mitigation for its requested consumptive water use of 28 mgd. SRBC staff finds appropriate mitigation for consumptive use by a new facility of this magnitude and at this location must be in the form of compensatory water or discontinuance of use during designated low flow periods rather than payment of the mitigation fee.

PPL is proposing an innovative approach of pooling its various water storage "assets" to meet its consumptive use mitigation requirements at several existing projects within the basin and at the proposed BBNPP facility. This approach was presented to the commissioners in the form of a general concept and not a specific plan on June 23, 2011. PPL refers to the plan as the Stored Asset Plan (SAP). PPL has not made a formal submission to the SRBC of the SAP; however, applications for several assets within the SAP have been submitted for review. The U.S. Nuclear Regulatory Commission (NRC) and other appropriate agencies will be on the distribution list for relevant correspondence pertaining to the SAP. Some of the details required in the plan include a list of specific water supply assets located upstream of BBNPP that are being considered as part of the SAP proposal, including the proposed amount of mitigation and expected licensing/permitting or contractual actions for each asset. In addition to sources of storage being identified, all necessary agreements among the different entities, both within the PPL corporate structure and any other project sponsors or owners of assets, must be resolved prior to approval of an asset" into the SAP. As a separate action from the BBNPP applications, SRBC staff will make a recommendation to the commissioners regarding acceptance, modification, or rejection of the consumptive use mitigation plan. (**0004-1** [Richenderfer, James])

Comment: Water Withdrawal. In accordance with the standard contained in SRBC regulations, the surface water withdrawal and the groundwater withdrawal may not cause significant adverse impacts to the water resources of the basin. In its evaluation, SRBC staff may consider effects on streamflows and other users; water quality degradation that may be injurious to any existing or potential water use; effects on fish, wildlife, or other living resources or their habitat; and effects on low flows of perennial or intermittent streams. SRBC staff also considers the reasonable foreseeable water needs of a project. SRBC staff evaluates each proposed withdrawal to determine the need for a protective passby flow condition, which restricts the ability to take water during low flow conditions. SRBC staff undertakes that evaluation using criteria that are applicable to all surface water and groundwater withdrawals influencing surface water. This protocol, adopted in 2003, enables SRBC to evaluate the impact of the withdrawal and involves looking both upstream and downstream to assess cumulative impact, taking into account all other withdrawals and discharges and their impacts on the resource, particularly during low flow periods...Because a passby flow is the "trigger" for projects to cease their withdrawal during low flows, upstream storage is typically necessary for projects pursuing non-interruptible withdrawals to allow continued operations during all flow conditions. Should SRBC determine that the requested surface water withdrawal cannot be approved without a passby condition, PPL would need to provide for water storage upstream of BBNPP to assure that all sections of the Susquehanna River are protected during periods of low flow. (**0004-3** [Richenderfer, James])

Comment: PPL's Application will further place pressure on limited water resources. Freshwater withdrawals by Americans increased by 8% from 1995-2000, and Americans per capita water withdrawal is three times above international average. (**0009-15** [Epstein, Eric])

Comment: PPL Bell Bend ("BNPP" or "Bell Bend") has repeatedly ignored or failed to factor, consider and address numerous water use...to the Susquehanna River and its environs if this Application is approved. (**0009-2** [Epstein, Eric])

Comment: Nuclear plants use millions of gallons daily for coolant and to perform normal industrial applications. There are five nuclear generation units on the Susquehanna River. Two plants, with three units, are located on the Lower Susquehanna, and have the capacity to draw in as much as half the flow of a River in a day. Bell Bend will increase the pressure on the River's resources.

In its application to the SRBC, PPL has requested approval for consumptive use of up to 31 mgd [million gallons per day] as a measure of conservatism and to account for variability within the range of monitoring accuracy required by SRBC. (**0009-20** [Epstein, Eric])

Comment: Water quality,...thermal inversion and effluent discharges, need to be included and factored into the Bell Bend Application. (**0009-22** [Epstein, Eric])

Comment: What actions will Bell Bend take to curb water use during periods of conservation and/ or drought? (**0009-24** [Epstein, Eric])

Comment: The U.S. Army Corps of Engineers should compel the Applicant to address, factor and analyze water use...identified in TMI-Alert's comments. (**0009-26** [Epstein, Eric])

Comment: The US. Nuclear Regulatory Commission should compel the Applicant to address, factor and analyze water use...identified in TMI-Alert's comments. (**0009-28** [Epstein, Eric])

Comment: The US. Nuclear Regularity Commission should compel the Applicant to address, factor and analyze the issues raised by Arnold D. Gundersen in his Expert Testimony.

The US. Nuclear Regularity Commission should compel the Applicant to address, factor and analyze the issues raised by Keith L. Harner in his Technical Evaluation. [The testimony of Mr. Arnold D. Gunderson and Mr. Keith L. Harner can be found at ADAMS Accession No. ML12200A220.] (**0009-30** [Epstein, Eric])

Comment: It is not uncommon for the plants to discharge chlorinated water (necessary to minimize bacterial contamination of turbines) or Clamtrol (chemical agent used to defeat Asiatic clam infestation) directly into the River. Will the water be treated with chemicals? How does PPL plan to defeat Asiatic clam and/ or Zebra mussel infestations? (**0009-31** [Epstein, Eric])

Comment: The proposed PPL Bell Bend nuclear power plant will be one of the largest nuclear reactors in the world. "Due to its sheer size and because it also has a lower thermodynamic efficiency (discussed in detail below), Bell Bend will draw an inordinately large amount of water from the Susquehanna River in order to cool the reactor. (**0009-5** [Epstein, Eric])

Comment: The Applicant did not address water quality, water use,...throughout the license application, but offered only cursory and superficial data, and failed to address numerous issues that could adversely impact the area surrounding the the proposed plant. (**0009-7** [Epstein, Eric])

Comment: Based upon consultation with a professional hydrogeological engineering firm, the water in our, the undergounds springs that feed our lake along with a steam thar comes off of the PPL prokject area that feeds our ponds, we anticipate the massive amount of groundwater which PPL plans on withdrawuing will severly deplete our supply of fresh water as well stress and kill our fish. No one to date has responded to us, where we have previously voiced the seriouness of this matter to the NRC as well as the UISACE. How are you going to protect the people, their natural and man-made resources and features from being totally destroyed. It does not appear that this project has been very thought out in terms of its impact on the human beings who live and own property on Confers Lane and with n the Village of Beach Haven and the Town of Berwick. (**0010-21** [DeRonde, Barbara and Robert])

Response: *The review team will assess consumptive water use and water-quality impacts on the Susquehanna River and associated biological communities, including thermal inversion, effluent discharges, and impacts during drought conditions, from construction and operation of the proposed facility in Chapters 4 and 5, respectively. The SRBC is the primary regulatory authority for water withdrawals from the Susquehanna River. The review team will work closely with the SRBC and other State agencies during preparation of the EIS. (BBNP-COL1-SS0015R)*

D.2.2.4 Comments Concerning Hydrology – Groundwater

Comment: The groundwater withdrawal application for dewatering major excavations during construction of BBNPP is currently undergoing review. The review process typically requires 12 months to complete...SRBC staff also will analyze the impact of the power block and resultant excess fill on groundwater withdrawal requests. With the withdrawal application, PPL also has submitted an aquifer testing waiver request. This waiver request is also under review. (**0004-6** [Richenderfer, James])

Comment: The Applicant did not address...groundwater use...throughout the license application, but offered only cursory and superficial data, and failed to address numerous issues that could adversely impact the area surrounding the the proposed plant. (**0009-9** [Epstein, Eric])

Comment: Having read the June 2011 report published by the GOE titled Nuclear Regulatory Commission Oversight of Underground Piping System Commensurate with Risk, but Proactive Measures Could Help Address Future Leaks. As a result of reading this document, we have gained a great deal of insight into a major problem at nuclear plants and its possible relationship to groundwater contamination... (**0010-12** [DeRonde, Barbara and Robert])

Comment: The question for the Commissioner of the NRC and the EPA is: To what extent are you willing to sacrifice your values to damage the image of the current president or the future one, whoever that will be, by supporting literally a "deadly" site plant, one that places human beings at great risk of having their...groundwater contaminated during and after construction. The mere fact that the neighbors on Confer Lane informed my wife that their water ran red for a few weeks during and after PPL had finished doing some test borings, suggests to me that the distance of the Bell Bend reactor is far too close for the preservation of health and safety for people. (**0010-4** [DeRonde, Barbara and Robert])

Response: *The groundwater system in the vicinity of the BBNPP site, as well as existing groundwater monitoring systems, will be described in Chapter 2 of the EIS. The effects of the construction and the operation of the plant on the local and regional groundwater resources and quality will be assessed in Chapters 4 and 5. Any groundwater monitoring systems proposed by* *the applicant will be discussed in Chapters 4 and 5. Cumulative impacts will be discussed in Chapter 7. (BBNP-COL1-SS0014R)*

D.2.2.5 Comments Concerning Ecology – Terrestrial

Comment: We have checked the Landscape Project habitat mapping and the Biotics Database for occurrences of any rare wildlife species or wildlife habitat on the referenced site. The Natural Heritage Database was searched for occurrences of rare plant species or ecological communities that may be on the project site. Please refer to Table 1 (attached) to determine if any rare plant species, ecological communities, or rare wildlife species or wildlife habitat are documented on site. A detailed report is provided for each category coded as Yes in Table 1. We have also checked the Landscape Project habitat mapping and Biotics Database for occurrences of rare wildlife species or wildlife habitat in the immediate vicinity (within ¼ mile) of the referenced site. Additionally, the Natural Heritage Database was checked for occurrences of rare plant species or ecological communities within ¼ mile of the site. Please refer to Table 2 (attached) to determine if any rare plant species, ecological communities, or rare wildlife species or wildlife habitat are documented within the immediate vicinity of the site. Detailed reports are provided for all categories coded as Yes in Table 2. These reports may include species that have also been documented on the project site. The Natural Heritage Program reviews its data periodically to identify priority sites for natural diversity in the State. Included as priority sites are some of the State's best habitats for rare and endangered species and ecological communities. Please refer to Tables 1 and 2 (attached) to determine if any priority sites are located on or in the vicinity of the site. A list of rare plant species and ecological communities that have been documented from Warren County can be downloaded from http://www.state.nj.us/dep/parksandforests/natural/heritage/countylist.html. If suitable habitat is present at the project site, the species in that list have potential to be present. [The tables referred to by this comment can be found at ML12187A055.] (**0001-1** [Cartica, Robert])

Comment: One of SRBC staff's concerns is that appropriate measures are taken to protect wetlands in the vicinity of the excavations. (**0004-7** [Richenderfer, James])

Comment: <u>No Impact Anticipated</u>

PNDI [Pennsylvania Natural Diversity Inventory] records indicate species or resources of concern are located in the vicinity of the project; however, based on the information you submitted concerning the nature of the project, the immediate location, and our detailed resource information, DCNR [Department of Conservation and Natural Resources] has determined that no impact is likely. Please see below for voluntary avoidance and conservation measures, and more information about the species occurrences known within the vicinity of the proposed project and alternative sites. No further coordination with our agency is needed for this project.

<u>Bell Bend Site</u>

PNDI records indicate there are no plant species or geologic features of concern in your project area; however, there are two terrestrial invertebrates of concern previously found onsite.

1. Euphydryas phaeton (Baltimore Checkerspot, S3) is a butterfly species of concern known from previous surveys to be found onsite. It inhabits moist areas such as wet meadows, bogs, and marshes. The larvae of this species use Turtlehead, Hairy Beardtongue, English plantain, Foxglove and White Ash as host plants; adult food sources are nectar from Milkweed, Virburnums and Wild Rose.
2. Poanes massasoit (Mulberry Wing, S2) is another butterfly species of concern known from previous collection on the project area. Habitat includes freshwater marshes or bogs. The larvae of this species use Carex siricla and other sedges as host plants; adult food source is flower nectar.

As a voluntary conservation measure, DCNR suggests using these host and food species in your eventual revegetation plan; this would provide additional habitat for these species. Because these species utilize bog and wet, marshy areas as habitat, DCNR suggests avoiding and minimizing impacting wetlands onsite.(**0006-1** [Boyer, Emilee])

Comment: Nuclear power plants require large amounts of water for cooling purposes. PPL's Susquehanna Electric Steam Station power plant already removes large amounts of water from the Susquehanna River. Animals...who depend on these aquatic resources will also be affected Refer to Charts A-1 and A-2). [Tables A-1 and A-2 can be found at ADAMS Accession No. ML12200A220.] (**0009-13** [Epstein, Eric])

Comment: This letter is pertaining to the PNDI review that was completed for the BBNPP site located in Salem Township, Luzerne County, Pennsylvania.

<u>Potential Impact Anticipated</u>

PNDI records indicate species or resources of concern are located in the vicinity of the project. The PGC has received and thoroughly reviewed the information that you provided to this office, as well as PNDI data, and has determined that potential impacts to the following endangered species may be associated with your project:

Scientific Name	Common Name	PA Status	Federal Status
Myotis sodalis	Indiana Bat	ENDANGERED	ENDANGERED
Myotis leibii	Eastern Small-footed Myotis	THREATENED	N/A
Myotis septentrionalis	Northern myotis	SPECIAL CONCERN	N/

<u>Next Steps</u>

Indiana bats are a federally listed endangered species under the jurisdiction of the U.S. Fish and Wildlife Service. As a result, our agency defers comments on potential impacts to Indiana bats to the U.S. Fish and Wildlife Service.

Additionally, because of their ecological significance, the following seasonal restriction is suggested to avoid potential impacts to *Myotis leibii, Myotis septentrionalis,* and other bats within the area. All trees or dead snags greater than 5 inches in diameter at breast height that need to be harvested to facilitate the project (including any access roads or off-R.O.W. work spaces) shall be cut between November 16 and March 31. (**0012-1** [Mowrey, Olivia])

Comment: Conservation Measure(s)

National Wetland Inventory Mapping (NWI) and/or aerial photos suggest that wetlands may be located within the project area along Walker Run and several unnamed tributaries of the Susquehanna River. The PGC is requesting that the final project avoid, or at least minimize to the greatest practical extent, any adverse impacts to these resources and their associated wildlife habitat. (**0012-2** [Mowrey, Olivia])

Response: *The impacts of construction and operation of the proposed BBNPP on the terrestrial environment, including wetlands and species or resources of concern, will be discussed in Chapters 4 and 5, respectively, of the EIS. Cumulative impacts will be discussed in Chapter 7. Pursuant to Section 7 of the Endangered Species Act, on June 12, 2012, the NRC initiated informal consultation with the U.S. Fish and Wildlife Service (USFWS). (BBNP-COL1-SS0001R)*

Comment: Montour Site

PNDI records indicate there are no plant species or geologic features of concern known within the project area; however, there three plant species are known within the project vicinity.

1. *Dichanthelium villosissimum var. villosissimum* (Long-haired Panic-grass; Currently Tentatively Undetermined, Proposed State-listed Endangered) is a plant species that can be found in dry woods and serpentine barrens. This occurrence of Long-haired Panic-grass is new in the PNDI system since DCNR's last letter regarding this project in 2009; it was observed nearby along a disturbed field edge in 1994.
   Pinus echinata (Short-leaf Pine; no current state status, Proposed Tentatively Undetermined) is an evergreen tree that was observed in 1956 1.5 miles east of strawberry ridge. Habitat for Short-leaf Pine is wooded slopes and ridges, in low nutrient soil.
2. *Rotala ramosior* (Tooth-cup, State-listed Rare) is a plant that inhabits wet sandy shores and swampy, open ground; it flowers July through September. Tootheup was found nearby in 2004 along a shoreline.

If *Pinus echinata, Rotala ramosior*, or their critical habitat is found onsite, DCNR suggests voluntarily avoidance or minimization. Because of its proposed status of Endangered, if critical habitat for *D. villosissimum var. villosissimum* will be disturbed, DCNR highly suggests a voluntary botanical survey be conducted during the appropriate time of year to determine the presence or absence of this species within the project area. Survey protocol information can be found at http://www.gis.dcnr.state.pa.ushgis-er/Loginaspx. Please contact our office is you desire more information about this occurrence.

Humboldt Site

PNDI records indicate one resource of concern within the Humboldt Site boundary; the community Scrub Oak Shrubland (S3) is known within the Humboldt alternative site. DCNR recommends voluntary avoidance and minimization of impacts to this community. Please see http://www.naturalheritage.state.pa.us/factsheets/16086.pdf for more information on Scrub Oak Shrublands.

Seedco Site

PNDI records indicate there are no resources of concern within the Seedco site boundary; however, there is a rare moth, *Hypagyrtis ester* (Ester moth, S2S3) known in the project vicinity. The Ester moth was found near strip mines with patches of pines and scrubby grasslands. The most common habitat type for Ester moths is presumably in or near pines, as their larvae feed only on pine; it is most common in July and August. This response represents the most up-to-date review of the PNDI data files and is valid for two years. If project plans change or more information on listed or proposed species becomes available, our determination may be reconsidered. For PNDI project updates, please see the PNHP website at www.naturalheritage.state.pa.us for guidance. As a reminder, this finding applies to potential impacts under DCNR's jurisdiction only. Visit the PNHP website for directions on contacting the Commonwealth's other resource agencies for environmental review. (**0006-2** [Boyer, Emilee])

Comment: This letter is pertaining to the PNDI review that was completed for the Humboldt site located in Hazle Township, Luzerne County, Pennsylvania.

Potential Impact Anticipated

PNDI records indicate species or resources of concern are located in the vicinity of the project. The PGC has received and thoroughly reviewed the information that you provided to this office as well as PNDI data, and has determined that potential impacts to threatened, endangered, and species of special concern birds and mammals may be associated with your project. Therefore, additional measures are necessary to avoid potential impacts to the species listed below.

Scientific Name	Common Name	PA Status	Federal Status
Myotis sodalis	Indiana Bat	ENDANGERED	ENDANGERED
Myotis leibii	Eastern Small-footed Myotis	THREATENED	N/A
Myotis septentrionalis	Northern Myotis	SPECIAL CONCERN	N/A

Next Steps

Indiana bats are a federally listed endangered species under the jurisdiction of the U.S. Fish and Wildlife Service. As a result, our agency defers comments on potential impacts to Indiana bats to the U.S. Fish and Wildlife Service. Additionally, the following surveys should be performed for above listed species so that a more accurate determination can be made:

1. Eastern small-footed bat habitat assessment. All rocky habitat that may offer suitable roost sites for eastern small-footed bats should be completely delineated (with GIS shapefiles provided), and photo-documented within the above-mentioned area. Any rocky habitat that is identified, but not considered to be suitable eastern small-footed bat roost habitat should also be photo-documented and a written narrative shall be provided describing the reason(s) for its non-suitability.

2. Bat hibernacula investigation. To determine whether this project will affect any potential bat hibernacula, the project area should be surveyed for mine and cave openings. All openings should be accurately mapped using a GPS unit. If potential hibernacula occur within the

project area, these openings should be evaluated and sampled if necessary, using the revised Protocol for Assessing Abandoned Mines/Caves for Bat Surveys dated September 10, 2012 (attached). Bat hibernacula sampling should be conducted by a qualified bat surveyor on the U.S. Fish and Wildlife Service Qualified Indiana Bat Surveyor list. Suitable eastern small-footed bats that are captured during hibernacula sampling should be radio-tracked following the PGC's Standard and Minimum Effort Requirements for Qualified Indiana Bat Surveyor Netting within the Commonwealth of Pennsylvania for Environmental Review Projects (attached).

3. Bat mist netting with telemetry for state threatened and endangered species. A minimum of two mist nest sites within the project area shall be surveyed between May 15 and August 15 following the PGC's Standard and Minimum Effort Requirements for Qualified Indiana Bat Surveyor Netting within the Commonwealth of Pennsylvania for Environmental Review Projects (attached). Mist net surveys should be conducted by a qualified bat surveyor listed on the U.S. Fish and Wildlife Service Qualified Indiana Bat Surveyor list. Suitable eastern small-footed bats that may be captured during the mist net survey should be radio-tracked following the above-referenced PGC guidance.

A copy of the U.S. Fish and Wildlife Service Qualified Indiana Bat Surveyor list can be obtained from the U.S. Fish and Wildlife Services State College, PA field office. A PGC Special Use Permit will need to be obtained by the consultant prior to conducting any of the above listed surveys that involve the handling of bats. Finally, a draft survey plan shall be submitted at least 30 days prior to initiating the above listed surveys for PGC review and concurrence. [Attachments can be found at ADAMS Accession No. ML12311A156.] (**0011-1** [Mowrey, Olivia])

Comment: Conservation Measure

National Wetland Inventory Mapping (NWI) suggests that wetlands may be located within the project area and/or the vicinity. The PGC is requesting that the final project avoid, or at least minimize to the greatest practical extent, any adverse impacts to these resources and their associated wildlife habitat. (**0011-2** [Mowrey, Olivia])

Comment: This letter is pertaining to the PNDI review that was completed for the Montour site located in Derry Township, Montour County, Pennsylvania.

No Impact Anticipated

PNDI records indicate species or resources of concern are located in the vicinity of the project. However, based on the information you submitted concerning the nature of the project, the immediate location, and our detailed resource information, the PGC has determined that no impact is likely. Therefore, no further coordination with the PGC will be necessary for this project at this time. (**0013-1** [Mowrey, Olivia])

Comment: Conservation Measure

National Wetland Inventory Mapping (NWI) suggests that wetlands may be located within the project area and/or the vicinity. The PGC is requesting that the final project avoid, or at least minimize to the greatest practical extent, any adverse impacts to these resources and their associated wildlife habitat. (**0013-2** [Mowrey, Olivia])

Comment: This letter is pertaining to the PNDI review that was completed for the Seedco site located in Coal Township, Northumberland County, Pennsylvania.

Potential Impact Anticipated

PNDI records indicate species or resources of concern are located in the vicinity of the project. The PGC has received and thoroughly reviewed the information that you provided to this office as well as PNDI data, and has determined that potential impacts to threatened, endangered, and species of special concern birds and mammals may be associated with your project. Therefore, additional measures are necessary to avoid potential impacts to the species listed below.

Scientific	Name Common	PA Status
Myotis leibii	Eastern Small-footed Myotis	THREATENED
Myotis septentrionalis	Northern Myotis	SPECIAL CONCERN

Next Steps

Additionally, the following surveys should be performed for above listed species so that a more accurate determination can be made:

1. Eastern small-footed bat habitat assessment. All rocky habitat that may offer suitable roost sites for eastern small-footed bats should be completely delineated (with GIS shapefiles provided), and photo-documented within the above-mentioned area. Any rocky habitat that is identified, but not considered to be suitable eastern small-footed bat roost habitat should also be photo-documented and a written narrative shall be provided describing the reason(s) for its non-suitability.
2. Bat hibernacula investigation. To determine whether this project will affect any potential bat hibernacula, the project area should be surveyed for mine and cave openings. All openings should be accurately mapped using a GPS unit. If potential hibernacula occur within the project area, these openings should be evaluated and sampled if necessary, using the revised Protocol for Assessing Abandoned Mines/Caves for Bat Surveys dated September 10, 2012 (attached). Bat hibernacula sampling should be conducted by a qualified bat surveyor on the U.S. Fish and Wildlife Service Qualified Indiana Bat Surveyor list. Suitable eastern small-footed bats that are captured during hibernacula sampling should be radio-tracked following the PGC's Standard and Minimum Effort Requirements for Qualified Indiana Bat Surveyor Netting within the Commonwealth of Pennsylvania for Environmental Review Projects (attached).
3. Bat mist netting with telemetry for state threatened and endangered species. A minimum of two mist nest sites within the project area shall be surveyed between May 15 and August 15 following the PGC's Standard and Minimum Effort Requirements for Qualified Indiana Bat Surveyor Netting within the Commonwealth of Pennsylvania for Environmental Review Projects (attached). Mist net surveys should be conducted by a qualified bat surveyor listed on the U.S. Fish and Wildlife Service Qualified Indiana Bat Surveyor list. Suitable eastern

small-footed bats that may be captured during the mist net survey should be radio-tracked following the above-referenced PGC guidance.

A copy of the U.S. Fish and Wildlife Service Qualified Indiana Bat Surveyor list can be obtained from the U.S. Fish and Wildlife Services State College, PA field office. A PGC Special Use Permit will need to be obtained by the consultant prior to conducting any of the above listed surveys that involve the handling of bats. Finally, a draft survey plan shall be submitted at least 30 days prior to initiating the above listed surveys for PGC review and concurrence. [Attachments can be found at ADAMS Accession No. ML12311A159.] (**0014-1** [Mowrey, Olivia])

Comment: Conservation Measure

National Wetland Inventory Mapping (NWI) suggests that wetlands may be located within the project area and/or the vicinity. The PGC is requesting that the final project avoid, or at least minimize to the greatest practical extent, any adverse impacts to these resources and their associated wildlife habitat. (**0014-2** [Mowrey, Olivia])

Response: *The impacts of construction and operation of a nuclear power plant at the proposed alternative sites (Montour, Humbolt, and Seedco) on the terrestrial environment, including species or resources of concern, will be discussed in Chapter 9 of the EIS. Pursuant to Section 7 of the Endangered Species Act, on June 12, 2012, the NRC initiated informal consultation with the USFWS. (BBNP-COL1-SS0002R)*

D.2.2.6 Comments Concerning Ecology – Aquatic

Comment: Lastly, our 83 acre property contains a man-made stocked lake and fomer raceway (now covered with lawn). Our lake is fed by undergorund springs, adjacent ponds on our land but which are fed by sreams that come off PPL property. Any ditrubance to the water features ontheir land will severly impact our lake and our fish, which have been there since the late 1960's, when it had been engineerd and constructed under the Direction of Mr. George Perluke, Barbara DeRonde's father. We would appreciatge it very much aftercondietreing the human factors and the impact this nuclear power plasnt or even gas-fired plant would have upon our streeet's environment. (**0010-18** [DeRonde, Barbara and Robert])

Response: *The review team (NRC staff) is coordinating the evaluation of environmental impacts, including aquatic impacts, with numerous Federal and State agencies, including the U.S. Fish and Wildlife Service, the Susquehanna River Basin Commission, the Pennsylvania Department of Environmental Protection, the Pennsylvania Fish and Boat Commission, and the Pennsylvania Game Commission. This coordination includes periodic meetings of the review team, Federal and State agencies, and the applicant. The impacts of construction and operation of the proposed BBNPP on the aquatic environment, including water quality and species or resources of concern, will be discussed in Chapters 4 and 5, respectively, of the EIS. The cumulative impacts of construction and operation will be presented in Chapter 7 of the EIS. (BBNP-COL1-SS0013R)*

Comment: Early in the review process, PPL chose to pursue alternative analyses (using Instream Flow Incremental Methodology [IFIM]) in hopes of supporting its contention that the routine passby requirement (20 percent average daily flow) is not needed to protect aquatic resources and downstream water uses. A panel of experts representing PPL, SRBC, and water resource agencies of SRBC's member jurisdictions, including the Pennsylvania Fish and Boat Commission (PFBC), U.S. Fish and Wildlife Service (USFWS), U.S. Geological Survey (USGS) and the Pennsylvania Department of Environmental Protection (PADEP), was convened and reviewed the design of aquatic studies and an IFIM study developed by PPL to assess the potential adverse impacts of BBNPP water withdrawals on the Susquehanna River. (**0004-4** [Richenderfer, James])

Comment: PPL has completed most of the aquatic studies needed to analyze the passby flow requirement and have submitted them to SRBC in the JPA, and in a subsequent submission on April 27, 2012. Other aquatic studies are being conducted during the summer of 2012, including a mussel survey and a smallmouth bass study. SRBC staff's review of the IFIM study, in coordination with agencies of its member jurisdictions, is ongoing and may be complete to support SRBC action in March 2013. (**0004-5** [Richenderfer, James])

Comment: PPL has finalized the scope of all remaining aquatic studies so that fieldwork can be accomplished during favorable flow conditions this summer. PPL anticipates that data and reports will be submitted to SRBC in the September 2012 time frame. (**0004-9** [Richenderfer, James])

Response: *The review team appreciates the comments submitted by the Susquehanna River Board Commission (SRBC) and will work with the SRBC staff as it prepares the EIS. (BBNP-COL1-SS0026R)*

Comment: Nuclear power plants require large amount of water for cooling purposes. PPL's Susquehanna Electric Steam Station power plant already removes large amounts of water from the Susquehanna River. Animals...who depend on these aquatic resources will also be affected Refer to Charts A-1 and A-2). [Tables A-1 and A-2 can be found at ADAMS Accession No. ML12200A220.] (**0009-11** [Epstein, Eric])

Response: *The impacts of operation of the proposed BBNPP on the aquatic environment, including the effects of water consumption on species or resources of concern, will be discussed in Chapter 5 of the EIS. (BBNP-COL1-SS0027R)*

Comment: What impact will the Application have on shad ladders? What impact will this Application have on sport and commercial fishing? (**0009-17** [Epstein, Eric])

Response: *The impacts of operation of the proposed BBNPP on the aquatic environment, including the effects on migratory fish species and fishing, will be discussed in Chapter 5 of the EIS. (BBNP-COL1-SS0028R)*

Comment: It is not uncommon for the plants to discharge chlorinated water (necessary to minimize bacterial contamination of turbines) or Clamtrol (chemical agent used to defeat Asiatic clam infestation) directly into the River. Will the water be treated with chemicals? How does PPL plan to defeat Asiatic clam and/ or Zebra mussel infestations? (**0009-19** [Epstein, Eric])

Comment: In addition, a number of infestations, specifically Asiatic clams and Zebra mussels, have required power plants to prepare plans to defeat these aquatic invasions. (**0009-28** [Epstein, Eric])

Response: *The impacts of operation of the proposed BBNPP on the aquatic environment, including the effects of treatments used to control fouling of the cooling-water system and non-native clams and mussels, will be discussed in Chapter 5 of the EIS. (BBNP-COL1-SS0029R)*

Comment: ...fish kills,...need to be included and factored into the Bell Bend Application. (**0009-23** [Epstein, Eric])

Response: *The impacts of operation of the proposed BBNPP on the aquatic environment will be discussed in Chapter 5 of the EIS. (BBNP-COL1-SS0030R)*

Comment: The U.S. Army Corp of Engineers should compel the Applicant to address, factor and analyze...site-specific aquatic challenges identified in TMI-Alert's comments. (0009-27 [Epstein, Eric])

Comment: The U.S. Nuclear Regulatory Commission should compel the Applicant to address, factor and analyze...site-specific aquatic challenges identified in TMI-Alert's comments. (**0009-29** [Epstein, Eric])

Response: *The impacts of construction and operation of the proposed BBNPP on the aquatic environment, including water quality and species or resources of concern, will be discussed in Chapters 4 and 5, respectively, of the EIS. The cumulative impacts of construction and operation will be presented in Chapter 7 of the EIS. (BBNP-COL1-SS0031R)*

Comment: PPL Bell Bend ("BNPP" or "Bell Bend") has repeatedly ignored or failed to factor, consider and address numerous...site-specific aquatic challenges to the Susquehanna River and its environs if this Application is approved. (**0009-3** [Epstein, Eric])

Response: *The stressors on the aquatic environments in the project area, including the Susquehanna River, will be discussed in Chapter 2 of the EIS. The potential interaction of the proposed BBNPP and those stressors will be discussed in Chapter 7 of the EIS. (BBNP-COL1-SS0032R)*

Comment: The Applicant did not address...aquatic communities,...entrainment and impingement,...throughout the license application, but offered only cursory and superficial data, and failed to address numerous issues that could adversely impact the area surrounding the the proposed plant. (**0009-8** [Epstein, Eric])

Response: *The aquatic environments in the project area, including the Susquehanna River, will be discussed in Chapter 2 of the EIS. The impacts of operation of the proposed BBNPP on the aquatic environment, including the effects of entrainment and impingement on species of concern, will be discussed in Chapter 5 of the EIS. (BBNP-COL1-SS0033R)*

D.2.2.7 Comments Concerning Socioeconomics

Comment: Nuclear power plants require large amounts of water for cooling purposes. PPL'S Susquehanna Electric Steam Station power plant already removes large amounts water from the Susquehanna River...people who depend on these aquatic resources will also be affected Refer to Charts A-1 and A-2). [Tables A-1 and A-2 can be found at ADAMS Accession No. ML12200A220.] (**0009-12** [Epstein, Eric])

Response: *The review team will evaluate the socioeconomic impacts on the community from construction and operation of the BBNPP, including recreational activities and subsistence fishing, in Chapters 4 and 5 of the EIS. Cumulative impacts will be discussed in Chapter 7. (BBNP-COL1-SS0021R)*

D.2.2.8 Comments Concerning Historic and Cultural Resources

Comment: The Shawnee Tribe's Tribal Historic Preservation Department concurs that no known historic properties will be negatively impacted by this project. We have no issues or concerns at this time, but in the event that archaeological materials are encountered during construction, use, or maintenance of this location, please re-notify us at that time as we would like to resume consultation under such a circumstance. (**0005-1** [Jumper, Kim])

Comment: We have checked our records for burial, archeological and historical concerns and also any other cultural resource concerns regarding this License application and have no concerns to address at this time, however it does not exclude all of the other Wisconsin Tribes. At this time we would like you to defer this matter to the Haudasaunee Council. (**0007-1** [Williams, Corina])

Response: *The review team requested the participation of the State Historic Preservation Office, the Advisory Council on Historic Preservation, and multiple Federally recognized tribes in its scoping process. The review team will comply with the National Historic Preservation Act through its Section 106 National Environmental Policy Act process. The Haudasaunee Council was contacted on November 7, 2012. Appendix F will list key consultation correspondence, such as correspondence with the Haudasaunee Council. Historic and cultural resource impacts from the construction and operation of the proposed BBNPP will be addressed in Chapters 4 and 5 and cumulative impacts will be address in Chapter 7. (BBNP-COL1-SS0010R)*

D.2.2.9 Comments Concerning Meterology and Air Quality

Comment: The question for the Commissioners of the NRC and the EPA is: To what extent are you willing to sacrifice your values to damage the image of the current President or the future one, whoever that will be, by supporting literally a "deadly" site plant, on that places human beings at great risk of having their...air...contaminated during and after construction. The mere fact that the neighbors on Confers Lane informed my wife that their water ran red for a few weeks during and after PPL had finished doing some test borings, suggest to me that the distance of the Bell Bend reactor is far too close for the preservation of health and safety for people. (**0010-6** [DeRonde, Barbara and Robert])

Response: *The review team will evaluate air-quality impacts from construction and operation of the BBNPP in Chapters 4 and 5, respectively, of the EIS. Cumulative impacts will be discussed in Chapter 7. (BBNP-COL1-SS0022R)*

D.2.2.10 Comments Concerning Health − Nonradiological

Comment: The Applicant did not address...microbiologic organisms throughout the license application, but offered only cursory and superficial data, and failed to address numerous issues that could adversely impact the area surrounding the the proposed plant. (**0009-10** [Epstein, Eric])

Response: *Nonradiological human health impacts, including microbiological organisms, will be addressed in Chapters 4 and 5 of the EIS. Cumulative impacts of nonradiological human health impacts will be addressed in Chapter 7. (BBNP-COL1-SS0009R)*

D.2.2.11 Comments Concerning Health – Radiological

Comment: TMIA's membership have legitimate and historic concerns regarding radiological contamination resulting from radiological releases related to normal and abnormal operations that impact the value of its property, and interfere with the organization's rightful ability to conduct operations in an uninterrupted and undisturbed manner. (**0009-1** [Epstein, Eric])

Comment: Having read the June 2011 report published by the GEO title Nuclear Regulatory Commission Oversight of Underground Piping Systems Commensurate with Risk, but Proactive Measures Could Help Address Future Leaks. As a result of reading this document, we have gained a great deal of insight into a major problem at nuclear plants and its possible relation ship to...cancer. (**0010-13** [DeRonde, Barbara and Robert])

Comment: The question for the Commissioners of the NRC and the EPA is: To what extent are you willing to sacrifice your values to damage the image of the current President or the future one, whoever that will be, by supporting literally a "deadly" site plan, one that places human beings at great risk of having their soil air and groundwater contaminated during and after construction. The mere fact that the neighbors on Confers Lane informed my wife that their water ran red for a few weeks during and after PPL had finished doing some test borings, suggests to me that the distance of the Bell Bend reactor is far to close for the preservation of health and safety for people. (**0010-3** [DeRonde, Barbara and Robert])

Response: *The human health impacts of releases of radiological effluents from BBNPP to the environment will be evaluated in Chapters 4 and 5 of the EIS. Cumulative impacts will be discussed in Chapter 7 of the EIS. (BBNP-COL1-SS0005R)*

D.2.2.12 Comments Concerning Alternatives – Energy

Comment: The area now has an abundant supply of natural gas, representing a much safer power production technology that has no long term storage requirements for spent fuel and waste. (**0003-2** [Martin, David])

Comment: We would prefer that Bell Bend project be shelved for a safer, more cost effective energy alternative - a natural gas-fired plant, but not anywhere near the existing Susquehanna reactor oirour property. (**0010-16** [DeRonde, Barbara and Robert])

Comment: The cost to good will is not worth what will follow if they proceed with thier plans. I agree with my wife Barabara that safest, most cost effectie solution is for PPL to move toward a gas-fired, but not in close proximity to the people to the people on Confers Lane or any where near their existing reactors for fire safety reasons (**0010-20** [DeRonde, Barbara and Robert])

Comment: It is time for PPL mature and to move on to a safer technology for producing money for its executives and stockholders as it produces energy for use in New York City & New Jersey. (**0010-25** [DeRonde, Barbara and Robert])

Response: *Decisions regarding which alternative generation sources and alternatives to deploy are made by the applicant and regulatory bodies such as State energy planning agencies. The alternative energy sources must be technically viable, feasible, and competitive. Impacts from alternative actions such as the no-action alternative, new energy generation alternatives (including natural gas and renewable energy such as wind and solar), purchased electrical power, and a combination of alternatives will be considered in Chapter 9 of the EIS. (BBNP-COL1-SS0018R)*

D.2.2.13 Comments Concerning Alternatives – System Design

Comment: SRBC regulations also require that major projects explore options to limit the quantity or avoid consumptive use of water. PPL has submitted studies that investigate using dry cooling techniques as an alternative to natural draft cooling towers. Utilizing dry cooling technology at BBNPP would significantly reduce the consumptive use; however, this technology has not been utilized for nuclear power plants to date and most likely the cost would be prohibitive. Nonetheless, SRBC staff has outstanding comments pertaining to this issue that have not been resolved at this time. (**0004-2** [Richenderfer, James])

Response: *Impacts from alternative heat-dissipation systems will be considered in Section 9.4 of the EIS and will include impacts from dry cooling alternatives in addition to the selected heat-dissipation system. (BBNP-COL1-SS0020R)*

D.2.2.14 Comments Concerning Benefit-Cost Balance

Comment: The new security requirements for such plants increase the operating costs to levels that will not be sustainable in an energy market that will include an increasing per cent of renewable resources. (**0003-4** [Martin, David])

Response: *Neither the NRC nor the USACE has the authority under its regulations to ensure that the proposed plant is the least costly alternative to provide energy services under any particular set of assumptions concerning future circumstances. This authority and responsibility is most often the role of the State regulatory authorities, such as public service commissions or the competitive marketplace. The cost and benefits of construction and operation of the proposed BBNPP will be addressed in Chapter 10 of the EIS. (BBNP-COL1-SS0003R)*

D.3 References

74 FR 470. January 6, 2009. "PPL Bell Bend, LLC; Bell Bend Nuclear Power Plant Combined License Application; Notice of Intent To Prepare an Environmental Impact Statement and Conduct Scoping Process." *Federal Register*, Nuclear Regulatory Commission, Washington, D.C. TN1785.

77 FR 36012. June 15, 2012. "PPL Bell Bend, LLC; Bell Bend Nuclear Power Plant Combined License Application; Notice of Intent to Conduct a Supplemental Scoping Process on the Revised Site Layout." *Federal Register*, Nuclear Regulatory Commission, Washington, D.C. TN3907.

NRC (U.S. Nuclear Regulatory Commission). 2009. *Environmental Impact Statement Scoping Process Summary Report—Bell Bend Nuclear Power Plant Combined License Luzerne County, Pennsylvania.* Rockville, Maryland. Accession No. ML091760096. TN1787.

NRC (U.S. Nuclear Regulatory Commission). 2014. Memorandum From T.L. Terry to J. Dixon-Herrity, dated April 21, 2014, regarding "Scoping Summary Report Related to the Environmental Scoping Process for the Bell Bend Nuclear Power Plant Combined License Application." Washington, D.C. Accession No. ML14024A659. TN3651.

APPENDIX E

DRAFT ENVIRONMENTAL IMPACT STATEMENT
COMMENTS AND RESPONSES

APPENDIX E

DRAFT ENVIRONMENTAL IMPACT STATEMENT COMMENTS AND RESPONSES

As part of the U.S. Nuclear Regulatory Commission (NRC) review of the application for a new nuclear power reactor submitted by PPL Bell Bend, LLC, (PPL), the NRC and the U.S. Army Corps of Engineers (Corps or USACE) (together referred to as the "review team") solicited comments from the public on the draft environmental impact statement (EIS), which was issued in April 2014. PPL notified the NRC of changes in its power generation business by letter dated May 12, 2015 (PPL Bell Bend 2015-TN4379). PPL Bell Bend, LLC was renamed Bell Bend, LLC, and Bell Bend, LLC became a generation affiliate of Talen Energy Corporation (Talen Energy). The transaction became official on June 1, 2015. For purposes of this review, the abbreviation "PPL" will still be used to indicate the applicant. Bell Bend, LLC, under Talen Energy, is the applicant. A 75-day comment period began on April 24, 2015, when the U.S. Environmental Protection Agency (EPA) issued a *Federal Register* Notice (80 FR 22992 -TN4403) on the filing of the draft EIS to allow members of the public to comment on the results of the environmental review. The comment period ended on July 7, 2015.

As part of the process to solicit public comments on the draft EIS, the review team:

- placed a copy of the draft EIS at the McBride Memorial Library in Berwick, Pennsylvania;
- placed a copy of the draft EIS at the Mill Memorial Library in Nanticoke, Pennsylvania;
- made the draft EIS available in the NRC's Public Document Room in Rockville, Maryland;
- placed an electronic copy of the draft EIS on the NRC's Agencywide Documents Access and Management System (ADAMS) website at http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr2179/;
- provided a copy of the draft EIS, by request, to any member of the public;
- sent copies of the draft EIS to certain Federal, State, Tribal, and local agencies;
- published a notice of availability of the draft EIS in the *Federal Register* on April 21, 2015 (80 FR 22231 -TN4402);
- filed the draft EIS with the EPA;
- held two public meetings on June 4, 2015, in Bloomsburg, Pennsylvania.

In addition, as part of the process to solicit public comments on the draft EIS, the USACE Philadelphia District issued public notice CENAB-OPR-2008-01401-P13 dated April 17, 2015 (USACE 2015-TN4389).

A combined total of approximately 60 people attended the two public meetings in Bloomsburg. Four attendees provided oral comments. One attendee of the public meeting provided a letter with comments. A certified court reporter recorded those oral comments and prepared written transcripts of each meeting. The transcripts of the public meetings were published in June 2015 (see ADAMS Accession Number ML15176A769 for the transcript of the afternoon meeting and

Accession Number ML15176A766 for the evening meeting). In addition to the comments received at the public meetings, the NRC received 12 letters and e-mail messages containing comments.

The comment letters, e-mail messages, and transcripts of the public meetings are available in ADAMS, which is accessible at http://www.nrc.gov/reading-rm.html. Persons who do not have access to ADAMS or who encounter problems in accessing the documents located in ADAMS should contact the NRC's Public Document Room reference staff at 1-800-397-4209 or 301-415-4737. ADAMS accession numbers for the letters and e-mail messages are provided in Table E-1.

E.1 Disposition of Comments

Each set of comments from a given commenter was assigned a unique correspondence identifier, allowing each set of comments from a commenter to be traced back to the transcript, letter, or e-mail in which the comments were submitted. After the comment period concluded, the review team considered and dispositioned all comments received. To identify each individual comment, the team reviewed the transcripts of the public meetings and each piece of correspondence related to the draft EIS. As part of the review, the review team identified statements that it believed were related to the proposed action and recorded the statements as comments. Each comment was assigned to a specific subject area, and similar comments were grouped together. Finally, responses were prepared for each comment or group of comments.

Some comments addressed topics and issues that are not part of the environmental review for this proposed action. These comments included questions about NRC's safety review, general statements of support or opposition to nuclear power, and comments on the NRC regulatory process in general. These comments are included, but detailed responses are not provided because the comments address issues not directly related to the environmental effects of this proposed action and are, thus, outside the scope of the National Environmental Policy Act of 1969, as amended (NEPA) (42 U.S.C. § 4321 et seq.-TN661) review of this proposed action. If appropriate, these comments were forwarded to the appropriate organization within the NRC for consideration. Many comments, however, specifically addressed the scope of the environmental review, analyses, and issues contained in the draft EIS. Examples include comments about potential impacts, proposed mitigation, the agency review process, and the public comment period. Detailed responses to each of these comments are provided in this appendix. When the comments resulted in a change in the text of the draft EIS, the corresponding response refers the reader to the appropriate section of the EIS where the change was made. Throughout the final EIS, with the exception of this new Appendix E, revisions to the text from the draft EIS are indicated by vertical lines (change bars) in the margin beside the text.

Table E-1 provides a list of commenters identified by name, affiliation (if given), comment number, and the source of the comment.

Table E-2 provides an alphabetical index to the comment categories and lists the commenters and the specific comment identification number(s) that were included in each category.

Table E-1. Individuals Providing Comments During the Comment Period

Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #	Correspondence ID
Anonymous, Anonymous		reg.gov (ML15154A506)	0008
Cwiek, Phil	U.S. Army Corps of Engineers	Email (ML15175A423)	0006
Dehoff, Andrew	Susquehanna River Basin Commission	Letter (ML15191A328)	0013
Dennis, Lori		Meeting Transcript (ML15176A766)	0002-2
Edwards, Robert L		Email (ML15161A267)	0003
Epstein, Eric	TMI-Alert	Letter (ML15175A100)	0011
Epstein, Eric	TMI-Alert	Meeting Transcript (ML15176A769)	0001-1
George, Susan		Email (ML15166A570)	0005
Hartle, Mark A.	Pennsylvania Fish and Boat Commission	Letter (ML15204A772)	0009
Lapp, Jeffrey	U.S. Environmental Protection Agency	Email (ML15203A551)	0012
Natarelli, Helen		Meeting Transcript (ML15176A766)	0002-1
Sgarro, Rocco	Talen Energy	Email (ML15187A076)	0007
Shepler, Dennis		Meeting Transcript (ML15176A766)	0002-3
Stanseski, Pinky		Email (ML15166A077)	0004
Walker, John L.		Letter (ML15175A295)	0010
Zimmerman, Lora	Fish and Wildlife Service	Letter (ML15225A426)	0014

Table E-2. Comment Categories

Comment Category	Commenter (Comment ID)
Accidents-Severe	• Epstein, Eric (0011-8)
Alternatives-Energy	• Dehoff, Andrew (0013-12) • Epstein, Eric (0001-1-8) • George, Susan (0005-2) • Natarelli, Helen (0002-1-15)
Benefit-Cost Balance	• Edwards, Robert L (0003-3) • Epstein, Eric (0001-1-13) (0001-1-15) (0011-5)
Cumulative Impacts	• Walker, John L. (0010-5)
Ecology-Aquatic	• Dehoff, Andrew (0013-14) • Epstein, Eric (0011-14) (0011-16) (0011-18) (0011-21) • Hartle, Mark A. (0009-6) (0009-8) (0009-9) • Lapp, Jeffrey (0012-7) (0012-9) (0012-10) (0012-11) (0012-12)

Table E-2. (contd)

Comment Category	Commenter (Comment ID)
Ecology-Terrestrial	• Dennis, Lori (0002-2-3) • Hartle, Mark A. (0009-3) (0009-4) • Lapp, Jeffrey (0012-8) • Zimmerman, Lora (0014-1) (0014-2) (0014-3) (0014-4) (0014-5) (0014-6) (0014-7) (0014-8) (0014-9) (0014-10) (0014-11) (0014-12) (0014-13) (0014-14) (0014-15) (0014-16) (0014-17) (0014-18)
Editorial Comments	• Dehoff, Andrew (0013-16) (0013-17) • Sgarro, Rocco (0007-1)
Environmental Justice	• Lapp, Jeffrey (0012-14) (0012-15)
Health-Radiological	• Epstein, Eric (0011-7) • Natarelli, Helen (0002-1-5) (0002-1-10) (0002-1-12) • Sgarro, Rocco (0007-2)
Hydrology-Surface Water	• Cwiek, Phil (0006-1) (0006-2) (0006-3) (0006-4) (0006-5) (0006-6) (0006-7) (0006-8) • Dehoff, Andrew (0013-2) (0013-3) (0013-4) (0013-5) (0013-6) (0013-7) (0013-8) (0013-9) (0013-10) (0013-11) (0013-15) • Edwards, Robert L (0003-5) • Epstein, Eric (0001-1-4) (0001-1-7) (0001-1-12) (0011-2) (0011-3) (0011-4) (0011-10) (0011-13) (0011-19) (0011-20) (0011-22) (0011-23) (0011-24) • Hartle, Mark A. (0009-1) (0009-2) (0009-7) • Lapp, Jeffrey (0012-4) (0012-5) (0012-13) • Walker, John L. (0010-6)
Meteorology and Air Quality	• Anonymous, Anonymous (0008-1) • Walker, John L. (0010-8)
Need for Power	• Dehoff, Andrew (0013-13) • Natarelli, Helen (0002-1-8)
Opposition-Licensing Action	• Edwards, Robert L (0003-1) • Epstein, Eric (0001-1-5) (0011-6) (0011-9) (0011-11) • George, Susan (0005-1) • Natarelli, Helen (0002-1-1) (0002-1-9) (0002-1-13) • Stanseski, Pinky (0004-1)
Opposition-Licensing Process	• Epstein, Eric (0001-1-6) (0011-1)
Opposition-Nuclear Power	• Natarelli, Helen (0002-1-4) (0002-1-7) (0002-1-14) (0002-1-16)
Opposition-Plant	• Natarelli, Helen (0002-1-2)
Outside Scope-Miscellaneous	• Epstein, Eric (0001-1-10)
Outside Scope-NRC Oversight	• Dennis, Lori (0002-2-5) • Natarelli, Helen (0002-1-3) • Walker, John L. (0010-1)
Outside Scope-Safety	• Edwards, Robert L (0003-2) • Epstein, Eric (0001-1-9) (0001-1-11) (0001-1-17) • Natarelli, Helen (0002-1-6)

Table E-2. (contd)

Comment Category	Commenter (Comment ID)
Outside Scope-Security and Terrorism	• Shepler, Dennis (0002-3-1) (0002-3-3)
Process-ESP-COL	• Dehoff, Andrew (0013-1) (0013-18) • Dennis, Lori (0002-2-1) (0002-2-2) • Epstein, Eric (0001-1-1) (0001-1-2) (0001-1-3) (0001-1-16) (0001-1-18) (0011-25) (0011-26) (0011-27) • Lapp, Jeffrey (0012-1) (0012-2) (0012-3) (0012-6) • Walker, John L. (0010-3) (0010-7)
Process-NEPA	• Epstein, Eric (0011-15) (0011-17)
Socioeconomics	• Dennis, Lori (0002-2-4) • Epstein, Eric (0001-1-19) (0011-12) • Hartle, Mark A. (0009-5) (0009-10) • Natarelli, Helen (0002-1-11)
Uranium Fuel Cycle	• Edwards, Robert L (0003-4) • Epstein, Eric (0001-1-14) (0001-1-20) • Shepler, Dennis (0002-3-2) • Walker, John L. (0010-2) (0010-4)

E.2 Comments and Responses

Table E-3 shows a list of the comment categories included in this appendix in the order in which they appear. The balance of this appendix presents the comments, along with the review team's response to each comment, organized by topic category. The full citation to any references that are called-out in the review team's responses can be found in Section E.3 of this Appendix.

Table E-3. Comment Categories

E.2.1 Comments Concerning Process - COL

Comment: And we'd also ask you not to issue a final environmental impact study until the Susquehanna River Basin Commission settles whether or not they're going to issue and support and approve PPL's applications for mitigating measures, surface water withdrawals, and consumptive use. (**0001-1-18** [Epstein, Eric])

Comment: The NRC and the U.S. Army Corps of Engineers should delay issuing a final Environmental Impact Study until the Susquehanna Basin River Commission approves PPL's applications for consumptive use, mitigating measures and surface water withdrawals. (**0011-27** [Epstein, Eric])

Comment: EPA has concerns with the suspensions of reviews by the Susquehanna River Basin Commission (SRBC) of consumptive water use, surface water withdrawal, and groundwater withdrawal applications and the suspension of NRC's nuclear reactor safety review. EPA considers the approvals of consumptive water use and NRC's nuclear reactor safety review to be critical to decision-making for this project. It is unclear that a decision on the Draft EIS should proceed without an analysis and determination that consumptive-use allocations are possible, and effects of withdrawal have been presented and reviewed by SRBC; it is appropriate to include the analysis in the EIS. (**0012-1** [Lapp, Jeffrey])

Comment: It would be prudent to delay a Final EIS or Record of Decision on the EIS until it is clear that information is available to complete the application to SRBC and that a consumptive use permit could be issued. (**0012-6** [Lapp, Jeffrey])

Comment: Fundamental to any authorization by the SRBC is a finding that the project is consistent with the "Comprehensive Plan for the Water Resources of the Susquehanna River Basin" (Comprehensive Plan) (dated December 2013, as amended June 2014), as mandated by the Susquehanna River Basin Compact.

The applicant submitted applications to the SRBC in 2009 for BBNPP for a water withdrawal of up to 42.0 million gallons per day (mgd) from the North Branch Susquehanna River (NBSR) and a consumptive use of that water of up to 28.0 mgd for plant operations and safety purposes. SRBC staff reviewed all submissions related to the BBNPP applications and, in a letter to PPL dated December 28, 2012, provided staff's anticipated recommendations regarding passby flow requirements/low flow protection and consumptive use mitigation, subject to change as specified, at PPL's request so that it could evaluate storage requirements to provide necessary releases to ensure uninterrupted operation of BBNPP. However, as you are aware, the applicant has not submitted a substantive plan addressing consumptive use mitigation and flow augmentation to meet low flow protection requirements for the BBNPP project.

SRBC's technical review was suspended in March 2013 (as described in SRBC's correspondence dated March 26, 2013), and remains so to date, pending submittal of sufficient information to address these and other deficiencies in the applications. When complete, the technical review will be used to develop appropriate recommendations to approve, limit, condition, or deny the withdrawal and consumptive water use at BBNPP to avoid significant adverse impacts, including adverse cumulative impacts, to the water resources of the basin. (**0013-1** [Dehoff, Andrew])

Comment: The NRC staff's preliminary environmental recommendation in the DEIS is that a license for the new reactor could be issued, based on its assessment of information primarily supplied by the applicant. However, there remains a number of issues related to impacts to water resources that should be resolved, and outstanding and necessary document submittals and studies that should be considered in making any determination.

In particular, our review of the conceptual storage plan proposed to meet SRBC's requirements for low flow protection and consumptive use mitigation is fraught with obstacles and flawed in several respects, lacking a demonstration of sufficient quantity of stored water and acceptable operations plans (trigger locations, trigger periods, trigger release rates) for the timely and reliable release of that water at the several facilities indicated. Based on these factors alone, SRBC would suggest that NRC's preliminary conclusion is premature.

Considering that water availability is critical for operations and safety of the project, SRBC finds from our review of the DEIS that the evaluation of the environmental impact of the project is incomplete and unbalanced, and therefore does not give policymakers and the public the full picture that is needed to make reasoned and balanced choices on the use of the Susquehanna basin's water resources. (**0013-18** [Dehoff, Andrew])

Response: *The comments are generally in opposition to the NRC's publication of a final EIS or issuance of a Record of Decision (ROD) for the Bell Bend Nuclear Power Plant (BBNPP) prior to completion of all steps identified by PPL, the NRC and other agencies to implement PPL's primary plan to provide a source of water upstream of BBNPP site to mitigate BBNPP's consumptive use.*

The primary plan as presented in submissions to the NRC from PPL and described in Section 2.2, describes one combination of facilities and operations that, if implemented, appears to be consistent with the Susquehanna River Basin Commission's (SRBC's) requirements for consumptive-use mitigation and site-specific low-flow protection. As noted by commenters, all of a number of actions by the applicant, State and Federal agencies, and independent third parties would be required to fully implement the plan. As discussed in Section 2.2, implementation of PPL's primary plan would require purchasing rights to 36.8 cfs (23.8 Mgd) of Cowanesque Lake water currently allocated for mitigation of consumptive use by a downstream generating station (PPL Bell Bend 2013-TN3541), identified by the NRC staff as the Three Mile Island nuclear power plant (TMI). PPL stated that it also plans to purchase sufficient water at the Holtwood Dam hydroelectric site to provide a source of water for mitigation of TMI consumptive use (Talen 2015-TN4424). In addition, PPL (PPL Bell Bend 2013-TN3541) stated that it plans to reallocate to BBNPP the 13.6 cfs (8.8 Mgd) of Cowanesque Lake water currently used to mitigate consumptive use by PPL's Montour Steam Electric Station on the West Branch *of the Susquehanna River. To satisfy the Montour Steam Electric Station consumptive-use mitigation needs, PPL plans to expand its existing Rushton Mine water-treatment facility. Rushton Mine is a former underground coal mine that is currently owned by PPL; PPL pumps and treats groundwater from the mine to reduce acid drainage to receiving waters.*

The staff acknowledges that none of the actions required to implement PPL's primary plan have been completed to date, and that there is no certainty that PPL would be able to accomplish the proposed plan as currently envisioned. However, the SRBC reviewed the proposed plan and in a letter to the NRC dated August 12, 2013 (SRBC 2013-TN4429), the SRBC stated "In the most general terms, Commission [SRBC] staff would be able to recommend approval of the BBNPP project if/when PPL can demonstrate that it has a sufficient quantity of stored water under its control, that this water is available at acceptable upstream location(s), and that this water can be released by PPL to satisfy both consumptive-use mitigation and passby flow requirements, and any other regulatory and legal requirements in effect at the time of Commission [SRBC] action. While this may represent a significant challenge for PPL to meet, Commission [SRBC] staff are otherwise reasonably sure that there are no fatal flaws apparent with the primary option identified in PPL's conceptual plan."

The review team is not aware of any technical, regulatory, or legal constraints that would prevent PPL from accomplishing the steps described in their primary plan for consumptive-water-use mitigation. For the purpose of assessing potential environmental impacts of the proposed action, staff assumes PPL will be able to successfully negotiate for the transfer of water rights for Cowanesque from TMI to BBNPP and purchase sufficient water at the Holtwood Dam hydroelectric site to provide a source of water for mitigation of TMI consumptive use. In addition, staff assumes PPL will obtain approval to reallocate to BBNPP the 13.6 cfs (8.8 Mgd) of Cowanesque Lake water currently used to mitigate consumptive use by PPL's Montour Steam Electric Station on the West Branch of the Susquehanna River. Lastly, staff considers it feasible for PPL to expand its existing Rushton Mine water-treatment facility to provide water in the West Branch of the Susquehanna River to compensate for consumptive use by PPL's Montour Steam Electric Station. Although multiple actions would be required to implement the plan, the staff considers the primary plan as presented by PPL and as assessed in the draft EIS to be feasible. Impacts associated with this primary plan are presented in Chapter 5 of the EIS.

In addition, the commenters suggest that the NRC should not issue a final EIS and ROD for the BBNPP combined construction permit and operating license (COL) until all assessments by other agencies have been completed. NEPA (42 U.S.C. § 4321 et seq.-TN661) states the Federal government's requirement to prepare an EIS for major Federal actions significantly affecting the quality of the human environment. NEPA does not require the NRC to wait until all other agency reviews are complete before issuing a final EIS. By its nature, a NEPA EIS is a planning document. The EIS need only contain a reasonably complete discussion of potential mitigation measures. The EIS considers the environmental impacts of a proposed project, even if the regulation of such impacts falls outside of the NRC's jurisdiction and lies with another agency.

While the environmental analysis under Title 10 of the Code of Federal Regulations *(CFR) Part 51 (TN250) requires consideration of all significant environmental impacts, it does not authorize the NRC to regulate or enforce compliance with other environmental laws and regulations. It* *assumes that PPL will obtain any such required permits and comply with otherwise applicable laws and regulations—environmental or otherwise. The NRC will make its decision (e.g., whether to issue a license) based, in part, on a consideration of all environmental impacts, even those outside its jurisdiction, but the NRC does not assume responsibility or jurisdiction over all environmental impacts. Unless otherwise shown, other agencies can be assumed to be fulfilling their respective regulatory functions. The COL, if issued, would not authorize any of the activities that compose PPL's primary plan. In this case, PPL will be required to fully comply with any requirements imposed by the SRBC, the USACE, and any other agency with authority over any aspect of PPL's proposed plan.*

As noted above, the staff considers the primary plan for mitigation of BBNPP's consumptive water use as presented by PPL and as assessed in the draft EIS to be feasible. However, due to the numerous coordinated activities involved in its implementation, there is a reasonable chance that significant aspects of the plan may change prior to implementation. Up until such time as the license is issued, the NRC will evaluate any changes in PPL's primary plan to determine whether or not the potential impacts of the revised plan would fall within the bounds of the NRC's assessment of the plan in the EIS. Depending on the results of this evaluation, the NRC may determine it is necessary to prepare a supplemental EIS for the revised plan in accordance with 10 CFR 51.92 (TN250). Following the issuance of the COL, the NRC's responsibilities under NEPA (42 U.S.C. § 4321 et seq.-TN661) are complete and the NRC would not review any subsequent changes in the plan. Any changes by PPL to their primary plan prior to implementation would, however, be subject to review by the SRBC and other responsible resource agencies.

Changes were made in text describing PPL's primary plan in Sections 2.2 and 5.2.

Comment: I live less than a mile away from the proposed site. I am extremely concerned about it. I'm neither for nor against the building of it because I don't have enough information about it. So I--I would like to get more information regarding not only the construction but also the effects that it's going to have on the community, the land, the water quality, the air quality, the property value. I want to have all that information so that I can make an educated decision about it. I'm -- I'm very nervous about it. Again, but I'm not going to make judgment until I have more information. (**0002-2-1** [Dennis, Lori])

Comment: I wonder about Walker Run. Fortunately before we had this presentation some great people came and answered some of my questions while I was looking out there at the maps and that. And I do appreciate it very much, I'm -- I'm glad that you guys are having this--this presentation so that I can come up and ask questions because I don't think I have enough information about it. (**0002-2-2** [Dennis, Lori])

Response: *Throughout the environmental review process, NRC staff has taken measures to inform the public about the proposed project and about the staff's review. The application for a BBNPP COL was submitted by PPL in late 2008. A 75-day public scoping process began on January 6, 2009, via publication in the Federal Register (74 FR 470-TN1785) and press releases. Two public scoping meetings were held on January 29, 2009 at the Berwick High School in Berwick, Pennsylvania. Public notification of those meetings was made in three public newspapers (i.e., The Press-Enterprise, The Standard-Speaker and The Times Leader) on*

January 22, 25 and 29, 2009. Another 30-day scoping period started on June 15, 2012, via publication in the Federal Register (77 FR 36012-TN3907), where the public could submit scoping comments in writing. The draft EIS was published in April 2015. Copies of the draft EIS were available on the NRC website, the Federal Rulemaking website (www.regulations.gov), the NRC Public Document Room, the USACE office in State College, and at the public meeting on the draft EIS held on June 4, 2015 (80 FR 22231-TN4402). Two public comment meetings were held on June 4, 2015 at Bloomsburg University, Bloomsburg, Pennsylvania. Public notification of those meetings was published in three newspapers on May 17, 24 and 31, 2015. No changes were made to the EIS as a result of these comments.

Comment: I'm going to begin out just to chide whoever organized this just a little. Today is also the SRBC quarterly meeting in Baltimore. It seems we could have found a better date to hold the meeting than on the date that conflicts with some of the major stakeholders, especially since that meeting's taking place in Baltimore. (**0001-1-1** [Epstein, Eric])

Response: *The staff apologizes for the schedule inconvenience. Electronic copies of the draft EIS were made available to the public for 75 days starting April 24, 2015 and ending July 7, 2015. In addition to the public meeting, the public was also given the opportunity to submit comments directly to the NRC by letter and e-mail. No change was made to the EIS as a result of this comment.*

Comment: How can the NRC announce that only people within a 10-mile area of the plant be allowed to speak at this hearing when the NRC advised the Japanese that in a nuclear accident they should be 50 miles away to be safe? (**0010-3** [Walker, John L.])

Response: *The staff invited anyone interested to speak at its public meeting on the draft EIS held June 4, 2015, via the Federal Register notice (80 FR 22231-TN4402), press releases, and newspaper ads. The staff regrets the misunderstanding. No change was made to the EIS as a result of this comment.*

Comment: If the NRC was being truthful about the 50-mile limit in Japan, does it plan to draw a circle around the Bell-Bend site with a 50-mile radius, so that the public will be advised accordingly? (**0010-7** [Walker, John L.])

Response: *Emergency preparedness will be part of the safety review and will be documented in the Safety Evaluation Report. No change was made to the EIS as a result of this comment.*

Comment: We have three recommendations. The first recommendation would be, and we submitted it to actually respond to Arnie Gundersen's testimony, who happens to be a nuclear engineer and an expert in the field. We spent a lot of time, he spent a lot of time outlining questions. The first time around both the Corps and the NRC evaded responding to the questions. (**0001-1-16** [Epstein, Eric])

Comment: I would also note as being involved with this process that I would disagree that our concerns or questions are addressed. I've been doing this for over 30 years, and I don't remember the last time I testified at the NRC proceeding where my concerns have been addressed. They've been answered, and they usually refer to an index in the back of a book that exists near a place that's hard to find, so. I hope you're here to listen, but more importantly to me I hope you're here to address concerns, because none of our concerns which we've raised throughout the process in 2008 have been addressed. (**0001-1-2** [Epstein, Eric])

Comment: The NRC and the U.S. Army Corps of Engineers should compel PPL to address, factor and analyze water use and site-specific aquatic challenges identified in Arnie Gundersen's Expert Testimony. [Mr. Gundersen's testimony can be found at ML15175A100] (**0011-25** [Epstein, Eric])

Comment: The NRC and the U.S. Army Corps of Engineers should compel PPL to address, factor and analyze water use and site-specific aquatic challenges identified in TMI-Alert's testimony. (**0011-26** [Epstein, Eric])

Response: *The NRC does not compel applicants to address issues, but rather assesses the impacts of the project as proposed. Nevertheless, the staff did review and consider Mr. Gundersen's testimony in the preparation of the draft EIS in accordance with its regulations, the NEPA (42 U.S.C. § 4321 et seq.-TN661), and the NRC's implementing regulations at 10 CFR Part 51 (TN250). Water use is addressed in Section 5.2 and aquatic ecology is addressed in Section 5.3. Alternative cooling systems are addressed in Section 9.4. The comments provide no new information and no changes were made to the EIS as a result of these comments.*

Comment: I don't think this plant's ever going to be built. I think today's a circus, I think it's a farce. And I'll tell you why. And I don't think there's a lot there's a lot of people in the industry wondering what the hell we're doing here....At any rate, the proposal calls for the use of a single evolutionary power reactor, which is interesting, because that reactor was renamed, it's actually the European power reactor. The design has not yet been approved. So we're talking today about a plant that doesn't have a reactor. You'd think you'd need one. I don't know if I'd buy a car without an engine. That's me. (**0001-1-3** [Epstein, Eric])

Comment: Also, conclusion on assessment of reactor safety would be pertinent to the EIS and the NEPA Record of Decision (ROD). Though there may be minimal difference between reactors' water consumption and other function, it would be preferable for the public and decision-makers to be informed on the safety analysis and its conclusions while the project is in the NEPA process. (**0012-2** [Lapp, Jeffrey])

Response: *The design certification application for the reactor design, which is referenced in the BBNPP COL application, was suspended by AREVA in February 2015. In early 2014, PPL requested that the NRC withhold review of the safety portion of its application, choosing to focus on the environmental portion of the review. A COL cannot be granted to PPL by the NRC until the design certification review, safety review of the COL, and environmental review of the COL have been completed. As such, the NRC plans to continue the environmental review of the proposed COL while the safety review and design certifications are suspended. The NRC staff will determine whether it must prepare a supplement to the environmental review in accordance with 10 CFR 51.92 (TN250). No changes were made to the EIS as a result of these comments.*

Comment: The NRC should be aware that on March 22, 2012, and April 16, 2012, the EPA sent letters to the US Army Corps of Engineer concerning the Clean Water Act (CWA) Section 404 permit application for the project, which was submitted prior to the Draft EIS. Given the importance of the aquatic resources at stake, the complexity of the project, and the potential impacts, EPA's comments to the Corps in response to the public notice for the project indicated that we are concerned that the Bell Bend project, as proposed, may result in substantial and unacceptable impacts to aquatic resources of national importance as covered in Part IV, paragraph 3(a), of the 1992 CWA Section 404(q) Memorandum of Agreement (MOA) between EPA and the Department of the Army. EPA appreciates the applicant's efforts to work with the regulatory agencies and to avoid and minimize impacts on site, however, the Draft EIS did not provide sufficient information to address our concerns raised in our comments to the Corps. EPA is committed to continuing to work with NRC and the applicant to assure that the proposed impacts resulting from this project are the least environmentally damaging practicable alternative, consistent with the CWA Section 404(b)(1) Guidelines and that significant degradation to Walker Run and the North Branch of the Susquehanna River is prevented. (**0012-3** [Lapp, Jeffrey])

Response: *Consistent with 10 CFR Part 51 (TN250), the NRC identifies an environmentally preferable alternative based on its impacts analysis; NUREG-1555, Section 9.3 (NRC 2000-TN614) directs the staff to extend the scope of the environmental review to determine whether the environmentally preferable alternative is obviously superior to the proposal. The USACE will complete an independent evaluation of the proposed project after publication of the final EIS. The USACE's independent ROD regarding the proposed permit will reference the analyses in the EIS and will also present any additional information required by the USACE to support its permit decision. This will include the USACE's determination on the least environmentally damaging practicable alternative (LEDPA), the consideration of impacts to the aquatic environment, public interest review (PIR) factors, a consideration of all comments received, and compliance with applicable laws and regulations. The USACE's final decision document will not be addressed in this EIS as the document is separate and independent and will not be completed until after issuance of the final EIS.*

E.2.2 Comments Concerning Process - NEPA

Comment: PPL Bell Bend has not disclosed or quantified the how many fish (game and consumable), fish eggs, shellfish will be killed annually if this Application is approved. Is the Corps in possession of this data? Has it been made available to the public for review? Has the Corps established "acceptable levels" of fish kills? If so, where can that data be found? (**0011-15** [Epstein, Eric])

Comment: What will the Corp's compliance reporting requirements be in regard to onsite 316 (a) and 316 (b) monitoring? Where will the results be published? Has the Corps and EPA executed a MOU? What will the Corps compliance reporting requirements be in regard to off site tritium monitoring? Where will the results be published? (**0011-17** [Epstein, Eric])

Response: *Chapter 5 of the EIS discusses impacts resulting from operation of the proposed BBNPP on the aquatic environment, including fish kills, temperature (thermal) effects, and the release of radionuclides. Section 316 (a) and Section 316 (b) of the Clean Water Act is outside* *of the USACE's Regulatory purview. The USACE's Public Interest Review (PIR) (33 CFR 320.4 [TN424]), however, directs the USACE to consider a number of factors as part of a balanced evaluation process. Both the USACE's Clean Water Act Section 404(b)(1) Guidelines and the PIR process will be part of an independent decision document and will not be addressed in this EIS.*

E.2.3 Comments Concerning Hydrology - Surface Water

Comment: In terms of water; I looked at the application, and again maybe I'm missing something. PPL has never completed their final application for consumptive water use, surface water withdrawals, or provided an approved plan for compensatory measures. Now, the plan they have is interesting and novel, not reality, in my mind; it's a pro forma sketch that's not even close to being in final format. In fact, during low flows, which was mentioned today, water would have to come from upstream. And there's just not enough water to accommodate the plant, and hopefully PPL is aware that the regulatory protocol has changed. In Pennsylvania we don't do money in lieu like we used to, where if you didn't have the water you could just pay a fee. We need the water. The times have changed.

Already we're talking about a plant which is owned by PP and L that draws 40 million gallons of water a day. And it returns the water to the river at elevated temperatures, and most of it is evaporated. As of May 26, 27 counties in the state were in drought, including Luzerne. Well, nuclear power plants are exempted from drought regulations. Got to wonder about that. If you look at the plant that's about to be built, we're talking about 15 billion gallons a year. 15 billion. That's a lot of water, all right. 11 billion will be vaporized, 4 billion will either be returned into the river, heated, or superheated. You guys say there's no impact, I believe there is. It would be nice if you answered our questions. (**0001-1-12** [Epstein, Eric])

Comment: On September 7th, 2012 the NRC staff informed PPL they did not have sufficient information on the draft EIS sections regarding consumptive water use. So there are RAIs, which are requests for additional information, November 28th, 2012, February 19th, 2014 which we reviewed. There was an audit held on March 17th, 2014. Frankly, I believe that and we disagree vehemently with this, is there was a conclusion reached by the Carnot before the NRC that they could approve water use issues, which I think is not only wrong but, man, border lining on pushing the truth. The schedule's principally been impacted by technical challenge but there is no resolution to consumptive water use, surface water withdrawals, or a plan for compensatory measures. That's an issue we've been litigating since the beginning. (**0001-1-4** [Epstein, Eric])

Comment: There is no plan or even an application for the millions of gallons of water per day the plant would require from the Susquehanna River Basin. (**0003-5** [Edwards, Robert L])

Comment: There is not sufficient information in the draft EIS to evaluate the adequacy of PPL's proposed plan for consumptive water use mitigation at the Bell Bend Nuclear Power Plant (BBNPP). Until such time as PPL/NRC provides a detailed consumptive water use mitigation plan and can demonstrate that the necessary agreements between Susquehanna River Basin Commission (SRBC) and PPL and between PPL and Exelon can be executed, the Corps cannot agree to any plan that involves use of Cowanesque Lake storage. (**0006-1** [Cwiek, Phil])

Comment: Presently, all of the available water supply storage (23,494 acre-feet) in the Corps' Cowanesque Lake is contracted to SRBC for use at the Susquehanna Steam Electric Station (SSES), Three Mile Island (TMI), and Montour Steam Electric Station (MSES). The Cowanesque Lake Reservoir Regulation Manual contains a formal water supply storage and release plan that is designed to satisfy the consumptive water use requirements of the three electric generating facilities, considering the specific location, timing, and amount of consumptive use. Furthermore, this site-specific plan at Cowanesque Lake has been developed through several years of investigation so as to minimize impacts to the reservoir's environmental and recreational features while concurrently supporting SRBC's broader low flow protection plan for the entire Susquehanna watershed. (**0006-2** [Cwiek, Phil])

Comment: The legal agreements necessary to execute a "switch" of consumptive use make-up water from TMI to BBNPP have not been executed. ---PPL proposes to purchase water storage rights within Cowanesque Lake currently allocated to Exelon's TMI plant. Has Exelon agreed to this change? Has a valuation been negotiated that is agreeable to both parties? Where will Exelon get consumptive use make-up water for TMI if PPL purchases Exelon's share of Cowanesque storage? What changes are necessary to the SRBC's storage contract with Exelon? (**0006-3** [Cwiek, Phil])

Comment: What legal, financial, and regulatory approvals have been secured for expanding the existing Rushton Mine facility to treat acid drainage from the underground mine? (**0006-5** [Cwiek, Phil])

Comment: Furthermore, the Corps and SRBC have recently completed a major revision to the Cowanesque Lake reservoir regulation manual. That manual now includes a water supply release plan specifically formulated to address consumptive use needs at SSES, TMI, and MSES according to SRBC's low flow protection policies (see attached table). [Commenter also submitted a table outlining the Cowanesque Lake water supply releases flow triggers and rates which can be found at ADAMS Accession Number ML15175A423]. This plan was only approved after extensive studies and analyses of impacts at Cowanesque Lake. Additional changes or alterations to the water supply release plan would likely invalidate theses earlier findings and would require the expenditure of much additional effort and funds. The Corps does not have funding available to conduct another water control plan update at Cowanesque Lake. (**0006-7** [Cwiek, Phil])

Comment: There is no water. PPL has never completed the application for consumptive water use, surface water withdrawals or provided an approved plan for compensatory measures to the Susquehanna River Basin Commission ("SRBC"). PPL has submitted a pro forma sketch that lacks substance, technical specifications and is not remotely close to being in final format. In fact, during low flows, water would have to come from upstream. There is not enough water to accommodate another nuclear power plant. (**0011-2** [Epstein, Eric])

Comment: It is clear black letter law that issues relating to "Compensatory Measures" in the PPL's Application fall Under the unambiguous purview of the SRBC....In Fact the SRBC explicitly told the NRC and USACE of Engineers during the Scoping Process that PPL would need approval for water withdrawal, consumptive use and mitigating strategies" ....The SRBC has suspended review of PPL's applications. (**0011-24** [Epstein, Eric])

Comment: Consumptive water use, surface water withdrawals and an approved plan for compensatory measures have not been approved by the Susquehanna River Basin Commission. (**0011-4** [Epstein, Eric])

Comment: Section 2.2.2, Section 2.3.2.1 and Section 7.2.1.1 provide an assessment of the consumptive mitigation for the cooling water demand for the operation of the Bell Bend Nuclear Power Plant. As stated in the Draft EIS, Talen Energy has applied for consumptive use permit from the Susquehanna River Basin Commission (SRBC) for 28 million gallons per day. The SRBC has made a prerequisite of permit approval that compensating water releases would need to come from upstream sources in the amount equal to the consumptive use at the Bell Bend Nuclear Power Plant. The Draft EIS provides a discussion on how Talen plans to meet this requirement and the potential environmental impacts. Talen's plan includes a series of offsets and trading of water resource allocations involving the water reallocation of PPL's Montour Steam Electric Station, expanding of the Ruston Mine water treatment facility and using water allocations related to PPL's Holtwood Dam. However, the Draft EIS does not indicate whether it has secured the critical allocation upstream of Bell Bend. In fact, the SRBC has suspended Talen Energy water consumption permit application as a result of lack of information in meeting the upstream water allocation requirement. (**0012-5** [Lapp, Jeffrey])

Comment: Part of PPL's conceptual plan to provide consumptive water use mitigation for BBNPP is to expand its water treatment operations at Rushton Mine to provide consumptive use mitigation releases for PPL's MSES (Sections 2.2.2 and 5.2.2.1, Page 5-11). PPL (PPL Bell Bend 2013-TN3541) stated that it plans "to reallocate to BBNPP the 13.6 cfs (8.8 Mgd) of Cowanesque Lake water currently used to mitigate consumptive use by PPL's Montour Steam Electric Station ...." Rushton Mine, a former underground coal mine that is owned by PPL, currently pumps and treats an estimated maximum of 6.9 cubic feet per second (cfs) (4.5 mgd) of groundwater for discharge to Moshannon Creek (PPL Bell Bend 2013-TN3541).

An application for Rushton Mine, submitted by Pennsylvania Mines LLC (a PPL company), was received by SRBC on December 28, 2011. The stated purpose was for the maintenance of a mine pool level and also for partial mitigation of consumptive use for PPL facilities. On November 27, 2013, the applicant requested to withdraw its application. SRBC has not reviewed the existing groundwater withdrawal; however, it has reviewed several projects involving withdrawals from inactive coal mines and the technical challenges are significant. It is particularly challenging to accurately characterize the available storage and water quality of the mine pool during critical low flows without recent pumping and drawdown data. Water quality data are particularly important so that treatment can be evaluated and upgraded if needed to meet contemporary standards.

To qualify as mitigation water, the discharge from Rushton Mine would have to be increased over the historic amount by the amount of the consumptive use at MSES during critical low flow periods. SRBC's general experience is that water production from mine pools may not meet volumetric expectations and therefore, test pumping is required to confirm yields and evaluate any impacts during low flow periods. NRC should consider in the DEIS other possible supplemental or alternate sources that may be necessary for mitigation water in the West Branch watershed.

Page 5-11 -In its analysis in the DEIS, NRC triggered releases from Rushton by flows at Wilkes-Barre using flow targets anticipated for BBNPP. Although mitigation releases for MSES are currently triggered at the Wilkes-Barre gage, any future consumptive use mitigation asset in the West Branch Susquehanna subbasin dedicated to MSES should consider a West Branch Susquehanna River (likely Williamsport) trigger gage. As drought events can be highly localized, the analysis conducted for the DEIS may not accurately assess potential impacts. (**0013-11** [Dehoff, Andrew])

Comment: SRBC notes that the DEIS addresses a wide array of issues to determine the environmental impact of BBNPP; however, it believes the discussion of water-related issues is lacking given the critical importance of uninterrupted cooling water to nuclear power generation and safety.

The reconnaissance-level evaluation, based on information largely supplied by the applicant, does not adequately address the technical challenges of the proposed withdrawals and consumptive use. Analysis of water-related issues is incomplete and in some cases incorrect, resulting in misinformation and possibly erroneous conclusions. SRBC's major concerns with the DEIS include:

1. The hydrologic analysis is over-simplified, which could lead to improper conclusions concerning levels of impact.

2. The plan for consumptive use mitigation and flow augmentation submitted by PPL lacks sufficient substantive detail for any credible technical review and is unlikely to succeed due to its inherent complexity.

3. The recently issued Finding of No Significant Impact for revised water supply operations at Cowanesque Lake would be rendered obsolete by the proposed changes to releases at Cowanesque Lake. (**0013-2** [Dehoff, Andrew])

Comment: In correspondence dated August 12, 2013, SRBC provided comments to the NRC on PPL's submittal outlining generally how it intends to provide mitigation for BBNPP. At that time, although it could not identify any single fatal flaw due to the general nature of the proposal, SRBC characterized the development of an acceptable consumptive use mitigation/flow augmentation plan as "a significant challenge for PPL to meet."

Significant information that would inform NRC's analysis remains absent from the record. SRBC regards the information in the DEIS describing the proposed consumptive water use and the related mitigation "plan" to be only conceptual in nature and of insufficient detail to satisfy SRBC's more rigorous review standards dictated by the codes and policies outlined above.

SRBC's Mitigation Requirements. There appears to be some confusion about SRBC's mitigation requirements in the DEIS (including, but not limited to, Sections 2.2.2.2, 2.3.1, 2.3.1.1, 2.3.2.l, 5.1.2.2, 5.2.2.1, 5.3.2.2, 7.2.2.1, 7.3.2.4, Table 10-2, and 10.2.2). SRBC makes a distinction between passby flow requirements and consumptive use mitigation. The distinction is important in the review of BBNPP because of the additional quantity of storage necessary to provide the proper protections to meet SRBC's requirements.

Passby flows are required for low flow protection for certain projects to avoid the significant adverse impacts related to a project's withdrawal (maximum instantaneous withdrawal rate and peak day withdrawal). Passby flows provide site-specific protection and commonly result in recommendations of an interruption of the withdrawal during designated low flow periods. Consumptive use mitigation is required of all approved consumptive water users to provide for broad protection of the water resources of the basin during periods of critical low flows. SRBC has contracted for programmed releases of water from storage to mitigate the impact of regulated consumptive losses on the main stem Susquehanna River and flows to the Chesapeake Bay.

In its December 28, 2012 letter, SRBC staff offered its recommendations for passby flows for BBNPP, based on its Low Flow Protection Policy Related to Withdrawal Approvals and on special aquatic studies conducted by the applicant (also see comments on "Aquatic Studies"). The letter also indicated that low flow protection requirements could be met by BBNPP using upstream releases of water from storage (flow augmentation) during designated low flow times in lieu of suspension of the withdrawal, thus avoiding periodic, temporary shutdown of the facility. In these preliminary findings, SRBC staff indicated that the amount of the release should "replace" the net withdrawal to mitigate potential significant adverse impacts downstream of the location of BBNPP' s discharge. When pass by flow protection periods coincide with critical low flow months, the flow augmentation releases to satisfy low flow protection requirements would also mitigate for consumptive use. However, low flow protection requirements also occur in May and June, and trigger at higher flows in July, so that offset releases would be more frequent than consumptive use mitigation. This is apparently not acknowledged nor is the total quantity of water storage necessary evaluated in the DEIS. (**0013-5** [Dehoff, Andrew])

Comment: Complexity of the Plan. PPL's preferred consumptive use mitigation plan itself (described in Section 2.2.2.2 of the DEIS) hinges upon an unprecedented level of complexity while lacking realistic estimates of level of effort, cost, and time to secure necessary legal, financial, and regulatory approvals. Failure by PPL to execute any element of the plan would likely derail the approval process for the entire BBNPP mitigation/flow augmentation effort. The various challenges include, but are not limited to:

1. A plan for consumptive use mitigation/flow augmentation would have to be prepared, based on monthly maximum demand (the actual expected need during a drought) rather than long-term averages, during critical 1 low flow months, and flow augmentation needs in the amount of the maximum net withdrawal triggered by designated monthly passby flow values for the months of May, June, and July;

2. A sequence of engineering and contractual arrangements would have to be secured;

3. Scientific studies for proposed water sources for consumptive use mitigation verifying sufficient storage quantities and reliable releases (or discharges) would need to be conducted;

4. Applications would have to be submitted to, and ultimately approved by, SRBC for the new projects and also the major modifications to existing projects (not all of which are controlled by PPL); and

5. Necessary revisions to policies, plans, and projects currently authorized by SRBC's Comprehensive Plan would have to be accomplished.

In order to secure mitigation water upstream of BBNPP, PPL's elaborate plan is to use storage in Cowanesque Lake that is currently allocated for other projects. To make this possible, PPL suggests it can substitute the new, untested and unapproved water sources of Ruston Mine (located on the West Branch) and Holtwood Dam/Lake Aldred (located downstream on the Susquehanna River) for consumptive use mitigation water at the Montour Steam Electric Station (MSES), which is owned by PPL, and Three Mile Island (TMI), which is located upstream of Holtwood Dam and not owned by PPL. The conceptual plan is highly speculative in its assumption that it is feasible to shift mitigation water storage obligations among multiple facilities, in essence creating "a house of cards" that will collapse if any element of this plan is found to be infeasible. As noted in the discussion that follows, there are significant questions and obstacles to each of these interrelated elements of PPL's conceptual plan. (**0013-6** [Dehoff, Andrew])

Comment: In its primary plan for consumptive water use mitigation, PPL stated its intent to rely on water stored in Cowanesque Lake to compensate for BBNPP consumptive use, both by planning "to reallocate to BBNPP the 13.6 cfs (8.8 Mgd) of Cowanesque Lake water currently used to mitigate consumptive use by PPL's Montour Steam Electric Station ..." and by "purchasing rights to 36.8 cfs (23.8 Mgd) of Cowanesque Lake water currently allocated for mitigation of consumptive use downstream of PPL BBNPP."

Contracts. SRBC currently owns 23,494 acre-feet of water supply storage within the USACE's Cowanesque Lake, in accordance with the terms of a water supply storage contract signed in 1986. The lake is subject to sedimentation and periodic bathymetric surveys are conducted to determine the available water supply storage. The reallocation contract with the USACE specifies the purpose of the water storage to be consumptive use mitigation. Requirements for additional flow augmentation in May, June, and July, related to potential adverse impacts from the withdrawal at BBNPP, are not consumptive use. As such, this poses a legal question that would have to be addressed and possible modification of the contract between SRBC and the USACE.

On Page 2-46, the DEIS notes that, "Of the water storage in Cowanesque Lake owned by the SRBC, 4,582 ac-ft are dedicated to mitigate the full consumptive use by TMI (19 Mgd), 13,061 ac-ft are available to mitigate up to 40 Mgd of consumptive use by SSES, and 3,000 ac-ft are available to mitigate part of the consumptive use (about 9 Mgd) of the Montour Steam Electric Station." SRBC and PPL have a contractual relationship (dating from 1986) that specifies rights to 66 percent of the water supply storage (rather than project-specific allocation rates in millions of gallons per day as indicated in the DEIS) to provide make-up for the consumptive use of water at SSES. In 1994, SRBC and PPL executed a settlement agreement related to the consumptive use of water at the MSES, which included approval of the use of 3,000 acre-feet of Cowanesque Lake water supply storage to help offset consumptive use at MSES.

Using the 3,000 acre-feet of water storage in Cowanesque Lake for consumptive use mitigation/flow augmentation for the BBNPP project, as outlined in the DEIS, would require reopening and revision of the contract that PPL has with the SRBC. Any re-designation of

Cowanesque storage to any facility other than MSES may also affect the application of Article 8, Compliance with SRBC Regulations, of the June 1986 Consumptive Use Make-up Agreement executed by PPL and SRBC.

Similarly, any purchase of rights to an additional volume of water storage in Cowanesque Lake would require a new contract between PPL and the SRBC that could not be executed before the modification of approvals with new mitigation solutions for existing projects to be displaced by BBNPP. Page 2-16 of the DEIS indicates that PPL plans to reallocate to BBNPP the water in Cowanesque Lake currently used to mitigate consumptive use by PPL's MSES on the West Branch Susquehanna River, and also the water in Cowanesque Lake "currently allocated for mitigation of consumptive use downstream of the BBNPP"; which by default, must be TMI. (**0013-7** [Dehoff, Andrew])

Comment: Reservoir Operations. The USACE and SRBC have recently completed a major revision to the reservoir regulation manual for Cowanesque Lake to reflect new water supply operations for existing agreements with utilities that need water from Cowanesque Lake for consumptive use mitigation. The revised manual includes a water supply release plan specifically formulated to address consumptive use needs at SSES, TMI, and MSES based on the results of a series of technical investigations and to more closely align with thresholds contained in SRBC's Low Flow Protection Policy Related to Withdrawal Approvals. As part of the evaluation of the proposed water supply operations, the USACE required a complete technical and environmental review of the reservoir operations and analyses of environmental and recreational impacts at Cowanesque Lake. This review process began in 2007 and, after almost a decade of work, is in the final stages of implementation pending final USA CE approval of the reservoir regulation manual. During the review process, a Finding of No Significant Impact was rendered in September 2013, that the changes in operation of the reservoir would not pose a significant environmental impact.

Using Cowanesque Lake for consumptive use mitigation and meeting low flow protection requirements for the BBNPP project would involve changes to the trigger location, timing of releases, and quantity of water released, and have not been adequately investigated in the DEIS. Changes (additions or alterations) to the water supply release plan would likely render obsolete the earlier findings, and are likely to require the USACE reservoir regulation manual to be revised again. SRBC anticipates that another complete technical and environmental review of the operation of the reservoir would be required by the USACE.

SRBC expects that the reservoir drawdowns resulting from releases for low flow protection compliance and consumptive use mitigation for the BBNPP project would increase in frequency and magnitude over the drawdowns contemplated in the recent technical studies, environmental assessment, and Finding of No Significant Impact. Sections 5.3.1.2, 5.3.2.2, and 7.2.1.1 of the DEIS outline the magnitude of the increased reservoir drawdowns. The impact of dewatering shallow area habitat, dewatering wetlands, and reduced recreational opportunities would have to be evaluated as part of the technical review process. If the impacts are determined to be significant, the review process could require more time to complete or render the use of Cowanesque Lake infeasible. Due consideration should be given to the time frame when evaluating the viability of using Cowanesque Lake to mitigate consumptive use for the BBNPP project. (**0013-9** [Dehoff, Andrew])

Response: *Water withdrawal and consumptive water-use for the proposed plant are described in Chapter 3, and water-use and water-quality impacts of the plant are described in Sections 4.2 and 5.2. The SRBC has the regulatory authority to approve water withdrawals and consumptive use for the proposed plant, and to impose* both consumptive-water-use mitigation requirements and site-specific low-flow protection requirements in the form of required passby flows*. Section 2.2.2 describes PPL's primary plan for consumptive-use mitigation and site-specific low-flow protection, as presented in submissions to the NRC from PPL. PPL's primary plan describes one combination of facilities and operations that, if implemented, appears to be consistent with the SRBC's requirements, as described in Sections 2.2.2, 2.3.2, and 5.2.2.1 and in the cited SRBC documents. All of a number of actions by PPL, State and Federal Agencies, and independent third parties would be required to fully implement the plan. As discussed in Section 2.2.2, implementation of PPL's primary plan would require purchasing rights to 36.8 cfs (23.8 Mgd) of Cowanesque Lake water currently allocated for mitigation of consumptive use by TMI (EA 2012-TN3371, SRBC 2011-TN3572). PPL stated that it also plans to purchase sufficient water at the Holtwood Dam hydroelectric site to provide a source of water for mitigation of TMI consumptive use (Talen 2015-TN4424). In addition, PPL (PPL Bell Bend 2013-TN3541) stated that it plans to reallocate to BBNPP the 13.6 cfs (8.8 Mgd) of Cowanesque Lake water currently used to mitigate consumptive use by PPL's Montour Steam Electric Station on the West Branch of the Susquehanna River. To satisfy the Montour Steam Electric Station consumptive-use mitigation needs, PPL plans to expand its existing Rushton Mine water-treatment facility. Rushton Mine is a former underground coal mine that is currently owned by PPL; PPL pumps and treats groundwater from the mine to reduce acid drainage to receiving waters.*

The comments generally address the complexity of PPL's primary plan and the difficulty in securing SRBC's approval for water withdrawal and consumptive use. The staff acknowledges that none of the actions required to implement PPL's primary plan have been completed to date, and that there is no certainty that PPL would be able to accomplish the proposed plan as currently envisioned. However, the SRBC reviewed the proposed plan and in a letter to the NRC dated August 12, 2013 (SRBC 2013-TN4429), the SRBC stated "In the most general terms, Commission [SRBC] staff would be able to recommend approval of the BBNPP project if/when PPL can demonstrate that it has a sufficient quantity of stored water under its control, that this water is available at acceptable upstream location(s), and that this water can be released by PPL to satisfy both consumptive-use mitigation and passby flow requirements, and any other regulatory and legal requirements in effect at the time of Commission [SRBC] action. While this may represent a significant challenge for PPL to meet, Commission [SRBC] staff are otherwise reasonably sure that there are no fatal flaws apparent with the primary option identified in PPL's conceptual plan."

Under NEPA (42 U.S.C. § 4321 et seq.-TN661), the NRC is permitted to move forward with its environmental analysis in the face of uncertainty and/or incomplete information. With regard to the primary plan, in the EIS the NRC acknowledges the lack of complete information and provides as comprehensive an analysis as it can with the available information. For the purpose of assessing potential environmental impacts of the proposed action, staff assumes PPL will be able to successfully negotiate for the transfer of water rights for Cowanesque from TMI to BBNPP and purchase sufficient water at the Holtwood Dam hydroelectric site to provide a source of water for mitigation of TMI consumptive use. In addition, staff assumes PPL will *obtain approval to reallocate to BBNPP the 13.6 cfs (8.8 Mgd) of Cowanesque Lake water currently used to mitigate consumptive use by PPL's Montour Steam Electric Station on the West Branch of the Susquehanna River. Lastly, staff considers it feasible for PPL to expand its existing Rushton Mine water-treatment facility to provide water in the West Branch of the Susquehanna River to compensate for consumptive use by PPL's Montour Steam Electric Station. Although multiple actions would be required to implement the plan, based on PPL's description of the primary plan for consumptive-use mitigation, on SRBC's description of its requirements and its comments on the primary plan, and on the staff's independent evaluation of the available water sources as described in Sections 2.3 and 5.2.2.1, the staff determined that there is reasonable assurance that a permit for consumptive use of water in the quantities needed for the BBNPP could be obtained.*

Sections 2.2.2 and 5.2 of the EIS were modified to better explain PPL's primary plan for consumptive-use mitigation and site-specific low-flow protection and to clarify SRBC's requirements.

Comment: Slide number 12 had to do with water use. Again, I don't know how you would approve a draft EIS when the SRBC has not granted water approval. The ecological impact issue obviously should have considered 316A, 316B, thermal impacts, and also the impact of invasive species. Which it didn't do. Or thermal pollution. (**0001-1-7** [Epstein, Eric])

Response: *The comment suggests that the NRC should not issue a final EIS for the BBNPP COL until all assessments by other agencies have been completed. NEPA(42 U.S.C. § 4321 et seq.-TN661) states the Federal government's requirement to prepare an EIS for major Federal actions significantly affecting the quality of the human environment. NEPA does not require the NRC to wait until all other agency reviews are complete before issuing a final EIS. By its nature, a NEPA EIS is a planning document. The EIS need only contain a reasonably complete discussion of potential adverse impacts and mitigation measures. The EIS considers the environmental impacts of a proposed project, even if the regulation of such impacts falls outside of the NRC's jurisdiction and lies with another agency.*

While the environmental analysis under 10 CFR Part 51 requires consideration of all significant environmental impacts, it does not authorize the NRC to regulate or enforce compliance with other environmental laws and regulations. It assumes that PPL will obtain any such required permits and comply with otherwise applicable laws and regulations (environmental or otherwise). NRC will make its decision (e.g., whether to issue a license) based, in part, on a consideration of all environmental impacts, , but the NRC does not assume responsibility or jurisdiction over all environmental impacts. Unless otherwise shown, other agencies are assumed to be fulfilling their respective regulatory functions. The NRC COL, if issued, would not authorize PPL's water withdrawal or consumptive water use. In this case, PPL will be required to fully comply with any requirements imposed by the SRBC, the USACE, and any other agency with authority over any aspect of PPL's water withdrawal and consumptive water use.

Ecological impacts of the proposed plant are evaluated in Section 5.3. The thermal effects of plant discharges are evaluated in Section 5.2.3.1. No changes were made to the EIS as a result of this comment.

Comment: Communities and ecosystems that depend on limited water resources are adversely affected by the SSES which draws 40 million of water a day and returns the back wash at elevated temperatures. As of May 26, 2015, the Department of Environmental Protection is maintaining a drought watch for 27 Pennsylvania counties -including Luzerne County. Yet PPL is exempted from water conservation efforts. Should nuclear power plants continue to be exempt from drought restrictions? (**0011-3** [Epstein, Eric])

Response: *Cumulative impacts on water use and water quality from the operations of the Susquehanna Steam Electric Station (SSES) and the proposed plant are evaluated in Section 7.2. Cumulative impacts on ecosystems are evaluated in Section 7.3. The SRBC regulates the withdrawal and consumptive use of water within the basin. Sections 2.2.2 and 5.2.2.1 describe the information provided by the SRBC regarding requirements on the proposed plant for consumptive-use mitigation and site-specific low-flow protection. The commenter's question about the exemption of nuclear power plants from drought restrictions is outside the scope of this EIS. No changes were made to the EIS as a result of this comment.*

Comment: A sample of the magnitude of the amount of water used at nuclear power plants is readily evidenced at PPL's Susquehanna Steam Electric Station located on the Susquehanna River in Luzerne County. The plant draws 0.86 million gallons per day from the Susquehanna River. For each unit, 14.93 million gallons per day are lost as vapor out of the cooling tower stack while 11 million gallons per day are returned to the River as cooling tower basin blow down. On average, 29.86 million gallons per day are taken from the Susquehanna River and not returned. This data is public information, and can be easily referenced by reviewing PPL's Pennsylvania Environmental Permit Report.

The proposed PPL Bell Bend nuclear power plant will be one of the largest nuclear reactors in the world. "Due to its sheer size and because it also has a lower thermodynamic efficiency (discussed in detail below), Bell Bend will draw an inordinately large amount of water from the Susquehanna River in order to cool the reactor. The amount of water anticipated for use by the PPL proposed Bell Bend nuclear power plant is detailed in a recent report written by Normandeau Associates, paid for by PPL, and submitted to the Susquehanna River Basin Commission.["] (4 [expert witness report of A. Gunderson, ADAMS Accession No. ML15175A100]).

Recent and consistent droughts in Pennsylvania (2002) as well as flooding (2006) have forced state and regulatory bodies to reexamine water as a commodity in the Commonwealth of Pennsylvania. The SRBC Drought Management Information Sheet 5, droughts and low-water flow demonstrates that regular that droughts occur in the region. occurred quite recently, with droughts occurring every decade except the 1970s. (**0011-10** [Epstein, Eric])

Response: *Water withdrawal and consumptive water-use for the proposed plant are described in Section 3; water-use and water-quality impacts of the plant are described in Sections 4.2 and 5.2. Cumulative impacts on water use and water quality from the operations of SSES and the proposed plant are evaluated in Section 7.2. The review team's evaluation of water-use impacts was based on the existing record of flows for the potentially affected rivers. For the Susquehanna River near the proposed plant site, the flow record from 1899-2013 was used,* *which encompassed several significant drought periods. No changes were made to the EIS as a result of this comment.*

Comment: PPL's Application will further place pressure on limited water resources. Freshwater withdrawals by Americans increased by 8% from 1995-2000, and Americans per capita water withdrawal is three times above the international average. (**0011-13** [Epstein, Eric])

Comment: Nuclear plants use millions of gallons daily for coolant and to perform normal industrial applications. There are five nuclear generation units on the Susquehanna River. Two plants, with three units, are located on the Lower Susquehanna, and have the capacity to draw in as much as half the flow of a River in a day. Bell Bend will increase the pressure on the River's resources. In its application to the SRBC, PPL has requested approval for consumptive use of up to 31 mgd as a measure of conservatism and to account for variability within the range of monitoring accuracy required by SRBC. (**0011-19** [Epstein, Eric])

Response: *The evaluation of cumulative impacts on water use contained in Section 7.2 included consideration of the projected increase in consumptive water use within the Susquehanna River basin. Total consumptive use of water in the Susquehanna River Basin upstream of the BBNPP site is anticipated to increase by about 160 cfs between 2005 and 2025 (SRBC 2008-TN699), an amount that is about 1 percent of the mean annual flow at Wilkes-Barre. The cumulative impacts of this increase in consumptive use would be minor during normal conditions, but would be significant during low-flow conditions without additional mitigation. Downstream cumulative impacts from SSES and BBNPP consumptive use during low-flow periods would be minor due to the existing consumptive use mitigation plan for SSES and implementation of the primary plan for BBNPP described in Section 2.2.2. Addressing the need for additional consumptive-use mitigation in the basin is a primary concern of the SRBC No changes were made to the EIS as a result of this comment.*

Comment: How will the Corps account for the loss of water? How will the Corps track the chemicals dispersion and maintain a "chain of custody?" How often will the Corps test for differential water temperatures? (**0011-20** [Epstein, Eric])

Response: *The SRBC has the regulatory authority to approve water withdrawals and consumptive use for the proposed plant, and to impose both consumptive-use mitigation requirements and site-specific low-flow protection requirements in the form of required passby flows. PPL's primary plan for consumptive-use mitigation and site-specific low-flow protection, as presented in submissions to the NRC from PPL, is described in Section 2.2.2. SRBC's requirements for consumptive-use mitigation and site-specific low-flow protection are described in Sections 2.2.2, 2.3.2, and 5.2.2.1, and in the cited SRBC documents. As described in Section 5.2, chemical and thermal discharges to the Susquehanna River, including monitoring requirements, will be regulated by the Pennsylvania Department of Environmental Protection under the terms of the proposed plant's National Pollutant Discharge Elimination System (NPDES) permit. No changes were made to the EIS as a result of this comment.*

Comment: Water quality....thermal inversion and effluent discharges, need to be included and factored into the Bell Bend Application. (**0011-22** [Epstein, Eric])

Response: *The water-quality impacts resulting from chemical and thermal plant discharges are evaluated in Section 5.2.3. No changes were made to the EIS as a result of this comment.*

Comment: Water shortages on the Lower Susquehanna reached critical levels in the summer of 2002. During the 2002 drought, the SSES was exempted from water conservation efforts. For the month of August 2002, 66 of 67 Pennsylvania counties had below normal precipitation levels....What actions will Bell Bend take to curb water use during periods of conservation and/or drought? (**0011-23** [Epstein, Eric])

Response: *The SRBC has the regulatory authority to approve water withdrawals and consumptive use for the proposed plant, and to impose both consumptive-use mitigation requirements and site-specific low-flow protection requirements in the form of required passby flows. PPL's primary plan for consumptive-use mitigation and site-specific low-flow protection, as presented in submissions to the NRC from PPL, is described in Section 2.2.2. SRBC's requirements for consumptive-use mitigation and site-specific low-flow protection are described in Sections 2.2.2, 2.3.2, and 5.2.2.1, and in the cited SRBC documents. The review team's evaluation of water-use impacts, described in Section 5.2, was based on the existing record of flows for the potentially affected rivers. For the Susquehanna River near the proposed plant site, the flow record from 1899-2013 was used, which encompassed several significant drought periods. Sections 2.2.2 and 5.2 of the EIS were modified to better explain PPL's primary plan for consumptive-use mitigation and site-specific low-flow protection and to clarify SRBC's requirements.*

Comment: Impacts are listed as "Small" and Mitigation Measures proposed are "None". PFBC provided comments and recommendations on Water Obstruction and Encroachment Permit E40-720 to Pennsylvania Department of Environmental Protection and has been satisfied with avoidance and mitigation measures associated with construction covered by this permit. If the permit approval expires before construction or construction modification is proposed, PFBC will reevaluate any proposals through review of the most current information available. (**0009-1** [Hartle, Mark A.])

Comment: We believe the EIS conclusion is accurate regarding water quality concerns anticipated to be a local and temporary increase in suspended solids from construction. Required erosion and sedimentation measures should mitigate most construction water quality impacts. (**0009-2** [Hartle, Mark A.])

Comment: The project will reduce flow in the river by the amount of its water withdrawal and will slightly reduce the river's assimilative capacity. Anticipated impacts to water quality due to the Bell Bend withdrawal that the EIS characterizes as "Small" should be offset by low flow protection and consumptive use mitigation required by SRBC. (**0009-7** [Hartle, Mark A.])

Response: *These comments raise no issues with the conclusions of the EIS. No changes were made to the EIS as a result of these comments.*

Comment: Will both the Moxie and the Susquehanna plant be withdrawing water from the Susquehanna River? (**0010-6** [Walker, John L.])

Response: *Cumulative impacts on water use and water quality from the combined use of Susquehanna River water by the SSES and BBNPP were evaluated in Section 7.2. The review team considered the cumulative impacts of other power plants in the region of interest, including the Moxie Freedom and Panda Liberty plants. As stated in Section 7.2, these plants will not require a significant supply of water to operate. For example, the Moxie Freedom, Panda Patriot, and Panda Liberty plants identified in Table 7-1 each have approved consumptive use (peak limits) that are less than 0.05 percent of the proposed BBNPP's consumptive use.*

Comment: PPL's proposed plan leaves a significant reach of the Susquehanna River "unprotected" during low flow conditions. --- PPL proposes to use water storage at its Holtwood Dam (downstream of Harrisburg, PA) to compensate for consumptive uses downstream of Exelon's TMI plant, leaving a 35-mile reach of the Main Stem Susquehanna River without consumptive use mitigation. In the past, SRBC's policy has been that make-up water for large consumptive users must be available at the point-of-taking in an amount sufficient to offset the consumptive use as it is occurring. (**0006-4** [Cwiek, Phil])

Comment: Part of the PPL conceptual plan to provide consumptive use mitigation for BBNPP is to use storage at Holtwood Dam/Lake Aldred (Section 2.2.2, Page 2-16). Page 2-16, Line 29 - It is stated that PPL controls sufficient water at the Holtwood Dam site to compensate for consumptive use downstream of the BBNPP site. The plan proposes that the storage at Holtwood Dam would provide consumptive use mitigation for TMI to replace the mitigation capacity currently used to mitigate TMI from Cowanesque Lake, and that capacity would then be reallocated to mitigate for BBNPP.

PPL submitted an application on March 9, 2012, for the Holtwood Hydroelectric Station to provide consumptive use mitigation for BBNPP as part of a proposed Corporate Stored Asset Plan. SRBC staff responded to the application in correspondence dated June 27, 2012. SRBC found that it could not recommend approval of operations at Holtwood, as proposed at that time, to meet the mitigation requirement at BBNPP. SRBC staff's comments on the general concept of Holtwood Dam as a mitigation source included:

1. Holtwood's downstream location would leave parts of the river unmitigated during designated low flow periods for any upstream consumptive use. In order to ensure appropriate consumptive use mitigation is restored, the quantity of mitigation water "in play" must be replaced by another source upstream of the designated consumptive use.

2. The plan assumes that Safe Harbor will be operated as "run of river." Safe Harbor is not operated as a run of river facility during low flows; it is operated as a peaking facility. With no requirement in place for minimum releases and the large storage capacity at Safe Harbor, there is no assurance that inflows to Holtwood will be sufficient to maintain the proposed operating regime.

3. PPL's OASIS model of its conceptual plan for consumptive use mitigation operations at Holtwood is constructed with invalid assumptions and incorrect data and, as such, its results are unreliable.

Both Holtwood and Conowingo have minimum pool elevations and releases designated in their respective Federal Energy Regulatory Commission (FERC) licenses that should be considered in the DEIS' s evaluation of potential impacts related to storing water in Holtwood Dam during low flows. For example, although the water volume at Holtwood may be sufficient to meet consumptive use needs if that were its only purpose, there is little predictable and manageable active water storage in Lake Aldred due to FERC-licensed pool requirements.

The manipulation of releases from Holtwood Dam for consumptive use mitigation may require review under the Conowingo Pond Management Plan. The plan, issued in 2006, took 4 years to develop, requiring cooperation of 28 work group members representing 18 Pennsylvania and Maryland state agencies, municipal governments, involved utilities, and the SRBC.

Holtwood Dam is located downstream of TMI. Although the DEIS (Page 5-12) discusses the TMI release as being smaller than that for BBNPP and being located on a larger water body, it does not thoroughly evaluate the potential adverse impacts to the 35-mile unprotected reach of the main stem Susquehanna River possibly incurred by moving the mitigation source downstream. If the concept of using Holtwood Dam storage as a mitigation source for TMI is found to be unacceptable, alternate mitigation sources would need to be identified and reviewed.

Further, TMI's surface water withdrawal currently operates without passby flow requirements. Changing the mitigation source for TMI will require new reviews using current SRBC regulations and policies, including the Low Flow Protection Policy Related to Withdrawal Approvals. Should such a review demonstrate that low flow protection is required for TMI, SRBC may determine that flow augmentation needed to offset that requirement would need to be upstream of TMI, and therefore could disqualify Holtwood as a mitigation option. (**0013-10** [Dehoff, Andrew])

Response: *The SRBC has the regulatory authority to approve water withdrawals and consumptive use for the proposed plant, and to impose both consumptive-use mitigation requirements and site-specific low-flow protection requirements in the form of required passby flows. PPL's primary plan for consumptive-use mitigation and site-specific low-flow protection, as presented in submissions to the NRC from PPL, is described in Section 2.2.2 and includes a portion of the Susquehanna River below TMI that would be unaffected by releases from Holtwood intended to mitigate for TMI consumptive use. SRBC was aware of this when they provided comments to the NRC staff on PPL's primary plan. SRBC's requirements for consumptive-use mitigation and site-specific low-flow protection are described in Sections 2.2.2, 2.3.2, and 5.2.2.1, and in the cited SRBC documents. The information provided by the SRBC did not indicate that PPL's proposed use of Holtwood to provide consumptive-use mitigation for TMI would render the primary plan infeasible. Sections 2.2.2 and 5.2 of the EIS were modified to better explain PPL's primary plan for consumptive-use mitigation and site-specific low-flow protection and to clarify SRBC's requirements. Section 5.2 was revised to better describe the review team's evaluation of the potential impacts of TMI consumptive use on the Susquehanna River between TMI and Holtwood.*

Comment: Proposed changes to the water supply release plan at Cowanesque Lake would invalidate the recently completed reservoir regulation manual. ---Operating Cowanesque Lake for consumptive water use mitigation at BBNPP instead of TMI would involve a change to the trigger location (Wilkes-Barre rather than Harrisburg gage) as well as changes to the timing and amount of releases. For instance, releases for BBNPP might potentially be needed in May and June as well as the July-August-September-October-November period currently considered for SSES, TMI, and MSES. The possible impact of PPL's proposed changes at Cowanesque Lake have not been adequately investigated in the draft EIS. (**0006-6** [Cwiek, Phil])

Comment: Page 2-27, Line 10 -It is stated that "post-regulation" streamflow statistics were calculated beginning in 1981 due to the completion of the last major upstream dam in 1980. While construction of large dams has the potential to alter hydrology, it has not been demonstrated that the changes in flow statistics are solely caused by the construction of the dams and not just correlated to the timing of their construction. As stated in the DEIS, the referenced dams have a combined drainage area of approximately 12 percent of the drainage area to the Wilkes-Barre gage. Additionally, the referenced dams with a listed purpose of water supply, which would be anticipated to have a higher occurrence of supplementing low flows (rather than recreation and flood control) have a drainage area of approximately 3 percent of the drainage area to the Wilkes-Barre gage.

The "period of record" used for the analysis in the DEIS excluded the most significant historic drought periods. As acknowledged earlier in Section 2.3.1.1, the droughts of record occurred from 1930 to 1934 and from 1962 to 1965. The approximate 30-year period of record used in the DEIS analysis includes only the droughts in 1999 and 1991, which are ranked, based on number of days with flows less than the monthly P95 (July through November), as number 10 and 19 at the Wilkes-Barre gage and 11 and 20 at the Harrisburg gage for the full period of record. The most important droughts are not included in the period of record in the DEIS, which underestimates potential impacts of the project during critical low flow periods.

For the reasons articulated in the above paragraphs, for this project, SRBC staff anticipates using the entire period of record for its technical review of BBNPP applications. The NRC should do the same. At minimum, the analysis in the DEIS should be expanded at the Wilkes-Barre gage to include the entire period of record. (**0013-4** [Dehoff, Andrew])

Comment: Storage Volume. Based on a cursory review, while it appears that the combined peak day quantities for the two facilities proposed to be reallocated exceed the rates requested for the new power plant (32.6 mgd vs. 28.0 mgd), the analysis does not appear to capture the potential complexities of the proposed transfer; therefore, not providing an accurate portrayal of potential impacts.

1. SRBC' s water supply storage in Cowanesque Lake currently provides consumptive use mitigation water, while the water proposed to be allocated would be needed for both consumptive use mitigation and meeting low flow protection requirements. As the low flow protection discharges trigger prior to the consumptive use mitigation discharges, the analysis should evaluate 28.0 mgd of water being released earlier and for a longer duration of time.

2. Approximately 7,988 acre-feet of the allocations proposed to be obtained are currently released based on low flows at the U.S. Geological Survey (USGS) gage at

Harrisburg (for TMI), while the water needs for BBNPP would be released based on low flows at the USGS gage at Wilkes-Barre. The effects on reservoir storage of changing the trigger gage from the Harrisburg gage to the Wilkes-Barre gage does not appear to have been adequately evaluated in the analysis. These two gages are a straight-line distance of approximately 88 miles apart and have drainage areas that differ by over 14,000 square miles. Low flow events can be, and at times historically have been, localized in nature and the gages will reflect those differences.

3. SRBC staff completed an analysis of the full period of record for the 20 years with the greatest frequency of low flow events (days at or below monthly P95 flows) for the Harrisburg and Wilkes-Barre USGS gages. Of these 20 years, only 65 percent of the years having low flow events coincided for both gages. Of those years that did coincide, the duration of the events varied, sometimes dramatically. As an example, staff found that in 1962, 44 days of low flow occurred at Harrisburg while 71 days of low flow occurred at Wilkes-Barre. Releases may be needed on additional days when switching to the USGS gage at Wilkes-Barre.

4. For further illustration, an analysis was completed for 2 years of recent low flow events. In 1991, the demand of the existing projects proposed to be reallocated (TMI and MSES) would have been 1,065 acre-feet of water. During the same year, the proposed BBNPP would require 5,032 acre-feet, an almost five-fold increase. Similarly in 1999, demands for the projects to be reallocated was 1,474 acre-feet and proposed demand for BBNPP would be 5,117 acre-feet.

The DEIS should evaluate whether the volume of water supply storage available will be sufficient to meet BBNPP demands, throughout the entire period of record. In addition, SRBC is concerned that the DEIS analysis is incomplete in its assessment of impacts to Cowanesque Lake, particularly during the recreation season. Such an evaluation should include:

1. Expected changes to drawdown durations;

2. Potential that reservoir levels do not rebound in winter/spring; and

3. The impact of the simultaneous SSES and BBNPP drawdown. (**0013-8** [Dehoff, Andrew])

Response: *The applicant's primary plan for consumptive-use mitigation and site-specific low-flow protection, as presented in submissions to the NRC from the applicant, is described in Section 2.2.2. SRBC's requirements for consumptive-use mitigation and site-specific low-flow protection are described in Sections 2.2.2, 2.3.2, and 5.2.2.1, and in the cited SRBC documents. The review team's evaluation of water-use impacts, described in Section 5.2, considered the change in trigger location for the releases from Cowanesque Lake and included changes to the timing and amount of consumptive-use mitigation and site-specific low-flow protection releases resulting from the applicant's primary plan and SRBC's stated requirements. The review team's evaluation of water-use impacts, described in Section 5.2, was based on the existing record of flows for the potentially affected rivers. For the Susquehanna River near the proposed BBNPP site, the flow record from 1899-2013 was used, which encompassed several significant drought periods. The NRC staff evaluated the occurrence and duration of releases from Cowanesque Lake by month. In addition, the staff evaluated impacts separately for the recreation season. The NRC staff's evaluation did not* *provide information about the potential for the lake elevation to rebound in the winter/spring; the staff assumed that the lake would rebound each year and relied on modeling completed for the SRBC (EA 2012-TN3371) as the basis for that assumption.*

Sections 2.2.2 and 5.2.2.1 of the EIS were modified to better explain PPL's primary plan for consumptive-use mitigation and site-specific low-flow protection and to clarify SRBC's requirements. Sections 2.3.1 and 5.2.2.1 were revised to reflect the use of the long flow record and the evaluation of significant drought periods. The discussion in Section 7.2 of the cumulative impact to Cowanesque Lake from operation of SSES and the proposed BBNPP was similarly revised.

Comment: Additional storage reallocation from flood control to water supply at Cowanesque Lake is not an option. Earlier investigations by COE resulted in a recommendation to reallocate a portion of Cowanesque Lake's flood control storage to water supply storage. The full amount of reallocated storage was subsequently purchased by SRBC. These same investigations also concluded that any additional reallocation of flood control storage space would significantly and adversely affect the flood risk management purpose for which the project was originally authorized and constructed. (**0006-8** [Cwiek, Phil])

Response: *As described in Section 7.2, under PPL's primary plan for consumptive-use mitigation and site-specific low-flow protection, and using the requirements provided by the SRBC, the NRC staff determined that the conditions of the record drought year (1964) would result in a demand for releases from Cowanesque Lake in an amount greater than the available water supply storage. However, the staff's evaluation did not consider nor assume that Cowanesque Lake storage would be reallocated from flood control to water supply to satisfy this demand. No changes were made to the EIS as a result of this comment.*

Comment: The Draft EIS provides a good understanding of the effects of climate change. It also provides estimates of greenhouse gas emissions of the proposed alternatives. These assessments are beneficial in order for the NRC to make an informed decision on the project and take into account the Council on Environmental Quality draft guidance (https://www.whitehouse.gov/administration/eop/ceq/initiatives/nepa/ghg-guidance) on Climate Change. However, the Draft EIS does not include a discussion on the Climate Change adaptation measures incorporated into the alternatives to determine resiliency. As stated in the Draft EIS, this project is in one of the most flood-prone areas in the United States. For this reason, EPA recommends that NRC include a discussion on how it will monitor any changes to the environment as a result of climate change that may affect the operation of the proposed alternatives and include the appropriate adaptation measures that may be required. (**0012-13** [Lapp, Jeffrey])

Response: *The potential effects of climate change on water-use and water-quality impacts are discussed in Section 7.2. The review team determined that while the hydrologic changes that are attributed to climate change may noticeably alter the water resources within the Susquehanna River Basin, the review team did not identify anything that suggests the cumulative impacts would be destabilizing. In addition, the potential effects of climate change on water resources were similar for the alternative sites considered. NRC's regulatory role in environmental monitoring is limited to radiological monitoring, described in Section 5.9.6. Water* *monitoring during operation of the proposed BBNPP is discussed in Section 5.2.4. No changes were made to the EIS as a result of this comment.*

Comment: According the Draft EIS, PPL (now Talen Energy) has determined that the combined dewatering activities related to the construction of the nuclear island structures, the cooling water towers, and the Essential Service Water Emergency Make-up System would reduce groundwater base flow to Walker Run by 201,600 gallons per day (page 414 Draft EIS). Further stated that the reduction is about 5% of the estimated annual average discharge rate for the Walker Run watershed. According to Pennsylvania Department of Environmental Protection, Walker Run has a designated use as a Cold Water and Migratory Fishery. The Pennsylvania Fish and Boat Commission has designated Walker Run as a Wild Trout Stream. Both designations underscores the value of the aquatic resource. By evaluating the groundwater reduction impact on an annual average impact does not go far enough in assessing the impact to the stream and associated wetlands. Evaluating the impact of reduced flow based on annual average flow is not protective of summer low flows on the aquatic resource. Impacts on summer flow could be as much as 30% of the normal stream flow. It is recommended that the reduced groundwater base flow be compared to the critical summer flows of Walker Run.

Approaches to avoidance of the impact to base flow should be assessed. Contingencies and adaptive management for potential reduced flows should be presented. (**0012-4** [Lapp, Jeffrey])

Response: *The available information on groundwater recharge in the Walker Run watershed and groundwater discharge to Walker Run is limited to average information inferred from studies in other watersheds. In Section 4.2.1, the review team used this information to estimate that the excavation dewatering could potentially reduce average baseflow in Walker Run by 8 percent. The review team revised Section 4.2.1 to indicate that the amount of dewatering required is expected to vary with local conditions and is expected to be less during relatively dry conditions when the groundwater elevation is relatively low. This will tend to reduce the impact of dewatering on flow in Walker Run; Section 4.2.2.1 was revised to reflect this conclusion.*

Comment: Reader's Guide, Page 9 .:_The third paragraph relates the proposed consumptive use of surface water as a percent of mean annual flow but there is no similar mention of the consumptive use as a percent of low flows. Potential impacts would be expected to most likely occur during low flow events. As such, relating the consumptive use to low flows (7Q10, or monthly P95 during low flow months) would more accurately convey the magnitude and potential impact of the consumptive use to the general reader. (**0013-3** [Dehoff, Andrew])

Response: *The Reader's Guide was revised to include the review team's evaluation of the impact of consumptive use on low flows.*

Comment: Table 5-1 does not seem to consider the additional reduction of NBSR flows as measured at Wilkes-Barre from SSES, which underestimates the potential adverse cumulative impacts related to the project. (**0013-15** [Dehoff, Andrew])

Response: *Table 5-1 quantifies the percent reduction in Susquehanna River flow from the withdrawal and consumptive use of the proposed BBNPP. For the mean annual flow, the reduction of river flow by the SSES consumptive use has no effect on the percent reduction due* *to the proposed plant. At the low flows, the NRC staff assumed that the effect of SSES consumptive use on the river flow would be mitigated by upstream releases. No changes were made to the EIS as a result of this comment.*

E.2.4 Comments Concerning Ecology - Terrestrial

Comment: I do have the same concerns; what it's going to affect our environment, how's it going to affect the wildlife around there; we have some beautiful wetlands around there[.] (0002-2-3 [Dennis, Lori])

Response: *The review team describes wetlands and wildlife in the project area in Section 2.4.1. The description of wetlands includes information from a wetland functions and values assessment conducted by PPL using the USACE Highway Methodology, a process that includes consideration of multiple wetland functions and values, including but not limited to wildlife habitat and aesthetics. The review team discusses potential impacts to wildlife and wetlands from development of the BBNPP site in Section 4.3.1, and potential impacts to wildlife and wetlands from operation of BBNPP in Section 5.3.1. No changes were made to the EIS as a result of this comment.*

Comment: The Northern cricket frog (*Acris crepitans*), a state endangered species, may be affected by plant construction and operation. PFBC responded to a Pennsylvania Natural Diversity Inventory search associated with the Bell Bend Plant with a Species Impact Review #43303 dated October 27, 2014. This letter, which is attached, indicated that the Northern cricket frog is a species of concern at the site. Surveys, seasonal restrictions and other measures to protect this animal may be recommended by our agency to assess presence of this species or to avoid or minimize impacts. This review is valid for two years. (0009-3 [Hartle, Mark A.])

Response: *Section 2.4.1 discusses the two northern cricket frog individuals that were recorded by PPL in November 2007 based on nonbreeding calls at different wetland locations along Walker Run on the BBNPP site. Section 4.3.1 discusses potential impacts to the species from site-preparation and wetland-mitigation activities. No impacts to the northern cricket frog are anticipated from BBNPP operation; thus, the species is not discussed in Section 5.3.1. The review team has revised the EIS to include a summary of the Pennsylvania Fish and Boat Commission (PFBC) Species Impact Review letter #43303 (ML15204A772) of October 27, 2014, noting that PFBC may require further surveys prior to activities that could impact the northern cricket frog on the BBNPP site. It should be noted, however, that the applicant would be responsible for these surveys and not the NRC.*

Comment: Other than the endangered species listed above, PFBC is satisfied with avoidance measures implemented to date in construction plans. Most wetland impacts will be avoided. The EIS describes proposed mitigation that includes a stream and floodplain restoration project on two reaches of Walker Run and restoration of the North Branch Canal System. PFBC reviewed the Walker Run restoration project plans and is satisfied with the improved ecological values provided by the project as mitigation. In our comments to Pennsylvania DEP regarding Water Obstruction and Encroachment Permit E40-720, we stated that, "While there are stream and wetland impacts at this site, the proposed stream channel relocation and wetland mitigation will increase aquatic resources on and adjacent to this site." (0009-4 [Hartle, Mark A.])

Response: *Comment noted. Section 4.3.1 discusses the wetland avoidance and wetland mitigation measures proposed by PPL (now Talen). No changes were made to the EIS as a result of this comment.*

Comment: The Draft EIS should contain a table that clearly outlines the proposed temporary, permeant and conversion impacts to all wetland and streams on site for all phases of the project. EPA appreciates the applicant's efforts to work with the regulatory agencies to avoid and minimize impacts. When PPL first approached the resource agencies in June 2008, the site plan identified jurisdictional wetland impacts for approximately 100 acres (ac). By September 2008, PPL had reduced impacts to wetland to about 38 ac and were further reduced to approximately 27 ac by August 2009, and to approximately 11 ac in the present design as presented in the in the Draft EIS. Of the currently proposed impacts, 1.21 ac will be permanently filled and 9 ac will be converted from Palustrine Forested to Shrub/Scrub. (0012-8 [Lapp, Jeffrey])

Response: *Wetland impacts and mitigation are described in Section 4.3.1. Table 4-2 in Section 4.3.1 (terrestrial ecology) summarizes the temporary, permanent, and conversion impacts to wetland types on the BBNPP site in Important Bird Area No. 72 and the Susquehanna Riverlands Environmental Preserve. A new table (Table 4-3) has been added to Section 4.3.1 listing permanent and temporary wetland impacts at various stages in development of the site plan to illustrate the reduction in wetland impacts over time. Tables 4-2 and 4-3 have been footnoted to indicate that temporary and permanent impacts to BBNPP water resources are summarized in Table 4-7 in Section 4.3.2 (Aquatic Ecology).*

Comment: The BBNPP project site is located within the known swarming radius of three Indiana bat and one northern long-cared bat hibernacula and contains potential summer habitat for both species.

Based on a review of the effects analysis outlined in the BA, the Service does not concur with the NRC's effect determination of "may affect, but are not likely to adversely affect" for the Indiana bat or northern long-eared bat. Although the Service appreciates the proposed minimization and protection measures outlined in the BA, the loss 315 acres of Indiana and northern long-cared bat swarming and potential summer habitat is significant and not discountable.

While we cannot concur with your effect determination, we also do not feel it is appropriate for us to make an alternative determination if you have the additional information available to support your conclusion. NRC may either provide additional information that supports your determination, or request that the biological assessment serve as an initiation package in accordance with 50 CFR 402.14 and request that we initiate formal consultation pursuant to section 7 of the Endangered Species Act of 1973, as amended (87 Stat. 884; 16 U.S.C. 1531 et seq.) for the BBNPP and adverse effects that construction and operation are likely to have on Indiana bat and northern long-eared bat. Under provisions of section 7(a)(2) of the Act, a federal agency that authorizes, permits, or carries out activities must consult with the Fish and Wildlife Service to ensure that its actions will not jeopardize the continued existence of any listed species. Formal consultation concludes with the Service's issuance of a biological opinion. (0014-1 [Zimmerman, Lora])

Response: *Section 2.4.1 discusses the life history, habitat requirements, and occurrences of the Indiana bat and northern long-eared bat (NLEB) in the project area. Section 4.3.1 discusses potential impacts to both bat species from preconstruction and construction activities. Section 4.3.1 also discusses PPL's proposed mitigation for the Indiana bat, which may also concurrently serve as mitigation for the NLEB, whose life history is similar. Section 5.3.1 discusses potential impacts to both species from operation and maintenance activities. Sections 4.3.1 and 5.3.1 note that the review team has prepared a biological assessment addressing the subject bat species (NRC and USACE 2015-TN4435). The review team has expanded the EIS to include detailed information on the life history and habitat requirements of both species, as well as potential impacts to the species, from the biological assessment (NRC and USACE 2015-TN4435). In April 2015, the NRC initiated formal consultation with FWS in accordance with 50 CFR 402.14 under Section 7 of the Endangered Species Act concerning likely adverse effects on the Indiana bat and NLEB. The NRC received a biological opinion and incidental take statement (FWS 2015-TN4436) from FWS in November 2015 which concludes formal consultation.*

Comment: Your project is located adjacent to Important Bird Area (IBA) number 72. IBAs are designated by the Pennsylvania Ornithological Technical Committee. They are the most critical regions in the Commonwealth for conserving bird diversity and abundance, and are the primary focus of Audubon Pennsylvania's conservation efforts. To find out more information about this IBA, including which bird species breed there, visit: http://netapp.audubon.org/IBA/State/US-PA?

The potential exists for avian mortality from habitat destruction and collision with two 475-foot cooling towers within the project boundaries. Site-specific factors that should be considered in project siting to avoid and minimize the risk to birds include avian abundance; the quality, quantity and type of habitat; geographic location: type and extent of bird use (e.g. breeding. foraging. migrating, etc.); and landscape features. Please review the enclosed information for general recommendations for avoiding and minimizing impacts to migratory birds within and around the project area. Please be aware that since these arc general guidelines, some of them may not be applicable to the current project design or they may have already been included in the project design. (0014-2 [Zimmerman, Lora])

Response: *The EIS acknowledges that the project footprint overlaps with part of IBA No. 72 (Figures 2-27 and 4-2). Section 2.4.1 characterizes IBA No. 72 and the avifauna it supports. Section 4.3.1 discusses reductions in the availability and suitability of nesting and spring/fall staging due to habitat loss, conversion and fragmentation that would result from site preparation activities. Section 5.3.1 discusses impacts to avifauna from collisions with cooling towers during plant operation and concludes that only minimal impacts to local bird populations are anticipated. The review team broadened and added detail to the evaluation of potential impacts to avian species in the EIS by considering applicable types of impacts in the attachment to the U.S. Fish and Wildlife Service letter #2009-0501 of August 5, 2015 (ML15225A426) entitled "Adaptive Management Practices for Conserving Migratory Birds."*

Comment: The Service recommends that applicants carefully evaluate their proposed project in light of the National Bald Eagle Management Guidelines to determine whether or not eagles might be disturbed as a direct or indirect result of the project. These guidelines as well as additional eagle information are available at http://www.fws.gov/northeast/ecologicalservices/eagle.html. To assist you in making a decision regarding impacts to bald eagles in Pennsylvania, a screening form and map of known bald eagle nests in 2013 can be found at http://www.fws.gov/northeast/pafo/bald eagle.html

The siting and construction of new towers creates a potentially significant impact on migratory birds, especially some 350 species of night-migrating birds. The primary factors that affect the magnitude of the risk to birds posed by a particular tower are the height of the structure above the surrounding landscape; whether the structure is lighted, and if so, the type of lighting employed; the use of guy wires; the location of the tower; and the weather patterns in the area of the tower site. Communication towers are estimated to kill 4-5 million birds per year. Most massive bird kills occur as the birds become attracted to and confused by clouds that are illuminated by tall lighted structures. (0014-3 [Zimmerman, Lora])

Response: *Section 2.4.1 discusses bald eagle presence in and use of the project area. Section 4.3.1 discusses negligible impacts to the bald eagle from preconstruction and construction activities. Section 5.3.1 discusses negligible impacts to the bald eagle from operation and maintenance activities. The review team has updated the EIS to include information from the National Bald Eagle Management Guidelines and the locations of bald eagle nests in Pennsylvania as of 2014. Section 5.3.1 discusses impacts to avifauna from collisions with cooling towers during plant operation, and concludes that impacts to local bird populations would be minimal, basing the analysis largely on previous studies of avian collisions with the co-located SSES cooling towers. The project will include installation of a meteorological tower, but not communication towers. The review team has added information to Section 5.3.1 regarding potential avian collisions (including night-migrating birds) with the meteorological tower. Updated information has not altered the conclusions presented in the draft EIS.*

Comment: Any company/licensee proposing to site a new communications tower is strongly encouraged to co-locate the communications equipment on an existing communication tower or related structure (e.g., church steeple, billboard mount, monopole, or building mount). Depending on tower load factors, from 6-10 providers may co-locate on an existing tower. (0014-4 [Zimmerman, Lora])

Response: *The project will include installation of a meteorological tower, but not communication towers. The review team has added information to Section 5.3.1 regarding potential avian collisions with the meteorological tower. Updated information has not altered the conclusions presented in the draft EIS.*

Comment: If co-location is not feasible, providers are strongly encouraged to construct towers less than 200 feet above ground level, using construction techniques which do not require guy wires (e.g., use a monopole). Such towers should be unlighted. If at all possible, new towers should be located within existing "antenna farms," preferably in areas not used by migratory birds or listed species. Avoid siting towers in or near (within 3-5 miles) of wetlands, other known bird concentration areas (e.g., Important Bird Areas, refuges), or in critical habitat of threatened or endangered species known to be affected by towers. Review local meteorological conditions, and avoid siting towers in areas with an especially high incidence of fog, mist, and low ceilings. (0014-5 [Zimmerman, Lora])

Response: *The project will include installation of a 197-ft meteorological tower, but no towers will be greater than 200 ft tall other than two 475-ft cooling towers. The proposed BBNPP cooling towers are sited near wetlands and IBA No. 72. Section 5.3.1 discusses impacts to avifauna from collisions with the cooling towers during plant operation, and concludes that impacts to local bird populations would be minimal, basing the analysis largely on previous studies of avian collisions with the co-located SSES cooling towers. The review team has added information to the EIS regarding potential avian collisions with the meteorological tower. Updated information has not altered the conclusions presented in the draft EIS.*

Comment: If taller (>200 feet above ground level) towers requiring lights for aviation safety must be constructed, the minimum amount of pilot warning and obstruction avoidance lighting required by the Federal Aviation Administration should be used. Wherever possible, non-flashing lights should not be used. (0014-6 [Zimmerman, Lora])

Response: *The two proposed cooling towers would be 475 ft tall. Section 5.3.1 discusses impacts to avifauna from collisions with the cooling towers during plant operation, and concludes that impacts to local bird populations would be minimal, basing the analysis largely on previous studies of avian collisions with the co-located SSES cooling towers. As discussed in Section 5.3.1, PPL intends to follow Federal Aviation Administration (FAA) requirements regarding lighting of the cooling towers. Strobe lights and minimal lighting levels dictated by FAA regulations would be used to reduce the risk of bird collisions. No changes were made to the EIS as a result of this comment.*

Comment: Towers which must use guy wires for support should have daytime visual markers on the wires to minimize collisions by these diurnally moving species, especially if constructed in known raptor or waterbird concentration areas. (0014-7 [Zimmerman, Lora])

Response: *The only proposed BBNPP tower that would employ guy wires is the meteorological tower. The review team added an evaluation of avian mortality due to potential collisions with the meteorological tower and associated guy wires, including the possible need for visual markers, to Section 5.3.1. Updated information has not altered the conclusions presented in the draft EIS.*

Comment: Towers should be constructed so as to limit or minimize habitat loss within the tower "footprint." Road access and fencing should be minimized to reduce or prevent habitat fragmentation and disturbance, and to reduce above-ground obstacles to birds in flight. However, a larger tower footprint is preferable to the use of guy wires in construction. (0014-8 [Zimmerman, Lora])

Response: *Section 3.2.2.2 discusses the two cooling towers that would be built and operated as part of the project. The two cooling towers (which would not require guy wires) would occupy only about 14 ac consisting primarily of old-field and fragmented upland forest habitat. Because* *the cooling towers would be situated adjacent to the power block, they would not further fragment remaining habitat on the BBNPP site. Section 5.3.1 discusses impacts to avifauna from collisions with the cooling towers during plant operation; only minimal impacts to local bird populations are anticipated. No changes were made to the EIS as a result of this comment.*

Comment: Where disturbance is necessary, clear natural or semi-natural habitats (e.g., forests, woodlots, reverting fields, shrubby areas) and perform maintenance activities (e.g., mowing) between September 1 and March 31, which is outside the nesting season for most native bird species. Without undertaking specific analysis of breeding species and their respective nesting seasons on the project site, implementation of this seasonal restriction will avoid take of most breeding birds, their nests, and their young (i.e., eggs, hatchlings, fledglings). (0014-9 [Zimmerman, Lora])

Response: *The applicant's intention to restrict clearing of trees greater than 5 inches diameter at breast height (DBH) to November 15 through March 31, in order to protect the Federally endangered Indiana bat, was revised to 3 inches DBH, in order to also protect the Federally threatened northern long-eared bat, in Section 4.3.1, in accordance with the terms and conditions in the FWS incidental take statement (ITS) (ML15345A142) received by NRC in November 2015. ITS terms and conditions also include reporting of any endangered or threatened species found dead or injured as a result of the implementation of the BBNPP project. The NRC will require applicant compliance with these (and other) terms and conditions of the ITS by including them as conditions in its COL.Section 4.3.1 also discusses how the seasonal tree cutting restriction would reduce impacts to migratory birds that nest in forest habitat, their nests, and young. PPL is not required by natural resource agencies to recognize seasonal constraints for clearing other habitats. Section 4.3.1 explains that wildlife inhabiting these habitats could be adversely affected by site preparation activities. Section 4.3.1 has been revised to address the potential impacts of the timing of site preparation on birds and other wildlife, including those using non-forested habitat. Updated information has not altered the conclusions presented in the draft EIS.*

Comment: New towers should be designed structurally and electrically to accommodate the applicant's antennas and comparable antennas for at least two additional users (minimum of three users required for each tower structure), in order to reduce the number of towers needed in the future, unless this design would require the addition of lights or guy wires to an otherwise unlighted and/or unguyed tower. (0014-10 [Zimmerman, Lora])

Response: *The project will include installation of a meteorological tower, but not communication towers. The review team has added information to the EIS regarding potential avian collisions with the meteorological tower. Updated information has not altered the conclusions presented in the draft EIS.*

Comment: Security lighting for on-ground facilities and equipment should be down-shielded to keep light within the boundaries of the site. (0014-11 [Zimmerman, Lora])

Response: *Security lighting is not addressed in the EIS. Section 5.3.1 has been expanded to include a discussion of the potential adverse (although minimal) effects of artificial lighting and the potential benefits of down-shielding lights.*

Comment: If a tower is constructed, and if requested, Service personnel should be allowed access to the site after construction is complete to conduct both large (e.g., crane, swan, and goose) and small dead-bird searches, to place net catchments below the towers, and to place radar, Global Positioning System, infrared, thermal imagery, or acoustical monitoring equipment as necessary to assess and verify bird migrations and habitat use. (0014-12 [Zimmerman, Lora])

Response: *PPL would address access to the site for the purpose of conducting avian collision mortality, habitat use, and bird migration studies in accordance with any agreements, commitments or requirements they may have with wildlife regulatory agencies. No changes were made to the EIS as a result of this comment.*

Comment: Towers no longer in use or determined to be obsolete should be removed within 12 months of cessation of use. (0014-13 [Zimmerman, Lora])

Response: *Section 5.3.1 discusses impacts to avifauna from collisions with cooling towers during plant operation and concludes that only minimal impacts to local bird populations are anticipated. The project will include installation of a meteorological tower, and the review team has added information to Section 5.3.1 regarding potential avian collisions with the meteorological tower. The review team assumes the applicant will employ both the cooling towers and the meteorological tower throughout the duration of plant operation. However, removal of facilities, including towers, no longer in use or obsolete from the BBNPP site would be at the discretion of PPL who would obtain any necessary permits from applicable regulatory agencies and time the removal accordingly. Updated information has not altered the conclusions presented in the draft EIS.*

Comment: Where disturbance is necessary, clear natural or semi-natural habitats (e.g., forests, woodlots, reverting fields, shrubby areas) and perform maintenance activities (e.g., mowing) between September 1 and March 31, which is outside the nesting season for most native bird species. Without undertaking specific analysis of breeding species and their respective nesting seasons on the project site, implementation of this seasonal restriction will avoid take of most breeding birds, their nests, and their young (i.e., eggs, hatchlings, fledglings). (0014-14 [Zimmerman, Lora])

Response: *The applicant's intention to restrict clearing of trees greater than 5 inches diameter at breast height (DBH) to November 15 through March 31, in order to protect the Federally endangered Indiana bat, was revised to 3 inches DBH, in order to also protect the Federally threatened northern long-eared bat, in Section 4.3.1 in accordance with the terms and conditions in the FWS incidental take statement (ITS) (FWS 2015-TN4436) received by NRC in November 2015. ITS terms and conditions also include reporting of any endangered or threatened species found dead or injured as a result of the implementation of the BBNPP project. The NRC will require applicant compliance with these (and other) terms and conditions of the ITS by including them as conditions in its COL. Section 4.3.1 also discusses how the seasonal tree cutting restriction would reduce impacts to migratory birds that* *nest in forest habitat, their nests, and young. PPL (now Talen) is not required by natural resource agencies to recognize seasonal constraints for clearing other habitats. Section 4.3.1 explains that wildlife inhabiting these habitats could be adversely affected by site preparation activities. Section 4.3.1 has been revised to address the potential impacts of the timing of site preparation on birds and other wildlife, including those using non-forested habitat. Updated information has not altered the conclusions presented in the draft EIS.*

Comment: Minimize land and vegetation disturbance during project design and construction. To reduce habitat fragmentation, co-locate roads, fences, lay down areas, staging areas, and other infrastructure in or immediately adjacent to already-disturbed areas (e.g., existing roads, pipelines, agricultural fields) and cluster development features (e.g., buildings, roads) as opposed to distributing them throughout land parcels. Where this is not possible, minimize roads, fences, and other infrastructure. (0014-15 [Zimmerman, Lora])

Response: *The plant would be co-located adjacent to the existing SSES (Section 2). Section 4.3.1 describes PPL's iterative revision of the plant layout to reduce encroachment into jurisdictional wetlands. Further, PPL has minimized encroachment into IBA No. 72 to the extent practicable while siting the project within its property boundary. The layout depicted in Figures 2-27 and 4-2 avoids most wetlands and the majority of IBA No. 72 and the Susquehanna Riverlands Environmental Preserve (SREP). Some impacts to wetlands, IBA No. 72, and the SREP are nevertheless unavoidable; these are described in Section 4.3.1. Section 10.2.1 has been updated to address unavoidable adverse impacts to IBA No. 72 and the SREP. Fragmentation of forest habitat would also be unavoidable and noticeable. Section 4.3.1 describes the potential effects of forest fragmentation on forest interior birds.*

Comment: Avoid permanent habitat alterations in areas where birds are highly concentrated. Examples of high concentration areas for birds are wetlands, State or Federal refuges, Audubon Important Bird Areas, private duck clubs, staging areas, rookeries, leks, roosts, and riparian areas. Avoid establishing sizable structures along known bird migration pathways or known daily movement flyways (e.g., between roosting and feeding areas). (0014-16 [Zimmerman, Lora])

Response: *Section 4.3.1 describes PPL's iterative revision of the plant layout to reduce encroachment into jurisdictional wetlands. Section 4.3.1 has been revised to note that through this process PPL has also reduced encroachment into IBA No. 72. Developing the BBNPP as depicted in Figures 2-27 and 4-2 avoids most wetlands and the majority of IBA No. 72 and the SREP. Some impacts to wetlands, IBA No. 72, and the SREP are nevertheless unavoidable; these are described in Section 4.3.1. Section 10.2.1 has been updated to note unavoidable adverse impacts to IBA No. 72 and the SREP. Two 475-ft cooling towers would be sited on the BBNPP site along the North Branch Susquehanna River (Section 3.2.2.2), which may serve as an avian migration corridor based on seasonal use of IBA No. 72 by some bird species (Sections 2.4.1 and 4.3.1). Section 5.3.1 discusses impacts to avifauna from collisions with the cooling towers during plant operation, and minimal impacts to local bird populations are anticipated.*

Comment: To conserve area-sensitive species, avoid fragmenting large, contiguous tracts of wildlife habitat, especially if habitat cannot be fully restored after construction. Maintain contiguous habitat corridors to facilitate wildlife dispersal. Where practicable, concentrate construction activities, infrastructure, and man-made structures (e.g., buildings, cell towers, roads, parking lots) on lands already altered or cultivated, and away from areas of intact and healthy native habitats. If not feasible, select fragmented or degraded habitats over relatively intact areas. (0014-17 [Zimmerman, Lora])

Response: *PPL's proposed layout of the BBNPP as depicted in Figures 2-27 and 4-2 avoids most wetlands and the majority of IBA No. 72 and the SREP. These avoided areas encompass much of the intact forest habitat on the BBNPP site. Some impacts to wetlands, IBA No. 72, and the SREP are nevertheless unavoidable, and some impacts would occur in old-field/former agricultural and scrub/shrub habitat (Figure 4-2). All these impacts are described in Section 4.3.1. Section 10.2.1 has been updated to address unavoidable adverse impacts to IBA No. 72 and the SREP. Some fragmentation of forest habitat would also be unavoidable and noticeable. The review team describes the potential effects of forest fragmentation on forest interior birds in Section 4.3.1 and concludes that occupancy of the BBNPP site and IBA No. 72 by forest interior birds would likely be noticeably reduced. This fact is a contributor to the review team's overall conclusion of MODERATE impacts to terrestrial ecology in Section 4.3.1. Most areas of relatively intact forest habitat on the BBNPP site that connect to other large areas of relatively intact forest habitat offsite would remain following construction and may function as wildlife dispersal/travel corridors through the developed site. These areas occur along the North Branch Susquehanna River, the northern and southwestern parts of the site, and to a lesser extent in the southeastern portion of the site (Figure 4-2). Section 4.3.1 has been updated to include a more detailed discussion of the post-construction connectivity of onsite forest with offsite forest.*

Comment: Develop a habitat restoration plan for the proposed site that avoids or minimizes negative impacts to birds, and that creates functional habitat for a variety of bird species. Use only plant species that are native to the local area for revegetation of the project area. (0014-18 [Zimmerman, Lora])

Response: *Section 4.3.1 indicates that temporarily disturbed upland forest, old field, and wetland habitat would be restored by grading and revegetating with native plant species to the extent practicable, and then allowed to revert to a natural state. Revegetation and natural succession is expected to create habitat for avian species favoring native habitats over time. No changes were made to the EIS as a result of this comment.*

E.2.5 Comments Concerning Ecology - Aquatic

Comment: PFBC provided comments and reviewed results on an Instream Flow Incremental Methodology study that evaluated impacts of the proposed Bell Bend water withdrawal on fish and mussels. Small impacts during low flow conditions were shown for a riffle fish species, Northern Hogsucker (*Hypentilium nigricans*) and Green Floater, *Lasmigona subviridis*, a mussel that utilizes shallow fine substrate habitat. The Susquehanna River Basin Commission in its December 28, 2012 letter, which is provided, specified a passby flow equal to the monthly flow that is exceeded 95% of the time from May through October. PFBC is satisfied that the low flow protection required by SRBC will negate operational impacts to riverine habitat at low flows. (**0009-6** [Hartle, Mark A.])

Response: *This comment supports operational effects conclusions in Section 5.3.2 in relation to flow conditions in the Susquehanna River. Section 5.3.2 of the EIS has been revised to include additional context regarding effects of low-flow conditions to habitats that support several fish species.*

Comment: Provision of consumptive use mitigation water from Cowanesque Reservoir will draw the reservoir down over short periods in infrequent low flow events, which will affect aquatic plants, juvenile fish, amphibians, snakes and turtles in the water storage reservoir as indicated in Section 10 of the EIS. PFBC has not requested any activities to modify or mitigate impacts. (**0009-9** [Hartle, Mark A.])

Response: *This comment provides no new information and no changes were made to the EIS as a result of this comment.*

Comment: The EIS denotes "Small" impacts due, in part, to impingement and entrainment of fish and aquatic life at the project intake. A study of Bell Bend (up to 42 MGD) impingement and entrainment impacts was performed by PPL by examining impingement and entrainment of fish at the existing Susquehanna Steam Electric Station intake (58.32 MGD withdrawal). PFBC is extremely concerned about fish lost through operation of this project. The Susquehanna Steam Electric Station (SSES) withdraws water from the same pool as planned for Bell Bend' withdrawal of up to 42 MGD. We conducted an analysis which assumes that impacts at Bell Bend would be similar to the Susquehanna Steam Electric Station, which has a fish friendly intake in terms of screen size, orientation and intake velocity and prorated impacts to the size of the Bell Bend withdrawal. Table 1 attached to this letter defines the number and dollar value of fish expected to be trapped against the intake screen (impingement) at the project site. A total of 128 fish with a replacement value of $96 per year are expected to be lost through impingement. This is a small number and value. Table 2, however, shows the number and dollar value of fish expected to be lost through the intake screen (entrainment) at the project site is projected as 9.6 million fish per year with a replacement value of $2.6 million dollars. PFBC supports any measures that may be incorporated into intake design and construction to limit entrainment losses and will request mitigation for this substantial number of fish lost to the Susquehanna River if the Bell Bend Nuclear Power Plant is licensed and operated. We note that this loss is compounded by the number of fish lost at the SSES intake. (**0009-8** [Hartle, Mark A.])

Response: *The commenter provides an assessment of impingement and entrainment losses based on a PPL study (Normandeau 2010-TN491). The review team agrees with the commenter's conclusion regarding minimal effects on aquatic resources from impingement losses. However, the commenter assumes the number of entrained organisms corresponds equally to individual fish. Section 5.3.2 of the EIS describes the entrainment samples consisting of fish eggs and larvae primarily from species that are prolific spawners. In addition, fish egg and larvae mortality rates from natural causes were not considered in the commenter's assessment. An expanded discussion on entrainment losses in relation to corresponding equivalent adults is provided in Section 5.3.2 of the EIS for context to assess entrainment losses.*

Comment: The Applicant did not address water quality, water use, aquatic communities, groundwater use, entrainment and impingement, and impact microbiologic organisms throughout the license application, but offered only cursory and superficial data, and failed to address numerous issues that could adversely impact the area surrounding the proposed plant. (0011-11 [Epstein, Eric])

Response: *The commenter is concerned that the information provided to the NRC by the applicant did not address hydrology, aquatic ecology, or microbiological organisms in sufficient detail. The review team reviewed the applicant's Environmental Report, and additional resources pertaining to these resource areas that were obtained from Federal and State agencies, research literature, and local media. The review team conducts an independent assessment from these numerous sources in addition to the applicant's Environmental report and describes the conclusions in the EIS. No changes were made to the EIS as a result of this comment.*

Comment: Millions of fish (game and consumable), fish eggs, shellfish and other organisms are sucked out of the Susquehanna River and killed by nuclear power plants annually. Now large water consumers, including PPL, are compelled to invetorize mortality rates and identify species of aquatic life affected by water intakes. (**0011-14** [Epstein, Eric])

Comment: [F]ish kills [need to be included and factored into the Bell Bend Application.] (**0011-21** [Epstein, Eric])

Response: *The commenter is concerned about aquatic organism mortality as a result of cooling-water-intake operation. The BBNPP cooling-water-intake system must comply with EPA's Clean Water Act Section 316(b) Phase I requirements specified in 40 CFR 125.84 (TN254) for intake structures. Impingement and entrainment losses from operation of the BBNPP are described in Section 5.3.2. No changes were made to the EIS as a result of this comment.*

Comment: What impact will the Application have on shad ladders? What impact will this Application have on sport and commercial fishing? (**0011-16** [Epstein, Eric])

Response: *The commenter is concerned about the construction and operation effects of BBNPP on shad ladders, commercial, and recreational fishing. The Pennsylvania Fish and Boat Commission maintains fish ladders for migratory fishes at locations well to the south of the BBNPP site; these fish ladders will not be affected by BBNPP construction and operation. Construction and operation effects to recreational and commercial fishing are described in Sections 4.3.2 and 5.3.2, respectively. No changes were made to the EIS as a result of this comment.*

Comment: It is not uncommon for the plants to discharge chlorinated water (necessary to minimize bacterial contamination of turbines) or Clamtrol (chemical agent used to defeat Asiatic clam infestation) directly into the River. Will the water be treated with, chemicals? How does PPL plan to defeat Asiatic clam and/or Zebra mussel infestations? (**0011-18** [Epstein, Eric])

Response: *Section 3.4.4 of the EIS describes the concentration and use of biocides, anti-scalants, and chemical neutralizers during operation. Section 5.3.2 of the EIS describes the effects of these chemicals to aquatic resources, and the incidence of invasive species such as* *the Asiatic clam and zebra mussels, and determined that discharge of biocides, anti-scalants, and chemical neutralizers would not noticeably affect aquatic resources. No changes were made to the EIS as a result of this comment.*

Comment: Impingement and entrainment -Susquehanna River Intake System. While the intake structure design will meet EPA design threshold of 0.5 fps for intake through-screen velocity, EPA recommends the analysis and incorporation of a fish return system. Any other Best Management Practices to reduce impacts to species' larval phases should be assessed and considered. (**0012-7** [Lapp, Jeffrey])

Response: *Section 5.3.2 of the EIS describes the evaluation of a fish-return system as part of the NPDES permitting action by the Pennsylvania Department of Environmental Protection (PADEP). The Clean Water Act Section 316(b) Phase I requirements specified in 40 CFR 125.84 (TN254) require that intake structures for new facilities be designed to use best available technology to minimize adverse environmental effects. Section 5.3.2 has been revised to include a description of a proposed fish return system.*

Comment: [The Draft EIS should contain a table that clearly outlines the proposed temporary, permeant [permanent] and conversion impacts to all wetland and streams on site for all phases of the project. EPA appreciates the applicant's efforts to work with the regulatory agencies to avoid and minimize impacts. Additionally the project would permanently affect 997 linear ft (0.21 ac) of onsite streams and temporarily affect 1,443 linear ft (0.34 ac) of onsite streams. It is EPA's hope that the NRC can continue to minimize impacts to aquatic resources, including direct and secondary impacts. (**0012-9** [Lapp, Jeffrey])

Response: *Section 4.3.1 provides tables of temporary and permanent effects to wetlands. Section 4.3.2 of the EIS has been revised to include a table of temporary and permanent effects to BBNPP water resources.*

Comment: To ensure adequate wetland and stream compensation is achieved, a thorough assessment of the aquatic resources including their current condition, and functions and value to the watershed should be made using appropriate and acceptable methods. This assessment is necessary to identify the functional replacement needs of the streams and wetlands onsite and in the watershed and help determine appropriate compensatory mitigation. Any approved mitigation plan should include observable and measurable success criteria to which the success of the mitigation project can be measured, along with an adaptive management plan to adjust any problems that arise post mitigation construction. This information should be presented in a NEPA analysis and is essential for the CWA Section 404 review. (**0012-10** [Lapp, Jeffrey])

Response: *The commenter requests a functions and values assessment for aquatic and wetlands resources be included in the EIS. An extensive wetlands functions and values assessment is provided in Section 2.4.1 and an assessment of avoidance and minimization measures and compensatory mitigation is described in Sections 4.3.1 and 4.3.2. No changes were made to the EIS as a result of this comment.*

Comment: The project site boundary consists of approximately 2,055 acres, of which 975 acres would be altered to support construction and operation of the facility. Waterways on the site include the North Branch Susquehanna River, Lake Took-a-While, unnamed tributary to Lake Took-a-While, North Branch Canal, Walker Run and Eastern tributary to Walker Run plus associated wetland systems. EPA in its comment letters to the Corps (March 22, 2012, and April 16, 2012) stated that these aquatic resources are significant. As stated above (comment 1), baseflow to Walker Run may be jeopardized, with the potential loss of the cold water fishery resource. Appropriate analysis and approaches to avoid impacts is critical for maintain the ecological condition of the resource. (**0012-11** [Lapp, Jeffrey])

Response: *Direct effects from BBNPP construction and operation to waterbodies on or adjacent to the BBNPP site are described in Sections 4.3.2 and 5.3.2 of the EIS, respectively. Baseflow alterations to Walker Run are described in Sections 4.2.1 and 5.2.1. No changes were made to the EIS as a result of this comment.*

Comment: Additionally, as withdrawal allocations from the Susquehanna River have not been clearly identified, it is difficult to confirm that impacts to ecological flow and local habitat of the River will be unaffected by the water demand of the project. This analysis is needed to fully assess the potential environmental impacts, including direct, secondary, and cumulative impacts. (**0012-12** [Lapp, Jeffrey])

Response: *Direct and indirect effects from operation of BBNPP to Susquehanna River habitats under varying flow conditions are described in Section 5.3.2 of the EIS. Cumulative effects to Susquehanna River habitats are described in Section 7.3.2 of the EIS. Sections 5.3.2 and 7.3.2 of the EIS have been revised to include additional context regarding instream flow studies and the potential for effects to habitats that support several fish species under site-specific low-flow releases.*

Comment: Section 5.2.2.1 provides a discussion of the anticipated passby flow requirements for BBNPP that were defined by SRBC staff in a letter to PPL dated December 28, 2012. These requirements were established after lengthy review of aquatic studies and a series of meetings with PPL and other resource agencies, specifically to mitigate the potential significant adverse impact of the withdrawal of 42.0 mgd and net withdrawal (or consumptive use) of 28.0 mgd of the BBNPP during low flow conditions in the Susquehanna River.

While Section 2.4.2.1 provides an adequate discussion of two reports used extensively to establish necessary low flow protection (referred to in Section 11.0 as Normandeau, 2012 -TN1607 and Kleinschmidt et al., 2012 -TN1608), another two of the main aquatic studies used for this review should be discussed in the DEIS. These reports are Potential Effects of the Bell Bend Project on Aquatic Resources and Downstream Users (DEIS reference Normandeau, 2012 -TN1605) and Potential Effects of the Bell Bend Project on the Water Quality of the Backwater Areas Used by Fry and Young-Of-The-Year Smallmouth Bass for the Year 2012 (DEIS reference Normandeau et. al., 2012 -TN1945). Note that Section 11.0 incorrectly references the study plan for the report (Normandeau et. al., 2012 -TN1945) instead of the report itself.

Due to the importance of the two studies referenced above in establishing the potential impacts of the net withdrawal of the BBNPP on the NBSR and setting appropriate low flow protection requirements, SRBC staff requests that Section 2.4.2.3 be expanded to reference the reports, acknowledge the potential significant adverse impact of the net withdrawal, and indicate agreement that the low flow protection through flow augmentation is necessary to avoid plant shutdown.

The Normandeau et. al. TN1605 report also indicates potential impacts to fish species other than Smallmouth Bass, such as the Northern Hogsucker. Even though these other species may not have recreational value, SRBC and other resource agencies have determined them to be an important component of the aquatic life in the river. Section 2.4.3.2 should be expanded to discuss these species as well.

The potential significant adverse impacts of BBNPP's net withdrawal to aquatic communities and their habitat would only be mitigated under current standards by implementation of the defined passby flow offset requirements. The discussion in the DEIS should be broadened to promote better understanding of the importance of establishing the low flow protection beyond simply mitigation of the consumptive water use. (**0013-14** [Dehoff, Andrew])

Response: *Section 2.4.2 references the reports indicated in the context of describing the current baseline and history of the BBNPP site. Water-withdrawal effects and site-specific low-flow protection are discussed in Sections 5.2.2 and 5.3.2. Section 2.4.2 provides a table and discussion of species known to be present in the North Branch Susquehanna River, which includes the Northern Hog Sucker. Site-specific low-flow release conditions that are protective of aquatic resources were updated in Section 5.2.2. Sections 2.4.2 and 5.3.2 have been revised to include additional context regarding the cited references and effects of site-specific low-flow conditions to habitats that support several fish species. The Normandeau et al. 2012-TN1945 reference was deleted from Section 11.0; the correct reference is ERM and Ecology III 2012-TN1606,"Potential Effects of the Bell Bend Project on Water Quality of Backwater Areas Used by Fry and Young-Of-The-Year Smallmouth Bass for the Year 2012."*

E.2.6 Comments Concerning Socioeconomics

Comment: We have a great community, and I know it's going to be beneficial in bringing jobs; and that's another thing that I said, if there's a job market that's going to be opened up, I'd like to know about it. I teach high school; I'd like to be able to tell my students hey, they're--they're hiring people up the road in the power plant. What kind of training do these kids need to have for it. What kind of background. (**0002-2-4** [Dennis, Lori])

Response: *Section 2.5.2.7 discusses educational facilities within the economic impact area, including a brief discussion of universities and community colleges. The NRC staff expanded this discussion to include technical schools as well. Further information about the types of jobs that would be available can be obtained from PPL.*

Comment: Economic Impacts to Community Infrastructure and Community Services

Impact is stated in the EIS as "moderate". PFBC saw no clear category to describe potential impacts to recreational fishing and boating, so we will place our comments in this category. During water intake installation, recreational fishing and boating will be affected on the north bank of the river and in the river channel where the intake is to be located. Aids to Navigation

(ATONs), signage and indication to boaters and anglers where safe passage is available should be accommodated during the construction phase. Coordination with our agency will be necessary during the construction process. (**0009-5** [Hartle, Mark A.])

Response: *Section 4.4.4.2 was updated to address the impacts of water-intake installation on recreational fishing and boating.*

Comment: PFBC has a concern that was not considered in the EIS. Any increased security measures that may be imposed in the future have a high potential to exclude the public from the Susquehanna River near the Bell Bend Nuclear Power Plant and Susquehanna Steam Electric Station. If this occurs, negative economic impacts and loss of recreational use will result. PFBC would like to indicate for the record that we would oppose limitation of public use of the Susquehanna River in the vicinity of the Bell Bend Nuclear Power Plant. We have seen increases in security limit uses of public resources in the past. (**0009-10** [Hartle, Mark A.])

Response: *Section 5.4 was updated to address the impact of security measures on recreational fishing and boating.*

Comment: Then they say okay, we'll bring in more jobs. Oh, right. Yeah, bring in more jobs, and these people will come, they'll build it, they'll leave, we'll have to deal with it, or there may be some that are here now, but it's still a danger to us in the area, and we have to deal with it and live with it. And they'll say well, then why don't you move away. I don't want to move away. This is my -- my -- my town, my area, and I like it here, and as long as -- who knows, in the future I may, but I -- I certainly don't plan on it. (**0002-1-11** [Natarelli, Helen])

Response: *This comment provides general information in opposition to the proposed BBNPP. It does not provide any specific information relating to the environmental effects of the proposed action. No changes were made to the EIS as a result of this comment.*

Comment: So it always is disturbing to me when we do economic impacts and we don't have a longitudinal view of what's getting impacted. Whether it's water being diverted so people can't farm, whether it's water being diverted so people can't build homes, whether it's water being diverted for other and I believe sanitary and hygienic needs. (**0001-1-19** [Epstein, Eric])

Comment: Nuclear power plants require large amounts of water for cooling purposes. PPL's Susquehanna Electric Steam Station power plant already removes large amounts water from the Susquehanna River. Animals and people who depend on these aquatic resources will also be affected Refer to Charts A-1 and A-2) [Tables A-1 and A-2 can be found at ADAMS Accession No. ML15175A100]. (**0011-12** [Epstein, Eric])

Response: *Impacts of plant construction and operation on the use of water resources are addressed in Chapters 4 and 5 of the EIS. The comment provides no new information. No change was made to the EIS as a result of these comments.*

E.2.7 Comments Concerning Environmental Justice

Comment: The application methodology used to identify the population of interest in the Environmental Justice analysis (minority population determination) is somewhat flawed. The threshold values using the 20% criterion (page 2-289) was miscalculated. The threshold values should be calculated by taking the percentage point of the block group plus 20% of the percentage point (example: Block group's county percentage of Native Americans is 5%, therefore, if the block group is equal to or great than (5+(5*.20)) or 6%, it is a population of interest.) It is likely that a larger population would be identified using this methodology. If so, it is important that communication on the project has reached minority and/or low income communities and that the project has considered any impacts that might adversely affect the population. (**0012-14** [Lapp, Jeffrey])

Response: *As an independent agency, the NRC is not bound by the requirements of Executive Order 12898 "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income." However, the Commission determined that it was appropriate for staff to consider environmental justice issues as a part of its NEPA (42 U.S.C. § 4321 et seq.-TN661) responsibilities. Consequently, the basis for identifying minority and low-income populations is based upon NUREG-1555, The Environmental Standard Review Plan (NRC 2000-TN614); and the Interim Staff Guidance Document ISG-026, Attachment 2 (NRC 2014-TN3769). These documents are based on the Commission's Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions (69 FR 52040-TN1009), which outlines the process in which minority populations are identified for the purposes of the environmental review in a manner based upon the guidance provided by the President's Council on Environmental Quality (CEQ). No change to the EIS was made as a result of this comment.*

Comment: The low-income population for Pennsylvania is 13.3% (http://quickfacts.census.gov/qfd/states/42000.html); that should be the threshold value for the low-income population determination (page 2-189, 2.6.2.3, Low-Income Populations). (**0012-15** [Lapp, Jeffrey])

Response: *The basis for identifying minority and low-income populations is the Commissions Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions (69 FR 52040-TN1009), which outlines the process in which minority populations are identified for the purposes of an environmental review. The NRC staff followed this guidance in its environmental justice assessment. No changes to the EIS were made as a result of this comment.*

E.2.8 Comments Concerning Meteorology and Air Quality

Comment: With regards to air quality - while the draft EIS identifies Luzerne County as attainment for all criteria pollutant, the draft EIS does not account for transport of potential pollutants into neighboring counties. The surrounding counties of Carbon, Northampton, Lehigh, and Berks are all part of nonattainment areas for the 2008 ozone NAAQS. Additionally, the counties of Northampton and Lehigh are designated nonattainment for the 2006 PM2.5 NAAQS.

In addition, on page 2-215, line 34, the draft EIS indicates that "EPA requires states to submit a SIP for maintenance areas to provide for continued attainment in the area for at least 10 years after redesignation." This is factually incorrect. EPA requires states to submit a SIP for nonattainment areas; as part of the redesignation process (from nonattainment to attainment) the EPA requires states to submit a maintenance plan that covers the first of two 10 year maintenance periods, thus the newly redesignated area must maintain the NAAQS for the next 20 years.

As stated in the draft EIS, EPA approved the Luzerne County maintenance plan for the 1997 ozone NAAQS on December 19, 2007 (72 FR 64948) for the first 10 years of the maintenance period (i.e. from 2007 to 2017). This means that a second maintenance plan is due eight years after approval of the first, i.e. December 2015. The draft EIS should reference this second maintenance plan and not the one approved in 2007 as it is not designed to include the period between 2017 to 2027. (**0008-1** [Anonymous, Anonymous])

Response: *In light of the State Implementation Plan proposed by the Pennsylvania Bureau of Air Quality, it is not likely that emissions will degrade air quality in Luzerne County or its neighboring counties such as Carbon, Northampton, Lehigh, or Berks. Section 2.9.2 of the EIS was modified to clarify that the EPA requires states to submit a maintenance plan for maintenance areas to provide for continued attainment in the area for the two 10-year maintenance periods after redesignation and to reference the second maintenance plan. The General Conformity Budget included in the final maintenance year of 2017 in the applicable ozone maintenance plan will serve as the budget for the project. This General Conformity Budget will be in effect for years beyond 2017. If the PADEP issues a second 10-year maintenance plan, the NRC will work with PADEP to include a General Conformity Budget for the maintenance years of the second 10-year maintenance plan. Also, if PADEP issues an applicable State Implementation Plan revision for the area for another National Ambient Air Quality Standard, the NRC will work with PADEP to include the General Conformity Budget for the applicable State Implementation Plan revision.*

Comment: Is anyone considering what the cumulative emissions from a third nuclear plant and a new gas powered plant will be? (**0010-8** [Walker, John L.])

Response: *Table 7-1 has been modified to include new natural gas facilities that have been proposed or constructed since issuance of the draft EIS. Cumulative impacts from these new gas powered plants and the BBNPP are addressed in Section 7.6. Specifically, criteria pollutants were address in Section 7.6.1. The region of influence was determined to be Luzerne County.*

E.2.9 Comments Concerning Health - Radiological

Comment: And like they say, there's only low radiation. Okay, so you have one power plant with radiation, two power plants, then you're going to get another one, so that's three times the radiation. It's not just low level from one, it's low level from three. There's been a lot of cancer in the area. I'm not saying, I don't have proof that it's from the power plant. But I do think it could contribute to it. (**0002-1-5** [Natarelli, Helen])

Response: *The comment concerns cumulative radiological impacts. Section 5.9.3.1 of the EIS estimates the potential radiation doses from operation of SSES Units 1 and 2 and the proposed BBNPP and compares them to EPA's dose standards (40 CFR Part 190-TN739) in accordance with 10 CFR 20.1301(d)(3)(e). The cumulative doses for SSES and BBNPP were below the 40*

CFR Part 190 dose standards. Section 7.8 of the EIS addresses the cumulative radiological impacts of the operation of proposed BBNPP, including SSES Units 1 and 2 and other sources in the region. No changes to the EIS were made as a result of this comment.

Comment: And more radiation in the air. And they say there's not but there is. It's not a hundred percent sure that there isn't, we wouldn't have that here if it wasn't for them. (**0002-1-10** [Natarelli, Helen])

Response: *The NRC requires licensees to monitor radioactive effluents (routine and inadvertent) discharged into the environment; thus, each nuclear power plant is required to have a Radiological Environmental Monitoring Program (REMP). The REMP quantifies the environmental impacts associated with radioactive effluent releases from the plant. The REMP monitors the environment over time, starting before the plant operates to establish background radiation levels and continuing throughout its operating lifetime to monitor radioactivity in the local environment. The REMP provides a mechanism for determining the levels of radioactivity in the environment to ensure that any accumulation of radionuclides released into the environment will not become significant as a result of plant operations. The REMP also measures radioactivity from other nuclear facilities that may be in the area (i.e., other nuclear power plants, hospitals using radioactive material, research facilities, or any other facility licensed to use radioactive material). Thus, the REMP monitors the cumulative impacts from all sources of radioactivity in the vicinity of the power plant. To obtain information on radioactivity around the plant, samples of environmental media (e.g., surface water; groundwater; drinking water; air; milk; locally grown crops; locally produced food products; river, ocean, or lake sediment; and fish and other aquatic biota) are collected from areas surrounding the plant for analysis to measure the amount of radioactivity, if any, in the samples. The media samples reflect the radiation exposure pathways (i.e., inhalation, ingestion, and physical location near the plant) to the public from radioactive effluents released by the nuclear power plant and from background radiation (i.e., cosmic sources and naturally occurring radioactive material, including radon and global fallout). The information obtained through the REMP verifies that measurable concentrations of radioactive materials and levels of radiation in the environment are not higher than expected when compared against data on the amount of radioactive effluent discharged. The findings from the REMP are summarized in the Annual Radiological Environmental Operating Report and the Annual Radioactive Effluent Release Report. The Offsite Dose Calculation Manual specifies the limits for all radiological releases. As part of its environmental review, the NRC staff reviews REMP reports to look for adverse data or evidence of a buildup of radioactivity in the environment. The results of the NRC staff's review were discussed in Sections 2.11, 5.9.6.and 7.8 No changes to the EIS were made as a result of this comment.*

Comment: In addition, the DEIS cites two errors in the Bell Bend ER:

Page 4-108, Lines 15&16: note mentions failure to revise the maximum dose in Section 4.5.5.1 in ER Rev 4

Page 5-83, Table 5-11, footnote (b); Page G-5, Lines 20-22; Page G-9, Table G-6, footnote (a): each citation notes that wrong values were used in the ER and corrected values from the applicant's calculation were used in the DEIS For these two items, I will be forwarding you a letter docketing the revisions we made to the ER based on our corrective actions. (**0007-2** [Sgarro, Rocco])

Response: *Sections 4.9, 5.9, and Appendix G of the EIS were revised to reflect the corrections in PPL's environmental report (ER).*

Comment: I just think it's a danger and a health hazard here, and I think we have enough already. (**0002-1-12** [Natarelli, Helen])

Comment: TMIA's membership living with 50 miles of the proposed Bell Bend Nuclear Generating Station ("BBNPP" or "Bell Bend") have immediate concerns relating to the plant's operation. TMIA's membership have legitimate and historic concerns regarding radiological contamination resulting from radiological releases related to normal and abnormal operations that impact the value of its property, and interfere with the organization's rightful ability to conduct operations in an uninterrupted and undisturbed manner. (**0011-7** [Epstein, Eric])

Response: *NRC regulations provide a mechanism to protect the public health and safety from the effects of radiation from nuclear reactors, materials, and waste facilities by requiring the agency to conduct its licensing functions in a manner which is receptive to environmental concerns. The NRC's regulatory limits for radiological protection are set to protect workers and the public from the potential harmful health effects of radiation on humans. The limits are based on the recommendations of standards-setting organizations. Radiation standards reflect extensive scientific study by national and international organizations and incorporate conservative assumptions and models to account for differences in gender and age so as to ensure that workers and all members of the public are adequately protected from radiation.*

As explained in Section 5.9, the amount of radioactive material released from nuclear power facilities is well measured, well monitored, and known to be very small. The doses of radiation that are received by members of the public as a result of exposure to nuclear power facilities are very low (i.e., less than a few millirem). To put this in perspective, each person in this country receives a total annual dose of about 360 millirem from natural sources of radiation. Radiation from natural and man-made sources is not different in its properties or effect.

To ensure that the nuclear power plants are operated safely within radiation protection requirements, the NRC licenses the plants to operate, licenses the plant operators, and establishes license conditions for the safe operation of each plant. The NRC provides continuous oversight of plants through its Reactor Oversight Process to verify that they are being operated in accordance with NRC rules and regulations. The NRC has full authority to take whatever action is necessary to protect public health and safety and may demand immediate licensee actions, up to and including a plant shutdown.

The NRC's primary mission to protect the public health and safety continues to be met. These comments provided no additional information; therefore, no changes to the EIS were made as a result of these comments.

E.2.10 Comments Concerning Accidents - Severe

Comment: Many TMI-Alert members live are subject to radiological contamination, evacuation, loss of property, or other harms in the event of any mishap at the plant. (**0011-8** [Epstein, Eric])

Response: *This comment concerns postulated reactor accidents. The NRC analyzed the potential environmental impacts, or risks, of postulated accidents in Section 5.11 of the EIS. These severe accident risks include population dose risk, health risks, economic risks, land decontamination risks, and population dose risk from water ingestion. The risk of a severe accident cannot be reduced to zero; however, as discussed in Section 5.11 of the EIS, the NRC staff found that the potential environmental impacts (risks) from a postulated accident from the operation of the proposed BBNPP would be SMALL. These risks are significantly less than the risk of current-generation operating reactors and the risk levels set forth in the Commission's Safety Goals Policy statement (51 FR 30028-TN594). Accordingly, no change was made to the EIS as a result of this comment.*

E.2.11 Comments Concerning the Uranium Fuel Cycle

Comment: I think we should have learned from the anthracite experience that we had here. The waste that's here ain't going anywhere. It's going to stay. It's going to be a legacy issue. They build a new plant, the waste is going to stay. (**0001-1-14** [Epstein, Eric])

Comment: I still think the Achille heel here is the nuclear waste. You know, if we're going to build another plant, and I'm not really sure how much is at Susquehanna now, I know they generate 60 metric tons a year. The question I have is why are we building another plant if we still haven't solved the issue of where the current waste is going to go. I don't know anybody that would buy a house and they would buy the house and the builder would say look, you can flush for 30 years and then we'll put in a toilet. It just makes no sense to me. (**0001-1-20** [Epstein, Eric])

Comment: I'm more concerned about storing used rods. Senator Harry Reid is no longer in power of the -- of the situation. We--we spent billions of dollars to hollow out Mount Yucca (Yucca Mountain). It's done. We have paid in through our electric bill. It's done. Why isn't the used spent rods being sent to Nevada. (**0002-3-2** [Shepler, Dennis])

Comment: the existing Susquehanna plant generates 60 metric tons of nuclear waste a year and there is no plan for the additional nuclear waste that will be generated. (**0003-4** [Edwards, Robert L])

Comment: How does this new company plan to deal with the spent nuclear rods currently on site and with newly created nuclear waste with no place identified for long term storage? (**0010-2** [Walker, John L.])

Comment: How can anyone replicate the situation that PPL has carried out for the past thirty years -begin and continue to create nuclear power without any idea what they were going to do with the waste? (**0010-4** [Walker, John L.])

Response: *These comments concern the environmental impacts of onsite storage and eventual disposal of low-level radioactive waste (LLW), spent fuel, and high-level radioactive* *waste produced by the proposed BBNPP. Section 6.1 addresses the environmental impacts of the fuel cycle, and specifically addresses the options for shipping LLW and the environmental impacts of radioactive waste disposal after the waste is shipped from the proposed BBNPP site. As stated in Section 6.1.6, PPL will be able to ship Class A LLW to Tennessee and to Energy Solutions in Clive, Utah. Waste Control Specialists, LLC, in Texas is licensed to accept Class A, B and C LLW. Section 6.1.6 also addresses measures to reduce the generation of LLW as well as options such as the addition of interim and extended onsite storage capacity if licensed disposal facilities are temporarily not available. Finally, Section 6.1.6 discusses the recently issued final rulemaking related to continued storage of spent nuclear fuel. On August 26, 2014, the Commission issued a revised rule at 10 CFR 51.23 (TN250) and associated Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel (NUREG-2157). The revised rule adopts the generic impact determinations made in NUREG-2157 and codifies the NRC's generic determinations regarding the environmental impacts of continued storage of spent nuclear fuel beyond a reactor's operating license. As directed by 10 CFR 51.23(b) (TN250), the impacts assessed in NUREG-2157 (NRC 2014-TN4117) are deemed incorporated into this EIS. No change was made to the EIS as a result of these comments.*

E.2.12 Comments Concerning Cumulative Impacts

Comment: Why is the NRC planning to have both a third nuclear plant at the Susquehanna location and a MOXIE installation located in close proximately? (**0010-5** [Walker, John L.])

Response: *PPL is requesting a COL for the BBNPP at the BBNPP site adjacent to the existing SSES. The NRC's responsibility is to review the impacts of construction and operation of the proposed BBNPP in accordance with its regulations and the NEPA (42 U.S.C. § 4321 et seq.-TN661). The Moxie Freedom Generation Plant is a natural gas power plant proposed by Moxie Liberty LLC approximately 1.5 mi north of the BBNPP site. The NRC does not regulate natural gas power plants and has no jurisdiction over the proposed installation. The cumulative effects of BBNPP and other past, present and reasonably foreseeable future projects are described in Chapter 7. The Moxie Freedom Generation Plant has been added to projects listed in Table 7-1 and the tables of other projects in Section 9.3 that are considered in the cumulative impact assessment of the BBNPP and alternative sites. The staff has considered the potential contribution of the Moxie Freedom Generation Plant in its assessment of cumulative impacts and has made changes in the EIS as appropriate -.*

The need for power for the proposed BBNPP can be found in Chapter 8. The NRC staff assessed the need for power for the proposed BBNPP as part of the overall need for electricity in the PPL service area. Staff made this assessment based upon the long-term analysis performed by PJM Interconnection, the Regional Transmission Organization (RTO) that manages all electricity dispatch for PPL. The staff relied upon the PJM forecast to determine the need for power and therefore does not evaluate whether other specific power plants are included or excluded in those forecasts. No changes were made in Chapter 8 as a result of this comment. -

E.2.13 Comments Concerning the Need for Power

Comment: You're supplying power to New York, New Jersey, whomever, I don't even know, but I know it's not for us. And even if it was, go there. Let them have their own power. You supply it from their own states, not here. (**0002-1-8** [Natarelli, Helen])

Response: *This comment provides no new information relevant to the environmental review of the COL application. No change was made to the EIS as a result of this comment.*

Comment: SRBC notes that there are more combined-cycle natural gas (CCGT) power plants planned in the basin than are included in DEIS analysis. The projects listed in Table 7-1, Past, Present, and Reasonably Foreseeable Project and Other Actions Considered in the BBNPP Cumulative Analysis, should be revised to include the following projects that have applications submitted to SRBC and other partner agencies:

1. Moxie Freedom (~1,000 MW, Salem Township, Luzerne County, Pennsylvania)

2. Invenergy -Lacka\Vanna Energy Center (~1,500 MW, Jessup Borough, Lackawanna County, Pennsylvania)

3. Hunlock Creek Expansion (~170 MW increase, Hunlock Township, Luzerne County, Pennsylvania)

4. Panda/Sunbury Generation/Hummel Station Repowering and Expansion (~l,000 MW, Monroe Township, Snyder County, Pennsylvania)

The DEIS states on Page 7-1, Line 20, "future actions are those that are reasonably foreseeable through the building and operation of the proposed BBNPP, including decommissioning." While SRBC does not specifically monitor trends in power plant applications, it does appear that there has been an increase in interest in siting CCGT power plants in the Susquehanna River Basin. Several pre-application and planning discussions about additional CCGT power plant projects have been held with SRBC staff. Current market conditions and the development of Marcellus shale gas favor development of additional CCGTs. (**0013-13** [Dehoff, Andrew])

Response: *Section 7.1 was revised to included updated information regarding projects in the area. The comment indirectly questions the inclusion of certain expected natural gas-fired power plants in the forecasts relied upon by the review team in the assessment of need for power. Section 8.4 of the draft EIS presents the review team's assessment of projected power generation supply conditions. The assessment uses the most recent established and vetted public forecasts for the PJM region generally and the PPL service area specifically. The review team does not attempt to reconcile the inclusion of specific proposed power plants in those forecasts. No changes to Chapter 8 of the EIS were made as a result of this comment.*

E.2.14 Comments Concerning Alternatives - Energy

Comment: And your slide 15 is actually in conflict with Pennsylvania law, flat out violates Act 129. (**0001-1-8** [Epstein, Eric])

Response: *The staff assumed that the commenter was referring to Pennsylvania Act 129 of 2008, Amending Title 66 (Public Utilities) of the Pennsylvania Consolidated Statutes. This Act expanded the Public Utility Commission's oversight responsibilities and imposes new requirements on electric distribution companies, with the overall goal of reducing energy consumption and demand. Slide 15 of the draft EIS public meeting presentation identified the suite of alternative energies and alternative sites that were evaluated in the EIS. Slide 15 presented the staff's evaluation of all reasonable alternatives to the proposed project under NEPA. This slide was not in conflict with Act 129 because the Act does not preclude the evaluation of alternatives in the NRC's EIS; therefore, no changes were made to the EIS as a result of this comment. – Pennsylvania Act 129 can be found at:* *http://www.puc.pa.gov/filing_resources/issues_laws_regulations/act_129_information.aspx*

Comment: to me, any other kind of -- any alternative, solar, many that you mentioned before, would be better than a nuclear plant. (**0002-1-15** [Natarelli, Helen])

Comment: I strongly believe it is time to invest in the future and develop renewable energy sources including solar and wind. (**0005-2** [George, Susan])

Response: *The staff does not promote any particular form of energy generation, including nuclear. However, the NRC does examine energy alternatives as part of its responsibilities to evaluate environmental impacts of the proposed action. The staff's evaluation of renewable alternative energy sources, including wind, solar, geothermal, fuel cells, and biomass, is in Section 9.2.3 of the EIS. This section describes potential impacts from these renewable energy sources in comparison with the proposed action. Alternatives not requiring new generating capacity, including conservation and demand-side management, are discussed in Section 9.2.1 of the EIS. The staff generally concluded in the EIS that these technologies did not represent reasonable alternatives to a large baseload power plant located at the BBNPP site. The staff concluded in Section 9.2.5 of the EIS that none of the feasible alternative energy options were environmentally preferable to the proposed action. No change was made to the EIS as a result of these comments.*

Comment: Section 9.2.2.2 of the DEIS provides a comparison of the environmental impact of nuclear power plants versus natural-gas-fired power plants (CCGTs) using combined-cycle technology. SRBC comments pertain to the water consumption aspect of power generation. About 73 percent of all water consumed in the Susquehanna River Basin is used for power generation. From a cumulative consumptive use standpoint, the power generation segment of water users is clearly significant with regard to water resources in the basin.

The analysis in Section 9.2.2.2 is somewhat outdated, using a previous analysis for SSES, and does not compare CCGTs of similar size as BBNPP. The analysis would be more appropriate if it used current CCGT technology and two 800-MW CCGT units, which are fairly standard. Further, SRBC believes the benefits of CCGTs with regard to consumptive water use are understated in the DEIS. The statement in the second paragraph under "Other Impacts" that CCGTs consume one-third of the water that a similarly sized nuclear power would is true, but should be expanded. For example, the proposed consumptive water use for BBNPP is estimated to be 28.0 mgd. A similarly sized CCGT plant using wet cooling technology would consume approximately 7.4 mgd, a very significant and beneficial difference as compared to BBNPP.

Page xl, Table ES-4 -The environmental impact for water use and quality for both a nuclear and natural gas fuel power plant are both listed as small. The requested consumptive use quantity for the proposed nuclear power plant equates to approximately 730 gal/MWh while currently proposed natural gas power plants are requesting approximately 300 gal/MWh for evaporative cooling systems and only 5 to 10 gal/MWh for dry cooling systems. SRBC questions the value of utilizing the same classification of environmental impact (small) for such a wide range of consumptive use values.

Dry cooling technology is a viable option for CCGTs because of the efficiency of the power generation process. The 28.0 mgd of consumptive use for BBNPP would be compared to about 0.2 mgd consumptive use of water for a 1,600-MW CCGT power plant utilizing dry cooling technology, or about 0.7 percent of the water needed for BBNPP. The result is that there are almost no environmental impacts to aquatic resources or the hydrology of the river. SRBC believes that CCGT with dry cooling technology constitutes a large beneficial impact for water resources.

To formally recognize the benefits of dry cooling technology, SRBC adopted Resolution No. 2015-02 on March 5, 2015, promoting its use for power generation. There is an operating CCGT power plant utilizing dry cooling in the region, the 839-MW Hunterstown Plant, demonstrating the viability of the technology under contemporary conditions. Additionally, two CCGT power plants designed with dry cooling are under construction (Liberty and Patriot), and two more are currently in the permitting process within the basin.

SRBC requests that a separate subsection be added to Section 9.2.2.2 that properly analyzes the alternate power generation option of CCGT power plants with dry cooling. (**0013-12** [Dehoff, Andrew])

Response: *These comments refer to the staff's analysis in Section 9.2.2.2 of the natural gas energy alternative and the cooling method analyzed. The SRBC suggested that the impacts of a 1,600 MW(e) natural gas alternative should have been compared to the BBNPP. The analyses in the EIS did assume a 1,600 MW(e) natural gas plant. Although the EIS text notes that 2,400 MW(e) of natural gas generation was an alternative assessed in SSES Units 1 and 2 License Renewal Application Final EIS (NRC 2009-TN1725), as also stated in the EIS for the purposes of comparison applicant's proposed action the staff analyzed 1,600 MW(e) combined cycle gas turbines, the same overall size as the proposed BBNPP. The SRBC comments that about 73 percent of all water consumed in the Susquehanna River Basin is used for power generation and, therefore, from a cumulative consumptive-use standpoint, the power generation segment of water users is clearly significant with regard to water resources in the basin. To provide context regarding the significance of consumptive use for the BBNPP proposed actions or its alternatives, the staff would note that in the SRBC's August 12, 2013 letter to the NRC (SRBC 2013-TN4429) regarding PPL's Consumptive Water Use Mitigation Plan, the SRBC stated that while PPL would face significant challenges to implement its plan, SRBC staff are otherwise reasonably sure that there are no fatal flaws apparent with the primary option identified in PPL's conceptual plan. The SRBC further notes the differences in water use between the proposed BBNPP and natural gas generation, a fact which the staff noted in Section 9.2.2.2 of the EIS. SRBC acknowledged, without challenge, that the NRC determined that both the BBNPP and a natural gas alternative would have SMALL consumptive-use* *impacts, but questioned the value of utilizing the same classification of environmental impact (small) for such a wide range of consumptive-use values. The staff evaluates impacts in accordance with its regulations - Environmental Protection Regulations Applicable to NRC's Domestic Licensing and Related Regulatory Functions, 10 CFR Part 51 (TN250) wherein a SMALL impact is defined as: SMALL - Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. Based on its regulations and guidance, the NRC does not attempt to determine further granularity to impacts that have been determined to be either not detectable or so minor that they will be neither destabilizing nor noticeable, and stands by its determination of SMALL consumptive water use impacts for both the BBNPP and the natural gas alternatives.*

The SRBC challenged the NRC to consider dry cooling as an alternative to the wet cooling assessed in the EIS based on lesser cooling water demands. The staff uses wet cooling in the analysis of all energy alternatives to equitably compare the energy alternatives to the proposed action, a nuclear power plant using wet cooling towers. The staff does not address cooling methods for alternative energies as a matter of practice. As assessed in Section 9.2.2 and summarized in Table 9-2, with the exception of SMALL to MODERATE air-quality impacts and MODERATE beneficial socioeconomic impacts, which would not be affected by a change to dry cooling, all other impacts to resource areas from the natural gas alternative using wet cooling were determined by staff to be SMALL. In this particular case, if dry cooling towers were used for the natural-gas-fired plant, impacts to aquatic resources and surface water use could be further reduced because much less water would be withdrawn from the Susquehanna River. Impacts to aquatic resources and surface-water use would be less than those with wet cooling towers, which are already characterized as SMALL in Table 9-2. Therefore, although the impacts to aquatic resources and surface water might be reduced by the use of dry cooling, such impacts would still be defined by NRC's regulations as SMALL and adverse, but not beneficial. The staff believes that when SRBC described the impacts of dry cooling as "beneficial," it was suggesting that the impacts of dry cooling would be less than the impacts of wet cooling. That is not the same as saying that building a dry cooling system would improve the environment. However, when the NRC staff uses the term "beneficial" in describing impacts, it is describing an actual improvement in the environment (e.g., when building a plant improves socioeconomic conditions because of increased tax payments). The SMALL impacts to land use and terrestrial ecology from wet cooling could also be SMALL if dry cooling were applied, however such impacts might increase if the plant footprint increased from the addition of dry cooling. Whether such an increase would result in a MODERATE impact determination is beyond the scope of this discussion. The review team concludes that, even if dry cooling were applied to the natural gas alternative, given the other factors that contribute to a determination of environmentally preferable, such as greenhouse gas emissions, it would not be "environmentally preferable" to construction of a new baseload nuclear power-generating plant located within PPL's region of interest. Text has been added to Section 9.2.2.2 in response to this comment.

E.2.15 Comments Concerning Benefit-Cost Balance

Comment: There's no money. Here's what we're looking at when it comes down to it, and I deal with the budget on a regular basis. I'm coming from Harrisburg, and anybody who lives here knows that we're probably not going to have a budget done on time. I don't know where you think you're going to get the money from.

But in order to build a reactor, they originally proposed they would need 80 percent of the project to come from tax payers, 4.58 billion. Apparently I'm living in a different world where I don't know the politicians who are likely to give out that kind of money. It's a loan, really doesn't have to be paid back.

The real cost, if you look at the experiments in Florida and Texas, is closer to about 15 billion. Actually I went on the website; I think PPL has acknowledged that their plant which initially was supposed to be 4.5 billion, we're at around 15, 15 billion right now. And this begs the question, and this is what I always wanted to ask PPL: Forbes Magazine said back in 2007 you were one of the best managed and most profitable utilities. You paid out a hundred eighty one percent in dividend increases in the last 12 years. Pay for the plant yourself. It's America. It's capitalism. It's a free market, baby. If you can't run with the big dogs, don't get off the porch. I mean I'm getting tired of someone, as someone who looks at this issue, time and time again, you guys are always coming looking for the money. Just to give you an example of what's happening right now in Georgia, with people that are trying to build a nuclear power plant, this is this is this is a summary from last week. Georgia Power local nuclear power plant will likely be deployed even further, months behind the three year delay.

So the first new plant we're building is already three years behind. A report by staff and engineers to Georgia Public Service Commission by the way the rate payers there were lucky, they got to pay for the plant ahead of the plant ever generating electricity. Okay. They extended the deadline for this plant two to three more months. That costs about $2 million a day, just so that you know what you're looking forward to. This was going to be the first new reactor which was supposed to begin operation in April 2016, according to the company. With another to follow after. Now the earliest that plant will open is 2019 and 2020.

So put etiology aside; put the fact you don't have the water aside; put the fact you don't have a license aside; this is a tremendous financial undertaking. It's a lot of money. It's got to come from somewhere. And the company is not going to provide the money. (**0001-1-13** [Epstein, Eric])

Comment: When they first came to us, and us being the rate payers of Pennsylvania, said they wanted to build their first nuclear power plant, they said the cost would be 2.1 billion. The final cost was 4.1 billion. In 1997 and '98 I was part of the team that negotiated a settlement, we bailed them out for 2.86 billion. 2.86 billion in stranded costs. So it doesn't matter how you feel about nuclear power; on this particular issue what matters is who's going to wind up paying for a source that we were originally promised was too cheap to meter. (**0001-1-15** [Epstein, Eric])

Comment: Using $4.5 billion in federal subsidies to build a plant for the benefit of a corporation that will invest ZERO dollars in the project is unacceptable. NO CORPORATE WELFARE. (**0003-3** [Edwards, Robert L])

Comment: There is no money. PPL wants to build a new nuclear reactor, but needs a federal subsidy of $4.5 billion or 80% of the projected cost of the project. This "nuclear loan" is guaranteed by the U.S. Treasury (that is -taxpayers); and the real cost, based on overruns in

Florida and Texas, is actually $10 billion! Which begs the obvious question: Why aren't the shareholders of one the "best managed" and "most profitable utilities" (Forbes Magazine, December, 2007) assuming the risk for a multibillion dollar slam dunk?

Please note that Georgia Power's Vogtle nuclear plant will likely be delayed even further - months beyond the three-year delay that project developers have already acknowledged. A report by staff and engineers to the Georgia Public Service Commission extended the deadline by two to three months to begin work on concrete walls and hoisting a section of the plant into place. Regulators estimate it will cost Georgia Power $2 million each day that it runs behind on the project's schedule. The first new reactor at the facility was slated to begin operations in April 2016, with another to follow a year after. Now, it will likely be sometime in 2019 and 2020 when those units come online. (Source: Utility.Drive.com. May 15, 2015).

PPL's operating nuclear plants were projected to cost $2.1 billion, but cost overruns resulted in a $4.10 billion price tag for rate payers. Don't be fooled again by the same people who brought you electricity "too cheap to meter." (**0011-5** [Epstein, Eric])

Response: *The costs and benefits of construction and operation of the proposed BBNPP were addressed in Chapter 10 of the EIS using the best information available to the review team. The NRC does not have the authority to regulate the cost of construction or the price of electricity. Therefore, these comments are not within the scope of this environmental review. No changes were made to the EIS as a result of these comments.*

E.2.16 General Comments in Opposition to the Licensing Action

Comment: And frankly, I've looked at PPL's applications, as we do at Peach Bottoms for their EPU, or whatever. I can tell you right now that was the worst application I've ever seen, straight out. I don't know where it is, but that if it's SRBC, but I doubt that in its current form that those plans are going anywhere. (**0001-1-5** [Epstein, Eric])

Comment: I'm definitely opposed to having another reactor in the area. (**0002-1-1** [Natarelli, Helen])

Comment: [W]e can't do anything about the two that we have here. But hopefully we can do more about not bringing any more in here. And go somewhere else to the other states and let them deal with it like we have to. Why should we have to bear everything and just come here because they think we're everyday people and we don't care. Or just plain people. But we do care, we live here. (**0002-1-13** [Natarelli, Helen])

Comment: It's like -- and first of all there should be more people here. I'm surprised in the Berwick, Bloomsburg area. And even around my area. But people say what's the use, they're going to do what they want. So we don't even come. And it's hard. It's hard for me because I've lived here all my life, and I have family; I have a daughter, a grandson, and they plan on living here. And it's scary. They don't -- I mean they're not worried about it because they're -- they're young and they don't care. When I was younger I wish I would have objected to this, the two power plants that were here, I would have done more, but I wasn't aware then; and they're younger now, they're not aware. But I am now. It's -- it's just that we have enough, I think, with the two, we have enough to worry about now; I don't think we need one or two more to worry about also. And they think oh, this is a -- okay, we're plain people here, we're not high profile people, most of us, or anything, we're just plain, everyday, ordinary people that want to live a good life and love this area. And like I said, now we have to worry about the two that are here and then plus if another one comes in? (**0002-1-9** [Natarelli, Helen])

Comment: Building another nuclear reactor at Bell Bend is ill-advised and unacceptable. (**0003-1** [Edwards, Robert L])

Comment: I oppose the Bell Blend nuclear reactor. (**0004-1** [Stanseski, Pinky])

Comment: I am opposed to allowing Talen Energy to construct a third reactor (Bell Bend) at Susquehanna Steam nuclear plant near Berwick, Pennsylvania. (**0005-1** [George, Susan])

Comment: I am offering comments and testimony in opposition to the above mentioned Draft Environmental Impact Statement (DEIS"). (**0011-6** [Epstein, Eric])

Comment: PPL Bell Bend failed to factor, consider and address numerous water use and site-specific aquatic challenges to the Susquehanna River and its environs if this Application is approved. The Applicant did not adequately consider the additional impact another nuclear power plant will have on environment, habitat and ecosystem. (**0011-9** [Epstein, Eric])

Response: *These comments express opposition to the applicant's COL. The NRC carefully reviews the application against its regulations, which are intended to protect the public health and safety and the environment. No changes were made to the EIS as a result of these comments.*

E.2.17 General Comments in Opposition to the Licensing Process

Comment: Now, apparently, from what I've received, is on April 24th the NRC Army Corps issued a draft environmental impact statement, and that was based, apparently, on information they mostly garnered from the NRC. Or from PPL. I'll just come to the point. We happen to think that the conclusions by both the NRC and the Army Corps are fatally flawed. They're cursory, they border on regulatory negligence. There is no approved reactor design. Let's get that straight. There is no presume--- there is no approved consumptive water use. There ain't no money. It's really hard to build a plant without a reactor, without water, and without money. That's where we're at right now. Frankly, we will be filing a request for the Government Accountability Office to look into this process as related to your slide number 12, slide number 13, and also slide number 15. (**0001-1-6** [Epstein, Eric])

Comment: The NRC and USAEC's conclusions are cursory, fatally flawed and reek of regulatory negligence. There is no approved reactor design. There is no approved consumptive water use permit. There is no money.

TMI-Alert will request a formal audit by the Government Accountability Office to determine if regulatory collusion and willful manipulation of data has taken place. (**0011-1** [Epstein, Eric])

Response: *These comments express general opposition to the NRC's conclusions in the EIS. The commenters do not provide specific information to identify inaccuracies in the information referenced in the EIS or with the conclusions themselves. The NRC carefully reviews the application against its regulations, which are intended to protect the public health and safety and the environment. The environmental review described in this EIS was conducted by a review team consisting of NRC staff, its contractor's staff, and staff from the USACE. During the course of preparing this EIS, the review team reviewed the ER submitted by PPL (PPL Bell Bend 2013-TN3377) and supplemental revisions and documentation; consulted with Federal, State, Tribal, and local agencies; and followed the guidance set forth in NUREG-1555, Environmental Standard Review Plan (NRC 2000-TN614), NUREG-0800, Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants (NRC 2007-TN613), and Interim Staff Guidance "Environmental Issues Associated with New Reactors" (NRC 2014-TN3767). In addition, the NRC considered the public comments related to the ER. No changes were made to the EIS as a result of these comments.*

E.2.18 General Comments in Opposition to Nuclear Power

Comment: I don't even want other places to have these power plants but I certainly don't want it here. (**0002-1-14** [Natarelli, Helen])

Comment: I think they're the most dangerous. And we have enough here already, and then we're going to have to have another one to worry about? (**0002-1-16** [Natarelli, Helen])

Comment: And to me, and I know this may sound weird to you, but to me, like that's a devil in the sky to me. And to put another one here after we have two now, to endanger us even more, is disgusting. I just can't believe it. I can't. And I can't believe this has happened to begin with. (**0002-1-4** [Natarelli, Helen])

Comment: And they say okay, we have the resources here, we have water, we have the rivers. Go somewhere else where there's water and rivers. It's not just us. (**0002-1-7** [Natarelli, Helen])

Response: *These comments provide general information in opposition to nuclear power. They do not provide specific information relating to the environmental effects of the proposed action. No changes were made to the EIS as a result of these comments.*

E.2.19 General Comments in Opposition to the Existing Plant

Comment: I was opposed to the two that are here now and of course couldn't do anything about it. (**0002-1-2** [Natarelli, Helen])

Response: *This comment provides general information in opposition to the existing SSES. This comment does not provide specific information relating to the environmental effects of the proposed action. No change was made to the EIS as a result of this comment.*

E.2.20 Comments Concerning Issues Outside Scope - Miscellaneous

Comment: If you don't believe me, why don't you put into Google tonight AREVA, EDF, and see how many jobs they've cut and also see where the French Government is. The French

Government is now reducing their dependency on nuclear power from 80 to 50. The UniStar, which was supposed to be built at Nine Mile Point, they've withdrawn the application. Ameren has suspended their application for their EPR in Missouri. PPL has suspended their application likewise. (**0001-1-10** [Epstein, Eric])

Response: *Actions by the French government, jobs cut by AREVA and EDF, and applications withdrawn by Unistar and Ameren, are outside the scope of the proposed action. The NRC has no purview in these areas. No change was made to the EIS as a result of this comment.*

E.2.21 Comments Concerning Issues Outside Scope - NRC Oversight

Comment: I'm speaking for a lot of citizens and a lot of people, a lot of family, and I said to them why don't you come with me. And they said no, because why should we. They're only going to do what they want to do anyway. (**0002-1-3** [Natarelli, Helen])

Comment: Unfortunately, like -- like you had said before, not everybody is--is brave enough to come to the meetings because they do have the attitude of you guys are going to do whatever you want anyway. (**0002-2-5** [Dennis, Lori])

Comment: How safe should I feel with a new company, with no experience, operating 27 generating plants, one of which is a nuclear plant near my home? How can all of this combining of resources with no mention of skill levels in operating a nuclear plant occur in such a short time frame? (**0010-1** [Walker, John L.])

Response: *The NRC takes seriously its responsibility to protect the public health and safety and the environment in regulating the U.S. nuclear power industry. More information on the NRC's roles and responsibilities is available on the NRC's website at http://www.nrc.gov/what-we-do.html. While NRC oversight of the industry and operational safety are outside the scope of this environmental review, the following are examples of how the NRC addresses operational safety issues. The NRC maintains resident inspectors at each reactor site. These inspectors monitor the day-to-day operations of the plant and perform inspections to ensure compliance with NRC requirements. In addition, the NRC has an operational experience program that ensures that safety issues found at one plant are properly addressed at the others, as appropriate. The NRC will only issue a license or permit if it can conclude that there is reasonable assurance (1) that the activities authorized by the license or permit can be conducted without endangering the health and safety of the public and (2) that such activities will be conducted in compliance with the rules and regulations of the Commission. In addition, to ensure objectivity and independence in its regulatory activities, the NRC and the U.S. Office of Government Ethics (http://www.oge.gov) have stringent rules and procedures to ensure that employees of, and advisors to, the NRC are free of conflicts of interests and the appearance of conflicts of interest. The comment did not provide new information relating to the environmental effects of the proposed action. No change was made to the EIS as a result of these comments.*

E.2.22 Comments Concerning Issues Outside Scope - Safety

Comment: And again, I can't stress enough that I find it very difficult to understand why we're here, when the nuclear power plant that theoretically is going to be built has no approved reactor design. (**0001-1-11** [Epstein, Eric])

Comment: [W]e'd appreciate it if you would respond to our questions that also have to deal with aquatic impacts and also what happens to rusty pipes and things of that nature as the plant ages, known as aging management. (**0001-1-17** [Epstein, Eric])

Comment: To get back to the reactor design that's not approved, and just so we're clear here, which was designed by AREVA, AREVA requested on February 25th, AREVA, the people that produce the reactor design, that they suspend the process. And that is despite receiving almost 8 billion in Federal loan guarantees from the U.S. Department of Energy, which I -- I happen to find troubling. Anybody who follows energy on a regular basis knows that both AREVA and EDF are economically on their backs. And it's unlikely they're going to be putting any more research into this. This is just the reality of the situation. (**0001-1-9** [Epstein, Eric])

Comment: And also the danger, I hear that -- many years ago they had a meeting, and I came, and it was in the papers too, where they have a lot of problems even at these two up here, they have to shut down off and on, they have to do this, they have to do that, and it's like I don't even pay that much attention to it but I did read it in the papers the last time I was here, if you check back, I should have brought them but I didn't. It's just that I'm concerned about the safety too. We have to worry about the two that are here, now we're going to have to worry about if there's another one or more. (**0002-1-6** [Natarelli, Helen])

Comment: The proposed design by a French company is not approved for use in the U.S. (**0003-2** [Edwards, Robert L])

Response: *It is the NRC's responsibility to protect the health and safety of the public when authorizing the civilian use of radioactive material. Because NEPA regulations (42 U.S.C. § 4321 et seq.-TN661) do not include a safety review, the NRC has codified the regulations for preparing an EIS separately from the regulations for reviewing safety issues. The regulations governing the environmental review are set forth in 10 CFR Part 51 (TN250), Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions and the regulations covering the safety review are set forth in 10 CFR Part 52 (TN251), Licenses, Certifications, and Approvals for Nuclear Power Plants. For this reason, the licensing process includes an environmental review that is distinct and separate from the safety review. Because the two reviews are separate, operational safety issues are considered outside the scope of the environmental review, just as environmental issues are not considered part of the safety review.*

The safety review has not been completed by the NRC staff and a combined license cannot be issued until the safety review has been completed. Prior to certifying a design, the NRC must determine whether the design meets all safety requirements. Accordingly, this process appropriately analyzes and discloses the potential future implications of the approval based on the best available information at each phase of the certification and licensing process. If the

NRC approves the design referenced in the BBNPP COL application, the NRC will determine, under 10 CFR 51.92 (TN250), whether it must prepare a supplement to the EIS prepared for the BBNPP COL and will consider whether there are any substantial changes or significant new circumstances or information that were not evaluated in the COL EIS. That review would include appropriate consideration of whether the impacts of the design ultimately selected remains "bounded" by the impacts of the design parameters evaluated in the COL EIS. This approach ensures that the agency's decision regarding construction and operation of a facility will continue to be informed by the NEPA-required "hard look" at the environmental impacts of the proposed action.

Operational impacts to aquatic ecology are discussed in Section 5.3.2. Other comments are related to safety and are outside the scope of the environmental review. No changes were made to the EIS as a result of these comments.

E.2.23 Comments Concerning Issues Outside Scope - Security and Terrorism

Comment: I see nothing up here about security. And many years ago you never thought you'd have to worry about security, about somebody actually trying to break into a plant and blow it up. (**0002-3-1** [Shepler, Dennis])

Comment: Every plant is a potential weapon for terrorists. Unheard of years ago. Many, many years ago they stored these concrete cylinders to help store the waste rods. Well, they--they started with them right here in the perimeter. And now they built a facility to make it stronger. But we have so many potential terrorists in this world today. They're just sick. All it takes is one to crack these storage units into a dirty bomb...We have Yucca Mountain done. Why aren't we moving the waste to that one mountain, where we can protect it. Just doesn't make sense. (**0002-3-3** [Shepler, Dennis])

Response: *The EIS does not include security issues (e.g., physical protection and the capability to respond to an external attack). The NRC staff considers these issues in its safety review, separate from the environmental review. Some of the detailed information pertaining to security is considered to be safeguards information; as such, it cannot be shared with the public for security reasons. If a license is issued, security issues will be periodically reviewed, inspected, and updated at every operating plant. These reviews continue throughout the period of an operating license, whether it is for the original or renewed license. If issues related to security are discovered at a nuclear plant, they are addressed immediately, and any necessary changes are reviewed and incorporated under the operating license. These comments are related to security and terrorism, both of which are outside the scope of the environmental review. No changes were made to the EIS as a result of these comments.*

E.2.24 General Editorial Comments

Comment: The following is a list of minor comments on the Bell Bend DEIS for your information and use:

Table 2-16 footnote (a) typo: it lists "E" rather than "FE" for Federally Endangered.

Page 3-12, Lines 9 & 10: this discussion should refer to the four trains of ESW , not the “four PWR cooling loops".

Page 3-12, Line 24: The ESWEMS pumphouse is located at the west end of the pond.

Page 8-5, lines 10 and 30, and Page 8-6, Line 20 - All refer to a Section"0" that does not exist.

Page 7-35, Lines 38 & 39 - The reference to auxiliary boilers is incorrect; they are electrical and are not a combustion source. The diesel driven fire pumps should be added to this discussion.

Page 5-48, Line 19, and Page 5-49, Line 2: the Noise discussion should reference two “natural" draft cooling towers for clarity”

Page 2-5, Lines 3 & 4: Talen “Electric" should be Talen Energy.

Page 2-82, Line 22 and Page 4-36, Line 34: The second Normandeau reference should be eliminated. It refers to the 2013 mist net study which we corrected to eliminate an error in reporting the Northern long eared bat.

Page 2-83, Line 14: The Northern long eared bat finding only applies to the 2008 survey. (**0007-1** [Sgarro, Rocco])

Comment: 2. Page H-6-Susquehanna River Basin Commission:

a. The "Authority" section should be deleted in its entirety and replaced with "18 CPR Parts 801-808; Susquehanna River Basin Compact."

b. The "Activity Covered" section should be corrected to read "Water withdrawal > 100,000 gpd (30-day average) or consumptive use >20,000 gpd (30-day average). Covers withdrawals from groundwater and surface water within the Susquehanna River Basin."

c. The "Anticipated Application Submittal Date" is incorrectly listed as "Complete." SRBC has not found the applications submitted to date by the project sponsor to be complete. As discussed in our August 12, 2013, letter to your office, the review has been suspended pending submittal of additional information and a timeline for addressing the deficiencies has not been received. (**0013-16** [Dehoff, Andrew])

Response: *These comments are editorial in nature. The text was changed to reflect these comments.*

Comment: 3. Page 11-77, Line 31 -"835,000 mgd" should be deleted and replaced with "835.000 mgd."

4. Page 11-77, Line 32 -"23,100 mgd" should be deleted and replaced with "23 .100 mgd."

5. References to all letters listed in the beginning of this letter should be included.

6. Entire Document -References throughout the document to "Susquehanna River Board Commission" should be corrected to read "Susquehanna River Basin Commission." (**0013-17** [Dehoff, Andrew])

Response: *Comments regarding page 11-77 of the draft EIS and the spelling of the Susquehanna River Basin Commission were made as noted. However, only the August 12, 2013, March 26, 2013, and December 28, 2012 letters were referenced in this EIS. It is not the NRC's editorial practice to call out a letter in the reference listing if the letter was not used as a reference in the text of the EIS. However, the June 27, 2012 letter is in the NRC's Agencywide Documents Access and Management System website at Accession No. ML12194A306 and listed in Appendix C of this EIS.*

E.3 References

10 CFR Part 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions." Washington, D.C. TN250.

10 CFR Part 52. *Code of Federal Regulations*, Title 10, *Energy*, Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants." Washington, D.C. TN251.

33 CFR Part 320. *Code of Federal Regulations*, Title 33, *Navigation and Navigable Waters*, Part 320, "General Regulatory Policies." Washington, D.C. TN424.

40 CFR Part 125. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 125, "Criteria and Standards for the National Pollutant Discharge Elimination System." Washington, D.C. TN254.

40 CFR Part 190. *Code of Federal Regulations*, Title 40, *Protection of Environment*, Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations." Washington, D.C. TN739.

51 FR 30028. August 21, 1986. "Safety Goals for the Operation of Nuclear Power Plants; Policy Statement; Correction and Republication." *Federal Register*, Nuclear Regulatory Commission, Washington, D.C. TN594.

66 FR 65256. December 18, 2001. "National Pollutant Discharge Elimination System: Regulations Addressing Cooling Water Intake Structures for New Facilities." *Federal Register,* Environmental Protection Agency, Washington, D.C. TN243.

69 FR 52040. August 24, 2004. "Policy Statement on the Treatment of Environmental Justice Matters in NRC Regulatory and Licensing Actions." *Federal Register*, Nuclear Regulatory Commission, Washington, D.C. TN1009.

74 FR 470. January 6, 2009. "PPL Bell Bend, LLC; Bell Bend Nuclear Power Plant Combined License Application; Notice of Intent To Prepare an Environmental Impact Statement and Conduct Scoping Process." *Federal Register*, Nuclear Regulatory Commission, Washington, D.C. TN1785.

77 FR 36012. June 15, 2012. "PPL Bell Bend, LLC; Bell Bend Nuclear Power Plant Combined License Application; Notice of Intent to Conduct a Supplemental Scoping Process on the Revised Site Layout." *Federal Register*, Nuclear Regulatory Commission, Washington, D.C. TN3907.

80 FR 22231. April 21, 2015. "Bell Bend Nuclear Power Plant: Draft Environmental Impact Statement; Public Meeting and Request for Comment." *Federal Register*, Nuclear Regulatory Commission, Washington, D.C. TN4402.

80 FR 22992. April 24, 2015. "Environmental Impact Statements; Notice of Availability." *Federal Register*, Environmental Protection Agency, Washington, D.C. TN4403.

42 U.S.C. § 4321 et seq. National Environmental Policy Act (NEPA) of 1969, as amended. TN661.

EA (EA Engineering, Science, and Technology). 2012. *Optimizing Use of Commission-Owned Water Storage at Cowanesque Lake, Pennsylvania*. Sparks, Maryland. Accession No. ML15043A629. TN3371.

ERM and Ecology III (Environmental Resources Management and Ecology III, Inc.). 2012. *Potential Effects of the Bell Bend Project on Water Quality of Backwater Areas Used by Fry and Young-Of-The-Year Smallmouth Bass for the Year 2012*. Mt. Pleasant, South Carolina and Berwick, Pennsylvania. Accession No. ML12297A048. TN1606.

FWS (U.S. Fish and Wildlife Service). 2015. *Biological Opinion: Effects to the Indiana Bat (*Myotis sodalis*) and Northern Long-Eared Bat (*Myotis septentrionalis*) from the Construction and Operation of the Bell Bend Nuclear Power Plant, Luzerne County, Pennsylvania*. State College, Pennsylvania. Accession No. ML15345A142. TN4436.

Kleinschmidt, Biodrawversity, Alden, and Kapur & Associates. 2012. *Bell Bend Nuclear Power Plant Low Flow Impact Analysis—Mussels*. Accession No. ML123410050. TN1608.

Normandeau (Normandeau Associates, Inc.). 2010. *Impingement and Entrainment Sampling for the Proposed Bell Bend Nuclear Power Plant at the SSES Circulating Water Supply System Intake Structure, Luzerne County, Pennsylvania*. Revision 1, Stowe, Pennsylvania. Accession No. ML12205A260. TN491.

Normandeau (Normandeau Associates, Inc.). 2012. *Potential Effects of the Bell Bend Project on Aquatic Resources and Downstream Users*. Moncks Corner, South Carolina. Accession No. ML121930648. TN1605.

Normandeau (Normandeau Associates, Inc.). 2012. *Mussel Survey in the Susquehanna River near the proposed Bell Bend Project at Berwick, PA*. Stowe, Pennsylvania. Accession No. ML12262A004. TN1607.

Normandeau, Ecology, and ERM (Normandeau Associates, Inc., Ecology III, Inc., and Environmental Resources Management, Inc.). 2012. *Study Plan to Collect Supplemental Data to Assess the Potential Effects of the Bell Bend Project on Water Quality of Backwater Areas Used by Fry and Young-Of-The-Year Smallmouth Bass.* Draft for Discussion, Drumore, Pennsylvania, Berwick, Pennsylvania, and Exton, Pennsylvania. Accession No. ML14308A191. TN1945.

NRC (U.S. Nuclear Regulatory Commission). 2000. *Environmental Standard Review* Plan—Standard *Review Plans for Environmental Reviews for Nuclear Power Plants*. NUREG–1555, Main Report and 2007 Revisions, Washington, D.C. Available at http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1555/toc/. TN614.

NRC (U.S. Nuclear Regulatory Commission). 2007. *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, LWR Edition.* NUREG–0800, Washington, D.C. Accession No. ML070660036. TN613.

NRC (U.S. Nuclear Regulatory Commission). 2009. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants—Supplement 35 Regarding Susquehanna Steam Electric Station Units 1 and 2. Final Report.* NUREG–1437, Supplement 35, Washington D.C. Accession No. ML090700454. TN1725.

NRC (U.S. Nuclear Regulatory Commission). 2014. *Interim Staff Guidance on Environmental Issues Associated with New Reactors, COL/ESP–ISG–026.* Washington, D.C. Accession No. ML14092A402. TN3767.

NRC (U.S. Nuclear Regulatory Commission). 2014. *Attachment 2: Staff Guidance for the Socioeconomic and Environmental Justice Analysis for New Reactor Environmental Impact Statements, COL/ESP-ISG-026*. Washington, D.C. Accession No. ML14100A535. TN3769.

NRC (U.S. Nuclear Regulatory Commission). 2014. *Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel.* Final Report, NUREG–2157, Washington, D.C. Accession No. ML14198A440. TN4117.

NRC and USACE (U.S. Nuclear Regulatory Commission and U.S. Army Corps of Engineers). 2015. *Biological Assessment for the Indiana Bat (*Myotis sodalis*) and the Northern Long-Eared Bat (*Myotis septentrionalis*) for the Proposed Bell Bend Nuclear Power Plant Combined License Application, Luzerne County, Pennsylvania*. Rockville, Maryland (NRC) and Baltimore, Maryland (USACE). Accession No. ML15055A436. TN4435.

PPL Bell Bend (PPL Bell Bend, LLC). 2013. *Bell Bend Nuclear Power Plant Combined License Application Part 3: Environmental Report*. Revision 4, UniStar Nuclear Services, LLC, Baltimore, Maryland. Accession No. ML13120A411. TN3377.

PPL Bell Bend (PPL Bell Bend, LLC). 2013. Letter from R.R. Sgarro to NRC, dated October 21, 2013, regarding "Bell Bend Nuclear Power Plant Revised Redacted Response to RAI ENV-19." BNP–2013–142, Allentown, Pennsylvania. Accession No. ML13304B419. TN3541.

PPL Bell Bend (PPL Bell Bend, LLC). 2015. Letter from R.R. Sgarro to NRC, dated May 12, 2015, regarding "Bell Bend Nuclear Power Plant Name Changes Due to Spinoff Transaction." BNP–2015–028, Docket No. 52-039, Allentown, Pennsylvania. Accession No. ML15146A095. TN4379.

SRBC (Susquehanna River Basin Commission). 2008. *Consumptive Use Mitigation Plan.* Publication 253, Harrisburg, Pennsylvania. Accession No. ML14286A013. TN699.

SRBC (Susquehanna River Basin Commission). 2011. "Exelon Generating Company, LLC Three Mile Island Generating Station, Unit 1, Surface Water Withdrawal, Groundwater Withdrawal, and Consumptive Water Use for Power Plant Operations and Electric Power Generation." Docket No. 20110610, Harrisburg, Pennsylvania. Accession No. ML14310A013. TN3572.

SRBC (Susquehanna River Basin Commission). 2013. Letter from J.L. Richenderfer to NRC, dated August 12, 2013, regarding "Consumptive Water Use Mitigation for PPL Bell Bend, LLC; Bell Bend Nuclear Power Plant; Salem Township, Luzerne County, Pennsylvania; Commission Pending Nos. 2009-079 (SW), 2009-080 (CU), and 2012-007 (GW). Harrisburg, Pennsylvania. Accession No. ML13228A282. TN4429.

Talen (Talen Energy). 2015. Letter from R.R. Sgarro to NRC, dated November 6, 2015, regarding "Bell Bend Nuclear Power Plant Response to RAI ENV-30." BNP–2015–069, Allentown, Pennsylvania. Accession No. ML15331A001. TN4424.

USACE (U.S. Army Corps of Engineers). 2015. Public Notice in Reply to Application Number CENAB-OPR-P-2008-01401-P13 (PPL Bell Bend, LLC/Bell Bend Nuclear Power Plant) to Announce the Release and Availability of the Draft Environmental Impact Statement (DEIS), Prepared by the Nuclear Regulatory Commission (NRC) and the U.S. Army Corps of Engineers (Corps), and Notice of a Public Meeting/Public Hearing by the NRC and the Corps. PN 15-27, Baltimore District, Baltimore, Maryland. Accession No. ML16075A220. TN4389.

APPENDIX F

KEY CONSULTATION CORRESPONDENCE

APPENDIX F

KEY CONSULTATION CORRESPONDENCE

Table F-1 identifies correspondence received during the evaluation process for the combined license application for the siting of a new nuclear unit at the Bell Bend Nuclear Power Plant (BBNPP) site in Luzerne County, Pennsylvania. The correspondence can be found in the U.S. Nuclear Regulatory Commission's (NRC's) Agencywide Documents Access and Management System (ADAMS), which is accessible from the NRC website at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room) (note that the URL is case-sensitive). ADAMS accession numbers are also provided in Table F-1.

PPL notified the NRC of changes in its power generation business by letter dated May 12, 2015 (NRC accession number ML15146A095). PPL Bell Bend, LLC was renamed Bell Bend, LLC, and Bell Bend, LLC became a generation affiliate of Talen Energy Corporation (Talen Energy). The transaction became official on June 1, 2015. For purposes of this review, the abbreviation "PPL" will still be used to indicate the applicant. Bell Bend, LLC, under Talen Energy, is the applicant.

Table F-1. Key Consultation Correspondence

Source	Recipient	Date of Letter and ADAMS Accession Number
<u>Section 106 Consultation</u>		
Federal Agencies		
U.S. Nuclear Regulatory Commission, Mr. William Burton	Advisory Council on Historic Preservation, Mr. Don Klima	January 9, 2009 ML083470501
Advisory Council on Historic Preservation, Ms. Charlene Dwin Vaughn	U.S. Nuclear Regulatory Commission, Mr. William Burton	February 17, 2009 ML090500261
U.S. Nuclear Regulatory Commission, Mr. Anthony H. Hsia	Advisory Council on Historic Preservation, Mr. Reid Nelson	June 12, 2012 ML12073A074
Pennsylvania State or Local Agencies		
U.S. Nuclear Regulatory Commission, Mr. William Burton NRC	Pennsylvania Historical & Museum Commission, Mr. Douglas McLearen	January 9, 2009 ML083470653
Pennsylvania Historical and Museum Commission, Mr. Douglas McLearen	UniStar George Wrobel, cc to Ms. J. Davis, U.S. Nuclear Regulatory Commission	March 2, 2009 ML090720932
U.S. Nuclear Regulatory Commission, Mr. Robert G. Schaaf	Berwick Historical Society, Mr. Jim Stout	July 7, 2009 ML091560490
Berwick Historical Society, Mr. Bill Vezendy	U.S. Nuclear Regulatory Commission, Ms. Stacey Imboden	July 17, 2009 ML091980262

Table F-1. (contd)

Source	Recipient	Date of Letter and ADAMS Accession Number
U.S. Nuclear Regulatory Commission, Mr. Anthony H. Hsia	Pennsylvania Historical and Museum Commission, Mr. Douglas McLearen	June 12, 2012 ML12073A076
U.S. Nuclear Regulatory Commission, Mr. Anthony H. Hsia	Bucknell University, Dr. Katherine Faull	June 12, 2012 ML121110291
U.S. Nuclear Regulatory Commission, Mr. Anthony H. Hsia	Luzerne County Planning Commission, Mr. Adrian Merolli	June 12, 2012 ML121120005
U.S. Nuclear Regulatory Commission, Mr. Anthony H. Hsia	Salem Township Board of Supervisors, Mr. Robert M. Pearse	June 12, 2012 ML121110296
U.S. Nuclear Regulatory Commission, Mr. Anthony H. Hsia	Society for Pennsylvania Archaeology, Mr. Ted Baird	June 12, 2012 ML121110281
U.S. Nuclear Regulatory Commission, Mr. Anthony H. Hsia	Luzerne County Historical Society, Mr. Anthony T. P. Brooks	June 12, 2012 ML121110274
U.S. Nuclear Regulatory Commission, Mr. Anthony H. Hsia	Berwick Historical Society, Mr. Jim Stout	June 12, 2012 ML121110280
Salem Township, Ms. Karen Karchner	Numark Associates, Mr. Darby Stapp; cc to U.S. Nuclear Regulatory Commission, Ms. Laura Quinn-Willingham	June 28, 2012 ML12181A216
Numark Associates, Mr. Darby Stapp	Salem Township, Ms. Karen Karchner	June 28, 2012 ML122510098
Salem Township, Ms. Karen Karchner	Numark Associates, Mr. Darby Stapp; cc to U.S. Nuclear Regulatory Commission, Ms. Laura Quinn-Willingham	June 28, 2012 ML122510115
U.S. Nuclear Regulatory Commission, Mr. Michael Purdie	Salem Township, Ms. Karen Karchner	August 17, 2012 ML122510135
U.S. Army Corps of Engineers, Mr. Wade B. Chandler	Pennsylvania Historical and Museum Commission, Mr. Douglas McLearen	January 7, 2013 ML13010A299
Pennsylvania Historical and Museum Commission, Mr. Douglas McLearen	U.S. Army Corps of Engineers, Mr. Wade B. Chandler	February 13, 2013 ML13056A020 (copy of this letter only included in this appendix)
Native American Tribes		
U.S. Nuclear Regulatory Commission, Mr. William Burton	Absentee-Shawnee Tribe of Oklahoma, Ms. Karen Kaniatobe	January 9, 2009 ML083510872
U.S. Nuclear Regulatory Commission, Mr. William Burton	Delaware Nation, Mr. Kerry Holton	January 9, 2009 ML083510888
U.S. Nuclear Regulatory Commission, Mr. William Burton	Eastern Shawnee Tribe of Oklahoma, The Honorable Glenna Wallace	January 9, 2009 ML083520420
U.S. Nuclear Regulatory Commission, Mr. William Burton	Heron Clan Representative for the Cayuga Nation, Mr. Clint Halftown	January 9, 2009 ML083510880

Table F-1. (contd)

Source	Recipient	Date of Letter and ADAMS Accession Number
U.S. Nuclear Regulatory Commission, Mr. William Burton	Oneida Indian Nation, The Honorable Raymond Halbritter	January 9, 2009 ML083510897
U.S. Nuclear Regulatory Commission, Mr. William Burton	Oneida Nation of Wisconsin, The Honorable Rick Hill	January 9, 2009 ML083510895
U.S. Nuclear Regulatory Commission, Mr. William Burton	Onondaga Nation, Mr. Tony Gonyea	January 9, 2009 ML083510898
U.S. Nuclear Regulatory Commission, Mr. William Burton	St. Regis Mohawk Tribe, The Honorable James Ransom	January 9, 2009 ML083520468
U.S. Nuclear Regulatory Commission, Mr. William Burton	Seneca-Cayuga Tribe of Oklahoma, The Honorable LeRoy Howard	January 9, 2009 ML083520552
U.S. Nuclear Regulatory Commission, Mr. William Burton	Seneca Nation of Indians, Mr. Maurice John	January 9, 2009 ML083520472
U.S. Nuclear Regulatory Commission, Mr. William Burton	Shawnee Tribe, Mr. Ron Sparkman	January 9, 2009 ML083510894
U.S. Nuclear Regulatory Commission, Mr. William Burton	Stockbridge-Munsee Band of the Mohican Nation of Wisconsin, Mr. Robert Chicks	January 9, 2009 ML083510895
U.S. Nuclear Regulatory Commission, Mr. William Burton	Tonawanda Seneca Nation, The Honorable Roger Hill	January 9, 2009 ML083520483
U.S. Nuclear Regulatory Commission, Mr. William Burton	Tuscarora Nation, The Honorable Leo Henry	January 9, 2009 ML083520477
U.S. Nuclear Regulatory Commission, Mr. William Burton	Oneida Nation of Wisconsin, The Honorable Rick Hill	July 7, 2009 ML091560475
U.S. Nuclear Regulatory Commission, Mr. William Burton	Delaware Nation, Mr. Kerry Holton	July 7, 2009 ML091541273
U.S. Nuclear Regulatory Commission, Mr. William Burton	Seneca-Cayuga Tribe of Oklahoma, The Honorable LeRoy Howard	July 7, 2009 ML091560488
U.S. Nuclear Regulatory Commission, Mr. William Burton	Seneca Nation of Indians, Mr. Maurice John	July 7, 2009 ML091560513
U.S. Nuclear Regulatory Commission, Mr. William Burton	Absentee-Shawnee Tribe of Oklahoma, Ms. Karen Kaniatobe	July 7, 2009 ML091541164
U.S. Nuclear Regulatory Commission, Mr. William Burton	St. Regis Mohawk Tribe, The Honorable James Ransom	July 7, 2009 ML091560567
U.S. Nuclear Regulatory Commission, Mr. William Burton	Eastern Shawnee Tribe of Oklahoma, The Honorable Glenna Wallace	July 7, 2009 ML091560458
U.S. Nuclear Regulatory Commission, Mr. William Burton	Stockbridge-Munsee Band of the Mohican Nation of Wisconsin, Mr. Robert Chicks	September 2, 2009 ML092470274
U.S. Nuclear Regulatory Commission, Mr. William Burton	Onondaga Nation, Mr. Tony Gonyea	September 2, 2009 ML092470231
U.S. Nuclear Regulatory Commission, Mr. William Burton	Oneida Indian Nation, The Honorable Raymond Halbritter	September 2, 2009 ML092460629

Table F-1. (contd)

Source	Recipient	Date of Letter and ADAMS Accession Number
U.S. Nuclear Regulatory Commission, Mr. William Burton	Heron Clan Representative for the Cayuga Nation, Mr. Clint Halftown	September 2, 2009 ML092460607
U.S. Nuclear Regulatory Commission, Mr. William Burton	Tuscarora Nation, The Honorable Leo Henry	September 2, 2009 ML092470260
U.S. Nuclear Regulatory Commission, Mr. William Burton	Tonawanda Seneca Nation, The Honorable Roger Hill	September 2, 2009 ML092470301
U.S. Nuclear Regulatory Commission, Mr. William Burton	Shawnee Tribe, Mr. Ron Sparkman	September 2, 2009 ML092470285
U.S. Nuclear Regulatory Commission, Mr. Anthony H. Hsia	Delaware Nation, Mr. Kerry Holton	June 12, 2012 ML12073A124
U.S. Nuclear Regulatory Commission, Mr. Anthony H. Hsia	Seneca Nation of Indians, Mr. Robert Odawi Porter	June 12, 2012 ML12073A299
U.S. Nuclear Regulatory Commission, Mr. Anthony H. Hsia	Absentee-Shawnee Tribe of Oklahoma, The Honorable George Blanchard	June 12, 2012 ML12073A130
U.S. Nuclear Regulatory Commission, Mr. Anthony H. Hsia	Eastern Shawnee Tribe of Oklahoma, The Honorable Glenna Wallace	June 12, 2012 ML12073A245
U.S. Nuclear Regulatory Commission, Mr. Anthony H. Hsia	Tonawanda Seneca Nation, The Honorable Roger Hill	June 12, 2012 ML12073A316
U.S. Nuclear Regulatory Commission, Mr. Anthony H. Hsia	Heron Clan Representative for the Cayuga Nation, The Honorable Clint Halftown	June 12, 2012 ML12073A308
U.S. Nuclear Regulatory Commission, Mr. Anthony H. Hsia	Onondaga Nation, Mr. Tony Gonyea	June 12, 2012 ML12073A270
U.S. Nuclear Regulatory Commission, Mr. Anthony H. Hsia	Shawnee Tribe, Mr. Ron Sparkman	June 12, 2012 ML12079A139
U.S. Nuclear Regulatory Commission, Mr. Anthony H. Hsia	Oneida Indian Nation, The Honorable Raymond Halbritter	June 12, 2012 ML12073A137
U.S. Nuclear Regulatory Commission, Mr. Anthony H. Hsia	Tuscarora Nation, The Honorable Leo Henry	June 12, 2012 ML12073A149
U.S. Nuclear Regulatory Commission, Mr. Anthony H. Hsia	St. Regis Mohawk Tribe, The Honorable Mark H. Garrow, The Honorable Randy Hart, and The Honorable Ron LaFrance, Jr.	June 12, 2012 ML12073A261
U.S. Nuclear Regulatory Commission, Mr. Anthony H. Hsia	Stockbridge-Munsee Band of the Mohican Nation of Wisconsin, Mr. Robert Chicks	June 12, 2012 ML12073A247
U.S. Nuclear Regulatory Commission, Mr. Anthony H. Hsia	Oneida Nation of Wisconsin, The Honorable Ed Delgado	June 12, 2012 ML12073A090
U.S. Nuclear Regulatory Commission, Mr. Anthony H. Hsia	Seneca-Cayuga Tribe of Oklahoma, The Honorable LeRoy Howard	June 12, 2012 ML12073A101
Oneida Tribe of Indians of Wisconsin, Ms. Corina Williams	U.S. Nuclear Regulatory Commission, Mr. Michael Purdie	August 7, 2012 ML122510139

Table F-1. (contd)

Source	Recipient	Date of Letter and ADAMS Accession Number
Oneida Tribe of Indians of Wisconsin, Ms. Corina Williams	U.S. Nuclear Regulatory Commission, Mr. Michael Purdie	August 13, 2012 ML122510154
U.S. Nuclear Regulatory Commission, Mr. Michael Purdie	Oneida Tribe of Indians of Wisconsin, Ms. Corina Williams	August 15, 2012 ML122510162
U.S. Nuclear Regulatory Commission, Mr. Michael Purdie	Haudenosaunee Council, Ms. Christine Abrams	August 27, 2012 ML122500970
U.S. Nuclear Regulatory Commission, Mr. William F. Burton	Haudenosaunee Council, Ms. Christine Abrams	November 7, 2012 ML12275A585
<u>Ecological Consultation</u>		
U.S. Fish and Wildlife Service		
U.S. Nuclear Regulatory Commission, Mr. William F. Burton	Pennsylvania Field Office of the U.S. Fish and Wildlife Service, Mr. David Densmore	January 12, 2009 ML083460637
U.S. Nuclear Regulatory Commission, Mr. William F. Burton	New Jersey Field Office of the U.S. Fish and Wildlife Service, Mr. Eric Davis	January 8, 2009 ML083500530
New Jersey Field Office of the U.S. Fish and Wildlife Service, Mr. Eric Davis	U.S. Nuclear Regulatory Commission, Mr. Robert Schaaf	March 13, 2009 ML091280435
Pennsylvania Field Office of the U.S. Fish and Wildlife Service, Mr. David Densmore	U.S. Nuclear Regulatory Commission, Chief, Rules and Directives Branch	July 10, 2009 ML092020071
Pennsylvania Field Office of the U.S. Fish and Wildlife, Mr. Clinton Riley	U.S. Nuclear Regulatory Commission, Ms. Laura Quinn- Willingham	May 7, 2012 ML121450545
U.S. Nuclear Regulatory Commission, Mr. Anthony H. Hsia	Pennsylvania Field Office of the U.S. Fish and Wildlife Service, Field Office, Mr. Clint Riley	June 12, 2012 ML12079A176
U.S. Nuclear Regulatory Commission, Mr. Anthony H. Hsia	New Jersey Field Office of the U.S. Fish and Wildlife Service, Mr. Eric Davis	June 12, 2012 ML12076A037
U.S. Fish and Wildlife Service, Ms. Sarah Gannon-Nagle	U.S. Nuclear Regulatory Commission, Ms. Laura Quinn-Willingham	March 14, 2013 ML13116A228
Pennsylvania Field Office of the U.S. Fish and Wildlife, Mr. Clinton Riley	U.S. Army Corps of Engineers, Ms. Amy Elliott	March 22, 2012 ML12107A344
U.S. Fish and Wildlife Service, Ms. Sarah Gannon-Nagle	U.S. Nuclear Regulatory Commission, Ms. Laura Quinn-Willingham	March 29, 2013 ML13101A284
PPL Bell Bend, LLC, Mr. Gary Petrewski	Pennsylvania Field Office of the U.S. Fish and Wildlife Service, Mr. Robert Anderson	June 7, 2013 ML13171A040
PPL Bell Bend, LLC, Mr. Gary Petrewski	Pennsylvania Field Office of the U.S. Fish and Wildlife Service, Mr. Robert Anderson	June 7, 2013 ML13171A040
U.S. Fish and Wildlife Service, Ms. Lora Zimmerman	U.S. Nuclear Regulatory Commission, Ms. Laura Quinn- Willingham	May 23, 2014 ML14253A417

Table F-1. (contd)

Source	Recipient	Date of Letter and ADAMS Accession Number
U.S. Nuclear Regulatory Commission, Ms. Jennifer Dixon-Herrity	U.S. Fish and Wildlife Service, Ms. Lora Zimmerman	April 17, 2015 ML15055A436
U.S. Fish and Wildlife Service, Ms. Lora Zimmerman	U.S. Nuclear Regulatory Commission, Ms. Jennifer Dixon-Herrity	August 5, 2015 ML15225A426
U.S. Fish and Wildlife Service, Ms. Lora Zimmerman	U.S. Nuclear Regulatory Commission, Ms. Jennifer Dixon-Herrity	November 30, 2015 ML15345A142
U.S. National Marine Fisheries Service		
U.S. Nuclear Regulatory Commission, Mr. William F. Burton	U.S. National Marine Fisheries Service, Ms. Patricia Kurkul	January 9, 2009 ML083500532
U.S. Nuclear Regulatory Commission, Mr. Anthony H. Hsia	U.S. National Marine Fisheries Service, Ms. Patricia Kurkul	June 12, 2012 ML12076A053
U.S. Nuclear Regulatory Commission, Mr. Butch Burton	U.S. National Marine Fisheries Service, Ms. Mary Colligan	February 4, 2013 ML13058A245
Other Federal Agencies		
U.S. Environmental Protection Agency, Mr. Kevin Magerr	U.S. Army Corps of Engineers, Ms. Amy Elliott	August 26, 2010 ML102640782
Susquehanna River Basin Commission, Brigadier General Peter A. Deluca	U.S. Nuclear Regulatory Commission, Mr. Dale E. Klein	February 18, 2011 ML110730021
U.S. Nuclear Regulatory Commission, Mr. Michael R. Johnson	Susquehanna River Board Commission, Brigadier General Peter A. Deluca	April 7, 2011 ML110830774
U.S. Nuclear Regulatory Commission, Mr. Allen Fetter	FEMA LOMC Clearinghouse	November 18, 2011 ML113070296
Susquehanna River Basin Commission, Mr. James L. Richenderfer	U.S. Army Corps of Engineers, Ms. Amy Elliott	February 22, 2012 ML12107A337
Susquehanna River Basin Commission, Mr. James L. Richenderfer	U.S. Army Corps of Engineers, Ms. Amy Elliott	February 29, 2012 ML12060A134
Susquehanna River Basin Commission, Colonel David E. Anderson	U.S. Nuclear Regulatory Commission, Mr. Michael R. Johnson	March 2, 2012 ML120550079
U.S. Environmental Protection Agency, Mr. John R. Pomponio	U.S. Army Corps of Engineers, Ms. Beth Bachur	March 22, 2012 ML12107A345
U.S. Environmental Protection Agency, Mr. Shawn M. Garvin	U.S. Army Corps of Engineers, Colonel David E. Anderson	April 16, 2012 ML12132A042
Susquehanna River Basin Commission, Mr. James L. Richenderfer	U.S. Nuclear Regulatory Commission, Mr. Anthony H. Hsia	June 11, 2012 ML12076A111

Table F-1. (contd)

Source	Recipient	Date of Letter and ADAMS Accession Number
Delaware River Basin Commission, Ms. Carol R. Collier	U.S. Nuclear Regulatory Commission, Mr. Anthony H. Hsia	June 11, 2012 ML12115A009
Susquehanna River Basin Commission, Mr. James L. Richenderfer	U.S. Nuclear Regulatory Commission, Ms. Laura Quinn-Willingham	August 12, 2013 ML13228A282
Pennsylvania State Agencies		
U.S. Nuclear Regulatory Commission, Mr. William F. Burton	Pennsylvania Fish and Boat Commission, Mr. Chris Urban	January 9, 2009 ML083510239
U.S. Nuclear Regulatory Commission, Mr. William F. Burton	Pennsylvania Game Commission, Mr. James Leigey	January 9, 2009 ML083500555
U.S. Nuclear Regulatory Commission, Mr. William F. Burton	Pennsylvania Department of Conservation and Natural Resources, Mr. Justin Newell	January 12, 2009 ML083500498
New Jersey Department of Environmental Protection, Natural Heritage Program, Mr. Herbert A. Lord	U.S. Nuclear Regulatory Commission, Ms. Stacey Imboden	January 27, 2009 ML090400936
Pennsylvania Department of Conservation and Natural Resources, Ms. Joy VanDervort-Sneed	U.S. Nuclear Regulatory Commission, Ms. Stacey Imboden	February 12, 2009 ML090440181
Pennsylvania Fish and Boat Commission, Mr. Chris Urban	U.S. Nuclear Regulatory Commission, Ms. Stacey Imboden	March 5, 2009 ML090790548
U.S. Nuclear Regulatory Commission, Mr. Anthony H. Hsia	Pennsylvania Game Commission, Mr. James R. Leigey	June 11, 2012 ML12074A168
U.S. Nuclear Regulatory Commission, Mr. Anthony H. Hsia	Pennsylvania Department of Conservation and Natural Resources, Mr. Justin Newell	June 12, 2012 ML12076A068
U.S. Nuclear Regulatory Commission, Mr. Anthony H. Hsia	Pennsylvania Fish and Boat Commission, Mr. Chris Urban	June 12, 2012 ML12076A091
Pennsylvania Game Commission, Ms. Olivia A. Mowery	U.S. Nuclear Regulatory Commission, Chief, Rulemaking, Announcements and Directives Branch	October 18, 2012 ML12311A156
Pennsylvania Game Commission, Ms. Olivia A. Mowery	U.S. Nuclear Regulatory Commission, Chief, Rulemaking, Announcements and Directives Branch	October 18, 2012 ML12311A157
Pennsylvania Game Commission, Ms. Olivia A. Mowery	U.S. Nuclear Regulatory Commission, Chief, Rulemaking, Announcements and Directives Branch	October 18, 2012 ML12311A159
Pennsylvania Game Commission, Ms. Olivia A. Mowery	U.S. Nuclear Regulatory Commission, Chief, Rulemaking, Announcements and Directives Branch	October 18, 2012 ML12311A158
U.S. Nuclear Regulatory Commission, Mr. William F. Burton	Pennsylvania Department of Environmental Protection, Mr. Michael D. Bedrin	January 3, 2013 ML12318A293

Table F-1. (contd)

Source	Recipient	Date of Letter and ADAMS Accession Number
U.S. Nuclear Regulatory Commission, Mr. William F. Burton	Pennsylvania Department of Conservation and Natural Resources, Mr. Nathan Dewar	January 16, 2013 ML13007A202
Pennsylvania Game Commission, Mr. Nathaniel Dewar	U.S. Nuclear Regulatory Commission, Ms. Laura Quinn-Willingham	May 20, 2013 ML13225A356
PPL Bell Bend, LLC, Mr. Rocco R. Sgarro	U.S. Nuclear Regulatory Commission, Document Control Desk	October 3, 2013 ML13288A217
Pennsylvania Game Commission, Mr. John Taucher	U.S. Nuclear Regulatory Commission, Ms. Laura Quinn-Willingham	March 18, 2014 ML14125A170
Pennsylvania Department of Conservation and Natural Resources, Ms. Rebecca H. Bowen	U.S. Nuclear Regulatory Commission, Ms. Laura Quinn-Willingham	March 25, 2014 ML14125A171
PPL Bell Bend, LLC, Mr. Rocco R. Sgarro	U.S. Nuclear Regulatory Commission, Document Control Desk	April 24, 2014 ML14122A330
Pennsylvania Department of Conservation and Natural Resources, Ms. Rebecca Bowen	U.S. Nuclear Regulatory Commission, Ms. Laura Quinn-Willingham	March 25, 2014 ML14125A171
Pennsylvania Fish and Boat Commission, Mr. Christopher Urban	Pacific Northwest National Laboratory, Mr. Jim Becker	October 8, 2014 ML16075A226
Pennsylvania Game Commission, Mr. John Taucher	Talen Energy, Mr. Rocco Sgarro	October 19, 2015 ML15292A453
Pennsylvania Department of Conservation and Natural Resources, Mr. Greg Podniesinski	Talen Energy, Mr. Rocco Sgarro	November 5, 2015 ML16035A437
Pennsylvania Fish and Boat Commission, Mr. Christopher Urban	Talen Energy, Mr. Rocco Sgarro	November 23, 2015 ML16070A332
New Jersey State Agencies		
U.S. Nuclear Regulatory Commission, Mr. William F. Burton	New Jersey Natural Heritage Program, Mr. Herbert A. Lord	January 8, 2009 ML083500509
New Jersey Natural Heritage Program, Mr. Herbert A. Lord	U.S. Nuclear Regulatory Commission, Ms. Stacey Imboden	January 27, 2009 ML090400936
New Jersey Highlands Water Protection and Planning Council, Mr. Daniel J. Van Abs	U.S. Nuclear Regulatory Commission, Mr. John Fringer	May 10, 2012 ML12135A234
U.S. Nuclear Regulatory Commission, Mr. John Fringer	New Jersey Highlands Water Protection and Planning Council, Ms. Kim Ball Kaiser	May 3, 2012 ML12257A292
U.S. Nuclear Regulatory Commission, Mr. Anthony H. Hsia	New Jersey Natural Heritage Program, Mr. Herb Lord	July 12, 2012 ML12076A047
New Jersey Natural Heritage Program, Mr. Larry Miller	U.S. Nuclear Regulatory Commission, Ms. Laura Quinn-Willingham	June 28, 2012 ML12187A055

Commonwealth of Pennsylvania
Pennsylvania Historical and Museum Commission
Bureau for Historic Preservation
Commonwealth Keystone Building, 2nd Floor
400 North Street
Harrisburg, PA 17120-0093
www.phmc.state.pa.us

13 February 2013

Wade B. Chandler
US Army Corps of Engineers
Baltimore District
State College Field Office
1631 S. Atherton St., Suite 101
State College, PA 16801

Re: ER# 81-0658-079-TT
Bell Bend Nuclear Power Plant, Salem Township,
Luzerne County, Pennsylvania

Dear Mr. Chandler:

Thank you for submitting information concerning the above referenced project. The Bureau for Historic Preservation (the State Historic Preservation Office) reviews projects in accordance with state and federal laws. Section 106 of the National Historic Preservation Act of 1966, and the implementing regulations (36 CFR Part 800) of the Advisory Council on Historic Preservation, is the primary federal legislation. The Environmental Rights amendment, Article 1, Section 27 of the Pennsylvania Constitution and the Pennsylvania History Code, 37 Pa. Cons. Stat. Section 500 et seq. (1988) is the primary state legislation. These laws include consideration of the project's potential effects on both historic and archaeological resources.

Pursuant to your correspondence dated 7 January 2013, consultation has been undertaken with our office for this project by the US Nuclear Regulatory Commission under Section 106 of the National Historic Preservation Act and cultural resource surveys have been undertaken to determine the effect of this project to historic properties. All resources documented as a result of these surveys have either been avoided or determined not eligible for inclusion on the National Register of Historic Places. Archaeological site 36Lu288 was determined eligible for the National Register and an avoidance plan was developed in coordination with our office. We request at this time that the avoidance measures for 36Lu288 be included as a special condition on your permit. As a result of consultation for this project, it is our opinion that this project, as currently designed, will have no adverse effect to cultural resources.

Page 2
13 February 2013
ER# 81-0658-079-TT

If you need further information regarding archaeological resources, contact Steven McDougal at (717) 772-0923.

Sincerely,

Douglas C. McLearen, Chief
Division of Archaeology &
Protection

cc: DEP, Northeast Regional Office
NRC

DCM/srm

Appendix F-2

The NRC has not reproduced the U.S Fish and Wildlife Service's "Biological Opinion, Effects to the Indiana Bat (*Myotis sodalis*) and Northern Long-eared Bat (*Myotis septentrionalis*) from the Construction and Operation of the Bell Bend Nuclear Power Plant" in the paper reproduction of the final environmental impact statement for the combined license for the BBNPP. This document can be found in the ADAMS electronic public reading room, accessible at http://www.nrc.gov/reading-rm/adams.html using accession number ML15345A142. If you encounter issues accessing ADAMS, call the NRC at 1-800-397-4209 or 301-415-4737 or e-mail pdr.resource@nrc.gov.

APPENDIX G

SUPPORTING DOCUMENTATION ON RADIOLOGICAL DOSE ASSESSMENT

APPENDIX G

SUPPORTING DOCUMENTATION ON RADIOLOGICAL DOSE ASSESSMENT

The U.S. Nuclear Regulatory Commission (NRC) staff performed an independent dose assessment of the radiological impacts resulting from normal operation of the proposed Bell Bend Nuclear Power Plant (BBNPP) in addition to the nearby existing Susquehanna Steam Electric Station nuclear units. The results of this assessment are presented in this appendix and are compared to the results from PPL Bell Bend, LLC (PPL) found in Section 5.9, Radiological Impacts of Normal Operations, of this environmental impact statement (EIS). The appendix is divided into four sections: (1) estimates of dose to the public from liquid effluents, (2) estimates of dose to the public from gaseous effluents, (3) estimates of cumulative dose, and (4) estimates of dose to the biota from liquid and gaseous effluents.

PPL notified the NRC of changes in its power generation business by letter dated May 12, 2015 (NRC accession number ML15146A095). PPL Bell Bend, LLC was renamed Bell Bend, LLC, and Bell Bend, LLC became a generation affiliate of Talen Energy Corporation (Talen Energy). The transaction became official on June 1, 2015. For purposes of this review, the abbreviation “PPL” will still be used to indicate the applicant. Bell Bend, LLC, under Talen Energy, is the applicant.

G.1 Dose Estimates to the Public from Liquid Effluents

The NRC staff used the dose assessment approach specified in Regulatory Guide (RG) 1.109 (NRC 1977-TN90) and the LADTAP II computer code (Strenge et al. 1986-TN82) to estimate doses to the maximally exposed individual (MEI) and population from the liquid effluent pathway of the proposed BBNPP unit. The NRC staff used the Susquehanna Steam Electric Station (SSES) Units 1 and 2 annual radioactive effluent release reports for 2008 to 2014 to estimate doses to the MEI and population from the existing units’ liquid effluent releases (PPL Susquehanna 2009-TN743; PPL Susquehanna 2010-TN746; PPL Susquehanna 2011-TN714; PPL Susquehanna 2015-TN4383).

G.1.1 Scope

Doses from the proposed BBNPP unit to the MEI were calculated and compared to regulatory criteria for the following:

- Total body – Dose was the total for all pathways (i.e., drinking water, fish and shellfish consumption, shoreline usage, swimming exposure, and boating) with the highest value for either the adult, teen, child, or infant compared to the 3 mrem/yr per reactor design objective in Title 10 of the *Code of Federal Regulations* Part 50 (10 CFR Part 50), Appendix I (TN249).

- Organ – Dose was the total for each organ for all pathways (i.e., drinking water, fish and shellfish consumption, shoreline usage, swimming exposure, and boating) with the highest value for either the adult, teen, child, or infant compared to the 10 mrem/yr per reactor design objective specified in 10 CFR Part 50, Appendix I (TN249).

The NRC staff reviewed the exposure pathways and the input parameters and values used by PPL (PPL Bell Bend 2013-TN3377) for appropriateness, including references made to the AREVA U.S. Evolutionary Power Reactor (U.S. EPR) design certification document (AREVA 2014-TN3722). Default values from RG 1.109 (NRC 1977-TN90) were used when site-specific input parameters were not available from PPL. The NRC staff concluded that the exposure pathways and input parameters and values used by PPL were generally appropriate.

G.1.2 Resources Used

To calculate doses to the public from liquid effluents, the NRC staff used a personal computer version of the LADTAP II code entitled NRCDOSE, Version 2.3.13, obtained through the Oak Ridge Radiation Safety Information Computational Center (ORNL 2008-TN741).

G.1.3 Input Parameters

Table G-1 provides a list of the major parameters used in calculating dose to the public from liquid effluent releases during normal operation.

G.1.4 Comparison of Results

Table G-2 compares PPL's results for a single new unit with the results calculated by the NRC staff. Doses calculated by the NRC staff for the MEI and population are essentially the same as those developed by PPL.

For calculating the population dose from liquid effluents, the population distribution used by PPL was for 2080, 20 years beyond the anticipated operating license (Table G-3). However, NRC's Environmental Standard Review Plan (ESRP) Section 5.4.1 (NRC 2000-TN614) instructs the NRC staff to use the "...projected population for 5 years from the time of the licensing action under consideration." Assuming the combined construction permit and operating license (COL or combined license) licensing action occurs in 2025 and adding 5 years yields 2030. However, both the NRC staff and PPL used the population in 2080. The 2030 projected population is 1,989,526 and the 2080 projected population is 2,640,368; thus, the population doses calculated by the NRC staff and PPL are conservatively high.

Table G-1. Parameters Used in Calculating Dose to the Public from Liquid Effluent Releases

Parameter	NRC Staff Value		Comments
BBNPP liquid effluent source term (Ci/yr)[(a)(b)]	H-3	1.66×10^{3}	These values are from environmental report (ER) Table 3.5-7 (PPL Bell Bend 2013-TN3377).
	Na-24	5.72×10^{-3}	
	Cr-51	9.6×10^{-4}	
	Mn-54	5.10×10^{-4}	
	Fe-55	3.80×10^{-4}	
	Fe-59	9.00×10^{-5}	
	Co-58	1.44×10^{-3}	
	Co-60	1.70×10^{-4}	
	Zn-65	1.60×10^{-4}	
	W-187	4.30×10^{-4}	
	Np-239	5.40×10^{-4}	
	Sr-89	4.00×10^{-5}	
	Sr-91	7.00×10^{-5}	
	Y-91m	5.00×10^{-5}	
	Y-93	3.30×10^{-4}	
	Zr-95	1.20×10^{-4}	
	Nb-95	9.00×10^{-5}	
	Mo-99	1.63×10^{-3}	
	Tc-99m	1.59×10^{-3}	
	Ru-103	2.34×10^{-3}	
	Ru-106	2.84×10^{-2}	
	Ag-110m	4.10×10^{-4}	
	Te-129m	6.00×10^{-5}	
	Te-129	4.00×10^{-5}	
	Te-131m	2.90×10^{-4}	
	Te-131	5.00×10^{-5}	
	I-131	3.54×10^{-2}	
	Te-132	4.50×10^{-4}	
	I-132	1.14×10^{-3}	
	I-133	4.21×10^{-2}	
	Cs-134	2.45×10^{-3}	
	I-135	1.69×10^{-2}	
	Cs-136	2.90×10^{-4}	
	Cs-137	3.25×10^{-3}	
	Ba-140	3.93×10^{-3}	
	La-140	7.12×10^{-3}	
	Ce-141	5.00×10^{-5}	
	Ce-143	5.70×10^{-4}	
	Pr-143	5.00×10^{-5}	
	Ce-144	1.23×10^{-3}	
	Pr-144	1.23×10^{-3}	

Table G-1. (contd)

Parameter	NRC Staff Value	Comments
Discharge flow rate (ft^3/s)	19.3	Site-specific value from Table 5.4-4 of the ER (PPL Bell Bend 2013-TN3377).
Source term multiplier	1	Single-unit source term.
Site type	Freshwater	Discharge is to the Susquehanna River.
Reconcentration model	No impoundment	Site-specific value from Table 5.4-1 of the ER (PPL Bell Bend 2013-TN3377).
Impoundment total volume (ft^3)	0	Set to zero for “no impoundment” model (Strenge et al. 1986-TN82).
Shore width factor	0.2	Suggested value for river shoreline (NRC 1977-TN90; Strenge et al. 1986-TN82; PPL Bell Bend 2013-TN3377).
Dilution factor for aquatic food and boating	11.8	Site-specific value from Table 5.4-1 of the ER (PPL Bell Bend 2013-TN3377).
Dilution factor for shoreline and swimming	44	Site-specific value from Table 5.4-2 of the ER (PPL Bell Bend 2013-TN3377).
Dilution factor for drinking water	11.8	Site-specific value from Table 5.4-2 of the ER (PPL Bell Bend 2013-TN3377).
Transit time (hr)	0	Site-specific value from Table 5.4-2 of the ER (PPL Bell Bend 2013-TN3377).
Consumption and usage factors for adults, teens, children, and infants	Shoreline usage (hr/yr) 12 (adult) 67 (teen) 14 (child) 12 (infant)	Default values from RG 1.109 (NRC 1977-TN90).
	Boating usage (hr/yr) 52 (adult) 52 (teen) 29 (child) 52 (infant)	Default values from RG 1.109 (NRC 1977-TN90).
	Swimming usage (hr/yr) 12 (adult) 67 (teen) 14 (child) 12 (infant)	Default values from RG 1.109; swimming assumed to equal shoreline (NRC 1977-TN90).
	Drinking water usage (L/yr) 730 (adult) 510 (teen) 510 (child) 330 (infant)	Default values from RG 1.109 (NRC 1977-TN90).
	Fish consumption (kg/yr) 21 (adult) 16 (teen) 6.9 (child) 0 (infant)	Values from Table E-5, Reg. Guide 1.109 (NRC 1977-TN90).
Total 50-mi population	2,640,368	Site-specific value from Table 2.5-10 of the ER (PPL Bell Bend 2013-TN3377).

Table G-1. (contd)

Parameter	NRC Staff Value	Comments
Total 50-mi sport fishing harvest (kg/yr)	236,562	Site-specific value from Table 5.4-4 of the ER (PPL Bell Bend 2013-TN3377).
Total 50-mi sport invertebrate harvest (kg/yr)	0	Site-specific value from Table 5.4-4 of the ER (PPL Bell Bend 2013-TN3377).
Total 50-mi shoreline usage (person-hr/yr)	0	Site-specific value from Table 5.4-5 of the ER (PPL Bell Bend 2013-TN3377).
Total 50-mi swimming usage (person-hr/yr)	0	Site-specific value from Table 5.4-5 of the ER (PPL Bell Bend 2013-TN3377).
Total 50-mi boating usage (person-hr/yr)	564,660	Site-specific value from Table 5.4-4 of the ER (PPL Bell Bend 2013-TN3377).

(a) To convert Ci/yr to Bq/yr, multiply the value by 3.7×10^{10}.
(b) Only radionuclides included in RG 1.109 are considered (NRC 1977-TN90).

Table G-2. Comparison of Doses to the Public from Liquid Effluent Releases for Proposed BBNPP

Type of Dose[(a)]	PPL ER (2012)[(b)]	NRC Staff Calculation	Percent Difference
Total Body (mrem/yr)	0.56 (child)	0.56 (child)	0
Organ Dose (mrem/yr)	2.41 (child thyroid)	2.41(child thyroid)	0
Thyroid (mrem/yr)	2.41 (child)	2.41(child)	0
Population Dose from Liquid Pathway (person-rem/yr)	0.289	0.289	0

(a) To convert mSv to mrem multiply by 100.
(b) Results from ER Tables 5.4-16, 5.4-17 and 5.4-19 (PPL Bell Bend 2013-TN3377).

Table G-3. Population Projections from 2000 to 2080 within 50 mi of the Bell Bend Site (ER Table 2.5-9, PPL Bell Bend 2013-TN3377)

Population Projections[(a)] within Radii/Distances (mi)							
Year	0 to 10 mi	10 to 20 mi	20 to 30 mi	30 to 40 mi	40 to 50 mi	0 to 50 mi[(d)]	Annual Average Percent Change For the 10 Year Period
2000[(b)]	53,386	269,749	293,239	434,976	648,299	1,699,649	NA
2010[(c)]	55,963	282,451	306,906	455,252	678,692	1,779,264	0.46
2018[(c)]	58,680	296,217	321,921	477,536	711,786	1,866,140	NA
2020[(c)]	59,341	299,659	325,725	483,151	720,202	1,888,078	0.60
2030[(c)]	62,525	315,762	343,248	509,135	758,856	1,989,526	0.52
2040[(c)]	67,512	341,001	370,759	549,957	819,728	2,148,957	0.77
2050[(c)]	71,220	359,695	391,028	580,035	864,544	2,266,522	0.53
2058[(c)]	74,336	375,367	408,042	605,292	902,110	2,365,147	NA
2060[(c)]	75,048	379,121	412,082	611,269	911,064	2,388,584	0.53
2070[(c)]	78,927	398,445	432,770	641,724	956,770	2,508,636	0.49
2080[(c)]	82,954	419,042	455,573	675,688	1,007,111	2,640,368	0.51

(a) Population estimates and projections include transient and residential population.
(b) Residential population in 2000, U.S. Census Bureau, Decennial Census.
(c) The populations for years 2010 through 2080 have been projected using 1990 and 2000 U.S. census data and county population projections as described in ER Section 2.5.1.2 (PPL Bell Bend 2013-TN3377).
(d) Population numbers used in GASPAR II population runs

G.2 Dose Estimates to the Public from Gaseous Effluents

The NRC staff used the dose assessment approach specified in RG 1.109 (NRC 1977-TN90) and the GASPAR II computer code (Strenge et al. 1987-TN83) to estimate doses to the MEI and to the population within a 50-mi radius of the proposed BBNPP site from the gaseous effluent pathway for both the proposed and existing units.

G.2.1 Scope

The NRC staff reviewed the input parameters and values used by PPL (PPL Bell Bend 2013-TN3377) for appropriateness. Default values from RG 1.109 (NRC 1977-TN90) were used when input parameters were not available. The NRC staff concluded that the assumed exposure pathways and input parameters and values used by PPL were appropriate. These pathways and parameters were used by the NRC staff in its independent calculations using GASPAR II.

Joint frequency distribution data of wind speed and wind direction by atmospheric stability class for the BBNPP site provided in Table 5.4-14 of the ER (PPL Bell Bend 2013-TN3377) were used as input to the XOQDOQ code (Sagendorf et al. 1982-TN280) to calculate long-term average χ/Q and D/Q values for routine releases. The NRC staff's independent results compare favorably with those reported in ER Tables 5.4-20 and 5.4-21 (PPL Bell Bend 2013-TN3377). However, there are two exceptions. The applicant's calculation packages are correct, but wrong numbers were put into Table 5.4-20 for the skin dose to the nearest resident north northeast of the site and maximum organ dose to the nearest resident west northwest of the site.

Population doses were calculated for all types of releases (i.e., noble gases, iodines and particulates, and H-3 and C-14) using the GASPAR II code for the following exposure pathways: plume immersion, direct shine from deposited radionuclides, ingestion of vegetables, and ingestion of milk and meat.

G.2.2 Resources Used

To calculate doses to the public from gaseous effluents, the NRC staff used a personal computer version of the XOQDOQ and GASPAR II codes entitled NRCDOSE Version 2.3.10 (ORNL 2008-TN741) obtained through the Oak Ridge Radiation Safety Information Computational Center.

G.2.3 Input Parameters

Table G-4 provides a list of the major parameters used in calculating dose to the public from gaseous effluent releases during normal operation.

Table G-4. Parameters Used in Calculating Dose to Public from Gaseous Effluent Releases

Parameter	NRC Staff Value		Comments
New unit gaseous effluent source term (Ci/yr)[(a)]	Ar-41	3.4×10^{1}	These values are the same as those reported in ER Table 3.5-8 (PPL Bell Bend 2013-TN3377).
	Kr-85m	1.5×10^{2}	
	Kr-85	2.8×10^{3}	
	Kr-87	5.6×10^{1}	
	Kr-88	1.9×10^{2}	
	Xe-131m	2.7×10^{3}	
	Xe-133m	1.7×10^{2}	
	Xe-133	7.3×10^{3}	
	Xe-135m	1.5×10^{1}	
	Xe-135	1.2×10^{3}	
	Xe-138	1.2×10^{1}	
	I-131	8.8×10^{-3}	
	I-133	3.2×10^{-2}	
	H-3	1.8×10^{2}	
	C-14	18.9×10^{0}	
	Cr-51	9.7×10^{-5}	
	Mn-54	5.7×10^{-5}	
	Co-57	8.2×10^{-6}	
	Co-58	4.8×10^{-4}	
	Co-60	1.1×10^{-4}	
	Fe-59	2.8×10^{-5}	
	Sr-89	1.6×10^{-4}	
	Sr-90	6.3×10^{-5}	
	Zr-95	1.0×10^{-5}	
	Nb-95	4.2×10^{-5}	
	Ru-103	1.7×10^{-5}	
	Ru-106	7.8×10^{-7}	
	Sb-125	6.1×10^{-7}	
	Cs-134	4.8×10^{-5}	
	Cs-136	3.3×10^{-5}	
	Cs-137	9.0×10^{-5}	
	Ba-140	4.2×10^{-6}	
	Ce-141	1.3×10^{-5}	

Parameter	NRC Staff Value	Comments
Population distribution	Table 2.5-9 of the ER (PPL Bell Bend 2013-TN3377)	Population distribution used by PPL and the NRC staff was for 2080. Note that ESRP Section 5.4.1 requires use of "projected population for 5 years from the time of the licensing action under consideration." Using a 2080 population is conservative.
Wind speed and direction distribution	Tables 2.7-58 to 2.7-91 of the ER (PPL Bell Bend 2013-TN3377)	Site-specific data provided by PPL for the 6-year period from 2001 to 2006.
Atmospheric dispersion factors (sec/m^3)	Tables 2.7-130 to 2.7-161, 2.7-163, 2.7-164 of the ER (PPL Bell Bend 2013-TN3377)	Site-specific data provided by PPL for the 7-year period from 2001 to 2007.

Table G-4. (contd)

Parameter	NRC Staff Value	Comments
Ground-deposition factors (m^{-2})	Tables 2.7-151 to 2.7-157 of the ER (PPL Bell Bend 2013-TN3377)	Site-specific data provided by PPL for the 7-year period from 2001 to 2007.
Milk production rate within a 50-mi radius of the Bell Bend site (L/yr)	949,783,840	Site-specific data provided by PPL in ER Table 5.4-9 (PPL Bell Bend 2013-TN3377).
Vegetable/fruit production rate within a 50-mi radius of the BBNPP site (kg/yr)	757,711,190	Site-specific data provided by PPL in ER Table 5.4-11 (PPL Bell Bend 2013-TN3377).
Meat production rate within a 50-mi radius of the BBNPP site (kg/yr)	251,710,321	Site-specific data provided by PPL in ER Table 5.4-10 (PPL Bell Bend 2013-TN3377).
Pathway receptor locations (direction, distance, and atmospheric dispersion factors) – nearest site boundary, vegetable garden, residence, meat animal	Table 5.4-14 and Tables 2.7-151 to 2.7-157 of the ER (PPL Bell Bend 2013-TN3377)	Site-specific data provided by PPL (PPL Bell Bend 2013-TN3377).
Consumption factors for milk, meat, leafy vegetables, and vegetables	Milk (L/yr) 310 (adult) 400 (teen) 330 (child) 330 (infant) Meat (kg/yr) 110 (adult) 65 (teen) 41 (child) 0 (infant) Leafy vegetables (kg/yr) 64 (adult) 42 (teen) 26 (child) 0 (infant) Vegetables (kg/yr) 520 (adult) 630 (teen) 520 (child) 0 (infant)	Table 5.4-8 of the ER (PPL Bell Bend 2013-TN3377) and RG 1.109 (NRC 1977-TN90).
Fraction of year leafy vegetables are grown	0.58	Site-specific value from Table 5.4-7 of the ER (PPL Bell Bend 2013-TN3377).
Fraction of year that milk cows are on pasture	0.58	Site-specific value from Table 5.4-4 of the ER (PPL Bell Bend 2013-TN3377).
Fraction of MEI vegetable intake from own garden	0.76	Default value of GASPAR II code (Strenge et al. 1987-TN83).
Fraction of milk-cow intake that is from pasture while on pasture	1	Default value of GASPAR II code (Strenge et al. 1987-TN83).
Average absolute humidity over the growing season (g/m^3)	6.6	Site-specific value from Table 5.4-7 of the ER (PPL Bell Bend 2013-TN3377).
Average temperature over the growing season (°F)	63.2	Site-specific value from Table 5.4-7 of the ER (PPL Bell Bend 2013-TN3377).

Table G-4. (contd)

Parameter	NRC Staff Value	Comments
Fraction of year beef cattle are on pasture	0.58	Site-specific value from Table 5.4-7 of the ER (PPL Bell Bend 2013-TN3377).
Fraction of year beef cattle intake that is from pasture while on pasture	1	Default value of GASPAR II code (Strenge et al. 1987-TN83).

(a) To convert Ci/yr to Bq/yr, multiply the value by 3.7×10^{10}.

G.2.4 Comparison of Doses to the Public from Gaseous Effluent Releases

Table G-5 compares results documented in the ER (PPL Bell Bend 2013-TN3377) for doses from noble gases at the exclusion area boundary with the results calculated by the NRC staff. The doses provided by PPL and those calculated by the NRC staff were similar.

Table G-5. Comparison of Doses to the Public from Noble Gas Releases for a New Unit

Type of Dose	PPL ER[(a)]	NRC Staff Calculation	Percent Difference
Gamma air dose at owner-controlled area boundary – noble gases only (mrad/yr)	2.0	2.0	0
Beta air dose at owner-controlled area boundary – noble gases only (mrad/yr)	4.5	4.5	0
Total body dose at owner-controlled area boundary – noble gases only (mrem/yr)	1.3	1.3	0
Skin dose at owner-controlled area boundary – noble gases only (mrem/yr)	3.9	3.9	0

(a) Results from PPL ER Table 5.4-21 (PPL Bell Bend 2013-TN3377).

Table G-6 compares doses to the MEI calculated by PPL and the NRC staff. Doses to the MEI were calculated at the nearest residence, nearest garden, and nearest beef cattle. The doses estimated by PPL and those calculated by the NRC staff were similar.

G.2.5 Comparison of Results – Population Doses

Table G-7 compares the PPL population dose estimates taken from Table 5.4-15 of the ER (PPL Bell Bend 2013-TN3377) with the NRC staff estimates for the new unit. The NRC staff's independent calculation for population dose yields results that are comparable to the PPL ER estimates for the proposed BBNPP unit. Both PPL and the NRC staff used the population estimate for the year 2080, which is a factor of 1.3 times higher than the population estimated for the year 2018 (5 years past the expected licensing action).

Table G-6. Doses to the MEI from Gaseous Effluent Releases for a New Unit

Location	Pathway	Total Body Dose (mrem/yr)[(a)]	Skin Dose (mrem/yr)[(a)]	Max Organ Dose (mrem/yr)[(a)]
Nearest owner-controlled area boundary, 0.16 mi WSW	Plume	1.26	3.93	1.31
Nearest residence, 0.79 mi NNE	Ground	5.28E-04	6.20E-04	5.28E-04
Nearest residence, 0.53 mi WNW	Inhalation			
	Adult	5.83E-03	5.81E-03	1.35E-02 (Thyroid)
	Teen	5.88E-03	5.86E-03	1.57E-02 (Thyroid)
	Child	5.20E-03	5.18E-03	1.70E-02 (Thyroid)
	Infant	2.99E-03	2.98E-03	1.38E-02 (Thyroid)
Nearest garden, 0.25 mi SSW	Vegetable			
	Adult	0.1640.266	0.163	0.767 (Bone)
	Teen	0.632	0.265	1.27 (Bone)
	Child		0.631	3.08 (Bone)
Nearest meat animal, 0.33 mi WSW	Meat			
	Adult	0.0730	0.0729	0.353 (Bone)
	Teen	0.0611	0.0611	0.299 (Bone)
	Child	0.114	0.114	0.561 Bone)
Nearest milk cow, 0.74 mi SSW	Milk			
	Adult	1.69E-02	1.67E-02	7.86E-02 (Bone)
	Teen	3.04E-02	3.03E-02	0.154 (Bone)
	Child	7.35E-02	7.32E-02	0.356 (Bone)
	Infant	0.152	0.152	0.697 (Bone)

(a) Results from Table 5.4-20 of ER (PPL Bell Bend 2013-TN3377; Talen 2016-TN4443).

Table G-7. Comparison of Population Total Body Doses from Gaseous Effluent Releases for Proposed BBNPP

Pathway	PPL ER (person-rem/yr)[(a)(b)]	NRC Staff Estimated Population (person-rem/yr)[(a)]	Percent Difference
Plume	3.74	3.74	0
Ground Plane	5.77E-03	5.77E-03	0
Inhalation	1.13E-01	1.13E-01	0
Vegetable Ingestion	2.51	2.51	0
Milk Ingestion	7.58E-01	7.58E-01	0
Meat Ingestion	1.12	1.12	0
Total	8.25	8.25	0

(a) To convert from person-rem/yr to person-Sv/yr, divide by 100.
(b) Results from PPL ER Table 5.4-15 (PPL Bell Bend 2013-TN3377).

G.3 Cumulative Dose Estimates

Table G-8 compares PPL's results for cumulative dose estimates to the MEI with those calculated by the NRC staff. Cumulative dose estimates include doses from all pathways (i.e., external, liquid effluent, and gaseous effluent) for both the proposed BBNPP and the adjacent existing SSES Units 1 and 2. Cumulative dose estimates calculated by PPL (PPL Bell Bend 2013-TN3377) and the NRC staff were similar.

Table G-8. Comparison of Cumulative Doses to the Maximally Exposed Individual

Dose	PPL ER [a,b]	NRC Staff Estimate[c]	Percent Difference
Whole body (mrem/yr)[d]	12.3	12.3	0
Thyroid dose (mrem/yr)[d]	14.6	14.6	0
Dose to other organ – (mrem/yr)[d, e]	20.3	20.3	0

(a) Includes doses from direct radiation (PPL Bell Bend 2013-TN3377).
(b) Sum of dose from liquid and gaseous effluent releases for the two existing units and the proposed unit are from Table 5.4-24 of the ER (PPL Bell Bend 2013-TN3377).
(c) The NRC staff calculation included the sum of doses from liquid and gaseous effluent releases from the two existing units and the new proposed unit. Doses from effluents for the existing SSES units were taken as the maximum from the 2007 to 2012 annual radioactive effluent release reports (PPL Susquehanna 2008-TN754; PPL Susquehanna 2009-TN743; PPL Susquehanna 2010-TN746; PPL Susquehanna 2011-TN714; PPL Susquehanna 2012-TN1912; PPL Susquehanna 2013-TN3757).
(d) To convert from mrem/yr to mSv/yr, divide by 100.
(e) PPL combined the critical organ (child-bone) for liquids and gaseous effluents to conservatively represent the maximum dose (PPL Bell Bend 2013-TN3377).

G.4 Dose Estimates to the Non- Human Biota from Liquid and Gaseous Effluents

To estimate doses to the non-human biota from the liquid and gaseous effluent pathways, the NRC staff used the LADTAP II code (Strenge et al. 1986-TN82), the GASPAR II code (Strenge et al. 1987-TN83), and input parameters supplied by PPL in its ER (PPL Bell Bend 2013-TN3377) for its independent analysis.

G.4.1 Scope

The NRC staff policy is to estimate radiation doses to representative biota species. Fish, invertebrates, and algae are used as reference aquatic biota species. Muskrats, raccoons, herons, and ducks are used as reference terrestrial biota species. The NRC staff recognizes the LADTAP II computer program as an appropriate method for calculating dose to the aquatic biota and for calculating the liquid-pathway contribution to terrestrial biota. The LADTAP II code calculates an internal dose component and an external dose component and sums them for a total body dose. The NRC staff reviewed the input parameters used by PPL for appropriateness. Default values from RG 1.109 (NRC 1977-TN90) were used when input parameters were not available. The NRC staff concluded that all of the LADTAP II input parameters used by PPL were appropriate. However, the NRC staff used a smaller dilution factor for calculating dose to raccoon and heron in its independent calculations using LADTAP II.

The LADTAP II code calculates biota dose only from the liquid effluent pathway. Terrestrial biota could also be exposed via the gaseous effluent pathway. The gaseous pathway doses would be the same as doses for the MEI calculated using the GASPAR II code. PPL (PPL Bell Bend 2013-TN3377) used the MEI doses at the owner-controlled area boundary (0.16 mi from the plant) to estimate these doses. However, because animals may live within the owner-controlled area, closer than maximally exposed humans, the NRC staff used a location 0.10 mi from the release point for estimating onsite biota exposures. The ratio of radionuclide concentrations in air at the biota location to the concentrations at the MEI location is used to adjust (or scale) the dose. Dose from exposure to atmospheric plumes is directly proportional to air concentration. To account for the greater proximity of the main body mass of animals to the ground compared to humans, the biota calculation assumed a ground-deposition factor twice that used in the human MEI calculation. The gaseous pathway doses are summed and combined with the liquid-pathway doses for a total dose for the representative biota species.

Resources Used

To calculate doses to the biota, the NRC staff used a personal computer version of the LADTAP II and GASPAR II computer codes entitled NRCDOSE Version 2.3.13 (ORNL 2008-TN741). NRCDOSE was obtained through the Oak Ridge Radiation Safety Information Computational Center.

G.4.2 Input Parameters

The NRC staff used the input parameters for LADTAP II and GASPAR II specified in Sections N.2.3 and N.2.4 to calculate biota dose.

G.4.3 Comparison of Results

Table G-9 compares PPL's biota dose estimates from liquid and gaseous effluents taken from Table 5.4-29 of the ER (PPL Bell Bend 2013-TN3377) with the NRC staff's estimates. Dose estimates were similar until the NRC staff added a location closer to the sources of direct radiation and the gaseous release point.

Table G-9. Comparison of Dose Estimates to Biota from Liquid and Gaseous Effluents, BBNPP

Biota	Pathway	PPL ER[(a)] (mrad/yr)	NRC Staff Calculation (mrad/yr)	Percent Difference
Fish	Liquid	0.188	0.188	0
	Gaseous[(b)]	NA	NA	-
	Direct[(b)]	NA	NA	-
Muskrat	Liquid	0.61	0.61	0
	Gaseous	1.27	1.5	18
	Direct	1.87	9[(c)]	381
Raccoon	Liquid	0.16	0.20	25
	Gaseous	1.27	1.5	18
	Direct	1.87	9[(c)]	381
Heron	Liquid	1.65	2.07	33
	Gaseous	1.27	1.27	0
	Direct	1.87	4[(d)]	114
Duck	Liquid	0.59	0.59	0
	Gaseous	1.27	1.27	0
	Direct	1.87	4[(d)]	114
Algae	Liquid	2.13	2.13	0
	Gaseous[(b)]	NA	NA	-
	Direct[(b)]	NA	NA	-

Table G-9. (contd)

Biota	Pathway	PPL ER[(a)] (mrad/yr)	NRC Staff Calculation (mrad/yr)	Percent Difference
Invertebrate	Liquid	0.66	0.66	0
	Gaseous[(b)]	NA	NA	-
	Direct[(b)]	NA	NA	-

(a) PPL Bell Bend 2014TN3377.
(b) Fish, invertebrate species, and algae would not be exposed to gaseous effluents or direct exposure.
(c) Direct dose to muskrat and raccoon based on 2010 thermoluminescent dosimeter (TLD) data from average of 18 mrad/yr for the 5 TLD stations closest to an Independent Spent Fuel Storage Installation and a Low Level Radioactive Waste Handling Facility. Assumed half-year residence time.
(d) Direct dose to heron and duck based on the PPL values of 1.87 mrad/yr at the owner-controlled area boundary rounded up to 2.0 and then doubled to account for closer proximity of animals to sources than the owner-controlled area boundary.

G.5 References

10 CFR Part 50. *Code of Federal Regulations*, Title 10, *Energy*, Part 50, "Domestic Licensing of Production and Utilization Facilities." Washington, D.C. TN249.

AREVA (AREVA Inc.). 2014. *U.S. EPR Final Safety Analysis Report.* Revision 7, Lynchburg, Virginia. Accession No. ML14209A843. TN3722.

NRC (U.S. Nuclear Regulatory Commission). 1977. *Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I*. Regulatory Guide 1.109, Revision 1, Washington, D.C. Accession No. ML003740384. TN90.

NRC (U.S. Nuclear Regulatory Commission). 2000. *Environmental Standard Review* Plan—Standard *Review Plans for Environmental Reviews for Nuclear Power Plants*. NUREG–1555, Main Report and 2007 Revisions, Washington, D.C. Available at http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1555/toc/. TN614.

ORNL (Oak Ridge National Laboratory). 2008. *RSICC Computer Code Collection—NRCDOSE 2.3.10. Code System for Evaluating Routine Radioactive Effluents from Nuclear Power Plants with Windows Interface*. CCC–684, Radiation Safety Information Computational Center, Oak Ridge, Tennessee. TN741.

PPL Bell Bend (PPL Bell Bend, LLC). 2013. *Bell Bend Nuclear Power Plant Combined License Application Part 3: Environmental Report*. Revision 4, UniStar Nuclear Services, LLC, Baltimore, Maryland. Accession No. ML13120A411. TN3377.

PPL Susquehanna (PPL Susquehanna, LLC). 2008. *Susquehanna Steam Electric Station Units 1 and 2 Radioactive Effluent Release Report.* 2007 Annual Report, Berwick, Pennsylvania. Accession No. ML081690384. TN754.

PPL Susquehanna (PPL Susquehanna, LLC). 2009. *Susquehanna Steam Electric Station Units 1 and 2 Radioactive Effluent Release Report.* 2008 Annual Report, Berwick, Pennsylvania. Accession No. ML091390360. TN743.

PPL Susquehanna (PPL Susquehanna, LLC). 2010. *Susquehanna Steam Electric Station Units 1 and 2 Radioactive Effluent Release Report.* 2009 Annual Report, Berwick, Pennsylvania. Accession No. ML101170304. TN746.

PPL Susquehanna (PPL Susquehanna, LLC). 2011. *Susquehanna Steam Electric Station Units 1 and 2 Radioactive Effluent Release Report—2010 Annual Report.* Berwick, Pennsylvania. Accession No. ML11130A140. TN714.

PPL Susquehanna (PPL Susquehanna, LLC). 2012. *Susquehanna Steam Electric Station Units 1 and 2 Radioactive Effluent Release Report, 2011 Annual Report.* Berwick, Pennsylvania. Accession No. ML12122A977. TN1912.

PPL Susquehanna (PPL Susquehanna, LLC). 2013. *Susquehanna Steam Electric Station Units 1 and 2, 2012 Annual Report—Annual Radiological Environmental Operating Report.* Berwick, Pennsylvania. Accession No. ML131090071. TN3757.

PPL Susquehanna (PPL Susquehanna, LLC). 2015. *Susquehanna Steam Electric Station Units 1 and 2 Radioactive Effluent Release Report—2014 Annual Report*. Berwick, Pennsylvania. Accession No. ML15177A033. TN4383.

Sagendorf, J.F., J.T. Goll, and W.F. Sandusky. 1982. *XOQDOQ: Computer Program for the Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations.* NUREG/CR–2919, Pacific Northwest Laboratory, Richland, Washington. Accession No. ML081360412. TN280.

Strenge, D.L., R.A. Peloquin, and G. Whelan. 1986. *LADTAP II—Technical Reference and User Guide*. NUREG/CR–4013, Pacific Northwest Laboratory, Richland, Washington. Accession No. ML14098A069. TN82.

Strenge, D.L., T.J. Bander, and J.K. Soldat. 1987. *GASPAR II—Technical Reference and User Guide*. NUREG/CR–4653, Pacific Northwest Laboratory, Richland, Washington. Accession No. ML14098A066. TN83.

Talen (Talen Energy). 2015. Letter from R.R. Sgarro to NRC, dated June 18, 2015, regarding "Bell Bend Nuclear Power Plant Corrections to BBNPP Environmental Report." BNP-2015-031, Allentown, Pennsylvania. Accession No. ML15177A083. TN4384.

Talen (Talen Energy). 2016. Letter from R.R. Sgarro to NRC, dated January 4, 2016, regarding "Bell Bend Nuclear Power Plant Correction to ER Table 5.4-20." BNP-2016-001, Allentown, Pennsylvania. Accession No. ML16075A218. TN4443.

APPENDIX H

AUTHORIZATIONS AND CONSULTATIONS

APPENDIX H

AUTHORIZATIONS AND CONSULTATIONS

This appendix contains a list of the environment-related authorizations, permits, and certifications potentially required by Federal, State, regional, local, and affected Native American tribal agencies related to the combined license, pre-construction, construction, and operation of the proposed new nuclear unit at the Bell Bend Nuclear Power Plant site. PPL notified the U.S. Nuclear Regulatory Commission (NRC) of changes in its power generation business by letter dated May 12, 2015 (NRC Accession No. ML15146A095). PPL Bell Bend, LLC was renamed Bell Bend, LLC, and Bell Bend, LLC became a generation affiliate of Talen Energy Corporation (Talen Energy). The transaction became official on June 1, 2015. For purposes of this review, the abbreviation "PPL" will still be used to indicate the applicant. Bell Bend, LLC, under Talen Energy, is the applicant.

Table H-1 is adapted from Table 1.3-1 of the Environmental Report, Revision 4 (Accession No. ML13120A411), and letter dated May 2, 2014 (Accession No. ML14135A166), submitted to the NRC by the applicant.

The Susquehanna River Basin Commission (SRBC), by letter dated July 6, 2015 (Accession No. ML15191A328), clarified the applicant's Table 1.3-1 for the SRBC permit. The SRBC noted that the "Authority" section should be changed to "18 CPR Parts 801-808; Susquehanna River Basin Compact" and that the "Activity Covered" section should be changed to "Water withdrawal >100,000 gpd (30-day average) or consumptive use > 20,000 gpd (30-day average). Covers withdrawals from groundwater and surface water within the Susquehanna River Basin." The SRBC also stated that the "Anticipated Application Submittal Date" was incorrect, the review was suspended pending the need for additional information, and no formal schedule to address the needed information was received by the SRBC. PPL submitted its application to the SBRC by letters dated May 13, 2009 (Accession No. ML091730531) and January 14, 2011 (Accession No. ML110410619).

Additionally, the State Water Obstruction and Encroachment Permit (401 permit) was issued on May 24, 2013 (Accession No. ML13161A023). These documents can be found at the Agencywide Documents Access and Management System (ADAMS) electronic public reading room accessible at http://www.nrc.gov/readingrm/adams.html.

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

Agency	Authority	Requirement	License/ Permit No.	Expiration Date	Activity Covered	Anticipated Application Submittal Date
NRC	Title 10 of the *Code of Federal Regulations* (CFR) Part 40	Source Material License	--(a)	--(a)	Possession, use and transfer of source material	April 2022
NRC	Atomic Energy Act of 1954 (AEA), 10 CFR 51; 10 CFR 52.89	Environmental Impact Statement (EIS) and Record of Decision	--(a)	--(a)	Site approval for construction and operation of a nuclear power station as part of an application for a combined construction permit and operating license (COL)	Included in COL process
NRC	10 CFR 50.54; 10 CFR 52.17	Emergency Response Plan	--(a)	--(a)	Construction phase emergency response plan	Included in COL process
NRC	10 CFR 50.47	Emergency Response Plan	--(a)	--(a)	Operation phase emergency response plan	Included in COL process
NRC	10 CFR 52, Subpart C	COL	--(a)	--(a)	COL for a nuclear power station	Complete
NRC	10 CFR 70	Special Nuclear Material License	--(a)	--(a)	Possession, delivery, receipt, use, transfer of fuel	May 2022
NRC	10 CFR 30	By-Product Material License	--(a)	--(a)	Production, transfer, receipt, acquisition, ownership, possession of nuclear byproduct materials	March 2023

Table H-1. (contd)

Agency	Authority	Requirement	License/ Permit No.	Expiration Date	Activity Covered	Anticipated Application Submittal Date
Federal Aviation Administration (FAA)	49 United States Code (U.S.C.) § 44718, 14 CFR 77.13	Notice of Proposed Construction or Alteration – Construction Cranes	--(a)	--(a)	Construction of an object that has the potential to affect navigable airspace (>200 ft) or within 20,000 ft of an airport	July 2020
FAA	49 U.S.C. § 44718, 14 CFR 77.13	Notice of Proposed Construction or Alteration – Facility	--(a)	--(a)	Construction of an object that has the potential to affect navigable airspace (>200 ft) or within 20,000 ft of an airport	May 2022
Pennsylvania Department of Environmental Protection (PADEP)	25 Pennsylvania Code 217	State Radioactive Materials License	--(a)	--(a)	Possession, use, acquisition, ownership of radioactive materials not regulated by the NRC	August 2022
PADEP	25 Pennsylvania Code 266 Subpart N	Conditional Exemption for Low-Level Mixed Waste Storage	--(a)	--(a)	Exemption from hazardous waste handling requirements for low-level waste	June 2023
U.S. Army Corps of Engineers (USACE)	Federal Clean Water Act, Sec. 404; 33 CFR 322-323; Rivers and Harbors Appropriation Act, 33 U.S.C. § 403,	Individual Permit	--(a)	--(a)	Excavation, dredging, and/or disposal of dredged material in navigable waters; filling of waters of United States. Needed for	Complete

Table H-1. (contd)

Agency	Authority	Requirement	License/ Permit No.	Expiration Date	Activity Covered	Anticipated Application Submittal Date
	Section 10 316(a) and 316(b) of Clean Water Act				construction/ modification of the intake and discharge structure, and any filling of waters of the United States	
U.S. Environmental Protection Agency (EPA)	40 CFR 68	Risk Management Plan	--(a)	--(a)	Storage of Chemicals listed in Section 112(r) of the Clean Air Act in quantities above threshold	January 2017
EPA	40 CFR 262.12	Hazardous Waste Generator Registration (USEPA Identification Number)	--(a)	--(a)	Generation and storage of hazardous waste for <90 days	October 2017
EPA, PADEP	40 CFR 112, Subparts A-C, 25 Pennsylvania Code 245	Spill Prevention, Control, and Countermeasure Plan (SPCC Plan)	--(a)	--(a)	Onsite oil storage >1,320 gal (combined), >660 (single), or >42,000 gal (underground)	July 2018
EPA, Pennsylvania Department of Labor and Industry	Superfund Amendments and Reauthorization Act of 1986 (SARA) Title 3/ Emergency Planning and Community Right to Know Sections	Chemicals subject to Reporting Requirements	--(a)	--(a)	Use and storage of hazardous chemicals onsite	March 2020 for first report; annually thereafter

Table H-1. (contd)

Agency	Authority	Requirement	License/ Permit No.	Expiration Date	Activity Covered	Anticipated Application Submittal Date
	311-312/ Toxic Chemical Release Inventory Section 313					
U.S. Fish and Wildlife Services (FWS)	Endangered Species Act (ESA), Section 7 (16 U.S.C. § 35); 50 CFR 402	Consultation regarding potential to adversely impact protected species (non-marine species) and critical habitats	--(a)	--(a)	Identification of protected species and critical habitats onsite and in the vicinity, assessment of project construction and/or operation impacts, and concurrence on appropriate mitigation	Ongoing
State Historic Preservation Office (SHPO)/ Pennsylvania Historical and Museum Commission	National Historic Preservation Act (NHPA) Section 106; 36 CFR 800	Cultural Resources Review and - Consultation	--(a)	--(a)	Identification, description, and evaluation of cultural resources on and in the site vicinity with the potential to be impacted by plant construction and/or operations. Concurrence on appropriate mitigation	Complete

Table H-1. (contd)

Agency	Authority	Requirement	License/ Permit No.	Expiration Date	Activity Covered	Anticipated Application Submittal Date
Susquehanna River Basin Commission*	18 CFR Parts 803-808 Article 3 Section 310; 25 Pennsylvania Code Chapter 105	Surface- and Groundwater Withdrawal and Construction and Operation Consumptive Use Approvals	--(a)	--(a)	Water withdrawal >100,000 gpd or consumptive use >20,000 gpd. Covers withdrawals from groundwater and the Susquehanna River	Complete
Pennsylvania Fish and Boat Commission	Section 2305 of the Fish and Boat Code	Pennsylvania Threatened and Endangered Species Project Natural Diversity Index (PNDI) search;	--(a)	--(a)	Potential impact on State endangered, threatened, and candidate aquatic species onsite and in the vicinity, assessment of project construction and/or operation impacts, and concurrence on appropriate mitigation	Ongoing every 2 years until COL issued
Pennsylvania Department of Conservation and Natural Resources (PA DCNR)	17 Pennsylvania Code Chapter 45	Pennsylvania Threatened and Endangered Species; (PNDI search)	--(a)	--(a)	Potential impact on State plants that are rare, threatened, or endangered onsite and in the vicinity, assessment of project construction and/or operation impacts, and concurrence on appropriate mitigation	Ongoing every 2 years until COL issued

Table H-1. (contd)

Agency	Authority	Requirement	License/ Permit No.	Expiration Date	Activity Covered	Anticipated Application Submittal Date
Pennsylvania Game Commission	58 Pennsylvania Code Chapter 133	Pennsylvania Threatened and Endangered Species; (PNDI search)	--(a)	--(a)	Potential impact on State wildlife species that are rare, threatened, or endangered onsite and in the vicinity, assessment of project construction and/or operation impacts, and concurrence on appropriate mitigation	Ongoing every 2 years until COL issued
PADEP	Federal Clean Water Act, 33 U.S.C. § 1251 et seq., 25 Pennsylvania Code Chapter 93	Section 401 Water Quality Certification	--(a)	--(a)	Compliance with State water-quality standards	Complete
PADEP	40 CRF 122.29 25 Pennsylvania Code 91	Water Quality Management Part II Permit Application for Industrial Wastewater Facilities	--(a)	--(a)	Construction of industrial wastewater treatment facilities and intake structure	February 2019
PADEP	Federal Clean Water Act, Section 402; 33 U.S.C. § 1251 et seq.; Section 316(a) of Clean Water Act; 25 Pennsylvania Code Chapter 92	National Pollution Discharge Elimination System (NPDES) Permit	--(a)	--(a)	Discharge of industrial wastewater and stormwater during operation to surface water	December 2019

Table H-1. (contd)

Agency	Authority	Requirement	License/ Permit No.	Expiration Date	Activity Covered	Anticipated Application Submittal Date
PADEP/Luzerne County	25 Pennsylvania Code Chapters 92, 93, and 102	NPDES Individual Permit for Discharge of Stormwater Associated with Construction Activities and Post-Construction Erosion and Sediment Management	--(a)	--(a)	Discharge of stormwater during construction, erosion and sediment control during construction and post-construction, and post-construction stormwater management	Complete
PADEP/Luzerne County	25 Pennsylvania Code Section 287, 291	Registration as a Generator of Residual Waste	--(a)	--(a)	Onsite disposal of land-clearing and construction debris	December 2017
Federal Emergency Management Agency (FEMA)/Salem Township	Title 44, Emergency Management and Assistance	Floodplain Development Permit	--(a)	--(a)	Construction in 100-year floodplain	Complete
FEMA	Title 44, Emergency Management and Assistance	Floodplain Development Conditional Letter of Map Revision	--(a)	--(a)	Verification from FEMA/FEMA-approved local authority that floodplain analyses are correct for constructed plant – Walker Run	September 2019

Table H-1. (contd)

Agency	Authority	Requirement	License/ Permit No.	Expiration Date	Activity Covered	Anticipated Application Submittal Date
FEMA	Title 44, Emergency Management and Assistance	Floodplain Development Conditional Letter of Map Revision	--(a)	--(a)	Verification from FEMA/FEMA-approved local authority that floodplain analyses for constructed plant are correct – North Branch of the Susquehanna River	March 2023
PADEP	25 Pennsylvania Code Section 105.15	Environmental impact assessment to wetlands, fisheries, parks, cultural and historical resources, state game lands, water quality, and recreation	--(a)	--(a)	Construction and Altering Wetlands and Waterways	Complete
PADEP	25 Pennsylvania Code Section 245	Storage Tank Registration and Permitting	--(a)	--(a)	Storage of oil in aboveground storage tanks >21,000 gal combined of petroleum or hazardous substances and/or >1,000 gal of used oil; storing a regulated substance in underground tanks >250 gal	Construction: April 2018 Operation: May 2019
PADEP	25 Pennsylvania Code, Article III, Ch 121-145	Air Quality State Permit to Operate for Emission Sources	--(a)	--(a)	Operation-phase emission sources for diesel generators	June 2018

Table H-1. (contd)

Agency	Authority	Requirement	License/ Permit No.	Expiration Date	Activity Covered	Anticipated Application Submittal Date
PADEP	25 Pennsylvania Code Ch. 252	Environmental Laboratory Wastewater Certification	--(a)	--(a)	Laboratory accreditation for analysis of wastewater	June 2024
PADEP	25 Pennsylvania Code Ch. 110 Act 220	Water Use Registration	--(a)	--(a)	Registration for withdrawal of >10,000 gal per day of surface water	May 2023
PADEP	25 Pennsylvania Code Section 264a	Registration for Storage of Hazardous or Mixed Waste, Construction and Operational Phases	--(a)	--(a)	Generation and storage of hazardous waste	Construction: April 2018 Operation: July 2019
PADEP	40 CFR 70; 25 Pennsylvania Code Chapter 127	State Air Permit to Construct –Construction Phase	--(a)	--(a)	Construction of construction-phase air pollutant emission sources	Complete
PADEP	40 CFR 52.21; 25 Pennsylvania Code Chapter 122	Prevention of Significant Deterioration –Operational Phase	--(a)	--(a)	Construction of major stationary sources of attainment pollutants for operational phase facilities	March 2024

Table H-1. (contd)

Agency	Authority	Requirement	License/ Permit No.	Expiration Date	Activity Covered	Anticipated Application Submittal Date
PADEP	25 Pennsylvania Code Chapter 122	New Source Review –Operational Phase)	--(a)	--(a)	Construction of major stationary sources of attainment pollutants for operational phase facilities	March 2024
PADEP	40 CFR 70; 25 Pennsylvania Chapter 127	Title V Operating Permit	--(a)	--(a)	Operation of facility with major stationary sources of air emissions	March 2024
Pennsylvania Department of Labor	37 Pennsylvania Code Section 11	Storage Tank Registration and Permitting, Construction and Operation	--(a)	--(a)	Storage of flammable liquids in aboveground storage tanks >30 gal	Construction: April 2018 Operation: May 2019
Pennsylvania Department of Transportation (Penn DOT)	49 CFR 171-180; 67 Pennsylvania Code Chapter 403	Transport Permit for Hazardous Waste	--(a)	--(a)	Shipment of low-level radwaste or hazardous waste	June 2024
Penn DOT	67 Pennsylvania Code Chapter 441	Permit for Access to Highways	--(a)	--(a)	Access to and occupancy of highways by driveways and local roads	October 2010 to January 2018
Penn DOT	Aviation Code, Act of October 10, 1984, PL 837 No. 164, 67 Pennsylvania Code 479.4	Notice of Proposed Construction or Alteration –Construction Cranes	--(a)	--(a)	Construction of an object that has the potential to affect navigable airspace (>200 ft) or within 20,000 ft of an airport	July 2020

Table H-1. (contd)

Agency	Authority	Requirement	License/ Permit No.	Expiration Date	Activity Covered	Anticipated Application Submittal Date
Penn DOT	Aviation Code, Act of October 10, 1984, PL 837 No. 164, 67 Pennsylvania Code 479.4	Notice of Proposed Construction or Alteration -Facility	--(a)	--(a)	Construction of an object that has the potential to affect navigable airspace (>200 ft) or within 20,000 ft of an airport	May 2022
Penn DOT	67 Pennsylvania Code Section 459	Utility Construction on or above State Roads	--(a)	--(a)	Power line and service pipe installation under Rte. 11 to cooling water intake system	January 2019
PA Emergency Management Agency	FEMA May 24, 2010 letter	State Emergency Planning	--(a)	--(a)	Need letter of Agreement for nuclear emergency plan	March 2023
Luzerne County Emergency Planning Commission	SARA Title III; 10 CFR 50.47; FEMA May 24, 2010 letter	County Emergency Planning Committee	--(a)	--(a)	Need Letter of Agreement for nuclear emergency plan. Also need to meet SARA Title III requirements	March 2023
Columbia County Emergency Planning Commission	10 CFR 50.47; FEMA May 24, 2010 letter	County Emergency Planning Committee	--(a)	--(a)	Need Letter of Agreement for nuclear emergency plan.	March 2023
Salem Township	10 CFR 50.47; FEMA May 24, 2010 letter	Local Emergency Planning Committee	--(a)	--(a)	Need Letter of Agreement for nuclear emergency plan	March 2023
Salem Township	Zoning Ordinance Section 1302, Ordinance No. 2011-03	Zoning Permit	--(a)	--(a)	Need to rezone property for heavy industrial use	Complete

Table H-1. (contd)

Agency	Authority	Requirement	License/ Permit No.	Expiration Date	Activity Covered	Anticipated Application Submittal Date
Salem Township	Zoning Ordinance Section 1302, Ordinance No, 2011-03	Conditional Use Approval, Lot Subdivision Approval	--(a)	--(a)	Conditional use approval for electric power generating plants	Complete
Salem Township/ Luzerne County/ PADEP	Subdivision and Land Development Ordinance Section 501	Preliminary and Final Land Development Plan Approval	--(a)	--(a)	Construction of buildings and other structures	Preliminary: November 2017 Final: December 2017
Salem Township/ Luzerne County/ Penn DOT	Subdivision and Land Development Ordinance Section 800	Highway Occupancy Permit for Construction Entrances and Temporary Roads	--(a)	--(a)	Need to obtain a permit to establish construction entrances from local roads and to establish temporary roads during construction	April 2017
Salem Township	Zoning Ordinance Section 202 and 1303	Permit for Structure Demolition or Move	--(a)	--(a)	Demolish certain structures or move certain structures	April 2018
Salem Township	Subdivision Land and Development Ordinance; Pennsylvania Act 537, Sewage Facilities of 1966	Sewer Permit	--(a)	--(a)	Need to tie into municipal sewer system	March 2017
Salem Township	Zoning Ordinance Section 1303	Construction Permit	--(a)	--(a)	Permit to construct buildings and structures not within the scope of the NRC	September 2017
Salem Township	Zoning Ordinance Section 1303	Use and Occupancy Permit	--(a)	--(a)	Use and occupancy of buildings	November 2021

Table H-1. (contd)

Agency	Authority	Requirement	License/ Permit No.	Expiration Date	Activity Covered	Anticipated Application Submittal Date
Tennessee Department of Environment and Conservation – Division of Radiological Health	Tennessee Department of Environment and Conservation, Rule 1200-2-10.32	Tennessee Radioactive License – for Delivery	--(a)	--(a)	Transportation of radioactive waste into the State of Tennessee (below regulatory limits material)	June 2024
State of Utah Department of Environmental Quality – Division of Radiological Control	Utah Department of Environmental Quality, Radiation Control Rules R313 26	General Site Access Permit	--(a)	--(a)	Transportation of radioactive waste into the State of Utah	June 2024
U.S. Department of Energy	10 CFR 961.11	Standard Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste	DE-CR01-09RW09016	NA	Contract for disposal of spent nuclear fuel and/or high-level radioactive waste	Complete
U.S. Department of Transportation	49 CFR 107, Subpart G	Certification of Registration	--(b)	--(b)	Transportation of hazardous materials	--(b)

(a) Data not available. Applications for permits will be made before the beginning of construction, as required.
(b) This activity will be performed by an established carrier in accordance with the carrier's Certificate of Registration.

*See SRBC clarification regarding this permit at the beginning of this appendix.

APPENDIX I

GREENHOUSE GAS FOOTPRINT ESTIMATES FOR A REFERENCE 1,000-MW(E) REACTOR

APPENDIX I

GREENHOUSE GAS FOOTPRINT ESTIMATES FOR A REFERENCE 1,000-MW(E) REACTOR

The review team has estimated the greenhouse gas (GHG) footprint of various activities associated with nuclear power plants. These activities include building, operating, and decommissioning a plant. The estimates include direct emission from the nuclear facility and indirect emissions from workforce transportation and the fuel cycle.

Preconstruction/construction equipment estimates listed in Table I-1 are based on hours of equipment use estimated for a single nuclear power plant at a site requiring a moderate amount of terrain modification (UniStar 2007-TN1564). Preconstruction/construction equipment carbon monoxide (CO) emission estimates were derived from the hours of equipment use and carbon dioxide (CO_2) emissions were then estimated from the CO emissions using a scaling factor of 172 tons of CO_2 per ton of CO. The scaling factor is based on the ratio of CO_2 to CO emission factors for diesel fuel industrial engines as reported in Table 3.3-1 of AP-42 (EPA 2012-TN2647). A CO_2 to total GHG equivalency factor of 0.991 is used to account for the emissions from other GHGs such as methane (CH_4) and nitrous oxide (N_2O). The equivalency factor is based on non-road/construction equipment (Chapman et al. 2012-TN2644). Equipment emissions estimates for decommissioning are assumed to be one-half of those for preconstruction/construction. Data on equipment emissions for decommissioning are not available; the one-half factor is based on the assumption that decommissioning would involve less earthmoving and hauling of material, as well as fewer labor hours, when compared with preconstruction/construction.

Table I-1. GHG Emissions from Equipment Used in Preconstruction/Construction and Decommissioning (MT CO2e)

Equipment	Preconstruction/ Construction Total[(a)]	Decommissioning Total[(b)]
Earthwork and dewatering	12,000	6,000
Batch plant operations	3,400	1,700
Concrete	5,400	2,700
Lifting and rigging	5,600	2,800
Shop fabrication	1,000	500
Warehouse operations	1,400	700
Equipment maintenance	10,000	5,000
Total[(c)]	39,000	19,000

(a) Based on hours of equipment usage over a 7-year period
(b) Based on equipment usage over a 10-year period
(c) Results are rounded

Table I-2 lists the review team's estimates of the CO_2 equivalent (CO_2e) emissions associated with workforce transportation. Workforce estimates for new plant preconstruction/construction are conservatively based on estimates in various combined license applications, and the operational and decommissioning workforce estimates are based on Supplement 1 to NUREG–0586 (NRC 2002-TN665). The table lists the assumptions used to estimate total miles traveled by each workforce and the factors used to convert total miles to metric tons (MT) CO_2e. The workers are assumed to travel in gasoline-powered passenger vehicles (cars, trucks, vans, and sport utility vehicles) that get an average of 21.6 mi/gal of gasoline (FHWA 2012-TN2645). Conversion from gallons of gasoline burned to CO_2e is based on the U.S. Environmental Protection Agency (EPA) emissions factors (EPA 2012-TN2643).

Table I-2. Workforce GHG Footprint Estimates

	Preconstruction/ Construction Workforce	Operational Workforce	Decommissioning Workforce	SAFSTOR Workforce
Commuting trips (round trips per day)	1,000	550	200	40
Commute distance (miles per round trip)	40	40	40	40
Commuting days (days per year)	365	365	250	365
Duration (years)	7	40	10	40
Total distance traveled (miles)[a]	102,000,000	321,000,000	20,000,000	23,000,000
Average vehicle fuel efficiency[b] (miles per gallon)	21.6	21.6	21.6	21.6
Total fuel burned[a] (gallons)	4,700,000	14,900,000	900,000	1,100,000
CO_2 emitted per gallon[c] (MT CO_2)	0.00892	0.00892	0.00892	0.00892
Total CO_2 emitted[a] (MT CO_2)	42,000	133,000	8,000	10,000
CO_2e factor[c] (MT CO_2/ MT CO_2e)	0.977	0.977	0.977	0.977
Total GHG emitted[a] (MT CO_2e)	43,000	136,000	8,000	10,000

(a) Results are rounded.
(b) Source: FHWA 2012-TN2645.
(c) Source: EPA 2012-TN2643.

Title 10 of the *Code of Federal Regulations* (CFR) 51.51(a) (TN250) states that every environmental report prepared for the combined license stage of a light-water-cooled nuclear power reactor shall take Table S–3 from 10 CFR 51.51(b) as the basis for evaluating the contribution of the environmental effects of the uranium fuel cycle to the environmental costs of licensing the nuclear power reactor. 10 CFR 51.51(a) further states that Table S–3 shall be included in the environmental report and may be supplemented by a discussion of the environmental significance of the data set forth in the table as weighed in the analysis for the proposed facility.

Table S–3 does not provide an estimate of GHG emissions associated with the uranium fuel cycle; it only addresses pollutants that were of concern when the table was promulgated in the

1980s. However, Table S–3 does state that 323,000 MWh is the assumed annual electric energy use for the reference 1,000-MW(e) nuclear plant and this 323,000 MWh of annual electric energy is assumed to be generated by a 45-MW(e) coal-fired power plant burning 118,000 MT of coal. Table S–3 also assumes approximately 135,000,000 standard cubic feet (scf) of natural gas is required per year to generate process heat for certain portions of the uranium fuel cycle. The review team estimates that burning 118,000 MT of coal and 135,000,000 scf of natural gas per year results in approximately 253,000 MT of CO_2e being emitted into the atmosphere per year due to the uranium fuel cycle.

The review team estimated GHG emissions related to plant operations from a typical usage of various diesel generators onsite (UniStar 2007-TN1564). Carbon monoxide emission estimates were derived assuming an average of 600 hr of emergency diesel generator operation per year (four generators, each operating 150 hr/yr) and 200 hr of station blackout diesel generator operation per year (two generators, each operating 100 hr/yr). A scaling factor of 172 was then applied to convert the CO emissions to CO_2 emissions, and a CO_2 to total GHG equivalency factor of 0.991 was used to account for the emissions from other GHGs such as CH_4 and N_2O.

Given the various sources of GHG emissions discussed above, the review team estimates the total life-cycle GHG footprint for a reference 1,000 MW(e) nuclear power plant with an 80 percent capacity factor to be about 10,500,000 MT. The components of the footprint are summarized in Table I-3. The uranium fuel cycle component of the footprint dominates all other components. It is directly related to power generated. As a result, it is reasonable to use reactor power to scale the footprint to larger reactors.

The Intergovernmental Panel on Climate Change (IPCC) released a special report on renewable energy sources and climate change mitigation in 2012 (IPCC 2012-TN2648). Annex II of the IPCC report includes an assessment of previously published works on life-cycle GHG emissions from various electric generation technologies, including nuclear energy. The IPCC report included in its assessment only material that passes certain screening criteria for quality and relevance. The IPCC screening yielded 125 estimates of nuclear energy life-cycle GHG emissions from 32 separate references. The IPCC-screened estimates of the life-cycle GHG emissions associated with nuclear energy, as shown in Table A.II.4 of the report, ranged more than two orders of magnitude, from 1 to 220 g of CO_2e/kWh, with 25, 50, and 75 percentile values of 8, 16, and 45 g CO_2e/kWh, respectively. The range of the IPCC estimates is due, in part, to assumptions regarding the type of enrichment technology used, how the electricity used for enrichment is generated, the grade of mined uranium ore, the degree of processing and enrichment required, and the assumed operating lifetime of a nuclear power plant.

The review team's life-cycle GHG estimate of approximately 10,500,000 MT CO_2e for the reference 1,000 MW(e) nuclear plant is equal to about 37.5 g CO_2e/kWh, which places the review team estimate between the 50 and 75 percentile values of the IPCC estimates in Table A.II.4 of the report.

In closing, the review team considers the footprint estimated in Table I-3 to be appropriately conservative. The GHG emissions estimates for the dominant component (uranium fuel cycle) are based on 30-year-old enrichment technology assuming that the energy required for enrichment is provided by coal-fired generation. Different assumptions related to the source of energy used for enrichment or the enrichment technology that would be just as reasonable could lead to a significantly reduced footprint.

Table I-3. Nuclear Power Plant Lifetime GHG Footprint

Source	Activity Duration (yr)	Total Emissions (MT CO_2e)
Preconstruction/construction equipment	7	39,000
Preconstruction/construction workforce	7	43,000
Plant operations	40	181,000
Operations workforce	40	136,000
Uranium fuel cycle	40	10,100,000
Decommissioning equipment	10	19,000
Decommissioning workforce	10	8,000
SAFSTOR workforce	40	10,000
Total[a]		10,500,000

(a) Results are rounded

Emissions estimates presented in the body of this environmental impact statement have been scaled to values that are appropriate for the proposed project. The uranium fuel cycle emissions have been scaled by reactor power and plant capacity factor using the scaling factor determined in Chapter 6 and by the number of reactors to be built. Plant operations emissions have been adjusted to represent the number of large GHG emissions sources (e.g., diesel generators and boilers) associated with the project. The workforce emissions estimates have been scaled to account for differences in workforce numbers and commuting distance. Finally, equipment emissions estimates have been scaled by estimated equipment usage. As can be seen in Table I-3, only the scaling of the uranium fuel-cycle emissions estimates makes a significant difference in the total carbon footprint of the project.

References

10 CFR Part 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions." Washington, D.C. TN250.

Chapman, E.G., J.P. Rishel, J.M. Niemeyer, K.A. Cort, and S.E. Gulley. 2012. *Assumptions, Calculations, and Recommendations Related to a Proposed Guidance Update on Greenhouse Gases and Climate Change*. PNNL-21494, Pacific Northwest National Laboratory, Richland, Washington. Accession No. ML12310A212. TN2644.

EPA (U.S. Environmental Protection Agency). 2012. "Clean Energy: Calculations and References." Accession No. ML12292A648. TN2643.

EPA (U.S. Environmental Protection Agency). 2012. "Stationary Internal Combustion Sources." Chapter 3 in *Technology Transfer Network Clearinghouse for Inventories & Emissions Factors: AP-42.* Fifth Edition, Research Triangle Park, North Carolina. Accession No. ML12292A637. TN2647.

FHWA (Federal Highway Administration). 2012. "Highway Statistics 2010 (Table VM-1)." Office of Highway Policy Information, Washington, D.C. Accession No. ML12292A645. TN2645.

IPCC (Intergovernmental Panel on Climate Change). 2012. *Renewable Energy Sources and Climate Change Mitigation—Special Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge, United Kingdom. TN2648.

NRC (U.S. Nuclear Regulatory Commission). 2002. *Final Generic Environmental Impact Statement of Decommissioning of Nuclear Facilities: Regarding the Decommissioning of Nuclear Power Reactors*. NUREG–0586, Supplement 1, Volumes 1 and 2, Washington, D.C. Accession Nos. ML023470327; ML023500228. TN665.

UniStar (UniStar Nuclear Energy, LLC). 2007. *Technical Report in Support of Application of UniStar Nuclear Energy, LLC and UniStar Nuclear Operating Services, LLC for Certificate of Public Convenience and Necessity Before the Maryland Public Service Commission for Authorization to Construct Unit 3 at Calvert Cliffs Nuclear Power Plant and Associated Transmission Lines*. Public Service Commission of Maryland, Baltimore, Maryland. Accession No. ML090680053. TN1564.

APPENDIX J

PPL BELL BEND, LLC LEAST ENVIRONMENTALLY DAMAGING PRACTICABLE ALTERNATIVE ONSITE AND OFFSITE ALTERNATIVE ANALYSIS

APPENDIX J

PPL BELL BEND, LLC LEAST ENVIRONMENTALLY DAMAGING PRACTICABLE ALTERNATIVE ONSITE AND OFFSITE ALTERNATIVE ANALYSIS

PPL Bell Bend, LLC (PPL) provided an alternative site analysis (PPL Nuclear Development 2011-TN2274) that describes the offsite alternatives relative to wetland and stream impacts and a statement about the least environmentally damaging practical alternatives. PPL also provided an onsite alternative analysis that describes the onsite alternative layouts relative to wetland and stream impacts. These alternative site analyses can be found in the U.S. Nuclear Regulatory Commission (NRC) Agencywide Documents Access and Management System (ADAMS) under accession number ML15078A481. ADAMS is accessible from the NRC website at http://www.nrc.gov/reading-rm/adams.html#web-based-adams (in the Public Electronic Reading Room; note that the URL is case-sensitive).

Reference

PPL Nuclear Development (PPL Nuclear Development, LLC). 2011. *PPL Bell Bend Nuclear Power Plant, Luzerne County, Salem Township, Pennsylvania, Joint Permit Application, Revision 1.* Allentown, Pennsylvania. Accession No. ML13057A754. TN2274.

APPENDIX K

PPL BELL BEND, LLC MITIGATION PLAN SUMMARY FOR WETLAND AND STREAM IMPACT

APPENDIX K

PPL BELL BEND, LLC MITIGATION PLAN SUMMARY FOR WETLAND AND STREAM IMPACT

SUMMARY OF COMPENSATORY MITIGATION PLAN FOR WETLAND AND STREAM IMPACTS ASSOCIATED WITH THE BELL BEND NUCLEAR POWER PLANT (BBNPP)

Throughout the site selection and planning phase for the Bell Bend Nuclear Power Plant (BBNPP) project, steps were taken to avoid and minimize environmental impacts. Unfortunately, not all impacts could be avoided or minimized. The remaining unavoidable impacts are addressed through the performance of three primary mitigation projects. The proposed compensatory mitigation for the unavoidable impacts on wetlands and surface waters of the proposed BBNPP is intended to meet the mitigation requirements of the U.S. Army Corps of Engineers (USACE) Baltimore District, and includes the creation and enhancement of wetlands and streams to achieve conditions more suitable for use by wildlife species native to the region. The mitigation areas were chosen following a mitigation site selection process. Four general mitigation strategies were initially identified: (1) onsite and in-kind, (2) onsite and out-of-kind, (3) offsite and in-kind, and (4) offsite and out-of-kind. The mitigation strategy chosen for the proposed BBNPP project provides for onsite and in-kind mitigation, because this strategy or mitigation action would replace wetland and stream acreage and functional losses more effectively than the other three strategies.

The USACE requires mitigation for permanent impacts on jurisdictional streams and wetlands, characterized by either the permanent placement of fill/grading in a stream (stream enclosure/stream relocation) or by the permanent placement of fill/grading in a wetland (wetland converted to upland). Permanent stream and wetland impacts resulting from the BBNPP project are primarily caused by bridge and utility crossings and fill placement associated with the water-intake structure and plant infrastructure.

The USACE also requires mitigation for permanent wetland conversion impacts, characterized by the permanent conversion of a palustrine, forested (PFO) wetland type to either a palustrine shrub-scrub (PSS) wetland type or a palustrine, emergent (PEM) wetland type. The overall wetland location and acreage is not affected, but the lost functions and values must be considered and mitigated. Conversion impacts resulting from the BBNPP project are primarily caused by the cutting of trees for transmission lines, bridge spans, etc., that cause PFO wetlands to be converted to PSS or PEM wetlands. Table K-1, Table K-2, and Table K-3 at the end of this appendix summarize projected impacts on jurisdictional waters and wetlands and acres of proposed mitigation actions.

The mitigation plan chosen for the proposed BBNPP provides for onsite and in-kind mitigation that will replace wetland and stream acreage, and their function and value losses. The mitigation plan was designed to adhere to the Pennsylvania Code of Regulations (PA Code 25-105-TN1835) and address the concerns of the cooperating agencies, USACE, Susquehanna River

Basin Commission, Pennsylvania Department of Environmental Protection, Pennsylvania Department of Conservation and Natural Resources, Pennsylvania Fish and Boat Commission, and Pennsylvania Game Commission. This summary of the mitigation plan incorporates updates to the Joint Permit Application as submitted by PPL Bell Bend, LLC (PPL) to the USACE (PPL Nuclear Development 2011-TN1952).

The BBNPP Mitigation Plan was prepared in accordance with “Compensatory Mitigation for Losses of Aquatic Resources: Final Rule” (Mitigation Rule) (33 CFR Part 325 [TN425] and 33 CFR Part 332 [TN1472]) dated April 10, 2008. At the time of mitigation planning, there were/are no wetland banking opportunities or in-lieu fee programs available in Pennsylvania. Therefore, all proposed wetland and stream mitigation projects involve an onsite, in-kind permittee-responsible watershed approach. PPL proposes onsite and in-kind wetland and stream restoration and enhancement to mitigate the proposed impacts on the USACE jurisdictional waters. The plan proposes to replace functions and values that would be lost with the construction of BBNPP.

Compensatory mitigation for unavoidable impacts on approximately 10.25 ac of jurisdictional, forested and emergent (herbaceous) wetlands and 0.14 ac (742 linear feet) of stream habitat, will be required to satisfy the Section 10/404 standards of the Clean Water Act (33 U.S.C. § 1251 et seq.-TN662) and to obtain regulatory authorization for BBNPP construction.

This work includes (1) a stream and floodplain restoration project on two reaches of Walker Run, creating and enhancing wetlands and wild trout habitat as well as mitigating for permanent stream impacts; (2) removing a section of Confers Lane, creating wetlands and restoring a hydrologic connection between two exceptional value (EV) wetlands; and (3) restoring the North Branch Canal, enhancing wetlands at the PPL Riverlands location, and extending the existing recreational trail system.

The chosen mitigation projects are intended to address watershed and site-specific concerns such as replacement of forested wetland habitat and habitat quality improvements for reproducing brown trout populations in Walker Run. The mitigation plans propose to enhance specific stream portions by reducing sedimentation and stream bank erosion and improving the availability of trout-spawning substrate. Varying in-stream conditions including riffles, runs, and pools, as well as fish habitat structures will be established, and eventually a mature PFO wetland will exist along the length of the restored reach, improving canopy cover and reducing stream temperatures. The stream restoration and preservation mitigation opportunities will offset losses to watershed functions by increasing the ability to provide floodwater storage, naturally recharge local aquifers, improve water quality, and maintain stream and riparian functions that support corresponding ecology.

After the onsite wetland creation, wetland enhancement, and stream restoration activities for the proposed BBNPP project, annual monitoring conducted for 5 years, including monitoring for benthic macroinvertebrate and fish assessments in Walker Run, would be implemented in accordance with the requirements of the *Mitigation and Monitoring Guidelines* (USACE) (33 CFR Part 325 [TN425] and 33 CFR Part 332 [TN1472]). Furthermore, these projects would be protected in perpetuity through establishment of a legally binding protection mechanism. In addition, PPL is proposing 50-ft forested buffers will remain surrounding the majority of EV wetlands within the project boundary.

K.1 Wetland Mitigation

After field reconnaissance and site walkthrough of the BBNPP site between 2008 and 2011, specific locations were identified as having potential for wetland enhancement, or as being suitable for the creation of wetland communities.

The wetland mitigation component of the compensatory mitigation plan includes the following activities:

- Walker Run wetland creation, enhancement, and stream restoration. This proposed project will use natural stream channel design techniques to improve channel stability, water quality, and aquatic habitat along Walker Run and to restore the functionality of the floodplain. The project will create 7.87 ac of wetlands and enhance an additional 5.5 ac through invasive species removal and the planting of native herbaceous vegetation, shrubs, and trees. The project will also re-establish the connection between Walker Run and its floodplain to improve hydrology. The planting plan for this project was designed with the goal of eventually establishing mature PFO wetlands to mitigate for losses to forested wetland habitat, including Indiana bat habitat, resulting from permanent and wetland conversion impacts. The functions provided by these wetlands will exceed the functions lost as a result of BBNPP project impacts and will include enhanced fish habitat, stream stabilization, groundwater recharge, sediment reduction, flood flow alteration, and water-quality improvements.
- The implementation of the Walker Run mitigation project will cause permanent impacts on 0.25 ac of existing PEM wetlands at locations where the new stream channel will displace existing wetlands. However, the net mitigation totals created by the Walker Run mitigation component will replace the affected PEM areas.
- Riverlands − North Branch Canal (NBC) restoration with wetland enhancement. The reconnection of the NBC in its historical alignment has been identified as the preferred solution to address the proposed filling of the existing man-made NBC outfall channel as part of the intake structure construction. Also, 1.24 ac of wetlands will be enhanced near the proposed intake structure. The reconnection of the canal and enhancement of existing wetlands will mitigate for the wetland functions and values lost in conjunction with the intake structure construction such as recreation, educational opportunities, uniqueness, and visual quality.
- Confers Lane Removal to create and enhance wetlands. The abandonment of Confers Lane presents an opportunity to remove the roadbed, re-establish a connection between existing EV wetlands, and create 0.36 ac of additional forested wetland habitat. This small area will be planted with native herbaceous plants, shrubs, and trees to restore the PFO wetland post construction.

K.2 Stream Mitigation

The proposed BBNPP site contains two proposed stream restoration reaches located within the main stem of Walker Run. One segment will begin at the Beach Grove Road bridge and the second segment will begin at the north Market Street bridge.

The Walker Run mitigation project will account for all of the required stream mitigation for BBNPP. The existing straightened and channelized stream will be realigned, creating and enhancing a total of 2,213 linear feet of channel. Stream channel will be created where the existing channel is moved and lengthened. A net total of 1,360 linear feet of created stream channel and 853 linear feet of enhanced channel will result from the Walker Run mitigation project. Stream enhancements occur where the stream remains in its existing location but channel improvements are made such as bank grading or planting native vegetation. The implementation of the Walker Run mitigation project will cause permanent impacts on the approximate 2,799 linear feet of channel that will be abandoned in order to create 4,159 linear feet of new channel, thus resulting in a net gain of 1,360 linear feet of stream. The net mitigation totals created by the Walker Run mitigation component will replace the affected stream lengths.

The proposed stream restoration and stream preservation measures are intended to compensate for the unavoidable, direct loss of physical, biological and/or riparian function of affected streams. Stream restoration will take advantage of opportunities to reconnect channels to their historic flow paths and restore active connection to wooded floodplains. Stream preservation activities, intended to improve existing stream physical and ecological functions within the channel’s current flow path, include bank grading operations and floodplain creation at lower elevations, bank treatments, and native plantings.

K.3 Essential Service Water Emergency Makeup System Pond Mitigation

Although not required by the USACE, due to the fact that the pond will be constructed in uplands, the applicant will mitigate for the temporary impacts caused by the Essential Service Water Emergency Makeup System Pond construction. Construction of the Essential Service Water Emergency Makeup System Pond will require dewatering to support construction under dry conditions. This will result in 5.56 ac of temporary impacts on adjacent Wetlands 11 and 12 and temporary hydrology impacts on approximately 1,400 linear feet of Tributary 1 to Walker Run and Tributary 2. The mitigation plan calls for using the pumped groundwater by direct discharge and spray irrigation to maintain the water levels in the adjacent wetlands and stream to near natural conditions during the 18-month to 2-year construction period.

Table K-1. Summary of Impacts on Jurisdictional Wetlands and Waters and Recommended Mitigation

Wetland/Stream Type	Area of Impact	Impact Type	Recommended Mitigation (tied to replacement of functions and values)
Forested wetland (PFO)	0.51 ac	Permanent grading/fill	@ 2:1 = 1.02 ac
Forested wetland (PFO)	9.00 ac	Permanent conversion	< 2:1 = < 18.00 ac
Emergent wetland (PEM)	0.74 ac	Permanent grading/fill	@ 1:1 = 0.74 ac
Emergent wetland (PEM)	0.90 ac	Temporary grading/fill	NA; area will revert back to PEM post-construction conditions
Total area of permanent wetland impact = 10.25 ac			
Total area of temporary wetland impact = 0.90 ac			
Riparian stream	742 linear feet	Permanent grading/fill	@ 1:1 = 742 linear feet)
Riparian stream/Susquehanna river	317 linear feet	Temporary grading/fill (includes river dredging)	NA
Total feet of permanent waters impact = 742 linear feet			
Total feet of temporary waters impacts = 317 linear feet			

Table K-2. Summary of Proposed Wetlands Mitigation

Proposed Wetland Impact	Proposed Wetland Mitigation	Surplus Wetlands Mitigation
Forested wetland (PFO): 9.51 ac	Forested Creation (PFO): 8.23 ac Forested Enhancement (PFO): 6.74 ac (put toward PFO conversion impacts)[(a)]	Creation Surplus: 7.21 ac
Emergent wetland (PEM): 0.74 ac	NA	Creation Deficit: 0.74 ac
Total (all types) = 10.25 ac	Total (all types) = 15.03 ac	Net Creation Surplus: 6.47 ac (put toward PFO conversion impacts)[(a)]

(a) The functions and values of the 9.00 ac PFO conversion impact will be mitigated for by 6.47 ac of PFO creation, 6.74 ac of PFO enhancement, and 1,471 linear feet of stream mitigation.

Table K-3. Summary of Proposed Stream Impacts

Proposed Stream Impact	Proposed Stream Mitigation	Surplus Stream Mitigation
742 linear feet	Net Stream Channel Created: 1,360 linear feet Net Stream Channel Enhanced: 853 linear feet	Creation Surplus: 618 linear feet Enhancement Surplus: 853 linear feet
Total (all types): 742 linear feet	Total (all types): 2,213 linear feet	Net Surplus: 1,471 linear feet (put toward conversion PFO impacts)[(a)]

(a) The functions and values of the 9.00 ac PFO conversion impact will be mitigated for by 6.47 ac of PFO creation, 6.74 ac of PFO enhancement, and 1,471 linear feet of stream mitigation.

The Mitigation Plan for Wetland and Stream Impacts will be included in the USACE permit decision and will be available for review and inspection (although not for distribution) at:

U.S. Army Corps of Engineers, Baltimore District
Operations Division, Regulatory Branch
State College Field Office
1631 South Atherton Street
Suite 102
State College, PA 16801

Note: Please contact Mrs. Amy Elliott, Regulatory Project Manager, by e-mail at amy.h.elliott@usace.army.mil or phone number (814) 235-0573, to make arrangements for reviewing the Mitigation Plan.

K.4 References

33 CFR Part 325. *Code of Federal Regulations*, Title 33, *Navigation and Navigable Waters*, Part 325, "Processing of Department of the Army Permits." Washington, D.C. TN425.

33 CFR Part 332. *Code of Federal Regulations*, Title 33, *Navigation and Navigable Waters*, Part 332, "Compensatory Mitigation for Losses of Aquatic Resources." Washington, D.C. TN1472.

33 U.S.C. § 1251 et seq. Federal Water Pollution Control Act of 1972 [also referred to as Clean Water Act]. TN662.

PA Code 25-105 (Pennsylvania Code 25, Chapter 105). 1981. "Dam Safety and Waterway Management." *Pennsylvania Code*, Harrisburg, Pennsylvania. TN1835.

PPL Nuclear Development (PPL Nuclear Development, LLC). 2011. *Bell Bend Nuclear Power Plant Salem Township, Luzerne County, Pennsylvania, Joint Permit Application, Revision 1, Binder 1C, Section R—Construction Dewatering Mitigation Plan*. Allentown, Pennsylvania. Accession No. ML121930038. TN1952.

APPENDIX L

PPL'S RESPONSES TO COMMENTS RECEIVED BY THE U.S. ARMY CORPS OF ENGINEERS FROM THE PUBLIC NOTICE

APPENDIX L

PPL'S RESPONSES TO COMMENTS RECEIVED BY THE U.S. ARMY CORPS OF ENGINEERS FROM THE PUBLIC NOTICE

In accordance with Title 33 of the *Code of Federal Regulations* (CFR) 325.2(a)(3) (TN425) of the U.S. Army Corps of Engineers' (USACE) regulations, if the District determines, based on comments received in response to the public notice, that the views of the applicant on a particular issue is necessary to make a public interest determination, the applicant will be given the opportunity to furnish views on such issues. The USACE has provided PPL Bell Bend, LLC (PPL) with the opportunity to furnish resolutions or rebuttals of all objections and comments. PPL responses to public notice comments joint permit application PN-12-07 can be found in the U.S. Nuclear Regulatory Commission (NRC) Agencywide Documents Access and Management System (ADAMS) under accession number ML130070004 (PPL Bell Bend 2012-TN4210). ADAMS is accessible from the NRC website at http://www.nrc.gov/reading-rm/adams.html#web-based-adams (in the Public Electronic Reading Room; note that the URL is case-sensitive). The USACE will evaluate and consider comments, objections, and rebuttals as part of the permit review process. The USACE alone is responsible for reaching a decision on the merits of any application.

The USACE will base its evaluation of the Department of the Army Individual Permit application on the requirements of USACE regulations, the Clean Water Act (33 U.S.C. § 1251 et seq.-TN662) Section 404(b)(1) Guidelines, and the USACE public interest review process. The USACE permit decision will be made in its record of decision. As referenced below in Enclosure 10 of the applicant's response, the documents listed in Table L-1 were provided to the commenters for inclusion in the project record.

Table L-1. Documents Provided to Commenters for Inclusion in the Project Record

Reference Document Title	ML Number
Ecology III. *Environmental Studies in the Vicinity of the Susquehanna Steam Electric Station, 2008 Water Quality, Benthic Macroinvertebrates, and Fishes*. Prepared for PPL Susquehanna, LLC, July 2009.	ML13007A016
Ecology III. *Environmental Studies in the Vicinity of the Susquehanna Steam Electric Station, 2009 Water Quality and Fishes*. Prepared for PPL Susquehanna, LLC, September 2010.	ML12187A054
Ecology III. *Environmental Studies in the Vicinity of the Susquehanna Steam Electric Station, 2010 Water Quality and Fishes*. Prepared for PPL Susquehanna, LLC, November 2011.	ML12187A052
Normandeau Associates, Inc. *Potential Effects of the Bell Bend Project on Aquatic Resources and Downstream Users, Proposed Bell Bend Nuclear Power Plant site, Luzerne County, Pennsylvania*. Report No 21665.001-LFHC3, Revision 1, May 10, 2012.	ML12193A480
Normandeau Associates, Inc. *Study Plan for a Mussel Survey in the Susquehanna River Near the Proposed Bell Bend Project at Berwick, PA.* August 2011.	ML13007A016

Table L-1. (contd)

Reference Document Title	ML Number
Normandeau Associates, Inc., Ecology III, and Environmental Resources Management. *Study Plan to Collect Supplemental Data to Assess the Potential Effects of the Bell Bend Project on Water Quality of Backwater Areas Used by Fry and Young-of-the-Year Smallmouth Bass.* Report No. 21665.001-SMB1, Revision 1, April 2012.	ML13007A016 ML13007A017 ML13007A018
PPL Nuclear Development, LLC, BNP-2011-202, “Bell Bend Nuclear Power Plant, BBNPP IFIM and Aquatic Studies Workplan.” Correspondence to the SRBC, Docket No. 52-039, October 31, 2011.	Ml13007A019
PPL Nuclear Development, LLC, BNP-2012-044, “Bell Bend Nuclear Power Plant, Response to Comments Concerning Seasonal Availability and Water Use.” Correspondence to the SRBC, Docket No. 52-039, February 23, 2012.	ML12096A188
PPL Nuclear Development, LLC, BNP-2012-080, “Bell Bend Nuclear Power Plant, PPL Response to Commission Letters, Young of the Year (YOY) Bass 2012 Study Planning.” Correspondence to the SRBC, Docket No. 52-039, March 23, 2012.	ML12151A223
PPL Nuclear Development, LLC, BNP-2012-136, “Bell Bend Nuclear Power Plant, Avoidance of Consumptive Use, Revised Evaluation of Bell Bend Cooling Options.” Correspondence to the SRBC, Docket No. 52-039, August 21, 2012.	ML122560883
PPL Nuclear Development, LLC, BNP-2012-193, “Bell Bend Nuclear Power Plant Indiana Bat Biological Evaluation and Management Plan.” Correspondence to the NRC, Docket No. 52-039, August 30, 2012.	ML122690324
PPL Nuclear Development, LLC, BNP-2012-200, “Bell Bend Nuclear Power Plant, Mussel Survey Report.” Correspondence to the SRBC, Docket No. 52-039, September 6, 2012.	ML12262A004
Sargent & Lundy, LLC. *Construction Dewatering Design, Bell Bend Nuclear Power Plant, UniStar Nuclear Energy, Non-Safety Related.* Report No. SL-009665, Revision 3, November 18, 2011.	ML13007A009

References

33 CFR Part 325. *Code of Federal Regulations*, Title 33, *Navigation and Navigable Waters*, Part 325, "Processing of Department of the Army Permits." Washington, D.C. TN425.

33 U.S.C. § 1251 et seq. Federal Water Pollution Control Act of 1972 [also referred to as Clean Water Act]. TN662.

PPL (PPL Bell Bend, LLC). 2012. *Bell Bend Nuclear Power Plant Response to Public Notice Comments, Joint Permit Application.* Allentown, Pennsylvania. Accession No. ML130070004. TN4210.

APPENDIX M

SEVERE ACCIDENT MITIGATION ALTERNATIVES

APPENDIX M

SEVERE ACCIDENT MITIGATION ALTERNATIVES

M.1 Introduction

PPL Bell Bend, LLC (PPL) has submitted an application to construct an AREVA NP Inc. (AREVA) U.S. Evolutionary Power Reactor (U.S. EPR) at the Bell Bend Nuclear Power Plant (BBNPP) site. Current policy developed after the Limerick decision (Limerick Ecology Action v. NRC 1989-TN2067) requires that the U.S. Nuclear Regulatory Commission (NRC) consider alternatives to mitigate the consequences of severe accidents in a site-specific environmental impact statement (EIS). The severe accident mitigation alternative (SAMA) review presented here considers both severe accident mitigation design alternatives (SAMDAs) and procedural alternatives.

PPL notified the NRC of changes in its power generation business by letter dated May 12, 2015 (NRC Accession No. ML15146A095). PPL Bell Bend, LLC was renamed Bell Bend, LLC, and Bell Bend, LLC became a generation affiliate of Talen Energy Corporation (Talen Energy). The transaction became official on June 1, 2015. For purposes of this review, the abbreviation "PPL" will still be used to indicate the applicant. Bell Bend, LLC, under Talen Energy, is the applicant.

In Title 10 of the *Code of Federal Regulations* (CFR) 52.79(a)(38) (TN251), the NRC requires that applicants for a combined construction permit and operating license (combined license or COL) include "… a description and analysis of design features for the prevention and mitigation of severe accidents…" in the Final Safety Analysis Report (FSAR). The PPL COL application provides this information in the FSAR (PPL Bell Bend 2013-TN3447). The environmental report (ER) (PPL Bell Bend 2013-TN3377) submitted by PPL also includes information regarding the SAMA analysis.

In 10 CFR 52.47(a)(23) (TN251), the NRC requires that applicants for design certification include "… a description and analysis of design features for the prevention and mitigation of severe accidents…" in the application for design certification. In 10 CFR 52.47(a)(27) (TN251), the NRC requires a description of a "…design-specific probabilistic risk assessment (PRA) and its results," and in 10 CFR 52.47(b)(2) the NRC requires an ER that contains the information required by 10 CFR 51.55 (TN250). AREVA has submitted all of this information in documents that are part of its application for certification of the U.S. EPR design. In addition, in 10 CFR 52.79(a)(46) (TN251), the NRC requires COL applicants to provide a description of "…the plant-specific PRA and its results." PPL has also submitted this information in the BBNPP FSAR (PPL Bell Bend 2013-TN3447).

While the NRC staff has not completed its generic SAMDA review of the U.S. EPR for design certification, the NRC staff has conducted a review of the PPL SAMDA analysis specific to operation of a U.S. EPR at the BBNPP site. The staff reviewed input parameters and values used by PPL for appropriateness, including references made to the U.S. EPR design certification ER (AREVA 2009-TN576). The analysis is based on the following:

1. The PRA included as Section 19.1 of the U.S. EPR FSAR (AREVA 2014-TN3722) and SAMDA analysis in the U.S. EPR ER (AREVA 2009-TN576).
2. The results of the analysis of probability-weighted consequences (i.e., risks) of U.S. EPR design at the BBNPP site described in Section 5.11.2 of this EIS.

Section M.2 presents an analysis for a U.S. EPR at a generic site. Section M.3 presents an extended analysis that considers BBNPP site-specific information. These analyses have been updated by the NRC staff based on Revision 7 to the U.S. EPR FSAR (AREVA 2014-TN3722). The SAMDA analysis for the proposed U.S. EPR design certification will be finally resolved through the design certification rulemaking process.

M.2 U.S. EPR SAMDA Review – Generic Site

This section addresses the generic analysis of SAMDAs conducted by AREVA, the applicant for certification of the U.S. EPR design. The SAMA review in Section M.3 extends the generic SAMDA analysis to include BBNPP site-specific factors, including meteorology, population, and land use. Section M.3 also addresses SAMAs not included in the generic analysis because they do not involve reactor system design.

M.2.1 U.S. EPR Probabilistic Risk Assessment Results

AREVA conducted Level 1 and Level 2 PRAs to estimate the core damage frequencies (CDFs) that might result from a large number of initiating events and accident sequences. Table M-1 lists these CDF estimates and estimates of the large release frequencies (LRFs) of iodine, cesium, or tellurium. Releases associated with containment bypass, containment isolation failure, or containment failure at or before reactor vessel failure are considered to be large. Table M-1 also lists NRC staff goals related to CDFs and LRFs.

Table M-1. Comparison of U.S. EPR PRA Results with the Design Goals

	NRC Design Goal[(a)]		U.S. EPR PRA Results[(b)]	
	Core Damage Frequency (yr^{-1})	**Large Release Frequency (yr^{-1})**	**Core Damage Frequency (yr^{-1})**	**Large Release Frequency (yr^{-1})**
Internal At Power Events	1.0×10^{-4}	1.0×10^{-6}	2.4×10^{-7}	1.5×10^{-8}
Internal Flooding Events	1.0×10^{-4}	1.0×10^{-6}	6.1×10^{-8}	8.2×10^{-9}
Internal Fire Events	1.0×10^{-4}	1.0×10^{-6}	1.8×10^{-7}	7.3×10^{-9}
Low Power and Shutdown Events	1.0×10^{-4}	1.0×10^{-6}	6.0×10^{-8}	7.9×10^{-9}

(a) SECY-90-016 (NRC 1990-TN524)
(b) From Chapter 19 of the U.S. EPR FSAR (AREVA 2014-TN3722)

Although the U.S. EPR PRAs did not provide quantitative estimates of CDFs and LRFs for seismic and other external initiating events (e.g., hurricanes and tornadoes), they are discussed in the FSAR. Section 19.1.5.1 of the DCD FSAR (AREVA 2014-TN3722) presents the results of a PRA-based seismic margins analysis in which PRA methods are used to identify potential vulnerabilities in the design so corrective measures can be taken to reduce risk. Similarly, BBNPP FSAR Section 19.1.5.4 addresses risks associated with high winds, tornado missiles, external flooding, external fires, and other external events. Risks associated with these events are considered to be insignificant by AREVA because of the U.S. EPR provides a robust design against these potential events.

M.2.2 Potential Design Improvements

In the ER submitted as part of the design certification application (AREVA 2009-TN576), AREVA identified 167 candidate alternatives based on a review of industry documents, including previous SAMDA reviews and NRC evaluations of those reviews, and consideration of plant-specific enhancements. The candidate alternatives then were screened to identify candidates for detailed evaluation. The following screening categories were used:

- not applicable
- already implemented
- combined
- excessive implementation cost
- very low benefit
- not required for design certification
- consideration for further evaluation.

The development of the U.S. EPR design has benefitted from insights gained by performing numerous PRAs. The low CDFs and LRFs shown in Table M-1 are attributable to the implementation of design improvements already incorporated into the U.S. EPR design to prevent and mitigate severe accidents. Following are examples of 67 candidate alternatives already included in the design:

- severe accident heat removal system
- core melt retention system
- containment spray system
- containment and outer shield building annulus active vented-filtering system
- extension of station blackout capability through the use of additional diesel generators and increased direct current battery capacity
- improvement of direct current bus load shedding
- installation of self-actuating containment isolation valves
- replacement of steam generators with new designs
- installation of relief valves in the component cooling-water system
- implementation of a reactor coolant depressurization system
- addition of a motor-driven feedwater pump

- increase in seismic ruggedness of plant components
- addition of other engineered features as described in Section 19.1.3 of the U.S. EPR DCD FSAR, Rev. 7 (AREVA 2014-TN3722).

Of the remaining 100 candidate alternatives, the screening process eliminated 21 candidate alternatives as being not applicable to the U.S. EPR design; 4 candidate alternatives were combined with similar alternatives; and 50 candidate alternatives were procedural or administrative rather than design alternatives. Of the remaining 25 candidate alternatives, 1 was categorized as very low benefit because it would not significantly reduce risk and 24 were categorized as having excessive implementation costs. No candidate alternatives were identified for further evaluation.

M.2.3 Cost-Benefit Comparison

AREVA used the cost-benefit methodology found in NUREG/BR-0184, *Regulatory Analysis Technical Evaluation Handbook* (NRC 1997-TN676), to calculate the maximum attainable benefit associated with completely eliminating all risk for the U.S. EPR.

This methodology involves determining the net value for a SAMDA according to the following formula:

Net Value = (APE + AOC + AOE + AOSC) − COE

where:

APE	=	present value of averted public exposure ($)
AOC	=	present value of averted offsite property damage costs ($)
AOE	=	present value of averted occupational exposure costs ($)
AOSC	=	present value of averted onsite costs ($); this includes cleanup, decontamination, and long-term replacement power costs
COE	=	cost of enhancement ($).

If the net value of a SAMDA is negative, the cost of implementing the SAMDA is larger than the benefit associated with the SAMDA, and it is not considered to be cost beneficial.

To assess the risk reduction potential for SAMDAs, AREVA (2009-TN576) assumed that each design alternative would work perfectly to completely eliminate all severe accident risk from the internal events. This assumption is conservative because it maximizes the benefit of each design alternative. AREVA estimated the public exposure benefits for the design alternative on the basis of the reduction of risk expressed in terms of whole body person-rem per year received by the total population within a 50-mi radius of the generic site hosting a U.S. EPR.

Table M-2 summarizes AREVA's estimates of each of the associated cost elements. The results are based on the approach, parameters, and data listed in NUREG/BR-0184 (NRC 1997-TN676). Baseline risks used in the analysis were 1.81×10^{-1} person-rem/yr population dose risk and $185 per year for cost risk for internal events during full-power operation (AREVA 2009-TN576).

The monetary present value estimate for each risk attribute does not represent the expected reduction in risk resulting from a single accident; rather, it is the present value of a stream of potential losses extending over the projected lifetime of the facility (in this case projected to be 60 years). Therefore, the averted cost estimates reflect the expected annual loss resulting from a single accident, the possibility that such an accident could occur at any time over the licensed life, and the effect of discounting these potential future losses to present value.

Table M-2. Summary of Estimated Maximum Averted Costs for a Generic Site

Quantitative Attributes		Averted Cost Estimate ($)[a] 7% discount	3% discount
Health	Public (APE)	5,094	10,072
	Occupational (AOE)	264	607
Property	Offsite[b] (AOC)	2,603	5,147
	Onsite	NA[c]	NA[c]
Cleanup and Decontamination[d]	Onsite	8,215	19,110
Replacement Power[d]		36,888	129,243
Total[e]		53,063	164,179
Total with Seismic Risk		70,574	218,358

(a) From the design certification ER (AREVA 2009-TN576).
(b) Includes offsite cleanup and decontamination costs.
(c) NA = not analyzed.
(d) As defined above, AOSC = $45,103 ($8,215 and $36,888 for 7% discount), or $148,353 ($19,110 and $129,243 for 3% discount), includes onsite cleanup and decontamination costs and the cost of replacement power.
(e) Based on internal event, internal flooding, and internal fire risks.

As indicated above, AREVA estimated the total present dollar value equivalent associated with complete elimination of severe accidents at a single U.S. EPR unit site to range between about $53,100 and about $164,200. The estimated cost of replacement power has the largest effect on the averted cost. To account for the seismic risks, AREVA increased these estimates by a factor 1.33. The resulting best estimate of maximum averted costs is about $70,600 based on a 7 percent discount rate with an upper bound estimate of about $218,400 for the 3 percent discount rate. For a SAMDA to be cost beneficial, AREVA states the enhancement cost must be less than $70,600. Based on this total averted cost estimate of $70,600, AREVA concluded that none of the SAMDA candidates are cost beneficial.

M.2.4 NRC Staff Evaluation

In 10 CFR 52.47(a)(27) (TN251), the NRC requires that an applicant for design certification perform a design-specific PRA. The aim of this PRA is to seek improvements in the reliability of core and containment heat removal systems that are significant and practical. The set of potential design improvements considered for the U.S. EPR include those from industry guidance, previous SAMDA review, and review of the U.S. EPR design. The U.S. EPR design already incorporates many design enhancements (see Section M.2.2) related to severe accident prevention and mitigation. Such design improvements have resulted in an overall CDF that is almost one order of magnitude lower than the CDF for the existing Susquehanna Steam Electric Station Units 1 and 2, located near the proposed BBNPP site.

AREVA's averted cost estimates are based on point-estimate values, without consideration of uncertainties in CDF or offsite consequences. Even though this approach is consistent with that used in previous design alternative evaluations, further consideration of these factors could lead to significantly higher risk reduction values, given the extremely small CDF and risk estimates in the baseline PRA. Uncertainties either in CDF or in offsite radiation exposures resulting from a core damage event are fairly large because key safety features of the U.S. EPR design are unique, and their reliability has been evaluated through analysis and testing programs, rather than through operating experience.

Furthermore, in evaluating the costs of additional SAMDA candidates, AREVA did not explicitly assess the capital costs associated with the various alternatives. Instead, AREVA used the estimated costs of backfitting of similar SAMDAs provided by industry in license renewal applications. This approach has the potential to overestimate the actual costs of SAMDAs because the cost of implementing a modification to a reactor that has been built is always greater than implementing the modification in a design that is still evolving.

M.3 BBNPP Site-Specific SAMA Review

The discussion above evaluates SAMDAs for the U.S. EPR at a generic site. The discussion that follows updates that evaluation to include consideration of BBNPP site-specific factors including meteorological conditions, population distribution, and land use. It is based on the PPL SAMDA analysis for BBNPP presented in the ER (PPL Bell Bend 2013-TN3377). The last part of this discussion deals with procedural and training SAMAs.

M.3.1 Risk Estimates

PPL estimated severe accident risks for a U.S. EPR at the BBNPP site in Section 7.2 of its ER (PPL Bell Bend 2013-TN3377). The NRC staff evaluated the information for the U.S. EPR design supplied by AREVA (2014-TN3722) then applied by PPL with BBNPP site-specific data (i.e., meteorology, demographics, and land use) (PPL Bell Bend 2013-TN3377; PPL Bell Bend 2014-TN3724). The results of these analyses are found in Table 5-18 in Section 5.11 of this EIS.

Table 5-18, gives a CDF of 4.9×10^{-7} yr^{-1}, and population dose and cost risks of 5.6×10^{-1} person-rem yr^{-1} and \$304 yr^{-1}, respectively. These risks are based on internally initiated events, internal flooding events, and internal fire events that occur while the reactor is at power. The U.S. EPR FSAR (AREVA 2014-TN3722) states that the total CDF for events occurring while the reactor is at low power or shut down is estimated to be about an order of magnitude less than the total at power CDF, as is evident in Table M-1.

M.3.2 Cost-Benefit Comparison

In Section 7.3.2 of the ER (PPL Bell Bend 2013-TN3377), PPL estimates the averted costs associated with eliminating all severe accident risks associated for a U.S. EPR at the BBNPP site. The PPL analysis is an update of the AREVA SAMDA analysis (AREVA 2009-TN576) that includes site-specific information. PPL substituted population dose and offsite cost risks based on 2050 population projections for the BBNPP site for the population dose and offsite property costs in the AREVA analysis. Table M-3 shows both the AREVA generic averted cost estimates and the PPL estimates updated by the NRC staff to reflect the changes in the U.S. EPR ER (AREVA 2009-TN576).

Regarding the conservatism of the 2050 base year population for estimating severe accident impacts, PPL evaluated the BBNPP site using projections from the 2000 U.S. Census versus the more recent 2010 U.S. Census data. PPL provided the results of a sensitivity analysis showing that estimates of the 2050 base year population using projections from either 2000 or 2010 U.S. Census data produce very minor differences (PPL Bell Bend 2013-TN3806; PPL Bell Bend 2014-TN3805) and would have essentially no difference in the calculation of severe accident risk metrics, including maximum attainable benefit of SAMDAs. In addition, the NRC staff's independent analysis found that based on sensitivity studies, including use of the more recent 2010 U.S. Census data, the severe accident risk metrics are not sensitive to modest changes in population distribution. This is due mainly to the very low CDFs of advanced light-water reactors like the U.S. EPR.

In assessing the risk reduction potential of design improvements for the U.S. EPR, the NRC staff evaluated the AREVA risk reduction estimates for the various design alternatives and assessed the potential impact of uncertainties on the results. The data in Table M-2 and Table M-3 present the value of reducing the severe accident risk to zero. These values are used in screening potential SAMDAs. Using the results in Table M-2, AREVA concluded that no candidate alternative from an initial list of 167 alternatives would be cost beneficial beyond the 69 candidate alternatives already included in the design. The BBNPP site-specific values, although slightly higher than those estimated for a generic site, are less than the minimum estimated cost for a design change. Moreover, no SAMDA can reduce the risk to zero. Therefore, the staff concludes that it is highly unlikely that any additional SAMDA (i.e., beyond the 69 already implemented) would be cost beneficial at the BBNPP site.

Table M-3. Summary of Estimated Averted Costs for the BBNPP Site

Quantitative Attributes		Averted Cost Value Estimate ($)			
		AREVA Generic[a]		BBNPP Site[b]	
		7% Discount	3% Discount	7% Discount	3% Discount
Health	Public (APE)	5,094	10,072	5,093	10,072
	Occupational (AOE)	264	607	264	607
Property	Offsite[c] (AOC)	2,603	5,147	2,139	4,229
	Onsite	NA[d]	NA[d]	NA[d]	NA[d]
Cleanup and Decontamination	Onsite	8,215	19,110	8,267	19,110
Replacement Power		36,888	129,243	36,835	129,243
Total[e]		53,063	164,179	52,598	163,261
Total with Seismic Risk		70,574	218,358	69,995	217,137

(a) From the design certification ER (AREVA 2009-TN576).
(b) PPL Bell Bend 2013-TN3377
(c) Includes cleanup and decontamination costs.
(d) NA = not analyzed.
(e) Based on internal events, internal flooding, and internal fire risks.

It is noted that PPL used an earlier version of the MELCOR Accident Consequences Code System (MACCS) severe accident computer code and population distribution from the 2000

U.S. Census. Accordingly, the NRC staff performed independent confirmatory calculations using more recent versions of the MACCS severe accident computer code, as well as population distribution and demographic data from the more recent 2010 U.S. Census and found that its severe accident risk metrics and SAMDA results compare favorably with those from PPL's analysis and would not change any conclusions.

In addition to the results presented in Table M-3, as part of its SAMDA sensitivity analyses, PPL evaluated the sensitivity of the maximum attainable benefit at the BBNPP site using replacement power costs based on an expected higher plant capacity factor of 95 percent for the U.S. EPR reactor design. That is, PPL estimated a site-specific SAMDA averted cost using replacement power costs that are based on the expected capacity factor of 95 percent for the U.S. EPR reactor design. Results from PPL's SAMDAs analysis presented above in Table M-3 (i.e., the "BBNPP Site" column) are based on a 60 percent plant capacity factor (from guidance provided in NUREG/BR-0184 [NRC 1997-TN676]), rather than a more accurate value of 95 percent used in recent EISs. PPL's analysis found that the maximum benefit reported above in Table M-3 of $69,995 increased by about $28,000 to a revised value of $98,239. This increased value does not change the NRC staff's finding that no additional plant modifications are cost beneficial to implement because of the robust design of the U.S. EPR with respect to prevention and mitigation of severe accidents. Therefore, PPL found (PPL Bell Bend 2013-TN3377), and the NRC staff agreed, that although the maximum attainable benefit would be higher, it would still not be cost beneficial to implement additional SAMDAs for the U.S. EPR at the BBNPP site.

It is also noted that, for the averted costs presented above for both the generic site (Table M-2) and the BBNPP site (Table M-3), the results are based on earlier versions of ERs, which require updating based on the most recent PRA results presented in Chapter 19 of the U.S. EPR DCD, FSAR, Revision 7 (AREVA 2014-TN3722).

M.3.3 Procedural and Training SAMAs

The original list of 167 U.S. EPR SAMDAs included 51 candidate alternatives that were procedural or training in nature. These items were eliminated from consideration because they did not involve design changes. Examples of items screened out for this reason include the following:

- Develop procedures for replenishing diesel fuel oil.
- Emphasize steps in recovery of offsite power after a station blackout in training.
- Institute simulator training for severe accident sequences.
- Delay containment spray actuation after a large loss-of-coolant accident.
- Implement procedures to stagger high-pressure safety injection pump use after a loss of service water.
- Provide operator training on manually actuating the extra borating system.

These candidate alternatives fall within the scope of the SAMA review that the NRC staff conducts as part of its environmental review of applications. However, such SAMAs generally involve procedures that have not been developed and that typically are not developed until construction has been completed and the plant is approaching operation.

The NRC staff reviewed the candidate alternatives that were previously screened out because they did not involve design changes. Because the maximum attainable benefit is so low, a SAMA based on procedures or training for a U.S. EPR at the BBNPP site would have to reduce the CDF or risk to near zero to become cost beneficial. Based on its evaluation, the NRC staff concludes that that is unlikely that any of the SAMAs based on procedures or training would reduce the CDF or risk that much. Therefore, the NRC staff further concludes it is unlikely that these SAMAs would be cost-effective.

PPL (PPL Bell Bend 2013-TN3377) has stated that "… the plant administrative processes, procedures, and training program will be developed to address appropriate maintenance and use of the U.S. EPR design features which have been credited with the reduction of risk associated with postulated severe accidents." Based on this statement, the NRC staff expects that PPL will consider risk insights and mitigation measures in the development and implementation of procedures and training; however, this expectation is not crucial to the staff's conclusion because the staff already concluded procedural and training SAMAs would be unlikely to be cost-effective.

M.3.4 Conclusions

Based on its evaluation of the U.S. EPR PRA (AREVA 2014-TN3722) and SAMDA analysis (AREVA 2009-TN576), the BBNPP site-specific severe accident and SAMDA analyses (PPL Bell Bend 2013-TN3377) and its own independent review, the NRC staff concludes that that there are no additional U.S. EPR SAMDAs that would be cost beneficial at the BBNPP site. In addition, the NRC staff expects that PPL will consider risk insights and mitigation measures in the development of procedures and training; however, this expectation is not crucial to the NRC staff's conclusions because procedural and training SAMAs would unlikely be cost-effective.

As indicated above, the U.S. EPR design has yet to complete design certification review. AREVA will need to demonstrate and the NRC staff will confirm that the required safety criteria have been met before issuing a design certification rule for the U.S. EPR design. Additionally, the Bell Bend COL cannot be issued to PPL until this has been completed, the DCD appropriately incorporated into PPL's Final Safety Analysis Report for Bell Bend NPP, and the NRC staff has determine if the required safety criteria have been met.

M.4 References

10 CFR Part 51. *Code of Federal Regulations*, Title 10, *Energy*, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions." Washington, D.C. TN250.

10 CFR Part 52. *Code of Federal Regulations*, Title 10, *Energy*, Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants." Washington, D.C. TN251.

AREVA (AREVA NP Inc.). 2009. *AREVA NP Environmental Report Standard Design Certification*. ANP–10290, Revision 1, Bethesda, Maryland. Accession No. ML092650775. TN576.

AREVA (AREVA Inc.). 2014. *U.S. EPR Final Safety Analysis Report.* Revision 7, Lynchburg, Virginia. Accession No. ML14209A843. TN3722.

Limerick Ecology Action v. NRC (U.S. Nuclear Regulatory Commission). 1989. "Federal Reporter, Second Series, Volume 869, P 719 [3rd Circuit]." Available at http://en.wikisource.org/wiki/Federal_Reporter/Second_series/Volume_869. TN2067.

NRC (U.S. Nuclear Regulatory Commission). 1990. *Policy Issue: Evolutionary LWR Certification Issues and Their Relationships to Current Regulatory Requirements*. SECY–90–016, Washington D.C. Accession No. ML003707885. TN524.

NRC (U.S. Nuclear Regulatory Commission). 1997. *Regulatory Analysis Technical Evaluation Handbook.* NUREG/BR–0184, Washington, D.C. Accession No. ML050190193. TN676.

PPL Bell Bend (PPL Bell Bend, LLC). 2013. *Bell Bend Nuclear Power Plant Combined License Application Part 3: Environmental Report*. Revision 4, UniStar Nuclear Services, LLC, Baltimore, Maryland. Accession No. ML13120A411. TN3377.

PPL Bell Bend (PPL Bell Bend, LLC). 2013. *Bell Bend Nuclear Power Plant Combined License Application Part 2: Final Safety Analysis Report*. Revision 4, UniStar Nuclear Services, LLC, Baltimore, Maryland. Accession No. ML13120A374. TN3447.

PPL Bell Bend (PPL Bell Bend, LLC). 2013. Letter from R.R. Sgarro to NRC, dated May 29, 2013, regarding "Bell Bend Nuclear Power Plant COD Sensitivity." BNP–2013–075, Allentown, Pennsylvania. Accession No. ML13182A239. TN3806.

PPL Bell Bend (PPL Bell Bend, LLC). 2014. Letter from R. Sgarro to NRC, dated March 25, 2014, regarding "Bell Bend Nuclear Power Plant Response to ER RAI ENV-26 and Revised Schedule Information." BNP–2014–002, Allentown, Pennsylvania. Accession No. ML14098A246. TN3724.

PPL Bell Bend (PPL Bell Bend, LLC). 2014. Letter from R.R. Sgarro to NRC, dated February 18, 2014, regarding "Bell Bend Nuclear Power Plant Initial Response to and Schedule for RAI ENV-26." BNP–2014–017, Allentown, Pennsylvania. Accession No. ML14069A222. TN3805.

APPENDIX N

GENERAL CONFORMITY APPLICABILITY ANALYSIS RELATED TO ISSUANCE OF A COMBINED LICENSE FOR THE BELL BEND NUCLEAR POWER PLANT

APPENDIX N

GENERAL CONFORMITY APPLICABILITY ANALYSIS RELATED TO ISSUANCE OF A COMBINED LICENSE FOR THE BELL BEND NUCLEAR POWER PLANT

July 07, 2015

MEMORANDUM TO:	Jennifer L. Dixon-Herrity, Chief Environmental Projects Branch Division of New Reactor Licensing Office of New Reactors
FROM:	Ian C. Jung, Chief ***/RA/*** Environmental Technical Support Branch Division of Site Safety and Environmental Analysis Office of New Reactors
SUBJECT:	GENERAL CONFORMITY APPLICABILITY ANALYSIS RELATED TO ISSUANCE OF A COMBINED LICENSE FOR THE BELL BEND NUCLEAR POWER PLANT

The Environmental Technical Support Branch has completed its General Conformity Applicability Analysis in accordance with U.S. Environmental Protection Agency requirements at Title 40 of the *Code of Federal Regulations* Part 93, Subpart B, "Determining Conformity of General Federal Actions to State or Federal Implementation Plans." The staff's evaluation described in the enclosed General Conformity Applicability Analysis concludes that a general conformity determination is not required for either building or operating the Bell Bend Nuclear Power Plant because the total estimated direct and indirect emissions from building and operation are below *de minimis* levels.

Although not required by the General Conformity Regulations, many Federal agencies have found it helpful to include in their file a "record of non-applicability" documenting the analysis that the action was below the *de minimis* levels or was otherwise exempt.

Enclosure:
As stated

Docket No. 52-039

CONTACT: Stacey Imboden, NRO/DSEA
301-415-2462

MEMORANDUM TO: Jennifer L. Dixon-Herrity, Chief
Environmental Projects Branch
Division of New Reactor Licensing
Office of New Reactors

FROM: Ian C. Jung, Chief **/RA/**
Environmental Technical Support Branch
Division of Site Safety and Environmental Analysis
Office of New Reactors

SUBJECT: GENERAL CONFORMITY APPLICABILITY ANALYSIS RELATED TO ISSUANCE OF A COMBINED LICENSE FOR THE BELL BEND NUCLEAR POWER PLANT

The Environmental Technical Support Branch has completed its General Conformity Applicability Analysis in accordance with U.S. Environmental Protection Agency requirements at Title 40 of the *Code of Federal Regulations* Part 93, Subpart B, "Determining Conformity of General Federal Actions to State or Federal Implementation Plans." The staff's evaluation described in the enclosed General Conformity Applicability Analysis concludes that a general conformity determination is not required for either building or operating the Bell Bend Nuclear Power Plant because the total estimated direct and indirect emissions from building and operation are below *de minimis* levels.

Although not required by the General Conformity Regulations, many Federal agencies have found it helpful to include in their file a "record of non-applicability" documenting the analysis that the action was below the *de minimis* levels or was otherwise exempt.

Enclosure:
As stated

Docket No. 52-039

CONTACT: Stacey Imboden, NRO/DSEA
301-415-2462

DISTRIBUTION:
RidsNroDnrlLb2 Resource
RidsNroDsea
TTerry, NRO
SImboden, NRO
RidsNroDseaRhmb Resource
LQuinn-Willingham, NRO
BHarvey, NRO
PVokoun, NRO

ADAMS Accession No.: ML13329A340 (Pkg.) ***via email** NRO-002

OFFICE	NRO/DSEA/RENV:PM	NRO/DNRL:PM	NRO/DNRL:PM	NRO/DNRL:LA	OGC
NAME	SImboden	PVokoun	TTerry	MBrown*	MWright
DATE	06/16/2014	06/24/2014	06/24/2014	06/26/2014	06/29/2015

OFFICE	NRO/DSEA/RENV:BC
NAME	IJung
DATE	07/07/2015

OFFICIAL RECORD COPY

Clean Air Act Applicability Analysis Related to the Proposed Issuance of a Combined License for the Bell Bend Nuclear Power Plant

U.S. Nuclear Regulatory Commission
Docket No. 52-039
July 2015

1.0 Introduction

The U.S. Nuclear Regulatory Commission (NRC) has prepared this draft General Conformity Determination (GCD) in accordance with the U.S. Environmental Protection Agency (EPA) requirements at Title 40 of the *Code of Federal Regulations* (CFR) Part 93, Subpart B, "Determining Conformity of General Federal Actions to State or Federal Implementation Plans."[1] For the reasons set forth below, the NRC has determined that the potential issuance of a combined license (COL) for the Bell Bend Nuclear Power Plant (BBNPP) would conform to the applicable implementation plan pursuant to 40 CFR Part 93, Subpart B.

By letter dated October 10, 2008, the NRC received an application from PPL Bell Bend, LLC (PPL) for a COL for BBNPP, in accordance with the requirements contained in 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants," Subpart C, "Combined Licenses." BBNPP would be located west of the existing Susquehanna Steam Electric Station (SSES) Units 1 and 2 in Luzerne County, Pennsylvania (PA). The proposed BBNPP would have a total electrical output of approximately 1710 megawatts-electric (PPL 2013). The latest version of the application, Revision 4, was submitted on April 12, 2013. Granting the requested COL for BBNPP would authorize the COL holder to undertake construction and operation activities regulated by the NRC.

The BBNPP proposed site is located on the Susquehanna River in Luzerne County, PA, approximately 5 miles (mi) northeast of the Borough of Berwick, PA, and 1.6 mi to the north and west of the north branch of the Susquehanna River. The proposed site would occupy 975 acres west of the existing SSES Units 1 and 2. The major metropolitan centers closest to the site include: Wilkes-Barre, PA, which is approximately 19 mi to the northeast; Allentown, PA, which is approximately 50 mi to the southeast; and Harrisburg, PA, which is approximately 70 mi to the southwest (PPL 2013).

Luzerne County is currently designated in 40 CFR 81.339 as unclassifiable/attainment for all criteria pollutants, with the exception of the 8-hour ozone standard. Luzerne County is in the Scranton-Wilkes Barre maintenance area for the 1997 8-hour ozone standard. Luzerne County is part of the Northeast Pennsylvania-Upper Delaware Valley Interstate Air Quality Control Region according to 40 CFR 81.55. Pennsylvania is part of the Northeast Ozone Transport Region.

2.0 Regulatory Background and Requirements

According to the regulations implementing the Clean Air Act of 1977, as amended (CAA) (42 U.S.C. 7506), at 40 CFR 93.150(a), no department, agency, or instrumentality of the Federal government shall engage in, support in any way or provide financial assistance for, license or

[1] For reference, a glossary of excerpted terms used in 40 CFR 93.152 is provided in Section 7.0 of this draft GCD.

permit, or approve any activity which does not conform to an applicable implementation plan. As defined in Section 176(c)(1) of the CAA, conformity to an implementation plan means conformity to an implementation plan's purpose of eliminating or reducing the severity and number of violations of the National Ambient Air Quality Standards (NAAQS) and achieving expeditious attainment of such standards; and that such activities will not:

1. cause or contribute to any new violation of any standard in any area;

2. increase the frequency or severity of any existing violation of any standard in any area; or

3. delay timely attainment of any standard or any required interim emission reductions or other milestones in any area.

To control pollution, the EPA established NAAQS for six pollutants termed the "criteria" pollutants. They are carbon monoxide (CO), nitrogen dioxide (NO_2), ozone[2] (O_3), lead (Pb), particulate matter ($PM_{2.5}$ and PM_{10}), and sulfur dioxide (SO_2). The NAAQS are maximum allowable pollutant concentration levels in the air based on different averaging schemes for each specific pollutant. Pursuant to Section 107 of the CAA, in 40 CFR Part 81 the EPA designates geographical regions of the country as “attainment areas” if ambient pollutant concentrations are in compliance with the NAAQS and as “nonattainment areas” if ambient pollutant concentrations are not in compliance with the NAAQS. The EPA defines “maintenance area” as an area that was designated as nonattainment that has been re-designated in 40 CFR Part 81 to attainment, meeting the provisions of section 107(d)(3)(E) of the CAA and has a maintenance plan approved under section 175A of the CAA. Pursuant to Section 110 of the CAA, States with non-attainment areas are required to develop a state implementation plan (SIP) to demonstrate how the State will achieve and maintain the national primary and secondary ambient air quality standard within each air quality control region in the state.

Whether a Federal action conforms to an applicable implementation plan is determined according to the criteria and procedures set out either by the EPA regulations at 40 CFR Part 93, Subpart B or by an EPA-approved general conformity provision in the SIP itself. Pursuant to 40 CFR Part 51, “Requirements for Preparation, Adoption, and Submittal of Implementation Plans,” Subpart W, each state may promulgate its own general conformity regulations in lieu of the Part 93, Subpart B general conformity regulations. Pennsylvania does not have its own EPA-approved general conformity regulations. Therefore, pursuant to 40 CFR 93.151, NRC Federal actions in Pennsylvania are subject to the provisions of 40 CFR Part 93, Subpart B. The EPA-approved SIP applicable to this conformity evaluation is the 2013 SIP, “*State Implementation Plan Revision: NO_x Motor Vehicle Emission Budget Revisions Based on the MOVES2010a Model; and General Conformity Budget for Bell Bend Nuclear Power Plant* for the Scranton/Wilkes-Barre Eight-Hour Ozone Maintenance Area for the 1997 Ozone National Ambient Air Quality Standard.” This SIP was approved by EPA on June 15, 2015 (80 FR 34063).

In the Federal conformity regulations, specifically in 40 CFR 93.153(b), the EPA specifies emission rates for the criteria pollutants and their precursors based upon the severity of the nonattainment in an area (*de minimis* rates). Before a Federal agency can take its action, it is to perform an applicability analysis to determine whether the total direct and indirect emissions

[2] Attainment of the O_3 NAAQS is implemented by controlling emissions of two O_3 precursors: nitrogen oxides (NO_x) and volatile organic compounds (VOC).

caused by its action would be below or above these *de minimis* rates. For O_3 and its precursors in states within the Northeast Ozone Transport Region, such as Pennsylvania, the *de minimis* rate in a maintenance area is 50 tons per year (tpy) of VOC and 100 tpy of NO_x. A conformity determination is not required for emissions below these *de minimis* rates.

The NRC is required to perform a general conformity evaluation to ensure that emissions of air pollutants associated with its proposed Federal action to issue a COL authorizing certain construction activities and the operation of a new nuclear power plant in Luzerne County, PA, will not adversely affect the ability of the Scranton-Wilkes Barre maintenance area to meet the national 8-hour primary and secondary ambient air quality standards for ozone.

In the case, such as the one at hand, where multiple Federal agencies may have jurisdiction over a single project, each agency must make its own conformity determination pursuant to 40 CFR 93.154. When doing so, each agency is only responsible, according to the definition of "Federal action" in 40 CFR 93.152, for the portion of the project that it is permitting (58 FR 63227). Therefore, other Federal agencies from which permits or authorizations are required to build and operate BBNPP, such as the U.S. Army Corps of Engineers, are required to address the conformity determination requirements of 40 CFR Part 93, Subpart B relevant to their particular permits separately. In order to present the emissions attributable to NRC-authorized activities in context, this draft GCD describes both the entire project emissions and the portion of the entire project emissions that is attributable to NRC-authorized activities. Consistent with the CAA, the ultimate NRC conformity determination is focused on emissions attributable to NRC-authorized construction and operation, and the NRC has authority to impose mitigation measures only with respect to those emissions.

3.0 Process

The conformity evaluation for a Federal action in a nonattainment or maintenance area involves conducting a threshold applicability analysis to determine whether a conformity determination is required. If this threshold is met, then a conformity determination is performed. Only the criteria pollutants for which the area is in nonattainment or maintenance are so analyzed.

An applicability analysis is the process of determining whether a Federal action must be supported by a conformity determination. A conformity determination is not required if the Federal action meets any of the exceptions in 40 CFR 93.153(c).

If the applicability analysis finds that one of these criteria is met, then no conformity determination is necessary and the conformity evaluation is complete. Otherwise, the Federal agency must perform a conformity determination to determine whether the Federal action conforms to the applicable implementation plan. Regarding its Federal action of potentially issuing a COL to authorize construction and operation of BBNPP, the NRC determined that none of the exceptions in 40 CFR 93.153(c) are met.

Per 40 CFR 93.152, when conducting an applicability analysis in support of issuing a Federal permit or license for some aspect of a non-Federal undertaking, the relevant activity is the part, portion, or phase of the non-Federal undertaking that requires the Federal permit. The project is a non-Federal undertaking because the applicant is a non-Federal entity, PPL, and it will be performing the construction and operation of the facility. The NRC identified the "part, portion, or phase" of the non-Federal undertaking of building BBNPP that requires the Federal permit of a COL as being the "construction" and "operation" of BBNPP. The emissions caused by the construction and operation of BBNPP are included in this conformity evaluation. The NRC analyzed whether the total of direct and indirect emissions of VOC or NO_x (which are ozone precursors) caused by this potential Federal action in a maintenance area for ozone would equal or exceed the applicable *de minimis* rates in 40 CFR 93.153(b)(2). For States within the Northeast Ozone Transport Region, such as Pennsylvania, the applicable 40 CFR 93.153(b)(2) maintenance area *de minimis* rates are 50 tpy for VOC and 100 tpy for NO_x.

Emissions Related to NRC-Authorized Construction and Operation

In a final rule dated October 9, 2007 (72 FR 57416), the NRC defined “construction” (10 CFR 50.10(a) and 51.4) as those activities that fall within its regulatory authority. Construction includes, among other things, the driving of piles, subsurface preparation, placement of backfill, concrete, or permanent retaining walls within an excavation, installation of foundations, or in-place assembly, erection, fabrication, or testing, which are for safety-related structures, systems, or components (SSCs). The NRC considers these construction activities, along with facility operating activities, to have a reasonable nexus to its authority under the Atomic Energy Act of 1954 (AEA) to regulate radiological health and safety and/or common defense and security. As discussed in Section 2.0 above, a Federal agency is responsible for the conformity evaluation for only those parts, portions or phases of the project over which the NRC has permitting or licensing authority. Therefore, the NRC is responsible for only the conformity determination for the nuclear power plant construction and operation activities that require NRC authorization.

While undertaking a conformity evaluation, the Federal agency must account for both the direct and indirect emissions caused by the Federal action over which the agency has permitting or licensing authority. As defined in 40 CFR 93.152, “direct emissions” means those emissions of a criteria pollutant or its precursors that are caused or initiated by the Federal action and originate in a nonattainment or maintenance area and occur at the same time and place as the action and are reasonably foreseeable. “Caused by,” as used in the terms “direct emissions” and “indirect emissions,” means emissions that would not otherwise occur in the absence of the Federal action. “Reasonably foreseeable” emissions are projected future direct and indirect emissions that are identified at the time the conformity determination is made; the location of such emissions is known and the emissions are quantifiable as described and documented by the Federal agency based on its own information and after reviewing any information presented to the Federal agency. Therefore, the NRC has determined that only those reasonably foreseeable emissions caused by the BBNPP construction and operation activities that require NRC approval and that occur at the Bell Bend site are direct emissions for the purposes of this analysis.

As defined in 40 CFR 93.152, “indirect emissions” means those emissions of a criteria pollutant or its precursors:

1. that are caused or initiated by the Federal action and originate in the same nonattainment or maintenance area but occur at a different time or place as the action;

2. that are reasonably foreseeable;

3. that the agency can practically control; and

4. for which the agency has continuing program responsibility.

Here, as in the definition of direct emissions, “caused by” means emissions that would not otherwise occur in the absence of the Federal action and “reasonably foreseeable” means emissions that are identifiable and quantifiable. The differences between direct and indirect emissions are that indirect emissions occur at a different time or place as the action and are expressly limited to just those indirect emissions that the agency can practically control and for which the agency has continuing program responsibility. Even if a Federal licensing, rulemaking or other approving action is a required initial step for a subsequent activity that causes emissions, as is the issuance of a COL in this case, such initial steps do not mean that a Federal agency can practically control any resulting emissions. “Continuing program responsibility” means that a Federal agency has responsibility for emissions caused by (1) actions it takes itself; or (2) actions of non-Federal entities that the Federal agency, in exercising its normal programs and authorities, approves, funds, licenses or permits, provided the agency can impose conditions on any portion of the action that could affect the emissions. Therefore, emissions that may be reasonably foreseeable but that do not occur at the Bell Bend site are not indirect emissions for the purposes of this analysis because the NRC does not have continuing program responsibility for or practical control of these emissions. For example, per 10 CFR 50.10(a) and 51.4, the NRC does not have authority to control emissions resulting from the transportation of construction workers and construction materials to and from the prospective license holder’s site, or employees commuting to the operating plant. Thus, no offsite activities meet the CAA definition of “indirect emissions” such that they would be attributable to the NRC’s potential Federal action of issuing a BBNPP COL along with the onsite direct emissions caused by NRC-authorized construction and operation activities.

The emissions caused by the COL issuance include emissions from plant “operation” as well as from the plant “construction” discussed above. However, the CAA regulations at 40 CFR 93.153(d)(1) state that, notwithstanding the other requirements of 40 CFR Part 93, a conformity determination is not required for a Federal action (or portion thereof) that includes major or minor new or modified stationary sources that require a permit under the New Source Review (NSR) program or the Prevention of Significant Deterioration program. In the case of the potential operation of BBNPP, the NO_x and VOC emissions caused by operation will be subject to NSR permitting under Pennsylvania Department of Environmental Protection’s (PA DEP) Plan Approval minor source permitting process. Therefore, under 40 CFR 93.153(d)(1), the NRC is not required to consider the NO_x and VOC emissions from the operation of BBNPP in the following applicability analysis and conformity determination.

For these reasons, the following applicability analysis and conformity determination include only those direct, reasonably foreseeable emissions of NO_x and VOC caused by the BBNPP construction activities that require NRC approval and that occur at the Bell Bend site. They do not include indirect construction emissions or emissions caused by the operation of BBNPP because the NRC does not have continuing program responsibility for or practical control of the indirect construction emissions and the operational emissions are subject to permitting under PA DEP Plan Approval minor source permitting process.

Emissions Related to Preconstruction Activities

The NRC only regulates certain activities associated with building a nuclear power plant. NRC regulations at 10 CFR 50.10(a)(2) and 10 CFR 51.4 define the activities that are not NRC-regulated construction. Those activities associated with building the plant that are not within the purview of the NRC's Federal action are considered to be "preconstruction" activities as the term is used in 10 CFR 51.45(c). Such preconstruction activities include clearing and grading, excavating, erecting support buildings and transmission lines, and other associated activities. These preconstruction activities may take place before the application for a COL is submitted, during the NRC staff's review of a COL application, or after a COL is issued, all without NRC authorization.

Before a COL is issued, all emissions from preconstruction activities are neither direct emissions nor indirect emissions for purposes of compliance with the CAA because they are not caused or initiated by any NRC action as there has been no NRC-authorized action taken.

After a COL is issued, emissions from preconstruction activities are still not direct or indirect emissions (regardless of whether they occur at the same time and place as the action) for purposes of compliance with the CAA because preconstruction activities are not caused or initiated by the NRC action of issuing a COL. Furthermore, the NRC is not required to consider preconstruction activities in its conformity determination because 40 CFR 93.152 defines "Federal action" as the part, portion, or phase of the non-Federal undertaking that requires a Federal permit. Preconstruction activities do not require an NRC permit/license. Therefore, emissions from preconstruction activities are not considered in this applicability analysis.

4.0 Applicability Analysis

On July 10, 2009, NRC issued a request for additional information (RAI) requesting PPL provide estimates of ozone precursor (NO_x and VOC) emissions associated with construction and operation of the proposed BBNPP (NRC 2009).

The PPL initially responded to the RAI in a December 13, 2011, submittal (PPL 2011). This submittal contained an estimate of the total VOC and NO_x emissions from the proposed construction and operation of BBNPP. A revised response was submitted on January 20, 2012 (PPL 2012a). This response clarified fuel usage information and responded to a PA DEP request regarding emissions from small combustion units less than 50 horsepower (hp) in size. Refinements were made to the emissions estimation techniques.

In March 2012, PPL provided a second revision to the emissions estimates (PPL 2012b). This revision included emissions from small combustion units less than 50 hp in size, as requested by PA DEP. It also included updates to emission calculations for non-road diesel emissions.

The staff reviewed these emissions inventories. The applicant stated that the estimate of total VOC and NO_x emissions was based on standard EPA methods (e.g., EPA's NONROAD2008a and MOVES2010a models and methodologies) consistent with 40 CFR 93.159(b) (PPL 2012b). The applicant also provided emissions on a project year basis, rather than a calendar year basis, to allow for future changes to its construction schedule.

The applicant's projected total of direct and indirect emissions of ozone precursors for the entire project are based on EPA-recommended emissions estimation techniques. The applicant's engineering firm, Sargent & Lundy, developed a study of estimated fuel usage during construction of BBNPP (PPL 2012b). Sargent & Lundy included a list of assumptions in the fuel study; NRC staff considered these assumptions to be reasonable. The fuel study assumes that material and equipment manufactured outside of the United States would arrive at a port in the Baltimore, Maryland or Pennsylvania area. Concrete is assumed to be produced at a batch plant onsite. All cut and excavated soil will be disposed of onsite, which reduces fuel consumption and estimated equipment emissions. Fuel usage quantities were developed from preliminary construction sequence estimates, typical construction equipment usage, and power plant construction experience in the absence of detailed design information for BBNPP (PPL 2012b). Each major phase of construction was identified (early site preparation, site development and excavation, concrete structural work, etc.) and equipment needed to perform each phase was identified (soil compactor, crane, grader, etc.). Operating hours for each piece of equipment to perform each phase were estimated and found by NRC staff to be reasonable. Operating hours were multiplied by the fuel usage rate for each type of equipment. The total fuel usage for each piece of equipment within each phase was then portioned among the seven construction years, based on what activities within that phase would be performed each year. The portion of the building activities that are NRC-authorized construction were estimated by Sargent & Lundy as follows (PPL 2012b):

Table 1. Percentages of Activities for Building BBNPP that are within NRC Jurisdictional Authority

Type of Activity	Percent
Structural Concrete	50%
Switchyard	25%
Superstructure and Structural Steel	40%
Mechanical and Electrical Installation	50%
Soil Compaction for Powerblock	10%
Cooling Tower	10%
Major Equipment (heavy) Lift and Movement	75%

(PPL 2012b)

These values were multiplied by the total estimated fuel usage for an activity to determine the fuel usage for the NRC-authorized portion of that activity. Equipment listed in the Sargent & Lundy fuel study was matched with the steady-state emission factors and load factors in EPA's NONROAD2008a data files, and emissions for non-road equipment were then estimated using NONROAD2008a model and methodology (PPL 2012b).

For the purpose of a conservative assessment of emissions estimates, PPL assumed that all equipment to be used is fully deteriorated (PPL 2012b). The applicant assumed that all equipment would meet EPA Tier III engine emissions requirements (PPL 2012b). NRC staff found this to be consistent with similar submittals from other applicants. The NRC determined that the list of equipment used in the emissions inventory is not unreasonable given the level of detail known at this time.

- 7 -

On-road vehicle emissions were calculated using EPA's MOVES2010a model. This category of emissions includes workforce commuting and commercial and construction deliveries during the building period. PA DEP supplied data files to the applicant containing specific information for Luzerne County (meteorological data, vehicle age distribution, etc.). The Sargent & Lundy fuel study contained data for a number of vehicle trips and hours of operation. The applicant also estimated vehicle startup emissions in addition to vehicle operation emissions.

Because PA DEP included the BBNPP total project emissions into its most recent 8-hour ozone SIP revision (PA DEP 2012), and the NRC-authorized emissions are a portion of the total emissions, this section discusses both the entire project's emissions and the portion of those emissions attributable to the NRC's Federal action of issuing a COL.

Direct and Indirect Emissions of VOC (Year 1-7)

The NRC evaluated PPL's emissions inventory and found that the annual totals of direct and indirect VOC emissions for the entire project are below the applicable Section 93.153(b) *de minimis* rate of 50 tpy. Based on PPL's building schedule and equipment inventory, the highest emission rate, estimated at 13.8 tons VOC, is projected to occur in Year 2 of the project (PPL 2012b). Emissions caused by the proposed NRC Federal action of issuing a COL that authorizes specific construction activities make up a portion of this total value. Since the total value is less than the applicable Section 93.153(b) *de minimis* rate for VOC, the portion for NRC-authorized construction activities is necessarily also less than the applicable Section 93.153(b) *de minimis* rate for VOC. Therefore, a conformity determination is not required for VOC emissions.

Direct and Indirect Emissions of NO_x (Year 1-7)

The NRC evaluated PPL's emissions inventory for NO_x. Tables 2 and 3 show the sources of the total of direct and indirect emissions of NO_x for each year that building activities would occur for the entire project and for the portion of the emissions attributable to NRC-authorized construction activities, respectively. Most of the building activities occurring during the first two years are preconstruction activities (site clearing, grading); therefore, the NRC-authorized emissions during the first two years are lower. As discussed in Section 3.0, there are no indirect emissions attributable to NRC's Federal action; therefore, the Table 3 totals consist only of direct emissions. However, the direct emissions of NO_x caused by the NRC-authorized construction activities are less than the applicable Section 93.153(b) *de minimis* rate for NO_x. Therefore, a conformity determination is not required for NO_x emissions.

Table 2. Total Annual Direct and Indirect Emissions Estimates of NO_x for Building BBNPP (Tons per year)

Year	Nonroad Diesel	Small Combustion	Workforce Commuting	Comm. and Constr. Deliveries	On-site on-road mobile engines	Total
1	123.1	6.4	1.0	1.4	1.6	**133.5***
2	121.8	7.7	3.7	25.5	3.8	**162.6***
3	81.7	6.3	11.4	27.2	5.7	**132.2***
4	80.5	5.8	22.3	7.9	5.2	**121.6***
5	38.0	3.4	22.3	4.3	3.7	71.7
6	14.3	1.5	11.7	2.4	1.4	31.2
7	17.5	1.2	2.3	2.3	1.2	24.5

*Total of direct and indirect emissions exceeds the 100 tons per year *de minimis* rate in 40 CFR 93.153(b) (PPL 2012b).

Table 3. Total Annual Direct and Indirect Emissions Estimates of NO_x for NRC-authorized Construction of BBNPP (Tons per year)

Year	Nonroad Diesel	Small Combustion	Workforce Commuting	Comm. and Constr. Deliveries	On-site on-road mobile engines	Total
1	0.1	0.0	0	0	0	0.1
2	4.1	0.2	0	0	0.8	5.1
3	15.8	0.8	0	0	0.9	17.6
4	29.3	1.5	0	0	0.7	31.5
5	13.2	0.7	0	0	0.5	14.4
6	4.6	0.2	0	0	0.2	5.0
7	3.4	0.2	0	0	0.2	3.8

In October 2013, the PA DEP issued a *State Implementation Plan Revision: NO_x Motor Vehicle Emission Budget Revisions Based on the MOVES2010a Model; and General Conformity Budget for Bell Bend Nuclear Power Plant* for the Scranton/Wilkes-Barre Eight-Hour Ozone Maintenance Area for the 1997 Ozone National Ambient Air Quality Standard. This revised SIP was issued for comment in November 2013 and issued as final after EPA approval in June 2015. The SIP accounts for the total projected NO_x emissions from BBNPP of 162.6 tons during the peak building year by including a budget of 201.0 tons of NO_x per calendar year for building BBNPP. Including the total project emissions in a SIP is one way to demonstrate conformity per 40 CFR 93.158.

5.0 Conclusion

Based on the results of the applicability analysis described above, the NRC expects that the total emissions associated with building BBNPP would exceed the *de minimis* threshold for NO_x during years 1 through 4 of the project as seen in Table 2. The peak total of emissions is 162.6 tons NO_x in Year 2. The NRC expects that emissions associated with the NRC-authorized construction activities would be below the *de minimis* rate in Section 93.153(b) for NO_x as seen in Table 3. PA DEP included the total project emissions in its 2013 SIP revision, a portion of those emissions are attributable to NRC-authorized activities. Because emissions from NRC-authorized construction activities are below the *de minimis* rate in Section 93.153(b) for NO_x, and because the entire project emissions are included in the SIP, the NRC staff has determined that a conformity determination is not required.

6.0 References

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

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

10 CFR Part 52. Code of Federal Regulations, Title 10, *Energy*, Part 52, “Licenses, Certifications, and Approvals for Nuclear Power Plants.”

40 CFR Part 51. Code of Federal Regulations, Title 40, *Protection of Environment,* Part 51, “Requirements for Preparation, Adoption, and Submittal of Implementation Plans.”

40 CFR Part 81. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 81, “Designation of Areas for Air Quality Planning Purposes.”

40 CFR Part 93. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 93, “Determining Conformity of Federal Actions to State or Federal Implementation Plans.”

58 FR 63227. 1993. “Determining Conformity of General Federal Actions to State or Federal Implementation Plans.” *Federal Register*. U.S. Environmental Protection Agency.

72 FR 57416. October 9, 2007. “Limited Work Authorizations for Nuclear Power Plants.” *Federal Register*. U.S. Nuclear Regulatory Commission.

80 FR 34063. June 15, 2015. “Approval and Promulgation of Air Quality Implementation Plans; Pennsylvania; Update of the Motor Vehicle Emissions Budgets and General Conformity Budgets for the Scranton/Wilkes-Barre 1997 8-Hour Ozone National Ambient Air Quality Standard Maintenance Area.” *Federal Register*. U.S. Environmental Protection Agency.

Atomic Energy Act of 1954, as amended. 42 U.S.C. 2011, *et seq.*

Clean Air Act, as amended. 42 U.S.C. 7506 *et seq*.

Pennsylvania Department of Environmental Protection (PA DEP). 2012. Letter from J. Epps, Bureau of Air Quality, to G. Petrewski, PPL Nuclear Development, LLC, March 6, 2012. Accession No. ML12096A083.

PPL Bell Bend, LLC (PPL). 2011. Letter from R.Sgarro, PPL Bell Bend, LLC, to NRC, “Final Response to Environmental Requests for Additional Information TE 4.3-1, TE 4.3-2, TE 4.3-7, TE 4.3-10, MET 2.7-1, LU 4.1-1, LU 5.1-1 and LU 5.1-2”. December 13, 2011. Accession No. ML113550181.

PPL Bell Bend, LLC (PPL). 2012a. Letter from R.Sgarro, PPL Bell Bend, LLC, to NRC, "Revised Response to Environmental Request for Additional Information MET 2.7-1". January 20, 2012. Accession No. ML120310490.

PPL Bell Bend, LLC (PPL). 2012b. Letter from R.Sgarro, PPL Bell Bend, LLC, to NRC, "Revised Response to Environmental Request for Additional Information MET 2.7-1: Air Conformity Report, Revision 2". March 14, 2012. Accession No. ML120820274.

PPL Bell Bend, LLC (PPL). 2013. *Bell Bend Nuclear Power Plant Combined License Application, Part 3, Environmental Report*. Revision 4, Baltimore, Maryland. Accession No. ML13120A411.

U.S. Nuclear Regulatory Commission (NRC). 2009. Letter from S. Imboden (NRC) to R. Sgarro (PPL Bell Bend, LLC), "Subject: Requests for Additional Information Related to the Environmental Review for the Combined License Application for Bell Bend Nuclear Power Plant." July 10, 2009, Washington, D.C. Accession No. ML091620600.

7.0 Glossary (adapted from 40 CFR 93.152)

Applicability analysis is the process of determining if a Federal action must be supported by a conformity determination.

Applicable implementation plan or applicable State Implementation Plan (SIP) means the portion (or portions) of the SIP or most recent revision thereof, which has been approved under Section 110(k) of the CAA, a Federal implementation plan promulgated under Section 110(c) of the CAA, or a plan promulgated or approved pursuant to Section 301(d) of the CAA (Tribal implementation plan or TIP) and which implements the relevant requirements of the CAA.

Cause or contribute to a new violation means a Federal action that:
1. Causes a new violation of a NAAQS at a location in a nonattainment or maintenance area which would otherwise not be in violation of the standard during the future period in question if the Federal action were not taken; or

2. Contributes, in conjunction with other reasonably foreseeable actions, to a new violation of a NAAQS at a location in a nonattainment or maintenance area in a manner that would increase the frequency or severity of the new violation.

Caused by, as used in the terms "direct emissions" and "indirect emissions," means emissions that would not otherwise occur in the absence of the Federal action.

Conformity determination is the evaluation (made after an applicability analysis is completed) that a Federal action conforms to the applicable implementation plan and meets the requirements of 40 CFR 93, Subpart B.

Conformity evaluation is the entire process from the applicability analysis through the conformity determination that is used to demonstrate that the Federal action conforms to the requirements of 40 CFR 93, Subpart B.

Continuing program responsibility means a Federal agency has responsibility for emissions caused by:
1. Actions it takes itself; or

2. Actions of non-Federal entities that the Federal agency, in exercising its normal programs and authorities, approves, funds, licenses or permits, provided the agency can impose conditions on any portion of the action that could affect the emissions.

Continuous program to implement means that the Federal agency has started the action identified in the plan and does not stop the actions for more than an 18-month period, unless it can demonstrate that such a stoppage was included in the original plan.

Criteria pollutant or standard means any pollutant for which there is established a NAAQS at 40 CFR part 50.

Direct emissions means those emissions of a criteria pollutant or its precursors that are caused or initiated by the Federal action and originate in a nonattainment or maintenance area and occur at the same time and place as the action and are reasonably foreseeable.

Emergency means a situation where extremely quick action on the part of the Federal agencies involved is needed and where the timing of such Federal activities makes it impractical to meet the requirements of 40 CFR 93, Subpart B, such as natural disasters like hurricanes or earthquakes, civil disturbances such as terrorist acts and military mobilizations.

Emission inventory means a listing of information on the location, type of source, type and quantity of pollutant emitted as well as other parameters of the emissions.

Emissions budgets are those portions of the applicable SIP's projected emission inventories that describe the levels of emissions (mobile, stationary, area, etc.) that provide for meeting reasonable further progress milestones, attainment, and/or maintenance for any criteria pollutant or its precursors.

Emissions offsets, for purposes of 40 CFR 93.158, are emissions reductions which are quantifiable, consistent with the applicable SIP attainment and reasonable further progress demonstrations, surplus to reductions required by, and credited to, other applicable SIP provisions, enforceable at both the State and Federal levels, and permanent within the timeframe specified by the program.

Federal action means any activity engaged in by a department, agency, or instrumentality of the Federal government, or any activity that a department, agency or instrumentality of the Federal government supports in any way, provides financial assistance for, licenses, permits, or approves, other than activities related to transportation plans, programs, and projects developed, funded, or approved under title 23 U.S.C. or the Federal Transit Act (49 U.S.C. 1601 *et seq.*). Where the Federal action is a permit, license, or other approval for some aspect of a non-Federal undertaking, the relevant activity is the part, portion, or phase of the non-Federal undertaking that requires the Federal permit, license, or approval.

Federal agency means, for purposes of 40 CFR 93 Subpart B, a Federal department, agency, or instrumentality of the Federal government.

Increase the frequency or severity of any existing violation of any standard in any area means to cause a nonattainment area to exceed a standard more often or to cause a violation at a greater concentration than previously existed and/or would otherwise exist during the future period in question, if the project were not implemented.

Indirect emissions means those emissions of a criteria pollutant or its precursors:

1. That are caused or initiated by the Federal action and originate in the same nonattainment or maintenance area but occur at a different time or place as the action;

2. That are reasonably foreseeable;

3. That the agency can practically control; and

4. For which the agency has continuing program responsibility.

For the purposes of this definition, even if a Federal licensing, rulemaking or other approving action is a required initial step for a subsequent activity that causes emissions, such initial steps do not mean that a Federal agency can practically control any resulting emissions.

Maintenance area means an area that was designated as nonattainment and has been re-designated in 40 CFR part 81 to attainment, meeting the provisions of Section 107(d)(3)(E) of the CAA and has a maintenance plan approved under Section 175A of the CAA.

Maintenance plan means a revision to the applicable SIP, meeting the requirements of section 175A of the CAA.

Metropolitan Planning Organization (MPO) means the policy board of an organization created as a result of the designation process in 23 U.S.C. 134(d).

Mitigation measure means any method of reducing emissions of the pollutant or its precursor taken at the location of the Federal action and used to reduce the impact of the emissions of that pollutant caused by the action.

National ambient air quality standards (NAAQS) are those standards established pursuant to Section 109 of the CAA and include standards for carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone, particulate matter (PM_{10} and $PM_{2.5}$), and sulfur dioxide (SO_2).

Nonattainment area means an area designated as nonattainment under section 107 of the Clean Air Act and described in 40 CFR Part 81.

Precursors of a criteria pollutant are:

1. For ozone, nitrogen oxides (NO_x), unless an area is exempted from NO_x requirements under section 182(f) of the CAA, and volatile organic compounds (VOC).

2. For PM_{10}, those pollutants described in the PM_{10} nonattainment area applicable SIP as significant contributors to the PM_{10} levels.

3. For $PM_{2.5}$:

    (i) Sulfur dioxide (SO_2) in all $PM_{2.5}$ nonattainment and maintenance areas,

    (ii) Nitrogen oxides in all $PM_{2.5}$ nonattainment and maintenance areas unless both the State and EPA determine that it is not a significant precursor, and

(iii) Volatile organic compounds (VOC) and ammonia (NH_3) only in $PM_{2.5}$ nonattainment or maintenance areas where either the State or EPA determines that they are significant precursors.

Reasonably foreseeable emissions are projected future direct and indirect emissions that are identified at the time the conformity determination is made; the location of such emissions is known and the emissions are quantifiable as described and documented by the Federal agency based on its own information and after reviewing any information presented to the Federal agency.

Take or start the Federal action means the date that the Federal agency signs or approves the permit, license, grant or contract or otherwise physically begins the Federal action that requires a conformity evaluation under 40 CFR 93 Subpart B.

Total of direct and indirect emissions means the sum of direct and indirect emissions increases and decreases caused by the Federal action; i.e., the “net” emissions considering all direct and indirect emissions. The portion of emissions which are exempt or presumed to conform under Section 93.153 (c), (d), (e), or (f) are not included in the “total of direct and indirect emissions.” The “total of direct and indirect emissions” includes emissions of criteria pollutants and emissions of precursors of criteria pollutants.

8.0 Acronyms

AEA	Atomic Energy Act of 1954
BBNPP	Bell Bend Nuclear Power Plant
CAA	Clean Air Act
CFR	Code of Federal Regulations
CO	carbon monoxide
COL	combined license
EPA	U.S. Environmental Protection Agency
GCD	General Conformity Determination
hp	horsepower
mi	miles
MOVES	Motor Vehicle Emission Simulator
NAAQS	National Ambient Air Quality Standards
NO_2	nitrogen dioxide
NO_x	nitrogen oxide(s)
NRC	U.S. Nuclear Regulatory Commission
NSR	New Source Review
O_3	ozone
PA DEP	Pennsylvania Department of Environmental Protection
Pb	lead
$PM_{2.5}$	particulate matter with a diameter of 2.5 microns or less
PM_{10}	particulate matter with a diameter of 10 microns or less
PPL	PPL Bell Bend, LLC
RAI	request(s) for additional information
SIP	State Implementation Plan
SO_2	sulfur dioxide
SSC	structures, systems, or components
SSES	Susquehanna Steam Electric Station
tpd	tons per day
tpy	tons per year
VOC	volatile organic compound(s)

NRC FORM 335
(12-2010)
NRCMD 3.7

U.S. NUCLEAR REGULATORY COMMISSION

BIBLIOGRAPHIC DATA SHEET

(See instructions on the reverse)

1. REPORT NUMBER
(Assigned by NRC, Add Vol., Supp., Rev., and Addendum Numbers, if any.)
NUREG - 2179, Volume 2
Final

2. TITLE AND SUBTITLE
Environmental Impact Statement for the Combined License (COL) for the Bell Bend Nuclear Power Plant

3. DATE REPORT PUBLISHED

MONTH	YEAR
April	2016

4. FIN OR GRANT NUMBER

5. AUTHOR(S)
See Appendix A

6. TYPE OF REPORT
Technical

7. PERIOD COVERED (Inclusive Dates)

8. PERFORMING ORGANIZATION - NAME AND ADDRESS (If NRC, provide Division, Office or Region, U. S. Nuclear Regulatory Commission, and mailing address; if contractor, provide name and mailing address.)
Division of New Reactor Licensing
Office of New Reactors
U.S. Nuclear Regulatory Commission

9. SPONSORING ORGANIZATION - NAME AND ADDRESS (If NRC, type "Same as above", if contractor, provide NRC Division, Office or Region, U. S. Nuclear Regulatory Commission, and mailing address.)
Same as above

10. SUPPLEMENTARY NOTES
Docket No. 52-039

11. ABSTRACT (200 words or less)
This environmental impact statement (EIS) has been prepared in response to an application submitted on October 10, 2008 to the U.S. Nuclear Regulatory Commission (NRC) by PPL Bell Bend, LLC (PPL) for a combined construction permit and operating license (combined license or COL). PPL notified the NRC of changes in its power generation business by letter dated May 12, 2015. PPL Bell Bend, LLC was renamed Bell Bend, LLC, and Bell Bend, LLC became a generation affiliate of Talen Energy Corporation (Talen Energy). The transaction became official on June 1, 2015. For purposes of this review, the abbreviation "PPL" will still be used to indicate the applicant. Bell Bend, LLC, under Talen Energy, is the applicant. The proposed actions related to the application are (1) NRC issuance of a COL for a new power reactor unit at the Bell Bend Nuclear Power Plant (BBNPP) site in Luzerne County, Pennsylvania, and (2) U.S. Army Corps of Engineers (USACE) decision to issue, deny, or issue with modifications a Department of the Army (DA) permit to perform certaindredge and fill activities in waters of the United States and to construct structures in navigable waters of the United States related to the project. The NRC, contractors, and USACE make up the review team.
This EIS documents the review team's analysis, which considers and weighs the environmental impacts of constructing and operating one new nuclear unit at the BBNPP site and at alternative sites, including measures potentially available for reducing or avoiding adverse impacts.

12. KEY WORDS/DESCRIPTORS (List words or phrases that will assist researchers in locating the report.)
Bell Bend Nuclear Power Plant Combined License Application
Bell Bend Nuclear Power Plant COL
Bell Bend Nuclear Power Plant Environmental Review
Final Environmental Impact Statement
NEPA
NUREG-2179

13. AVAILABILITY STATEMENT
unlimited

14. SECURITY CLASSIFICATION
(This Page)
unclassified
(This Report)
unclassified

15. NUMBER OF PAGES

16. PRICE

NUREG-2179, Vol. 2
Final

Environmental Impact Statement for the Combined License (COL)
for the Bell Bend Nuclear Power Plant

April 2016