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NUREG-1917

Supplemental Environmental Impact Statement for the Combined License (COL) for North Anna Power Station Unit 3

Draft Report for Comment

Office of New Reactors

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Division of Site and Environmental Review
Office of New Reactors

Abstract

This supplemental environmental impact statement (SEIS) includes the U.S. Nuclear Regulatory Commission (NRC) staff's analysis that considers and weighs the environmental impacts of constructing and operating a new nuclear unit (Unit 3) at the North Anna Power Station (NAPS) site near Mineral, Virginia, and the mitigation measures available for reducing or avoiding adverse impacts.

On November 27, 2007, the NRC issued Early Site Permit (ESP)-003 to Dominion Nuclear North Anna, LLC for the NAPS ESP site (the site of the proposed Unit 3). An ESP is an NRC approval of a site as suitable for construction and operation of one or more new nuclear units. The NRC's detailed review of the environmental impacts of constructing and operating new units at the NAPS ESP Site is documented in NUREG-1811, *Environmental Impact Statement for an Early Site Permit (ESP) at the North Anna ESP Site*, which was published in December 2006. On November 27, 2007, Dominion submitted an application for a combined license (COL) for the NAPS site, referencing an ESP. A COL is a Commission approval for the construction and operation of one or more nuclear power facilities. For a COL application that references an ESP, the NRC staff, pursuant to Title 10 of the Code of Federal Regulations (CFR) Part 51.75(c), prepares a supplement to the ESP EIS in accordance with 10 CFR 51.92(e).

NRC regulations related to the environmental review of COL applications are contained in 10 CFR Part 51 and 10 CFR 52, Subpart C. Pursuant to NRC regulations in 10 CFR 51.50(c)(1), a COL applicant referencing an ESP need not submit information or analyses regarding environmental issues that were resolved in the ESP EIS, except to the extent the COL applicant has identified new and significant information regarding such issues. In addition, pursuant to 10 CFR 52.39, matters resolved in the ESP proceedings are considered to be resolved in any subsequent proceedings, absent identification of new and significant information.

The NRC staff's preliminary recommendation to the Commission, considering the environmental aspects of the proposed action, is that the COL be issued. This recommendation is based on (1) the application, including the Environmental Report (ER), submitted by Virginia Electric Power Company, doing business as Dominion Virginia Power and the Old Dominion Electric Cooperative, collectively referred to as Dominion; (2) the staff's review conducted for the ESP application and documented in the ESP EIS; (3) consultation with Federal, State, Tribal, and local agencies; (4) the staff's own independent review of potential new and significant information available since preparation and publication of the ESP EIS; (5) the staff's consideration of comments received during the public scoping process; and (6) the assessments summarized in this SEIS, including the potential mitigation measures identified.

The staff's evaluation of the safety and emergency preparedness aspects of the proposed action will be addressed in the staff's Safety Evaluation Report.

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Executive Summary

On November 27, 2007, the U.S. Nuclear Regulatory Commission (NRC) received an application from Virginia Electric and Power Company, doing business as Dominion Virginia Power and Old Dominion Electric Cooperative (ODEC) and collectively known as Dominion, for a combined license (COL) for a nuclear facility to be located at the North Anna Power Station (NAPS). Dominion Virginia Power and ODEC currently own NAPS as tenants in common, including the existing Units 1 and 2 and the Independent Spent Fuel Storage Installation. Dominion is the licensed operator of the existing nuclear units, with control of the NAPS site and existing facilities and authority to act as ODEC's agent. Dominion will own the proposed Unit 3 with the same ownership as the existing nuclear Units 1 and 2 at NAPS, and will construct and operate the proposed Unit 3.

The proposed Unit 3 site is located adjacent to existing nuclear Units 1 and 2 and wholly within the NAPS site, which is located in Louisa County, Virginia, approximately 10 km (6 mi) northeast of the town of Mineral. In an early site permit (ESP) issued on November 27, 2007, the NRC approved the NAPS site for two additional units. The proposed Unit 3 reactor specified in the application is an Economic Simplified Boiling Water Reactor design, which is being reviewed by the NRC.

Section 102 of the National Environmental Policy Act of 1969 (NEPA) (42 USC 4321) directs that an environmental impact statement (EIS) be prepared for major Federal actions that significantly affect the quality of the human environment. The NRC has implemented Section 102 of NEPA in Title 10 of the Code of Federal Regulations (CFR) Part 51. Further, in 10 CFR 51.20, the NRC has determined that the issuance of a COL under 10 CFR Part 52 is an action that requires an EIS.

The purpose of Dominion's requested action, issuance of the COL that encompasses both a construction permit and an operating license, is to obtain from the NRC a license to construct and operate a nuclear power plant. A license from the NRC to construct and operate nuclear power plants is necessary but not sufficient for construction and operation of the power plant. Dominion must obtain and maintain permits from other Federal, State, and local agencies and permitting authorities. Therefore, the purpose of the NRC environmental review of the Dominion application is to determine if a nuclear power plant of the proposed design can be constructed and operated at the NAPS site without unacceptable adverse impacts on the human environment.

The Dominion application incorporates information from both the ESP Site Safety Analysis Report and Environmental Report (ER). Subpart A of 10 CFR Part 52 contains NRC regulations related to ESPs. In November 2007, the NRC issued Early Site Permit (ESP)-003 to Dominion

Nuclear North Anna, LLC for the North Anna ESP Site (the site of the proposed Unit 3). An ESP is an NRC approval of a site as suitable for construction and operation of one or more new nuclear units. The NRC's detailed review of the environmental impacts of constructing and operating new units at the North Anna ESP Site is documented in NUREG-1811, *Environmental Impact Statement for an Early Site Permit (ESP) at the North Anna ESP Site*, published in December 2006. For a COL application that references an ESP, the NRC staff, pursuant to 10 CFR Part 51.75(c), prepares a supplement to the ESP environmental impact statement (SEIS) in accordance with 10 CFR 51.92(e).

NRC regulations related to the environmental review of COL applications are contained in 10 CFR Part 51 and 10 CFR 52, Subpart C. Pursuant to NRC regulations in 10 CFR 51.50(c)(1), a COL applicant referencing an ESP need not submit information or analyses regarding environmental issues that were resolved in the ESP EIS, except to the extent the COL applicant has identified new and significant information regarding such issues. In addition, pursuant to 10 CFR 52.39, matters resolved in the ESP proceedings are considered to be resolved in any subsequent proceedings, absent identification of new and significant information.

Upon acceptance of the Dominion application, the NRC began the environmental review process described in 10 CFR Part 51 by publishing in the *Federal Register* a Notice of Intent (73 FR 13589 and 73 FR 41132) to prepare an EIS and conduct scoping. The staff held a public scoping meeting in Mineral, Virginia, on April 16, 2008, and visited the NAPS site in April 2008. Subsequent to the scoping meeting and the site visit and in accordance with the provisions of NEPA and 10 CFR Part 51, the staff identified and evaluated the potential environmental impacts of constructing and operating a new unit at the NAPS site. Included in this supplemental EIS (SEIS) are (1) the results of the NRC staff's analyses, which consider and weigh the environmental effects of the proposed action (i.e., issuance of the COL) and of constructing and operating one additional nuclear unit at the NAPS site; (2) mitigation measures for reducing or avoiding adverse effects; (3) the environmental impacts of alternatives to the proposed action; and (4) the staff's recommendation regarding the proposed action.

To guide its assessment of environmental impacts of a proposed action or alternative actions, the NRC has established a standard of significance for impacts based on guidance developed by the Council on Environmental Quality (40 CFR 1508.27). The three significance levels established by the NRC – SMALL, MODERATE, or LARGE – are defined as follows:

> SMALL – Environmental effects are not detectable are so minor that they would 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 of the SEIS.

In preparing this SEIS, the staff reviewed Dominion's application, including the ER; reviewed the ESP EIS; consulted with Federal, State, Tribal, and local agencies; and followed the guidance set forth in NRC NUREG-1555, *Standard Review Plans for Environmental Reviews for Nuclear Power Plants (ESRP)*. In addition, the staff considered the public comments related to the environmental review received during the scoping process. These comments are provided in Appendix D.

The staff's preliminary recommendation to the Commission related to the environmental aspects of the proposed action is that the COL be issued as proposed. This recommendation is based on (1) the application, including the ER submitted by Dominion; (2) the staff's review conducted for the ESP application and documented in the ESP EIS; (3) consultation with Federal, State, Tribal, and local agencies; (4) the staff's own independent review of potential new and significant information available since preparation and publication of the ESP EIS; (5) the staff's consideration of comments received during the public scoping process; and (6) the assessments summarized in this SEIS, including the potential mitigation measures identified.

A 75-day comment period will begin on the date of publication of the U.S. Environmental Protection Agency Notice of Availability of the draft SEIS to allow members of the public to comment on the results of the NRC staff's review. During this period, the staff will conduct a public meeting near the NAPS site to describe the results of the NRC environmental review, provide members of the public with information to assist them in formulating comments on this SEIS, and accept public comments. After the comment period, the staff will consider and disposition all comments received. These comments and staff responses will be included in the final SEIS.

The staff's evaluation of the safety and emergency preparedness aspects of the proposed action will be addressed in the staff's Safety Evaluation Report. Specific information has been included in this document that will allow the reader to link the information presented in the ESP EIS document and this SEIS document. That information is presented in a table that follows the Abbreviations/Acronyms section.

Abbreviations/Acronyms

ABWRs	Advanced Boiling Water Reactors
AC	alternating current
ac	acre(s)
ALWR	Advanced Light Water Reactor
AEC	Atomic Energy Commission
AEO	Nuclear Energy Agency
ANL	Argonne National Laboratory
ANS	American Nuclear Society
APE	Area of Potential Effect
BEIR	Biological Effects of Ionizing Radiation
BMP	best management practices
BWR	boiling water reactor
°C	degree Celsius
CDC	Centers for Disease Control and Prevention
CDF(s)	core damage frequency
CEQ	Council on Environmental Quality
CETL	capacity emergency transfer limit
CETO	capacity emergency transfer objective
CFR	Code of Federal Regulations
cfs	cubic feet per second (water flow)
Ci	curies
Ci/MTU	curies per metric ton uranium
Ci/yr	curies per year
cm	centimeter(s)
CO_2	carbon dioxide
CO	carbon monoxide
COL	combined license
CPCN	Certificate of Public Convenience and Necessity
CSTE	Council of State and Territorial Epidemiologists
CTRs	Capacity Transfer Rights
CZMA	Coastal Zone Management Act
d	day
dBz	standard decibel(s)
dBA	A-weighted decibel (where A is a weighting factor for sensitivity)
DBA	Design Basis Accidents

DC	direct current
DCD	Design Control Document
DECOM	Decommissioning
DECON	Decontamination
DMME	Virginia Department of Mines, Minerals, and Energy
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
D/Q	Dispersion unit
DSEIS	draft supplemental environmental impact statement
DSM	demand-side management
DVP or Dominion	Dominion Virginia Power
EA	environmental assessment
EAB	Exclusion Area Boundary
EC	energy conservation
EEI	Edison Electric Institute
EHS	Electromagnetic Hypersensitive
EIA	Energy Information Administration
EIS	environmental impact statement
EMF(s)	electromagnetic fields
ENTOMB	Entombment
EPA	U.S. Environmental Protection Agency
EPP	Environmental Protection Plan
ER	Environmental Report
ESA	Endangered Species Act
ESBWR	Economic Simplified Boiling Water Reactor
ESE	east-southeast
ESP	early site permit
ESRP	Environmental Standard Review Plan
°F	degree Fahrenheit
FAA	Federal Aviation Administration
FEIS	final environmental impact statement
FHWA	Federal Highway Administration's
FR	Federal Register
FSAR	Final Safety Analysis Report
ft	foot/feet
ft/s	feet per second
ft^3/yr	cubic feet per year
gal	gallon

GEH	General Electric-Hitachi Nuclear Energy
GEIS	generic environmental impact statement
GIT	Georgia Institute of Technology
gpd	gallons per day
gpm	gallons per minute
ha	hectare(s)
Hg	mercury
hr	hour(s)
I-95	Interstate Highway 95
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IEEE	Institute of Electrical and Electronic Engineers
IFIM	instream flow incremental methodology
IGCC	integrated gasification combined cycle
IHA	Indicators Hydrological Alteration
in.	inch(es)
Inc.	Incorporated
INEEL	Idaho National Engineering and Environmental Laboratory
IPCC	Intergovernmental Panel on Climate Change
IRM	installed reserve margin
ISFSI	Independent Spent Fuel Storage Installation
IWSA	Integrated Waste Services Association
kg	kilogram
KKN	Kashiwazaki-Kariwa Nuclear Power Station
km	kilometer(s)
km/h	kilometer(s) per hour
kV	kilovolt
kW	kilowatt
kWe	kilowatt-electric
kWh	kilowatt-hours
L/d	liter(s) per day
L/s	liter(s) per second
LAS	Load Analysis Subcommittee
LDA	Locational Deliverability Areas
LLC	Limited Liability Company
LLW	low-level waste
LOLE	loss of load expectation
LOS	Level-of-Service

LPZ	low population zone
LR	license renewal
LSE	load serving entity
LWR	light-water reactor
m	meter(s)
mm	millimeter(s)
m/s	meter(s) per second
m^3	cubic meter(s)
m^3/d	cubic meter(s) per day
m^3/s	cubic meter(s) per second
m^3/y	Cubic meters(s) per year
MDPSC	Maryland Public Service Commission
MEI	maximally exposed individual
MGD	million gallons per day
mg/L	milligram(s) per liter
mGy/yr	milligray per year
mi	mile(s)
mi^2	square mile(s)
MIT	Massachusetts Institute of Technology
MLD	million gallons per day
MMS	Minerals Management Service
mph	miles per hour
mrad/yr	millirad(s) per year
mrem	millirem(s)
mrem/hr	millirem(s) per hour
mrem/yr	millirem(s) per year
MSL	mean sea level
mSv	millisievert(s)
mSv/yr	millisievert(s) per year
MT	metric ton(s) (or tonne[s])
MT/yr	metric ton(s) per year
MTU	metric ton(s)-uranium
MW	megawatt(s)
MWC	maximum water conservation
MWd/MTU	megawatt-days per metric ton of uranium
MW(e)	megawatts electric
MWh	megawatt hour(s)
MW(t)	megawatts thermal
NAICS	North American Industrial Classification System

NAPS	North Anna Power Station
NCDC	National Climatic Data Center
NCEMCS	North Carolina Electric Cooperatives
NCRP	National Council on Radiation Protection and Measurements
NCUC	North Carolina Utilities Commission
NEA	Nuclear Energy Agency
NEI	Nuclear Energy Institute
NEPA	National Environmental Policy Act of 1969
NESC	National Electrical Safety Code
NHPA	National Historic Preservation Act of 1966
NLCD	National Land Cover Dataset
NOI	Notice of Intent
NO_x	nitrogen oxide
NPCC	Northwest Power and Conservation Council
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NSPS	new source performance standards
ODCM	Offsite Dose Calculation Manual
ODEC	Old Dominion Electric Cooperative
OECD	Organization for Economic Co-Operation and Development
PAM	Primary Amebic Meningoencephalitis
PCBs	polychlorinated biphenyls
PJM	PJM Interconnection, LLC
PM	particulate matter
$PM_{2.5}$	particulate matter smaller than 2.5 micrometers
PM_{10}	particulate matter smaller than 10 micrometers
PNNL	Pacific Northwest National Laboratory
PPAs	Power Purchase Agreements
PPE	plant parameter envelope
ppm	parts per million
PRA	probabilistic risk assessment
RAA	Reliability Assurance Agreement
RADTRAN	Radiation Material Transportation (computer code)
RAI	Request(s) for Additional Information
rem(s)	Röetogen equivalent man (a special unit of radiation dose)
REMP	radiological environmental monitoring program
RFC	Reliability First Corporation
RIS	Regulatory Issue Summary

RPM	Reliability Pricing Model
RTO	regional transmission organization
RTEPP	Regional Transmission Expansion Planning Process
Ryr^{-1}	per reactor year
SACTI	Seasonal and Annual Cooling Tower Impacts
SAFSTOR	Safe Storage
SAMA	severe accident mitigation alternatives
SAMDAs	severe accident mitigation design alternatives
SCR	selective catalytic reduction
SEIS	supplemental environmental impact statement
SER	safety evaluation report
SERC	South Eastern Reliability Council
SHPO	State Historic Preservation Office/Officer
SIC	Standard Industrial Classification
SO_2	sulphur dioxide
SO_x	sulphur oxide
SR	State Route
SSAR	Site Safety Analysis Report
Sv	sievert
Sv/yr	sievert per year
TBT	tributyltin
TEDE	total effective dose equivalent
TLD	thermoluminescent dosimeter
USACE	U.S. Army Corps of Engineers
USC	United States Code
USCB	U.S. Census Bureau
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VAC	Virginia Administrative Code
VEPCo	Virginia Electric & Power Company (Virginia Power)
VDCR	Virginia Department of Conservation and Recreation
VDEQ	Virginia Department of Environmental Quality
VDGIF	Virginia Department of Game and Inland Fisheries
VDH	Virginia Department of Health
VDHR	Virginia Department of Historic Resources
VDOT	Virginia Department of Transportation
VNHP	Virginia Natural Heritage Program

VPDES	Virginia Pollutant Discharge Elimination System
Virginia-SCC	Virginia State Corporation Commission
VOC	volatile organic compound
WHO	World Health Organization
WHTF	Waste Heat Treatment Facility
χ/Q	dispersion values
yd	yard(s)
yd^3	cubic yard(s)
yr	year(s)

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5.5.1.4	Aesthetics	5.5.1.4	Aesthetics and Recreation
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Linking ESP EIS to SEIS

	ESP EIS Chapter and Section		SEIS Chapter and Section
Appendix D	Scoping Meeting Comments and Responses	Appendix D	Scoping Meeting Comments and Responses
Appendix E	Comments and Responses on the Draft Environmental Statement and the Supplement to the Draft Environmental Impact Statement	Appendix E	Comments and Responses on the Draft Supplemental Environmental Statement (to be completed in the final SEIS)
Appendix F	Key Correspondence	Appendix F	Key Consultation Correspondence
Appendix G	Environmental Impacts of Transportation	Appendix G	Environmental Impacts of Transportation
Appendix H	Supporting Documentation on Radiological Dose Assessment	Appendix H	Supporting Documentation on Radiological Dose Assessment
Appendix I	ESP Site Characteristics and Plant Parameter Envelope	Appendix I	ESP Site Characteristics and Plant Parameter Envelope
Appendix J	Dominion Nuclear North Anna, LLC, Permit Conditions, Commitments, Assumptions, and Unresolved Issues	Appendix J	Early Site Permit Conditions, Commitments, Assumptions, and Unresolved Issues
Appendix K	Staff's Independent Review of Water Budget and Water Temperature Impacts	Appendix K	Staff's Independent Review of Water Budget
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1.0 Introduction

On November 27, 2007, the U.S. Nuclear Regulatory Commission (NRC) received an application from Virginia Electric Power Company, doing business as Dominion Virginia Power, and the Old Dominion Electric Cooperative (ODEC), collectively referred to as Dominion, for a combined license (COL). The proposed action in the application is NRC issuance of a COL for construction and operation of a power reactor at the North Anna Power Station (NAPS) in Louisa County, Virginia. The location of the proposed nuclear reactor, Unit 3, is adjacent to the existing NAPS Units 1 and 2. Dominion is the licensee and operator of the existing two units at the NAPS site. The NAPS site and existing facilities are owned by Dominion and ODEC as tenants in common. Dominion has been authorized by the NAPS co-owner (ODEC) to act as its agent to apply for a COL for one additional nuclear unit at the NAPS site.

The COL application references an early site permit (ESP) for the North Anna ESP site, which is located at NAPS. In November 2007, NRC approved issuance of the ESP for two additional nuclear units at the North Anna ESP site. This approval was supported by information contained in the ESP final environmental impact statement, NUREG-1811 (ESP EIS) (NRC 2006). The permit, ESP-003, was issued to Dominion by the NRC on November 27, 2007 (NRC 2007). For a COL application that references an ESP, the NRC staff, pursuant to Title 10 of the Code of Federal Regulations (CFR) Part 51.75(c), prepares a supplement to the ESP EIS in accordance with 10 CFR 51.92(e). Therefore, the staff relies upon the analysis in the ESP EIS as the basis in preparation of this supplemental EIS (SEIS).

1.1 Background

A COL is a Commission approval for the construction and operation of one or more nuclear power facilities. NRC regulations related to COLs are found in Subpart C of 10 CFR Part 52. Section 102 of the National Environmental Policy Act of 1969 (NEPA) (42 USC 4321) directs that an EIS be prepared for major Federal actions that significantly affect the quality of the human environment. The NRC has implemented Section 102 of NEPA in 10 CFR Part 51. Further, in 10 CFR 51.20, the NRC has determined that the issuance of a COL under 10 CFR Part 52 is an action that requires an EIS. The NRC regulations setting standards for a review of a COL application are listed in 10 CFR 52.81. Detailed procedures for conducting the environmental portion of the review are found in guidance set forth in NUREG-1555, Environmental Standard Review Plan: Standard Review Plans for Environmental Review for Nuclear Power Plants and recent updates (NRC 2000).

According to 10 CFR 52.80(b), an application for a COL must contain an Environmental Report (ER), which provides the applicant’s input to the NRC’s EIS. NRC regulations related to ERs and EISs are found in 10 CFR Part 51.

1.1.1 COL Application and Review

The purpose of Dominion's requested action, issuance of the COL, is to obtain from the NRC a combined permit to construct and a license to operate a base-load nuclear power plant. In addition to the COL, Dominion must obtain and maintain permits from other Federal, State, and local agencies and permitting authorities. The purpose of the NRC environmental review of Dominion's application is to determine if a nuclear power plant of the proposed design can be constructed and operated at the NAPS site without unacceptable adverse impacts on the human environment.

Dominion submitted an ER as part of its COL application (Dominion 2007). In accordance with 10 CFR 51.45 and 10 CFR 51.50 (c)(1), the ER submitted with the COL application is not required to contain information or analysis that was previously submitted in the ER for the ESP application or address issues that were resolved in the ESP EIS. The ER for the COL stage is required to provide the following information:

- Information to demonstrate that the chosen design of the facility falls within the site characteristics and design parameters specified in the ESP
- Sufficient information to resolve any significant environmental issues that were not resolved in the ESP EIS
- New and significant information related to impacts of construction and operation that were resolved in the ESP process
- A description of the process used to identify new and significant information regarding conclusions presented in the ESP EIS
- Information that demonstrates that all environmental terms and conditions included as part of the ESP will be satisfied by the date of issuance of the COL.

The SEIS together with the ESP EIS provides the staff's evaluation of the environmental effects of constructing and operating a single Economic Simplified Boiling-Water Reactor (ESBWR) at the NAPS site. In addition to considering the environmental effects of the proposed action, the SEIS addresses alternative technologies to the proposed action and the benefits of the proposed action (e.g., the need for power). The Dominion application for a COL references an ESP; therefore, in accordance with 10 CFR 52.83, issues resolved as part of the ESP proceeding remain resolved except under conditions set forth in 10 CFR 52.39(a)(2). Environmental impacts not considered or unresolved in the ESP proceeding are evaluated and documented in this SEIS. In addition, measures and controls previously identified to limit adverse impacts are evaluated along with any new or significant information that would have the potential to affect the finding or conclusions reached in the ESP EIS. In accordance with 10 CFR 51.92(e)(3), the SEIS does not contain a separate discussion of alternative sites. The NRC's evaluation of alternative sites is in Chapters 8 and 9 of the ESP EIS (NRC 2006).

During the NAPS ESP review, the staff evaluated a set of values of plant design parameters for the reactors and associated facilities. These set of values, or plant parameter envelope (PPE), serve as surrogates for actual reactor design information. The approval of the ESP bound these values and assumptions for the COL review. In the COL application, Dominion provided the actual values for most parameters when it chose a reactor design. The staff's analysis of the environmental impacts associated with the COL will confirm the reactor design values provided in the COL application and necessary PPE values are bounded by the ESP and other required NRC regulations. The PPE values and assumptions can be found in Appendix I and J of the ESP EIS (NRC 2006).

Upon acceptance of Dominion's COL application, the NRC began the environmental review process by publishing in the *Federal Register* on March 13, 2008, a Notice of Intent (NOI) to prepare an SEIS and conduct scoping in compliance with requirements set forth in 10 CFR 51, (73 FR 13589). Due to some inaccuracies in the original Notice of Intent, a revised notice was published in the *Federal Register* on July 17, 2008 (73 FR 41132).

The NRC project staff and staff from its contractor, Pacific Northwest National Laboratory (PNNL), visited the NAPS site in April 2008 (NRC 2008). The NAPS site visit consisted of the following: (1) NRC and PNNL staff met with Dominion staff, their contractors, and State and local officials; (2) conducted an independent review for new and significant information; and (3) reviewed Dominion's implementation of its new and significant process.

On April 16, 2008, the NRC held a scoping meeting in Mineral, Virginia, to obtain public input on the scope of the environmental review. While developing the SEIS, the staff also reviewed the comments received during the scoping process and contacted Federal, State, Tribal, regional, and local agencies to solicit comments. A list of the organizations contacted is provided in Appendix B. Other documents related to the NAPS site were reviewed and are listed as references where appropriate.

To guide its assessment of environmental impacts of a proposed action or alternative actions, the NRC has established a standard of significance for impacts based on guidance developed by the Council on Environmental Quality (40 CFR 1508.27). The three significance levels established by the NRC – SMALL, MODERATE, or LARGE – are defined as follows:

> SMALL – Environmental effects are not detectable or are so minor that they would 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.

This SEIS presents the staff's analysis, which considers and weighs the environmental impacts of the proposed action at the NAPS site, including the environmental impacts associated with construction and operation of Unit 3 at the site, the environmental impacts of alternatives to granting the COL, and the mitigation measures available for reducing or avoiding adverse environmental effects. The SEIS also provides the NRC staff's preliminary recommendation to the Commission regarding the issuance of the COL for the NAPS site.

A 75-day comment period will begin on the date of publication of the U.S. Environmental Protection Agency Notice of Filing of the draft SEIS to allow members of the public to comment on the results of the NRC staff's review. A public meeting will be held near the site during the public comment period. During this public meeting, the staff will describe the results of the NRC environmental review, provide members of the public with information to assist them in formulating comments on the SEIS, and accept comments. After the comment period, the staff will consider all comments. The comments will be addressed in the final SEIS.

1.1.2 Concurrent Reviews

In reviews separate from the environmental review process, the NRC analyzes the safety characteristics of the proposed site and emergency planning information. These analyses will be documented in a Safety Evaluation Report (SER). The SER presents the conclusions reached by the NRC regarding (1) whether there is reasonable assurance that an ESBWR can be constructed and operated at the NAPS site without undue risk to the health and safety of the public; and (2) whether the emergency preparedness program meets the applicable requirements in 10 CFR Part 50, 10 CFR Part 52, 10 CFR Part 73, and 10 CFR Part 100. The ESBWR reactor design referenced in the application is a standard design that is undergoing certification review pursuant to 10 CFR Part 52, Subpart B. This review will be the subject of a later rulemaking by the NRC.

1.2 The Proposed Federal Action

The proposed Federal action is issuance, under the provisions of 10 CFR Part 52, of a COL for the NAPS site for an ESBWR reactor. The SEIS discloses the staff's analysis of the environmental impacts that could result from the construction and operation of a new unit at the NAPS site. These impacts are analyzed to resolve any issues deferred from the ESP proceeding and to determine if there is new and significant information regarding issues that were resolved in the ESP proceeding. In the context of a COL application that references an ESP, the term ''new'' in the phrase ''new and significant information'' is defined as any information that was both (1) not considered in preparing the ESP ER or EIS (as may be evidenced by references in these documents, applicant responses to NRC requests for additional information, comment letters, etc.) and (2) not generally known or publicly available during the preparation of the ESP EIS (such as information in reports, studies, and treatises).

For new information to be "significant," it must be material to the issue being considered; that is, it must have the potential to affect the finding or conclusions of the NRC staff's evaluation of the issue. The applicant for a COL need only provide information in the application about a previously resolved environmental issue if it is both new and significant (72 FR 49352).

The site for the proposed Unit 3 is located in Louisa County, Virginia, near the town of Mineral and approximately 64 km (40 mi) north-northwest of Richmond. The proposed site is completely within the confines of the current NAPS site, with the proposed Unit 3 to be adjacent to the existing Units 1 and 2.

In the SEIS, the staff evaluates the impacts of construction and operation of an ESBWR, with a total combined thermal power rating of 4500 megawatts thermal (MW(t)). The proposed unit would use a closed-cycle, combination dry and wet cooling tower system, with makeup water supplied from Lake Anna.

1.3 The Purpose and Need for the Proposed Action

The purpose and need for the proposed action (i.e., issuance of a COL) is to provide for additional base-load electrical generating capacity. Dominion indicated the need for the proposed action will assist them in fulfilling their native-load obligations as required by Senate Bill 1416 (SB 1416 2007) that was signed into law by the governor of the Commonwealth of Virginia in 2007.

The ultimate decision about whether or not to build a facility and the schedule for any construction are not within the purview of the NRC and would be determined by the license holder if the authorization is granted. A license from the NRC to construct and operate a nuclear power plant is necessary but not sufficient for construction and operation of the power plant. Certain long lead-time activities, such as ordering and procuring certain components and materials necessary to construct the plant, may begin before the COL is granted. Dominion must obtain and maintain permits or authorizations from other Federal, State, and local agencies and permitting authorities before undertaking certain activities.

1.4 Alternatives to the Proposed Action

Section 102(2)(C)(iii) of NEPA states that an EIS is to include a detailed statement on alternatives to the proposed action. This SEIS addresses the following categories of alternatives: (1) the no-action alternative, (2) energy source alternatives, and (3) system design alternatives. In accordance with 10 CFR 51.92(e)(3), the SEIS does not contain a separate discussion of alternative sites. The NRC's detailed evaluation of alternative sites is documented in Chapters 8 and 9 of the ESP EIS (NRC 2006).

1.5 Compliance and Consultations

Prior to construction and operation of the new unit, Dominion is required to hold certain Federal, State, and local environmental permits, as well as meet applicable statutory and regulatory requirements. Dominion (2007) provided a list of environmental approvals and consultations associated with the NAPS proposed Unit 3. Potential authorizations and consultations relevant to the proposed COL are included in Appendix L.

The staff has contacted the appropriate Federal, State, Tribal, and local agencies to identify any compliance, permit, or significant environmental issues of concern to the reviewing agencies that relate to the construction and operation of the proposed ESBWR reactor. A list of organizations contacted is included in Appendix B.

1.6 Report Contents

The subsequent chapters of this SEIS are organized as follows. Chapter 2 describes the proposed site and discusses the environment that would be affected by the addition of the new unit. Chapter 3 describes the power plant characteristics to be used as the basis for evaluating the environmental impacts. Chapters 4 and 5 examine the environmental impacts of construction (Chapter 4) and operation (Chapter 5) of the proposed Unit 3. Chapter 6 analyzes the environmental impacts of the uranium fuel cycle, transportation of radioactive materials, and decommissioning, while Chapter 7 discusses the cumulative impacts of the proposed action as defined in 10 CFR Part 51.75(c). Chapter 8 addresses the need for power. Chapter 9 discusses alternatives to the proposed action, and Chapter 10 summarizes the findings of the preceding chapters and presents the staff's preliminary recommendation with respect to issuance of the COL.

The appendices to the SEIS provide the following additional information.

- Appendix A – Contributors to the Supplemental Environmental Impact Statement
- Appendix B – Organizations Contacted
- Appendix C – Chronology of NRC Staff Environmental Review Correspondence Related to Dominion Virginia Power and Old Dominion Electric Cooperative's Application for a Combined License for Unit 3 at the North Anna Power Station Site
- Appendix D – Scoping Comments and Responses
- Appendix E – Comments and Responses on the Draft Supplemental Environmental Impact Statement (to be completed in the final SEIS)
- Appendix F – Key Consultation Correspondence
- Appendix G – Environmental Impacts of Transportation

- Appendix H – Supporting Documentation on Radiological Dose Assessment
- Appendix I – Early Site Permit Site Characteristics and Plant Parameter Envelope
- Appendix J – Early Site Permit Conditions, Commitments, Assumptions, and Unresolved Issues
- Appendix K – Staff's Independent Review of Water Budget Impacts
- Appendix L – Authorizations and Consultations
- Appendix M – Severe Accident Mitigation Alternatives.

1.7 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."

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

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

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

72 FR 49352. "Licenses, Certifications, and Approvals for Nuclear Power Plants." Vol. 72, No. 166. August 28, 2007.

73 FR 13589. "Dominion Nuclear Power, LLC; North Anna Power Station Combined License Application; Notice of Intent to Prepare and Environmental Impact Statement and Conduct Scoping Process." Vol. 73, No. 50. March 13, 2008.

73 FR 41132. "Virginia Electric and Power Company, D/B/A Dominion Virginia Power, and Old Dominion Electric Cooperative North Anna Nuclear Station Unit 3 Combined License Application; Correction and Supplement to Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process." Vol. 73, No. 138. July 17, 2008.

Dominion Virginia Power (Dominion). 2007. *North Anna 3 Combined License Application Part 3 Environmental Report*. Revision 0, November 27, 2007. Accession No. ML073321238.

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

Senate Bill 1416 (SB 1416). 2007. Electric Utility Service; advances scheduled expiration of capped rate period. Virginia General Assembly, Commonwealth of Virginia, Richmond, Virginia. Accessed at http://leg1.state.va.us/cgi-bin/legp504.exe?ses=071&typ=bil&val=sb1416 on October 14, 2008. Accession No. ML083260587.

U.S. Nuclear Regulatory Commission (NRC). 2006. *Environmental Impact Statement for an Early Site Permit (ESP) at the North Anna ESP Site – Final Report*. NUREG-1811, Vols. 1 and 2, Washington, D.C. Accession Nos. ML063480261 and ML063480263.

U.S. Nuclear Regulatory Commission (NRC). 2000. *Standard Review Plans for Environmental Reviews for Nuclear Power Plants.* NUREG-1555, Vol. 1, Washington, D.C. Includes 2007 revisions.

U.S. Nuclear Regulatory Commission (NRC). 2007. *North Anna Early Site Permit No. ESP-003.* Accession No. ML073180440.

U.S. Nuclear Regulatory Commission (NRC). 2008. Summary of Environmental Site Audit Related to the Review of the Combined License Application for North Anna Power Station, Unit 3. Accession No. ML082970800.

2.0 Affected Environment

The site proposed by Virginia Electric and Power Company, doing business as Dominion Virginia Power and the Old Dominion Electric Cooperative (ODEC), collectively known as Dominion, for a combined license (COL), is located in Louisa County, Virginia, within the existing boundaries of the currently operating North Anna Power Station (NAPS) site (Dominion 2007a). The NAPS property is owned by Dominion Virginia Power and ODEC as tenants in common. The NAPS site is located on the shore of Lake Anna approximately 64 km (40 mi) north-northwest of Richmond. Two operating nuclear generating units, Units 1 and 2, are located within the NAPS site. Dominion is the licensed operator of the existing units, controls the existing site, and has the authority to act as ODEC's agent in matters related to licensing and operating the proposed Unit 3 station.

The station location is described in Section 2.1, with the land, meteorology and air quality, geology, radiological environment, water, ecology, socioeconomics, historic and cultural resources, and environmental justice aspects (or conditions) of the site presented in Sections 2.2 through 2.10, respectively. Section 2.11 examines related Federal projects, and references are presented in Section 2.12.

2.1 Site Location

As shown in Figure 2-1, the proposed location for NAPS Unit 3 is wholly within the NAPS site and is west of and adjacent to the existing Unit 1 and 2 facilities. The centerline of the proposed Unit 3 would be located approximately in the center of the NAPS site.

The NAPS site is located in rural Louisa County, Virginia. The nearest population center that has more than 25,000 residents is Fredericksburg, Virginia. Figure 2-2 shows the location of the NAPS site in relationship to the counties and surrounding cities and towns within an 80-km (50-mi) radius of the site. The NAPS site is located within a triangle formed by the cities of Richmond, Charlottesville, and Fredericksburg, Virginia. Interstate Highway 95 (I-95) passes within 26 km (16 mi) of the site, and Interstate 64 passes within 29 km (18 mi). Access to the site is from Virginia State Route (SR) 700. The community of Mineral is located approximately 10 km (6 mi) southwest of the NAPS site. Louisa, the county seat, is 19 km (12 mi) west of the NAPS site. The NAPS site occupies approximately 422 ha (1043 ac) of land, and it is located on a peninsula on the southern shore of Lake Anna, approximately 8 km (5 mi) upstream of the North Anna Dam (NRC 2006a).

The staff did not identify any new information for this section since preparation of the *Final Environmental Impact Statement for an Early Site Permit (ESP) for the North Anna ESP Site*, *NUREG-1811, ESP EIS* (NRC 2006a).

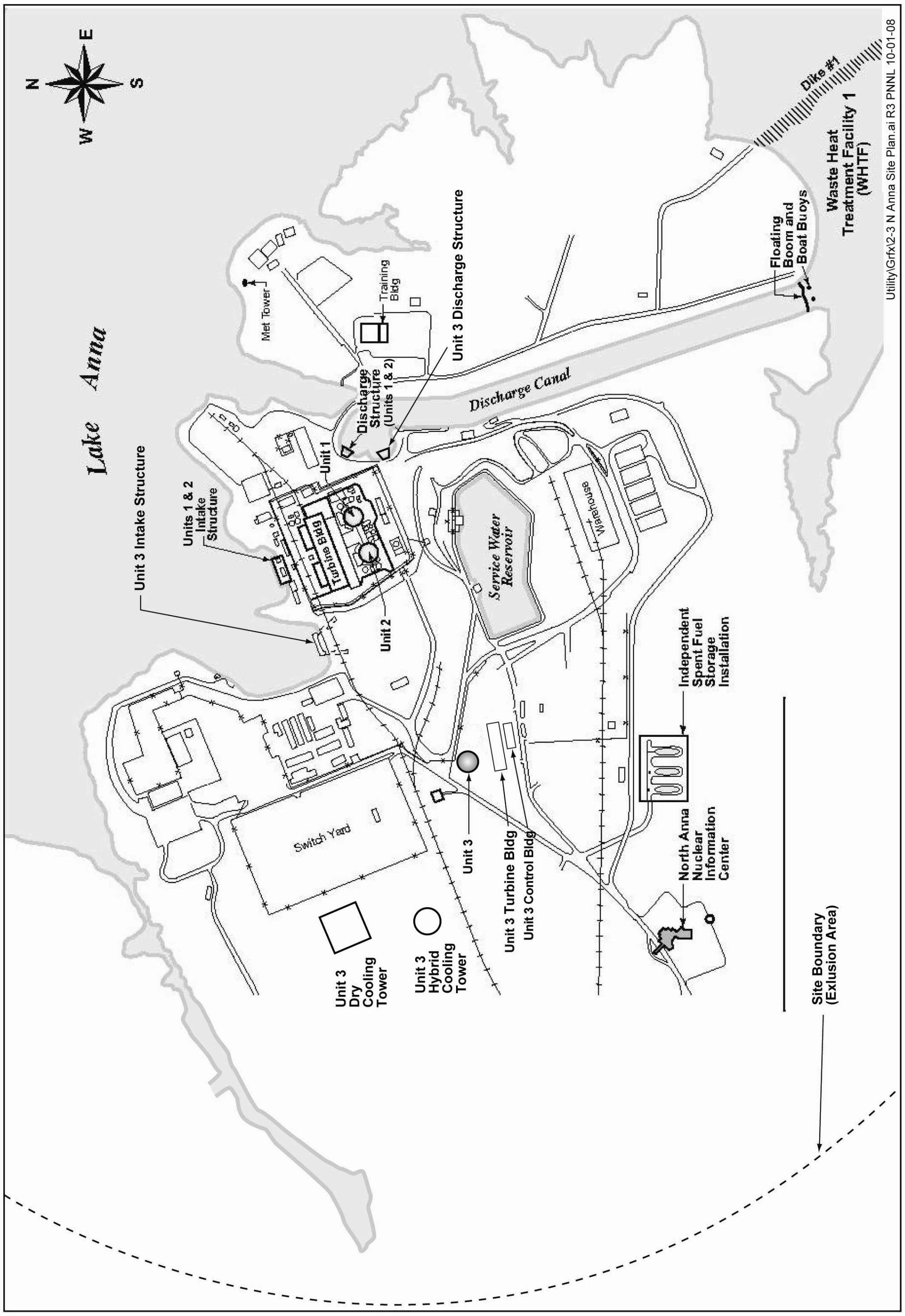

Figure 2-1. ESP Site Boundaries within the Existing NAPS Site (Adapted from NRC 2006a and Dominion 2007a)

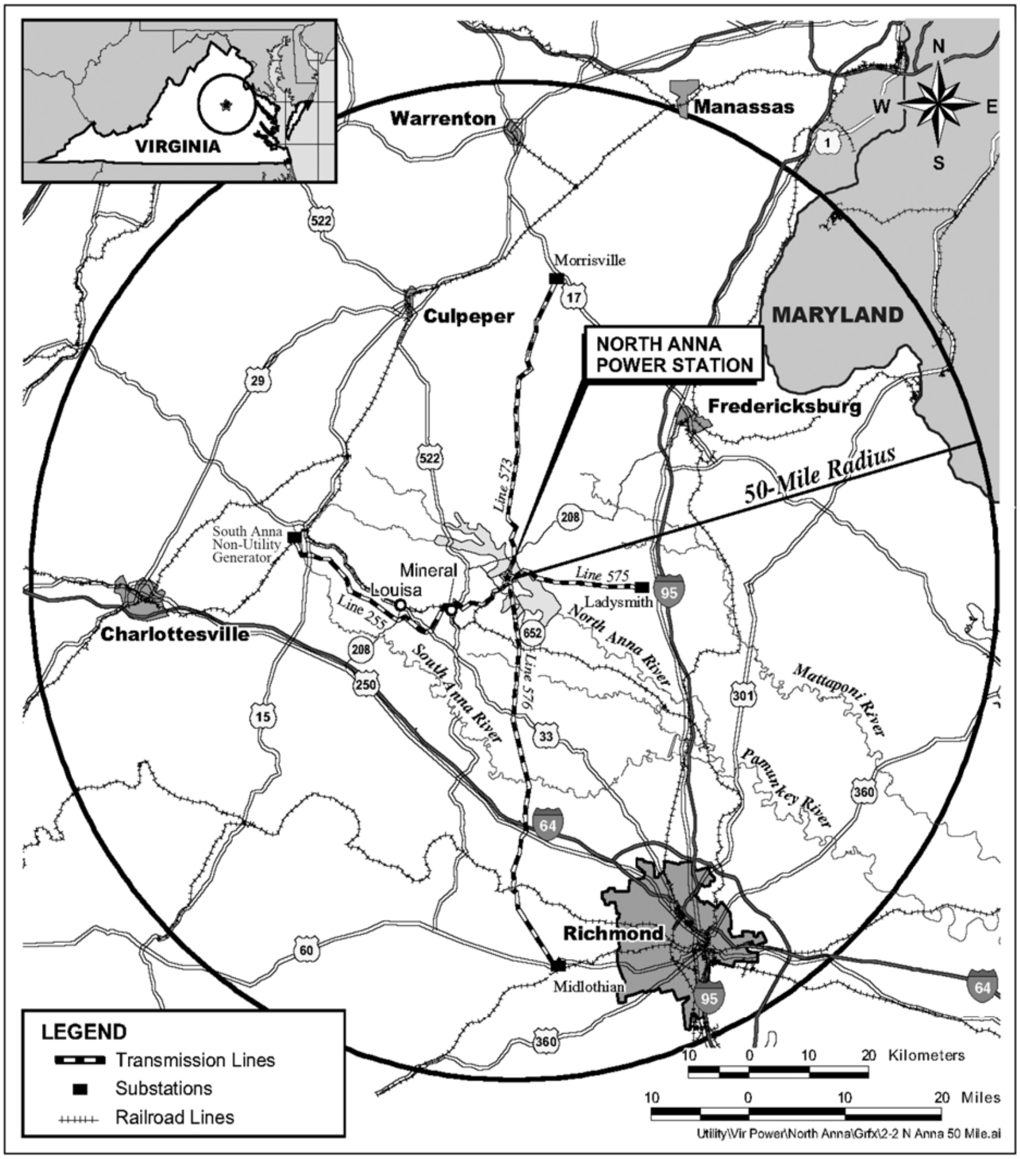

Figure 2-2. Location of NAPS, 80-km (50-mi) Region (NRC 2006a)

2.2 Land Use

This section discusses land-related issues for the NAPS site. Section 2.2.1 describes the site and the vicinity around the site. Section 2.2.2 discusses the existing transmission line rights-of-way. Section 2.2.3 discusses the region, defined as the area within an 80 km (50 mi) radius of the site boundary.

2.2.1 The Site and Vicinity

The NAPS site and vicinity are described in Section 2.2.1 of the ESP EIS (NRC 2006a). The ESP EIS assumed the location of two new nuclear units at the North Anna site, which was consistent with the ESP application (Dominion Nuclear North Anna, LLC 2006a). The COL application submitted by Dominion is for one new nuclear unit (Dominion 2007a).

Section 307(c)(3)(A) of the Coastal Zone Management Act (16 USC 1456(c)(3)(A)) requires an applicant seeking a Federal permit to conduct an activity that affects a coastal zone area to provide to the permitting agency a certification that the proposed activity complies with the enforceable policies of the state’s coastal zone program. The Virginia Department of Environmental Quality (VDEQ) oversees this program for the Chesapeake Bay Coastal Zone Management Area. The NAPS site is not within Virginia’s coastal zone for purposes of the Coastal Zone Management Act. However, Spotsylvania County and the associated portion of Lake Anna within Spotsylvania County are included within the Virginia coastal zone (VDEQ 2008a). Therefore, Dominion is required to provide a Coastal Zone Management Act certification to the Commonwealth of Virginia for proposed Unit 3 at the NAPS site (VDEQ 2008b).

2.2.2 Transmission Line Rights-of-Way

The North Anna transmission line rights-of-way are described in Section 2.2.2 of the ESP EIS (NRC 2006a).

A study conducted in 2007 by Interconnection (Dominion 2007a) determined that a new 24 km (15 mi) 500-kV transmission line to support the proposed Unit 3 would need to be constructed (Dominion 2007a). The line would be constructed from the existing North Anna Substation to the Ladysmith Switching Substation located east of the North Anna Substation. The line would be installed on new transmission towers built in the existing right-of-way (Dominion 2007a). PJM Interconnection is a regional transmission organization that coordinates the movement of wholesale electricity in all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and the District of Columbia (PJM 2008).

2.2.3 The Region

The region surrounding the NAPS site is described in Section 2.2.3 of the ESP EIS (NRC 2006a).

2.3 Meteorology and Air Quality

The climate for the geographic area in which the site is located has been characterized as modified continental, with mild winters, warm, moist summers, and relatively uniform rainfall throughout the year. Snow is relatively uncommon, occurring primarily in January and February. Light winds are perhaps the most important feature of this area in terms of reactor construction and operation because they will affect the dispersion of any releases to the environment. Much of the quantitative information on the meteorology for the NAPS site was based on historical observations made at the National Weather Service station at the Richmond, Virginia, airport.

No new and significant information was identified for meteorological data collected at the NAPS site as part of the ongoing operational monitoring program for Units 1 and 2. Specific information regarding wind speed and direction, atmospheric stability, ambient temperature, and moisture is available in Section 2.3 of the ESP EIS (NRC 2006a). The staff reviewed independent data sources and found no new and significant information regarding severe weather events beyond that reported in the ESP EIS.

Neither Louisa County nor nearby Orange County were included among those counties designated as Nonattainment for the 8-Hour Ozone National Ambient Air Quality Standards in the most recent Annual Report of the Virginia Department of Environmental Quality (VDEQ 2007c). While adjacent Spotsylvania County is designated as being in Nonattainment for the 8-hour Ozone Standard, this county has received a Deferment of Official Nonattainment Designation. The VDEQ (2008c) is reviewing air quality information in order to make a recommendation to the U.S. Environmental Protection Agency (EPA) on what areas may not meet EPA's 8-hour standard. Although Louisa and surrounding counties were not in violation of the former standards, the final status of all regions in Virginia will not be determined by EPA until 2010. The staff therefore sees no changes to the description of the NAPS site regional air quality.

Long term estimates of air concentration and deposition to the ground, normalized by release rate (χ/Q and D/Q) for sensitive receptors had been calculated in the ESP ER (Dominion Nuclear North Anna, LLC 2006a) and evaluated in the ESP EIS (NRC 2006a). These earlier values were based on sensitive receptors, each of which had a unique distance and direction. A review by Dominion of the location of the nearest receptors, conducted as part of the annual Radiological Environmental Monitoring Program review, showed that the closest receptor was now located 1.20 km (3930 feet) from the NW of North Anna Unit 1. As a result, Dominion made the assumption that all sensitive receptors (residence, vegetable garden, and meat animal) were at this distance and reanalyzed χ/Q and D/Q calculations with this assumption. This changed the expected values at the newly selected sites. However, the differences are consistent with what would be expected by moving these locations, and while this is new information, it is not significant and will not have any bearing on the earlier assessment presented in the ESP EIS (NRC 2006a).

2.4 Geology

Consideration of geology for the proposed Unit 3 site at NAPS and the surrounding area is limited in the environmental review. This section also provides information on key physiographic feature that are relevant in other sections. Readers are referred to the Final Safety Analysis Report (FSAR) for a more detailed description of geology, including seismic and geotechnical issues.

The proposed Unit 3 site lies within the Piedmont Physiographic Province (Trapp and Horn 2000). Detailed characteristics regarding this Province can be found in Section 2.4 of the ESP EIS (NRC 2006a).

The proposed Unit 3 site is underlain by rocks of the Ta River Metamorphic Suite, which extends thousands of feet below the ground surface. The crystalline metamorphic rocks near the ground surface have undergone extensive weathering to create a layer of saprolite about 30.5 m (100 ft) thick beneath the site. The geotechnical properties of the saprolite are unsuitable for use as a structural fill material for plant construction, and excavated material will have to be removed to another location (NRC 2006a). The ESP EIS addressed the mining deposits in the vicinity of the NAPS site (NRC 2006a).

The staff did not identify any new and significant information for this section since preparation of the ESP EIS (NRC 2006a).

2.5 Radiological Environment

A radiological environmental monitoring program (REMP) has been conducted around the NAPS site since 1976 (NRC 1976). The REMP includes monitoring of the airborne exposure pathway, the direct exposure pathway, the water exposure pathway, the aquatic exposure pathway from Lake Anna and the North Anna River, and the ingestion exposure pathway within a 40 km (25 mi) radius of the NAPS site. The preoperational environmental radiation monitoring program sampled various media in the environment to establish a baseline to determine the magnitude and fluctuation of radioactivity in the environment once the Units 1and 2 began operation (USAEC 1973). The preoperational monitoring program included collection and analysis of samples of air particulates, precipitation, milk, crops, soil, well water, surface water, fish, and silt as well as measurement of ambient gamma radiation. After operation of Units 1 and 2 began at NAPS, the monitoring program continued to assess the radiological impacts to workers, the public, and the environment. Modifications to the monitoring program are made based on changes in the area such as milk production, agricultural uses, and changes in lake use. Radiological releases are summarized in the reports entitled *Annual Radiological Environmental Operating Program* and *Annual Radioactive Effluent Release Report*; reports are issued annually. The *2007 North Anna Power Station, Annual Environmental Operating Report, January 1, 2007 to December 31, 2007* (VEPCo 2008a) reported the estimated maximum dose to a hypothetical individual at the station boundary because of liquid and gaseous effluents released during 2007 to be 0.0062 mSv (0.62 mrem). This dose compares to the approximately 3.0 mSv (300 mrem) dose received from background radiation (NCRP 1987). This estimated dose is similar to those of recent years. The limits for all radiological releases for Units 1 and 2 are specified in the Offsite Dose Calculation Manual (ODCM) (Dominion 2007c).

The annual effluent monitoring report and the annual environmental operating report for 2007 (VEPCo 2008a, 2008b) summarized results of groundwater sampling performed by Dominion around NAPS Units 1 and 2 and the Independent Spent Fuel Storage Installation (ISFSI) in support of the Nuclear Energy Institute (NEI) Ground Water Protection Initiative. This initiative was developed in response to the U.S. Nuclear Regulatory Commissions' Lessons Learned Task Force Report (NRC 2006b). Samples were analyzed for tritium and, in a few locations, for gamma emitters and strontium-89/90. VEPCo (2008a) reported that tritium results were indicative of lake-to-groundwater communication and not indicative of a leak from a radioactive system.

The Virginia Department of Health (VDH) also performs environmental monitoring around NAPS. The VDH samples airborne particulates, fish, milk, shellfish, silt, surface water, and vegetation. In addition, it measures external radiation around the NAPS site using thermoluminescent dosimeters (TLDs). Results of the VDH program were similar to those of Dominion's environmental monitoring program (VDH 2007a).

The NRC staff reviewed historical data on releases and estimated occupational and population doses and did not identify any new and significant information regarding the radiological environment since issuance of the North Anna ESP. The data and analysis showed that doses to the maximally exposed individuals around the NAPS site were a small fraction of the limits specified in Federal environmental radiation standards – Title 10 of the Code of Federal Regulations (CFR) Part 20; 10 CFR Part 50, Appendix I; and 40 CFR Part 190.

2.6 Water

This section presents a summary of the hydrological processes governing the movement and distribution of water in the existing environment at the proposed Unit 3 site at NAPS. The full description of hydrology, water use, water quality, and monitoring can be found in Section 2.6

of the ESP EIS (NRC 2006a). The NRC staff incorporates information by reference from the ESP EIS for this section. New information obtained since the ESP EIS was published is included where applicable in the following summary.

2.6.1 Hydrology

The site-specific and regional hydrological features of the existing environment that could be altered by the construction or operation of the proposed Unit 3 are shown in Figure 2-3 and are described in Section 2.6 of the ESP EIS (NRC 2006a). A description of the site's hydrological features was presented in Section 2.3.1 of the ESP Environmental Report (ER) (Dominion Nuclear North Anna, LLC 2006a); the COL ER stated that no new and significant information was identified for this section. The hydrological features of the site related to site safety (e.g., flood protection) are described by Dominion in the Final Safety Analysis Report (FSAR) portion of the COL application (Dominion 2007a).

A description of surface and groundwater hydrology is found in Section 2.6.1 of the ESP EIS (NRC 2006a). The hydrological monitoring data collected prior to preparation of the ESP EIS are discussed in Section 2.6.3 of the ESP EIS. Dominion provided no new information related to hydrologic monitoring. The staff independently reviewed USGS streamflow gauge data for the period after the preparation of the ESP EIS and determined they were consistent with past flows. Dominion calculates discharge released through the North Anna Dam using rating curves. These curves relate forebay stage and release structure settings to outflow discharge. Dominion does not take direct measurements of outflow discharge, and these rating curve estimates are the only discharge measurements available for the North Anna River immediately downstream of the North Anna Dam since the Partlow gauge (on the North Anna River near Partlow, VA) was discontinued in 1995. Staff identified new information that the Partlow gauge was reinstated and is being operated by USGS in cooperation with Dominion Virginia Power as of March 27, 2007 (USGS 2008).

The COL FSAR (Dominion 2007a) reports quarterly groundwater-level measurements from December 17, 2002, to September 29, 2003; a single measurement date of February 1, 2005; and quarterly measurements from November 29, 2006, to May 30, 2007. The latter set of data includes measurements made at the seven wells completed as part of the proposed Unit 3 subsurface field investigation. The FSAR states that some observation wells may need to be closed prior to site earthwork activities and that an evaluation will be conducted to determine whether new wells will be required to provide adequate evaluation of construction impacts on site groundwater levels. Regarding the frequency of monitoring, Dominion states that groundwater levels will be measured monthly during any construction-related dewatering, quarterly for 2 years following the completion of construction, and semi-annually or annually during plant operations.

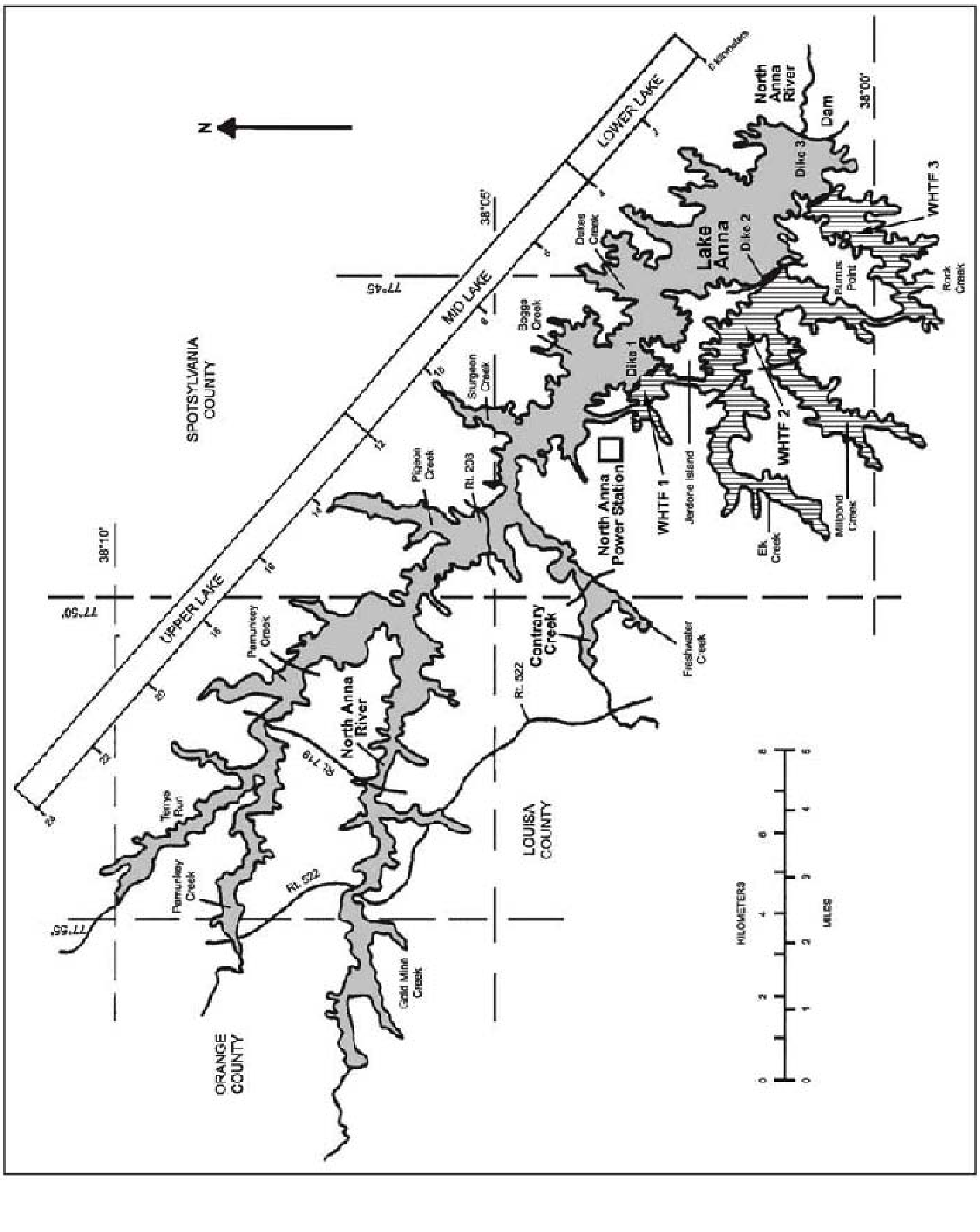

Figure 2-3. Lake Anna, the Waste Heat Treatment Facility (WHTF), and the Rivers and Creeks in the Vicinity of NAPS (NRC 2006a)

2.6.2 Water Use

Consumptive water use during plant operation is a key element of the affected environment for the proposed Unit 3, and forms the basis for evaluation of impacts of plant operation. Therefore, this section incorporates by reference the ESP EIS (NRC 2006a) and any new information identified by staff since the ESP EIS was prepared. In Section 2.3.2 of the COL ER, Dominion (2007a) identified no new and significant information relative to water use.

Dominion revised the water budget model that was used for the calculations in the ESP ER to incorporate more detailed information provided by the proposed cooling tower vendor. The results did not significantly change the conclusions that were presented in the ESP ER. The calculation did not result in a change in the plant parameter envelope (PPE) values that were the basis of the ESP ER. The staff had done an independent calculation using an alternative modeling approach at the ESP stage. The staff's independent calculation relied on long-term PPE values and, therefore, would remain unchanged with the new information from the cooling tower vendor.

2.6.3 Water Quality

The description of water quality of surface water and groundwater resources in the vicinity of the NAPS site in Section 2.6.3 of the ESP EIS (NRC 2006a) is incorporated by reference into this SEIS. The ESP EIS also describes pre-application monitoring programs for thermal and chemical water quality.

The water quality of Lake Anna, the tributaries draining into Lake Anna, and the North Anna River downstream of the dam are described in Section 2.6.3.1 of the ESP EIS (NRC 2006a), and Section 2.3.3.1 of the ESP ER (Dominion Nuclear North Anna, LLC 2006a). Dominion provided a table summarizing more recent Lake Anna water quality data in Section 2.3.3.1 of the COL ER (Dominion 2007a).

Localized elevated temperatures resulting from the thermal load discharge from operating Units 1 and 2 at NAPS remain the most significant water-quality concern associated with both the existing units and the proposed Unit 3. Operational impacts of proposed Unit 3 on Lake Anna water quality are discussed in Section 5.3.3 of this SEIS. Monitoring programs for thermal and chemical water quality are discussed in ESP EIS Sections 2.6.3.3 and 2.6.3.4, respectively.

Units 1 and 2 have a Virginia Pollutant Discharge Elimination System (VPDES) permit from the VDEQ (2007a). Before Unit 3 could begin to operate, Dominion would be required to obtain a VPDES permit for discharges from this unit. Dominion would also be required to demonstrate to VDEQ that the thermal effluent limitation for Unit 3 is adequate to ensure protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife through a Clean

Water Act Section 316(a) demonstration. If determined to be necessary, VDEQ may require additional monitoring prior to issuance of a VPDES permit. VDEQ may also require ongoing monitoring as a condition of the VPDES permit.

There were no site-specific data available for the nonradiological chemistry of the groundwater underlying the NAPS site at the time of the ESP EIS (NRC 2006a), and no new and significant groundwater quality information was identified in the COL ER (Dominion 2007a). In Section 2.3.3.2 of the ESP ER and in response to a request, Dominion provided a summary of published studies that characterize the water quality of crystalline aquifers in the Piedmont Province (Dominion Electric Environmental Services Environmental Biology 2004; Dominion Nuclear North Anna, LLC 2006a). The Piedmont region aquifers provide good quality water (USGS 2000). As with most crystalline rocks, the rocks of the Piedmont Province contribute relatively high levels of naturally occurring radioactivity to the groundwater.

Dominion is able to consider an ongoing thermal monitoring program associated with the existing Units 1 and 2 as part of the pre-application and pre-operational monitoring program for the Unit 3 site. It is expected that many of the same monitoring activities would be continued if Unit 3 were completed and would become part of Unit 3 operational monitoring. In Section 6.1 of the ESP ER, Dominion Nuclear North Anna, LLC describes the existing lake temperature measurements directly associated with the current site operation that were required under terms of its existing VPDES permit (Dominion Nuclear North Anna, LLC 2006a). Dominion's VPDES permit was reissued in October 2007 with continued terms for thermal monitoring in the Lake Anna Reservoir (VDEQ 2007a).

The current temperature monitoring program in Lake Anna and the Waste Heat Treatment Facility (WHTF) includes both continuous temperature stations and temperature profile locations. Temperature is recorded continuously at seven stations in the main body of Lake Anna, three stations in the WHTF, and one in the North Anna River below the dam. A requirement of the renewed VPDES permit is that Dominion is required to monitor temperature daily at the cooling water intake for Units 1 and 2, and at Outfall 101 where the once-through cooling water from Units 1 and 2 enters the discharge canal (VDEQ 2007a). The 2007 VPDES permit also added weekly temperature monitoring at the location where the WHTF discharges to the main body of the lake (Outfall 001, Dike 3). Temperature profiles are measured periodically (at least two quarters per year) at seven or more stations in the main body of the lake, as described in the ESP EIS (NRC 2006a).

As with the thermal monitoring, Dominion is able to consider its ongoing operational monitoring program for Units 1 and 2 as part of the pre-application and pre-operational monitoring program for the proposed Unit 3. Many of these same monitoring activities would be continued if Unit 3 were completed and would likely become part of the operational monitoring. In Section 6.6 of the ESP ER (Dominion Nuclear North Anna, LLC 2006a), Dominion Nuclear North Anna, LLC describes the chemical monitoring that is required under terms of its existing VPDES permit.

Section 3.6.1 of the COL ER provides results of surface-water quality monitoring near the intake for Units 1 and 2 since preparation of the ESP ER (Dominion 2007a). Copper and tributyltin are noted because their concentrations are at or above water quality criteria. Dominion's VPDES permit was renewed by VDEQ in October 2007, with similar chemical monitoring requirements. The NAPS Units 1 and 2 VPDES permit establishes chemical discharge limits at a variety of locations internal to the NAPS facility and at the discharge from the WHTF into Lake Anna at Dike 3. Chemical monitoring of a variety of constituents is required including pH, chlorine, copper, nickel, chromium, zinc, suspended solids, oil and grease, and biological oxygen demand. Water quality monitoring of effluent from NAPS Units 1 and 2 is required once per year; this monitoring has both chemical and biological (toxicity) components. While temperature is monitored both inside and outside the WHTF, no chemical monitoring is required outside the WHTF.

The Commonwealth of Virginia monitors Lake Anna, Lake Anna's tributaries, and the North Anna River downstream from Lake Anna. Results from this monitoring program provide the basis for the list of impaired waters in the Virginia Clean Water Act Section 303(d), which implements the Clean Water Act. Recent sampling by the Commonwealth has resulted in a public health advisory regarding the consumption of certain fish in Lake Anna and its tributaries. The advisory was triggered because polychlorinated biphenyls (PCBs) were detected in the tissues of certain fish. While the fish consumption use is categorized as impaired, the VDEQ considers the water quality of Lake Anna to be fully supportive of aquatic life, wildlife, and recreation uses (VDEQ 2007b).

Community-based monitoring of Lake Anna and WHTF water quality has been performed by volunteers from the Lake Anna Civic Association. Water samples are collected and analyzed for several standard water-quality metrics, such as the fecal coliform bacteria, *Escherichia coli*, and dissolved oxygen. Results from this monitoring program were provided to the Commonwealth of Virginia and the EPA, and also were reviewed by the staff.

2.7 Ecology

A detailed description of the terrestrial and aquatic ecology in the vicinity of the NAPS site is presented in Section 2.7 of the ESP EIS (NRC 2006a) and Section 2.4 of the ESP ER (Dominion Nuclear North Anna, LLC 2006a). The following sections update the description where appropriate with information developed since the ESP EIS was prepared, including information from the COL ER (Dominion 2007a), supplemental information provided by Dominion, and reviews of current information available from Commonwealth and Federal agencies.

2.7.1 Terrestrial Ecology

A detailed description of the terrestrial and aquatic ecology in the vicinity of the NAPS site is presented in Section 2.7.1 of the ESP EIS (NRC 2006a) and in Section 2.4 of the ESP ER (Dominion Nuclear North Anna, LLC 2006a). Dominion provided the staff with new information about the layout of the proposed facilities, the amount and distribution of wetlands onsite that may be affected by construction and operation of the proposed Unit 3, wildlife usage in the vicinity of the NAPS site, and the proposed new transmission line from NAPS to the Ladysmith Substation.

2.7.1.1 Biological Communities of the NAPS Site

As described in the ESP EIS, the NAPS site is located within the Piedmont Physiographic Province as described by Omernik (1987). Although forests in the Piedmont Province are nominally characterized by oak-hickory pine forest (Woods et al. 2003), this portion of northeastern Virginia has been settled since the colonial era and therefore no longer contains virgin forests. Vegetative cover surrounding NAPS is an irregular patchwork of row crops, pastures, pine plantations, abandoned (old) fields, and second-growth forests of hardwoods and mixed pine-hardwoods (Dominion Nuclear North Anna, LLC 2006a).

The overall proposed Unit 3 site footprint is approximately 121.4 ha (300 ac). Dominion classified the habitats within the construction footprint using National Land Cover Dataset (NLCD) data, and found that the COL site consisted of approximately 25 percent deciduous forest, 15 percent evergreen forest, 19 percent mowed grass areas, 33 percent developed areas and open space, and 8 percent wetlands (Dominion 2008c).

The amount of wetlands within the NAPS site footprint based on the NLCD data (approximately 9.7 ha (24 ac)) appears to be an overestimate. There is very little hydrophytic or wetland vegetation along most of the Lake Anna shoreline except at the upper or western end where the shorelines are shallower (Dominion Nuclear North Anna, LLC 2006a). In 2006, Dominion Nuclear North Anna, LLC completed a wetland delineation that identified 2.7 ha (6.68 ac) of non-tidal wetlands, 1676 m (5500 ft) of streams, and approximately 1.0 ha (2.49 ac) of open water (within a beaver pond) in the ESP construction footprint (Dominion Nuclear North Anna, LLC 2006c). In a September 2006 letter, the U.S. Army Corps of Engineers (USACE) verified this delineation (USACE 2006). In the ESP EIS, two intermittent streams were identified within the construction footprint. Dominion has since identified an additional intermittent stream flowing north into an unnamed arm of Lake Anna.

The description of common wildlife species at the NAPS site that was provided in the ESP EIS (NRC 2006a) is updated with the following information. In the ESP ER (Dominion Nuclear North Anna, LLC 2006a), Dominion Nuclear North Anna, LLC stated that although great blue herons were commonly observed at Lake Anna and the NAPS site, there were no known rookeries in the area. During its review for new and significant information for the COLA, Dominion indicated that there is now a rookery with approximately 20 nests located near Thurman Island, approximately 3.2 km (2 mi) from the existing NAPS site boundary (Dominion 2008d).

2.7.1.2 Biological Communities within the North Anna to Ladysmith Transmission Line Right-of-Way

In the ESP ER (Dominion Nuclear North Anna, LLC 2006a), Dominion Nuclear North Anna, LLC stated that no alterations to the transmission system would be required. In its COL ER (Dominion 2007a), Dominion indicated that an additional 500-kV transmission line, within the existing Ladysmith right-of-way would be required to ensure system reliability. The new transmission line is expected to be approximately 24 km (15 mi) long; the existing right-of-way is approximately 84 m (275 ft) wide, and will not need to be expanded to accommodate the new proposed transmission line.

The Ladysmith right-of-way starts at the NAPS site, crosses an unnamed arm of Lake Anna on the north side of the site, and then turns east across Lake Anna into Spotsylvania County. The right-of-way then travels generally east-south-east for approximately 19.3 km (12 mi) until it reaches the Ladysmith substation, located approximately 3.2 km (2 mi) beyond the Caroline County line.

The NAPS to Ladysmith right-of-way crosses approximately 20 small tributaries, and several wetland areas. The largest wetlands within the right-of-way are along Northeast Creek, approximately 4.8 km (3 mi) north of Lake Anna Dam, and along a tributary of South River, about 4.8 km (3 mi) west of the Ladysmith Substation (Dominion 2007a).

The right-of-way is currently cleared, and there are a variety of land uses within the right-of-way including grazing, agriculture, and silviculture typical of central Virginia. Vegetative cover types along and adjacent to the North Anna to Ladysmith right-of-way were characterized by Dominion using NLCD data (Dominion 2008c). Dominion estimated that the habitats within 45.7 m (150 ft) of either side of the right-of-way centerline consisted of approximately 41 percent deciduous forests, 19 percent evergreen forests, 16 percent pasture or hay, 13 percent cultivated crops, 5 percent developed lands, 4 percent open water, and less than 3 percent wetlands.

Wildlife surveys have not been performed and wetlands have not been delineated by Dominion along the Ladysmith right-of-way. A wetland impact analysis will be required prior to receiving Virginia State Corporation Commission (Virginia-SCC) certification of the proposed new transmission line (Dominion 2008e).

2.7.1.3 Threatened and Endangered Terrestrial Species

A detailed description of the threatened and endangered terrestrial species in the vicinity of the NAPS site is presented in Section 2.7.1 of the ESP EIS (NRC 2006a) and Section 2.4 of the ESP ER (Dominion Nuclear North Anna, LLC 2006a).

The list of threatened and endangered terrestrial species in the vicinity of the NAPS site and the Ladysmith transmission line right-of-way is provided in Table 2-1. Differences between the current list and that provided in the ESP EIS (NRC 2006a) include deletion of the cerulean warbler (*Dendroica cerulea*) and regal fritillary (*Speyeria idlaia*). Both species were removed from the U.S. Fish and Wildlife Service (USFWS) list of species of concern for Virginia (USFWS 2008) and neither have state status in Virginia. Additionally, the State-protected Dismal Swamp southeastern shrew (*Sorex longirostris fisheri*) was deleted because VDGIF no longer has records of its occurrence in Caroline County (VDGIF 2008a). The Canebrake rattlesnake (*Crotalus horridus*) was added to the list because it is now known to occur in Hanover County (VDGIF 2008a).

Animals

The Bald eagle (*Haliaeetus leucocephalus*) was removed from the Federal list of threatened or endangered species, but is still a State-threatened species. Bald eagles are occasionally observed along Lake Anna (seven were observed during the 2007/2008 Christmas Bird Count) (Audubon Society 2008). However, there are no known eagle nests at the NAPS site. The nearest known bald eagle nest is approximately 4.2 km (2.6 mi) to the west in the Contrary Creek drainage (Dominion 2008d). No eagle nests are known to occur along the NAPS to Ladysmith transmission line right-of-way (VDGIF 2008a). The loggerhead shrike (*Lanius ludoviciana*), a State-threatened species is likely to occur in the vicinity (VDGIF 2008a), but nesting near the NAPS site or the transmission line rights-of-way, including the NAPS to Ladysmith transmission line right-of-way, has not been recorded (Dominion Nuclear North Anna, LLC 2006a). Other species, such as the upland sandpiper (*Bartramia longicauda*) may occasionally migrate through the area (VDGIF 2008a). The eastern big-eared bat (*Plecotus rafinesquii macrotis*) and tiger salamander (*Ambystoma tigrinum*) have been reported in Hanover County, which is downstream from Lake Anna. The red-cockaded woodpecker (*Picoides borealis*) and Bachman's sparrow (*Aimophila aestivalis)* have been reported in Caroline County (VDCR 2008, VDGIF 2008a). However, the presence of these species at the NAPS site is unlikely, and reported observation sites are well away from the transmission lines, or portions of the North Anna River potentially affected by construction and operation of the proposed Unit 3 at the NAPS site.

Table 2-1. Federally or State Listed Terrestrial Species Known or Likely to Occur in Counties Adjacent to or Downstream from the Lake Anna Reservoir (Louisa, Orange, Spotsylvania, Caroline, and Hanover Counties)

Scientific Name	Species	Counties	Status[(a)]	Source
Birds				
Haliaeetus leucocephalus	Bald eagle	Louisa, Orange, Spotsylvania, Caroline, Hanover	ST	VDGIF 2008a, VDCR 2008, USFWS 2008
Picoides borealis	Red-cockaded woodpecker	Caroline	FE/SE	VDGIF 2008a
Lanius ludovicianus	Loggerhead shrike	Louisa, Orange, Spotsylvania, Caroline, Hanover	ST	VDGIF 2008a
Aimophila aestivalis	Bachman’s sparrow	Caroline	ST	VDGIF 2008a, VDCR 2008
Bartramia longicauda	Upland sandpiper	Louisa, Orange, Spotsylvania, Caroline, Hanover	ST	VDGIF 2008a
Mammals				
Plecotus rafinesquii macrotis	Eastern big-eared bat	Hanover	SE	VDGIF 2008a
Amphibians and Reptiles				
Ambystoma tigrinum	Tiger salamander	Hanover	SE	VDCR 2008
Crotalus horridus	Canebrake rattlesnake	Hanover	SE	VDGIF 2008a
Vascular Plants				
Isotria medeoloides	Small whorled pogonia	Spotsylvania, Hanover, Caroline	FT/SE	VDGIF 2008a, USFWS 2008 VDCR 2008
Helonias bullata	Swamp pink	Caroline, Hanover, Spotsylvania	FT/SE	VDGIF 2008a, VDCR 2008, USFWS 2008
Aeschynomene virginica	Sensitive joint-vetch	Caroline, Hanover	FT	USFWS 2008
Juncus caesariensis	New Jersey rush	Caroline	FS/ST	VDCR 2008

(a) FE = Federally endangered, FT = Federally threatened, FS = Federal species of concern, SE = State endangered, ST = State threatened.

Plants

There are no known populations of any plants species listed as threatened or endangered by the USFWS or the Commonwealth on the NAPS site (Dominion Nuclear North Anna, LLC 2006a; VDGIF 2008a; VDCR 2008). In addition, there are no known populations of such species in Louisa County (VDCR 2008; USFWS 2008).

The SEIS prepared for the license renewal of NAPS Units 1 and 2 (NRC 2002b) described three Federally listed plant species that could potentially occur in the North Anna transmission line rights-of-way: the small whorled pogonia (*Isotria medeoloides*), swamp pink (*Helonias bullata*), and the sensitive joint-vetch (*Aeschynomene virginica*). One additional rare plant species has been reported to occur in Caroline County; the New Jersey rush (*Juncus caesariensis*), a State threatened and Federal species of concern, which occurs in shaded stream banks and other wet areas (VDCR 2008).

An additional set of towers and a transmission line will be added to the existing NAPS to Ladysmith right-of-way (Dominion 2007a). Although Dominion has not performed a site-specific survey of this transmission line right-of-way, it has worked with the Virginia Natural Heritage Program to identify plants of conservation concern on its right-of-ways. Although several rare plant species have been located along other Virginia Power transmission line rights-of-way, no endangered or threatened plants were noted along the rights-of-way associated with the NAPS site (Dominion Nuclear North Anna, LLC 2006a). The NAPS to Ladysmith transmission line right-of-way has not been selected for specific field review because there are no known rare plant populations in the area, and the soils, topography, and habitats present within the right-of-way are not likely to support populations of rare plants (Dominion 2008f).

2.7.1.4 Terrestrial Ecological Monitoring

As stated in the ESP EIS (NRC 2006a), Dominion was not performing terrestrial ecological monitoring (Dominion Nuclear North Anna, LLC 2006a), and none was proposed in the COL ER (Dominion 2007a). However, Dominion does cooperate with private organizations, such as the local chapter of the Audubon Society, to allow informal monitoring of selected resources at and near NAPS, and has worked with the VDCR Natural Heritage Program to conduct rare plant surveys in transmission line rights-of-way. The NRC expects Dominion to work with the Commonwealth on development and implementation of any required monitoring programs.

2.7.2 Aquatic Ecology

A detailed description of the aquatic ecology in the vicinity of the NAPS site is presented in Section 2.7.2 of the ESP EIS (NRC 2006a) and Section 2.4 of the ESP ER (Dominion Nuclear North Anna, LLC 2006a). Dominion provided the staff with the results of aquatic monitoring studies in Lake Anna and downstream of the North Anna Dam conducted since the ESP EIS was prepared (NRC 2006a). Additionally, the staff reviewed VDGIF fisheries management reports during this time period.

2.7.2.1 Aquatic Communities in the Vicinity of the NAPS Site

The aquatic communities of Lake Anna, the WHTF, and the North Anna River downstream of Lake Anna are described in detail in Section 2.7.2 of the ESP EIS (NRC 2006a). A brief summary is provided here. Lake Anna is typical of many shallow reservoirs found in the southern and mid-Atlantic states. Since impoundment, Lake Anna has gone through a typical ecological succession of reservoirs, with productivity and aquatic communities stabilizing by 1975 and remaining relatively stable since 1985 (VEPCo 1986, 1989, 2001a, 2001b; NRC 2003; Dominion Nuclear North Anna, LLC 2006a, 2006b).

Aquatic Communities of Lake Anna

Over 40 species of fish representing 16 families have been reported in Lake Anna (Table 2-2) (VEPCo 1986; Dominion Nuclear North Anna, LLC 2006a, 2006b; Dominion 2007b, 2008a). Striped bass are stocked annually at variable rates by the VDGIF. Walleye were stocked annually in Lake Anna between 1972 and 2007, but stocking was discontinued because of poor post-stocking survival (VDGIF 2007). Sterile triploid herbivorous grass carp (*Ctenopharyngodon idella*) were stocked in the WHTF in 1994 by Virginia Power (NRC 2002b). The sterile grass carp were stocked (with the approval of the VDGIF) in the WHTF to control the growth of the nuisance aquatic plant hydrilla (*Hydrilla verticillata*). VDGIF (2007) notes aquatic plants are generally considered to be desirable in aquatic systems, and reports that "… it has taken years for the grass carp population to decline through natural mortality and only recently have small amounts of aquatic vegetation begun to emerge." Since the ESP EIS was prepared, annual monitoring of Lake Anna and WHTF fish populations by gill net and electrofishing has continued, and data suggest that fish species composition and abundance has remained relatively unchanged (Dominion Nuclear North Anna, LLC 2006b; Dominion 2007b, 2008a; VDGIF 2007).

As described in Section 2.7.2.1 of the ESP EIS, there is no commercial fishing on Lake Anna or the North Anna River. However, recreational fishing is very popular and professional fishing guides regularly take clients fishing on the lake. The warmer water that flows from the WHTF into Lake Anna at Dike 3 creates conditions conducive to good fishing during the winter, making the lake a popular fishing spot when cold weather slows or stops fishing at other ponds and lakes in the region. The VDGIF (2007) reported that fishing preferences in 2005 were similar to those in 2000, with most anglers seeking striped bass, largemouth bass, crappie, and catfish. Recreational fish species and supporting forage fish population structures, catch rates, and fishery management are described in detail in Section 2.7.2.1 of the ESP EIS (NRC 2006a).

Table 2-2. Fish and Selected Benthic Macroinvertebrates Reported from Lake Anna

Family	Scientific Name	Common Name
Anguillidae	*Anguilla rostrata*	American eel
Clupeidae	*Dorosoma cepedianum*	Gizzard shad
	Dorosoma petenense	Threadfin shad
	Alosa aestivalis	Blueback herring
Esocidae	*Esox niger*	Chain pickerel
	Esox lucius	Northern pike
Umbridae	*Umbra pygmaea*	Eastern mudminnow
Cyprinidae	*Ctenopharyngodon idella*	Grass carp
	Cyprinus carpio	Common carp
	Nocomis leptocephalus	Bluehead chub
	Nocomis micropogon	River chub
	Notemigonus crysoleucas	Golden shiner
	Cyprinella analostana	Satinfin shiner
	Notropis procne	Swallowtail shiner
	Notropis hudsonius	Spot tail shiner
Catostomidae	*Carpiodes cyprinus*	Quillback
	Catostomus commersoni	White sucker
	Erimyzon oblongus	Creek chubsucker
	Moxostoma macrolepidotum	Shorthead redhorse
	Hypentelium nigricans	Northern hog sucker
Ictaluridae	*Ameiurus nebulosus*	Brown bullhead
	Ameiurus natalis	Yellow bullhead
	Ameiurus catus	White catfish
	Ictalurus punctatus	Channel catfish[(a)]
	Ictalurus furcatus	Blue catfish
	Noturus insignis	Margined madtom
Fundulidae	*Fundulus diaphanus*	Banded killifish
Aphredoderidae	*Aphredoderus sayanus*	Pirate perch
Poeciliidae	*Gambusia affinis*	Mosquitofish
Moronidae	*Morone americana*	White perch[(a)]
	Morone saxatilis	Striped bass[(a,b)]
Centrarchidae	*Enneacanthus gloriosus*	Bluespotted sunfish
	Lepomis auritus	Redbreast sunfish
	Lepomis gibbosus	Pumpkinseed
	Lepomis gulosus	Warmouth
	Lepomis macrochirus	Bluegill
	Lepomis microlophus	Redear sunfish
	Lepomis cyanellus	Green sunfish
	Acantharchus pomotis	Mud sunfish
	Micropterus salmoides	Largemouth bass[(a)]
	Pomoxis nigromaculatus	Black crappie[(a)]

Table 2-2. (contd)

Family	Scientific Name	Common Name
Percidae	*Perca flavescens*	Yellow perch[(a)]
	Sander vitreus	Walleye[(a,c)]
	Etheostoma olmstedi	Tessellated darter
Corbiculidae	*Corbicula sp.*	Asiatic clam[(d)]
Unionidae	*Elliptio complanatus*	Unionid mussel
	Elliptio productus	Unionid mussel
Pisidiidae	*Sphaerium striatum*	Fingernail clam

(a) Recreationally important fishery.
(b) VDGIF stocks striped bass in Lake Anna annually.
(c) VDGIF stocked walleye in Lake Anna until 2007, but ceased after 2007.
(d) Asiatic clams (*Corbicula* sp.) are considered nuisance species.
Sources: VEPCo 1986; Dominion Nuclear North Anna, LLC 2006a, 2006b; Dominion 2007b, 2008a.

Lake Anna fisheries continue to be managed by the VDGIF with a focus on striped bass and largemouth bass.

Nuisance Species of Lake Anna

Asiatic clams are considered a nuisance species because once they are introduced, their high reproductive rate allows them to quickly occupy suitable habitat. Dominion continues to monitor clams twice per year in Lake Anna and the WHTF using an Ekman dredge sampler. In the course of monitoring Asiatic clam populations, Dominion also has looked for evidence that the zebra mussel (Dreissena polymorpha) has invaded Lake Anna, but this species has not been observed.

Aquatic Communities of the WHTF

The WHTF presently receives waste heat from the NAPS Units 1 and 2 once-through cooling system via the discharge canal. As described in Section 3.4.1.1 of the ESP ER (Dominion Nuclear North Anna, LLC 2006a), blowdown water from the proposed Unit 3 will be mixed with circulating water from Units 1 and 2 in the discharge canal prior to release into the WHTF. The same aquatic communities generally exist in the WHTF and Lake Anna, but Dominion's annual fish monitoring shows that fewer species are collected in the WHTF. Typically in the WHTF, bluegill and green sunfish are numerically dominant; fish biomass continues to be dominated by channel catfish, common carp, and gizzard shad (Dominion 2007b, 2008a).

Aquatic Communities of the North Anna River

A detailed description of the aquatic communities of the North Anna River below the dam are described in Section 2.7.2.3 of the ESP EIS (NRC 2006a), and Section 2.7.2.4 of the ESP ER

(Dominion Nuclear North Anna, LLC 2006a). Information provided through staff consultation with VDGIF and Dominion is summarized below.

During an extended drought in 2001 and 2002, discharges at the North Anna Dam were maintained at 0.6 m^3/s (20 cfs) from November 3, 2001 to December 18, 2002, and gradually increased to 1.2 m^3/s (40 cfs) from December 19 to 22, 2008, after a period of significant rainfall. During that period, Dominion monitored fish and invertebrate communities in the North Anna River below the dam and concluded that benthic invertebrate community structure and abundance both during and after low flows were comparable to historical measurements (Dominion Electric Environmental Services Environmental Biology 2004).

The North Anna River supports a diverse assemblage of stream fishes, with over 35 species representing 13 families reported (Table 2-3) (Dominion Electric Environmental Services Environmental Biology 2004; Dominion Nuclear North Anna, LLC 2006b; Dominion 2007b, 2008a). Redbreast sunfish (*Lepomis auritus*) have consistently been the most abundant species in the North Anna River since 1981 (VEPCo 2001a; Dominion Electric Environmental Services Environmental Biology 2004; Dominion Nuclear North Anna, LLC 2006b; Dominion 2007b, 2008a). Other abundant fish species are satinfin shiner (*Cyprinella analostana),* rosyface shiner (*Notropis rubellus*), swallowtail shiner (*N. procne*), and margined madtom (*Noturus insignis)* (Dominion 2008a). Dominion continues to monitor fish in the North Anna River by electrofishing (seine and backpack) at six stations between the dam and about 39 km (14 mi) downstream. Fish assemblage and abundance data collected since the ESP EIS are consistent with previous surveys (Dominion 2008a).

Since 1987, Virginia Power (now Dominion) biologists have gathered data on the abundance and distribution of bass species in the lower North Anna River. Dominion continues to conduct snorkel surveys at four stations during the summer months, observing number and size of smallmouth bass and largemouth bass along with substrate and cover type used by the fish. Historically, largemouth bass (*Micropterus salmoides*) have dominated the fish counts at upstream locations, while smallmouth bass (*M. dolomieu*) have been more prevalent at downstream locations. Recent monitoring data suggest that both species are found throughout the study area, with largemouth bass being more abundant in the upstream stations and smallmouth bass more abundant at the downstream stations (Dominion Nuclear North Anna, LLC 2006b; Dominion 2007b, 2008a). Recent Dominion surveys have indicated that despite the limited supply of forage in the river, largemouth bass and smallmouth bass populations are healthy (Dominion Nuclear North Anna, LLC 2006a).

Table 2-3. Fish Species Reported from the North Anna River

Family	Scientific Name	Common Name
Petromyzontidae	*Petromyzon marinus*	Sea lamprey
	Lampetra appendix	American brook lamprey
Amiidae	*Amia calva*	Bowfin
Anguillidae	*Anguilla rostrata*	American eel
Esocidae	*Esox niger*	Chain pickerel
Cyprinidae	*Cyprinella analostana*	Satinfin shiner
	Lythrurus ardens	Rosefin shiner
	Nocomis leptocephalus	Bluehead chub
	Nocomis micropogon	River chub
	Notropis amoenus	Comely shiner
	Notropis procne	Swallowtail shiner
	Notropis rubellus	Rosyface shiner
	Notropis hudsonius	Spottail shiner
	Notemigonus crysoleucas	Golden shiner
	Semotilus corporella	Fallfish or American chub
Catostomidae	*Erimyzon oblongus*	Creek chubsucker
	Hypentelium nigricans	Northern hog sucker
	Catostomus commersoni	White sucker
Ictaluridae	*Ameiurus natalis*	Yellow bullhead
	Ameiurus nebulosus	Brown bullhead
	Ictalurus punctatus	Channel catfish[(a)]
	Noturus gyrinus	Tadpole madtom
	Noturus insignis	Margined madtom
Aphredoderidae	*Aphredoderus sayanus*	Pirate perch
Fundulidae	*Fundulus diaphanus*	Banded killifish
Poeciliidae	*Gambusia holbrooki*	Eastern mosquitofish
Centrarchidae	*Lepomis auritus*	Redbreast sunfish
	Lepomis macrochirus	Bluegill[(a)]
	Lepomis gulosus	Warmouth
	Micropterus dolomieu	Smallmouth bass[(a)]
	Micropterus salmoides	Largemouth bass[(a)]
	Pomoxis nigromaculatus	Black crappie[(a)]
	Acantharchus pomotis	Mud sunfish
Percidae	*Etheostoma olmstedi*	Tessellated darter
	Etheostoma vitreum	Glassy darter
	Percina peltata	Shield darter
	Percina notogramma	Stripeback darter
Achiridae	*Trinectes maculates*	Hogchoker

(a) Recreationally important fishery.
Sources: Dominion Electric Environmental Services Environmental Biology 2004; Dominion Nuclear North Anna, LLC 2006b; Dominion 2007b, 2008a.

As stated in Section 1.5 of the ESP EIS (NRC 2006a), Dominion has agreed to conduct an Instream Flow Incremental Methodology (IFIM) study of the North Anna River below the dam. This study is required by the Commonwealth of Virginia to enable preparation of the Coastal Zone Management Act consistency determination that is required prior to the issuance of a COL (EA 2007). Study design, analysis, and interpretation were done in cooperation and consultation with the VDGIF and the VDEQ. The primary objective of the North Anna IFIM study is to determine whether any changes (generally reductions) in dam releases as a result of the proposed Unit 3 operation could have an impact on aquatic resources below the dam. The study uses hydrologic information, observations of substrate and cover, and application of a model that uses habitat-discharge relationships for a variety of key species to evaluate the effects of different flow regimes. The study also is evaluating changes to shoreline wetlands in five coves of the Lake Anna reservoir where tributary streams interface with the pooled reservoir water, and evaluating the effects of water level changes on dock and boat ramp functionality at selected locations in Lake Anna. The IFIM study is under way, but is not yet complete.

Because the IFIM study results are primarily intended to inform decisions on reservoir management and relies on modeling rather than direct observations of aquatic communities to reach conclusions, the staff believes the IFIM study results will provide additional information concerning optimal flow regimes and can be used to assess cumulative impacts to aquatic resources in the North Anna River. Once the IFIM study and required consultations with VDGIF and VDEQ are complete, the staff will review the final results and incorporate them into the final SEIS, as appropriate.

Based on a review of new information available since preparation of the ESP EIS, the staff concludes that the recent data on aquatic resources in Lake Anna, the WHTF, and the North Anna River downstream of the dam are consistent with previous studies.

2.7.2.2 Threatened and Endangered Aquatic Species

Using information provided in Section 2.4.2.3.5 of the ESP ER (Dominion Nuclear North Anna, LLC 2006a), Section 2.7.2.4 of the ESP EIS (NRC 2006a) states that

> Virginia Power has monitored fish populations in Lake Anna and the North Anna River for more than 25 years. No Federally or State-listed fish species has been collected in any of these monitoring studies, nor has any listed species been observed in creel surveys or occasional special studies conducted by Virginia Power biologists. No Federally or State-listed fish species' range includes Lake Anna or the North Anna River, and none are believed to occur in counties adjacent to Lake Anna or the North Anna River (i.e., Caroline, Hanover, Louisa, Orange, and Spotsylvania Counties).

A similar statement is provided regarding aquatic plants, based on information provided in the ESP ER, suggesting that no listed aquatic plant species have been collected in any of the routine monitoring surveys or in special studies, the ranges of listed aquatic plant species do not include Lake Anna or the North Anna River, and no listed aquatic plant species are believed to occur in the adjacent counties. New fish monitoring studies from Lake Anna and the North Anna River provided by Dominion since preparation of the ESP EIS confirm that no listed fish species have been collected in the study area (Dominion Electric Environmental Services Environmental Biology 2004; Dominion Nuclear North Anna, LLC 2006b; Dominion 2007b, 2008a); however, monitoring of plant species was not conducted.

Three species of aquatic invertebrates that could occur in counties adjacent to or downstream of the Lake Anna reservoir were identified as Federally or State-listed endangered or threatened in the ESP EIS (NRC 2006a): the dwarf wedgemussel *Alasmidonta heterodon*, the James spinymussel *Pleurobema collina*, and the Atlantic pigtoe *Fusconaia masoni* (Table 2-4). Two additional species, the green floater (mussel) *Lasmigona subviridis* and the Virginia Piedmont waterboatman (aquatic insect) *Sigara depressa*, were identified as occurring in the upper Pamunkey River watershed on the VDCR Natural Heritage website (VDCR 2008), but neither species were included on USFWS species lists by county (USFWS 2008). Based on the information provided to the staff by Dominion in support of the COL action, none of the species listed in Table 2-4 have been observed or collected in Lake Anna or the North Anna River during pre-impoundment surveys or in more recent routine monitoring surveys. Although no new information on threatened or endangered species in the vicinity of the ESP site was identified in the applicant’s COL ER (Dominion 2007a), there is potential for all of these species to occur in streams that border Lake Anna or the North Anna River. No information was provided by Dominion on the presence or absence of Federally or State-listed aquatic species inhabiting streams potentially affected by construction of new transmission lines in the NAPS to Ladysmith transmission line right-of-way. The staff expects that future monitoring studies and subsequent management actions, such as the one proposed for mussels in Lake Anna by Dominion (2008b) will assist resource agencies in determining the potential of threatened and endangered species occurring in Lake Anna, the North Anna River, or their tributaries.

Table 2-4. Federal or State Listed Threatened or Endangered Species Known or Likely to Occur in Counties Adjacent to or Downstream from the Lake Anna Reservoir

Scientific Name	Common Name	Counties	Status	Source
Alasmidonta heterodon	Dwarf wedgemussel	Hanover, Louisa, Spotsylvania	FE[(a)], SE[(b)]	VDGIF 2008b USFWS 2008
Pleurobema collina	James spinymussel	Orange, Hanover, Louisa, Caroline, Spotsylvania	FE, SE	VDGIF 2008b USFWS 2008
Fusconaia masoni[(c)]	Atlantic pigtoe	Orange, Hanover, Louisa, Caroline, Spotsylvania	FSOC[(d)], SE	VDGIF 2008b USFWS 2008
Lasmigona subviridis[(c)]	Green floater	Not specified	FSOC, ST[(e)]	VDGIF 2008b VDCR 2008
Sigara depressa	Virginia Piedmont water boatman	Not specified	SE	VDGIF 2008b VDCR 2008

(a) FE - Federal endangered.
(b) SE - State endangered.
(c) Added since publication of ESP EIS (NRC 2006a).
(d) FSOC - Federal species of concern.
(e) ST - State threatened.

2.7.2.3 Aquatic Ecology Monitoring

A description of the aquatic ecology monitoring program conducted in the vicinity of the NAPS site is provided in Section 2.7.2.5 of the ESP EIS (NRC 2006a) and Section 2.4.2 of the ESP ER (Dominion Nuclear North Anna, LLC 2006a). Dominion (or Virginia Power) has monitored fish populations in Lake Anna reservoir and the WHTF since the early 1970s, and in the North Anna River below the dam since the early 1980s. Consistent methods used over many years allow comparisons to be made between years and trends over time to be identified. As previously discussed, Dominion also completed invertebrate and fish surveys in the North Anna River during a period of drought to determine the effect of extended 0.6 m^3/s to 1.2 m^3/s (20 to 40 cfs) releases from the North Anna Dam on fish and invertebrate assemblages. Study results suggested that the biological assemblages observed during and after the drought event were comparable to those observed in previous surveys (Dominion Electric Environmental Services Environmental Biology 2004). Based on recent information provided in the COL ER (Dominion 2007a), Dominion expects to continue its regular aquatic ecology monitoring program of quarterly fish surveys, semi-annual shellfish surveys, and *Hydrilla* sp. inspections. Dominion also updated its monitoring plan in February 2008, proposing to add a smallmouth bass population study in the North Anna River below the dam and to search for mussels to determine whether subsequent shellfish monitoring is necessary (Dominion 2008b). Dominion also expects that the VDGIF will continue its aquatic ecology monitoring in Lake Anna as part of its fishery management responsibilities. Therefore, aquatic ecological monitoring during operation of the proposed Unit 3 most likely would be an extension of the existing Dominion and VDGIF existing monitoring programs, and Dominion does not intend to add any monitoring specific to Unit 3 construction activities, except as discussed above (Dominion Nuclear North Anna, LLC 2006a; Dominion 2007a).

2.8 Socioeconomics

This section describes the socioeconomic resources that could be potentially impacted by the construction, operation, and decommissioning of the proposed Unit 3. The discussion is organized into two major subsections that provide details on demographics and community characteristics. New information that has become available since the ESP EIS (NRC 2006a) was prepared is described, and differences that may affect the conclusions concerning impact levels reached in the ESP EIS are discussed.

2.8.1 Demographics

For the purposes of this analysis, the staff divided the total population within the analytical area into three major groups: (1) residents, who live permanently in the area; (2) transients who may temporarily live in the area but have a permanent residence elsewhere, and (3) migrant workers who travel into the area to work and then leave after their job is done. Transients and migrant workers are not characterized fully by the U.S. Census, which generally captures only resident populations. Detailed characteristics regarding the demographics of the region can be found in Section 2.8.1 of the ESP EIS (NRC 2006a). New information is presented in the following subsections. As part of the review of new information, the staff included in the scope of the socioeconomic analysis data for three counties in the region of interest that were not previously discussed in detail, to determine whether there might be impacts further downstream from the proposed site. A characterization of these counties is included in this section.

2.8.1.1 Resident Population

The information in this section is from the ESP EIS, Section 2.8.1, for the original region of interest (NRC 2006a). Table 2-5 lists the age distribution of the population in three additional downstream jurisdictions – Caroline, Hanover, and King William Counties in 2000 – and compares the populations with the population of Virginia. The age-distributed populations of these counties closely track within 2 to 3 percent of each other. The exception is King William County’s 18-to-24 age group (5.9 percent versus 9.6 percent for Virginia).

Table 2-5. Estimated Age Distribution of Population in 2000

Age Group	Hanover County		Caroline County		King William County		Virginia	
	People	%	People	%	People	%	People	%
Under 18	23,363	27.1	5476	24.8	3433	26.1	1,738,262	24.6
18 to 24	5921	6.9	1643	7.4	781	5.9	679,398	9.6
25 to 44	26,486	30.7	6611	29.9	4140	31.5	2,237,655	31.6
45 to 64	21,391	24.8	5534	25.0	3259	24.8	1,630,867	23.0
65 and over	9159	10.6	2857	12.9	1533	11.7	792,333	11.2
Totals	86,320	100.0	22,121	100.0	13,146	100.0	7,078,515	100.0

Source: USCB 2000b.

Table 2-6 contains data on population, projected population, and annual growth rates for the new area, as well as updated projections for the original region of interest. Between 1990 and 2000, Hanover County population increased 36 percent. During the same period, Caroline and King William Counties experienced a 15 percent and 20 percent population increase, respectively.

Table 2-7 presents updated population estimates for 2006. As shown in this table, all areas, with the exception of Henrico County and the City of Richmond, are experiencing growth at a rate higher than that generally seen in of Virginia. Historically, Caroline and King William Counties both grew more slowly than Louisa, and Orange Counties, while Hanover County grew faster than Louisa and Orange Counties but not as fast as Spotsylvania County. Population projections for the area show growth in Hanover County slowing considerably relative to the growth rates in the other counties. Louisa, Orange, and Spotsylvania Counties still are the centers of population growth near Lake Anna. Generally speaking, all areas are now projected to grow faster than when the analysis in the ESP EIS (NRC 2006a) was prepared.

Table 2-6. Population Growth in Henrico, Louisa, Orange, Spotsylvania, Caroline, Hanover, and King William Counties and the City of Richmond – 1980 to 2030

Year	Henrico County		Louisa County		Orange County		City of Richmond	
	Population	Annual % Growth	Population	Annual % Growth	Population	Annual % Growth	Population	Annual % Growth
1970	154,465		14,004		13,792		249,431	
1980	180,735	1.6	17,825	2.4	18,063	2.7	219,214	-1.3
1990	217,880	1.9	20,325	1.3	21,421	1.7	203,056	-0.8
2000	262,300	1.9	25,627	2.3	25,881	1.9	197,790	-0.3
2010	301,658[(a)]	1.4	33,923	2.8	34,127	2.8	190,039	-0.4
2020	339,703[(a)]	1.2	41,889	2.1	42,021	2.1	187,066	-0.2
2030	379,041[(a)]	1.1	50,739	1.9	50,732	1.9	187,066	0.0
	Spotsylvania County		Caroline County		Hanover County		King William	
1970	16,424		13,925		37,479		7497	
1980	34,435	7.7	17,904	2.5	50,398	3.0	9334	2.2
1990	57,405	5.2	19,217	0.7	63,306	2.3	10,913	1.6
2000	90,395	4.6	22,121	1.4	86,320	3.1	13,146	1.9
2010	134,163	4.0	29,201[(a)]	2.8	105,762	2.1	16,187	2.1
2020	175,402	2.7	36,058	2.1	124,097	1.6	19,119	1.7
2030	217,797	2.2	43,662	1.9	143,959	1.5	22,227	1.5

(a) Projected population for 2010 to 2030; values for 1970 through 2000 are actual census population numbers.
Sources: Weldon Cooper Center 2008; Virginia Workforce Connection 2008

Table 2-7. Population Growth in the Region of Interest – 2000 to 2006

	July 1, 2006	2000 Census	% Change 2000-06
Virginia	**7,642,884**	**7,078,515**	**8.0**
Caroline County	26,731	22,121	20.8
Hanover County	98,983	86,320	14.7
Henrico County	284,399	262,300	8.4
King William County	15,381	13,146	17.0
Louisa County	31,226	25,627	21.8
Orange County	31,740	25,881	22.6
Spotsylvania County	119,529	90,395	32.2
Richmond City	192,913	197,790	-2.5

Source: USCB 2007

2.8.1.2 Transient Population

The transient population includes people who work in or visit large workplaces, schools, hospitals and nursing homes, correctional facilities, hotels and motels, and who appear at recreational areas or special events where there may be seasonal and workday variations in population.

The transient population was characterized in the ESP EIS, Section 2.8.1.1 (NRC 2006a). Dominion has since contacted the Virginia Department of Conservation and Recreation, Louisa County, and King's Dominion Amusement Park, and has received updated information indicating that annual usage has increased at a rate consistent with the increase in population in the area. Staff has examined that data and believes that the new transient population data does not significantly affect the demand for community services in the region of interest.

2.8.1.3 Migrant Labor

Migrant workers are typically members of minority or low-income populations. Because migrant workers travel and can temporarily spend a significant amount of time in an area without being actual residents, they may be unavailable for counting by census takers. If this occurred, migrant workers would be under-represented in the minority and low-income population counts in the U.S. Census Bureau (USCB) data.

Migrant labor is characterized in the ESP EIS, Section 2.8.1.2 (NRC 2006a). Louisa County remains representative of the region, with 474 individual farms (USDA 2002). No new information was found to indicate the number of migrant workers in the area is different from the description in the ESP EIS.

2.8.2 Community Characteristics

The communities potentially most impacted by activities at the NAPS site are Henrico, Louisa, Orange, Spotsylvania Counties, and the City of Richmond, all of which are located in central Virginia. Community characteristics for those areas are provided in the ESP EIS, Section 2.8.2 (NRC 2006a). Additional information on Caroline, Hanover, and King William Counties is presented in this section, but because of the greater commuting distances and times involved in reaching these three counties, it is likely that the areas impacted by construction and operations of the proposed Unit 3 would remain in the counties considered originally. Some changes also have occurred in the community characteristics of the counties considered originally, and those also are considered in this section. However, these changes are not large or extensive enough to affect any impact levels previously determined and, therefore, are not significant.

2.8.2.1 Economy

The information for the original region of interest is provided in the ESP EIS, Section 2.8.2.1 (NRC 2006a). Brief discussions of the economy of each of the counties not considered originally follow, along with updated statistics for the counties considered originally.

Some comparative economic statistics for the three additional counties, along with updated information for original areas, are presented in Tables 2-8, 2-9, 2-10, 2-11, and 2-12. Table 2-8 presents information on the unemployment rate (updated for the entire region to include December 2007), the percentage of individuals below the poverty line for 2000 and 2005, and median household income for 2000 and 2005. Table 2-9 presents information on regional employment trends for Caroline, Hanover, and King William Counties. Table 2-10 contains county employment by proprietorship and industry (1990 and 2000) for the three additional counties. Table 2-11 contains employment by type of employer for 2006 for all counties. Table 2-12 is an aggregation of Table 2-10 and totals employment by industry or business type across the three counties for 1990 and 2000.

Table 2-8. Percent Unemployment, Individual Poverty, and Median Household Income

	Unemployment (% December 2003)	Unemployment (% December 2007)	Poverty (% Estimated 2000/2005)	Median Household Income, $ (2000/2005)
Caroline County	3.8	4.2	9.4/NA	39,845/46,301
Hanover County	2.7	2.6	3.6/5.4	59,223/68,219
Henrico County	3.0	3.0	6.2/8.2	49,185/57,154
King William County	3.3	3.1	5.5/NA	49,876/57,957
Louisa County	4.8	3.5	10.2/NA	39,402/45,786
Orange County	3.5	3.5	9.2/NA	42,889/49,838
City of Richmond	5.3	4.7	21.4/18.5	31,121/34,396
Spotsylvania County	1.9	2.8	4.7/5.7	57,525/66,846
Virginia	3.3	3.2	9.6/10.0	46,677/54,240

Note: Low income was defined as being in a household having an income below the official poverty level.
Sources: USCB 2000b; NRC 2006a; Virginia Employment Commission 2008; city-data.com 2008.

Table 2-9. Regional Employment Trends – 1990 and 2000

County, City, and State	Workers Employed Full-Time and Part-Time 1990	Workers Employed Full-Time and Part-Time 2000	% Change in Workers Employed 1990 – 2000	Unemployment Rate 1990 %	Unemployment Rate 2000 %
Caroline	5733	8033	40.1	7.5	2.2
Hanover	36,586	48,421	32.3	2.8	1.6
King William	4650	4796	3.1	3.1	1.9

Sources: BEA 2000 and NRC 2006a.

Table 2-10. County Full-Time and Part-Time Employment by Type and by Industry

Industry	Caroline County		Hanover County		King William County	
	1990	2000	1990	2000	1990	2000
Total employment	5733	8033	36,586	48,421	4650	4796
Wage and salary employment	4421	5180	30,205	41,121	3760	3929
Proprietors employment	1312	2853	6381	7300	890	867
Nonfarm proprietor employment	5476	2642	5792	6703	750	711
Farm proprietor employment	195	211	589	597	140	156
By Industry						
Farm employment	257	263	758	783	212	205
Agriculture services, fishing, and other	73	(D)	450	(D)	61	117
Mining	16	(D)	133	(D)	10	52
Construction	733	776	5912	6880	372	473
Manufacturing	637	508	4029	4681	1448	866
Transportation and public utilities	352	533	1435	1565	99	80
Wholesale trade	122	131	4284	5248	119	198
Retail trade	959	1420	5620	7684	909	693
Finance, insurance, and real estate	282	713	1828	2808	201	298
Services	916	2076	8935	12,894	664	1073
Government and government enterprises	1386	1487	3202	4783	555	741

D – Not shown to avoid disclosure of confidential information, but the estimates for this item are included in the totals.
L – Fewer than 10 jobs, but the estimates for this item are included in the totals.
Source: BEA 2000.

Table 2-11. County Full-Time and Part-Time Employment by Type, 2006

Industry	Caroline County	Hanover County	Henrico County	King William County	Louisa County	Orange County	Spotsylvania County & Fredericksburg	City of Richmond
Total employment	10,007	56,717	210,999	5180	15,414	12,115	75,896	184,176
Wage and salary employment	5811	46,874	187,019	3972	7540	9856	61,857	174,412
Proprietors employment	4196	9843	23,980	1208	7874	2259	14,039	9764
Nonfarm proprietor employment	3997	9278	23,813	1061	7436	1785	13,749	9764
Farm proprietor employment	199	565	167	147	438	474	290	0
Total Employment, Year 2000	8033	48,421	194,787	4796	11,641	10,558	59,872	196,175
Percent Growth in Total Employment, 2000 to 2006	12.5%	17.1%	8.3%	8.0%	32.4%	14.7%	26.8%	-6.1%

Source: BEA 2006.

Table 2-12. Aggregated Full-Time and Part-Time Employment by Industry or Business Type for Caroline, Hanover, Henrico, King William, Louisa, Orange, and Spotsylvania Counties, Fredericksburg, and the City of Richmond, 1990 to 2006

Industry or Business Type	1990 Employment	2000 Employment	2006 Employment	% Increase or Decrease, 1990-2000	% Increase or Decrease, 2000-2006
Total employment	469,287	534,283	560,497	13.8%	4.9%
Wage and salary employment	419,218	475,978	491,530	13.5%	3.2%
Proprietors employment	50,069	58,305	68,967	16.4%	18.3%
Nonfarm proprietor employment	52,175	55,929	66,886	7.2%	19.6%
Farm proprietor employment	2253	2376	2081	5.5%	-12.4%
By Industry					
Non-Farm Employment	464,045	528,954	555,855	14.0%	5.1%
Farm employment	2989	2953	2561	-1.2%	-13.3%

(a) Summations and percentages are for numbers shown in Table 2-8 (i.e., as with Table 2-8, some county data are not reported because of confidentiality issues). Data at the individual industry level are not comparable between 2006 and the earlier years due to the reorganization of national economic accounts from Standard Industrial Classification (SIC) to the North American Industrial Classification System (NAICS).

Sources: BEA 2000, 2006.

Most of the counties showed unemployment rates in December 2007 below those in December 2003. The single exception was Spotsylvania County, whose extraordinarily low unemployment rate in December 2003 approached the rates in other nearby areas and in Virginia by December 2007. Estimated poverty rates increased after 2000 in all local jurisdictions where estimates were available for 2005. However, median household incomes increased in all the local jurisdictions. As well, 2006 data show that employment continued to grow in all of the jurisdictions except Richmond between 2000 and 2006, the last year for which this data was available.

Employment in Caroline County was approximately 8033 in 2000 (see Table 2-9), but almost 68 percent of working adults commuted out of the county to work (Virginia Employment Commission 2008). The existing employment base in Caroline County represents an increase of 40.1 percent over the 1990 level (Table 2-9). The largest employers in Caroline County are the Caroline County School Board, County of Caroline, U.S. Department of Defense, Highway Service Venture, and Union Bankshares Corporation (Virginia Employment Commission 2008). The unemployment rate in Caroline County was 4.2 percent in December 2007 (Table 2-8), an increase from the annual unemployment rate of 2.2 percent in 2000 (Table 2-7). Caroline County had the third lowest median household income and third highest individual poverty rate of the eight jurisdictions studied (Table 2-8). In percentage terms, the fastest growing employment sectors in Caroline County during the decade of the 1990s were finance, insurance, and real estate (152.8 percent); services (126.6 percent); and transportation and public utilities (51.4 percent) (Table 2-10). The towns of Bowling Green and Port Royal are the only two incorporated towns in Caroline County.

Employment in Hanover County was approximately 48,421 in 2000 (see Table 2-9), but almost 65 percent of working adults commuted out of the county to work (Virginia Employment Commission 2008). The existing employment base in Hanover County represents an increase of 32.3 percent over the 1990 level (Table 2-9). The largest employer (2616 people) is Hanover County Schools. The second largest employer (1200 workers) is Supervalu Eastern Region, a food distribution center (Hanover County Economic Development 2006). The unemployment rate in Hanover County was 2.6 percent in December 2007 (Table 2-8), an increase from the annual unemployment rate of 1.6 percent in 2000 (Table 2-9). Hanover County had the highest median household income and lowest individual poverty rate of the eight jurisdictions studied (Table 2-8). In percentage terms, the fastest growing employment sectors in Orange County during the decade of the 1990s were finance, insurance, and real estate (53.6 percent), government and government enterprises (49.4 percent), and services (44.3 percent) (Table 2-10). The town of Ashland is the only incorporated town in Hanover County.

Employment in King William County was approximately 4796 in 2000 (see Table 2-9), but about 70 percent of working adults commuted out of the county to work (Virginia Employment Commission 2008). The existing employment base in King William County represents an increase of 3.1 percent over the 1990 level (Table 2-9). The largest employer (over 500 people) is Smurfit Stone, a paperboard mill. Other large employers (100 to 199 employees) are Nestle Purina Pet Care, Food Lion, and West Point Veneer (King William County 2008). The unemployment rate in King William County was 3.1 percent in December 2007 (Table 2-8), an increase from the annual unemployment rate of 1.9 percent in 2000 (Table 2-9). King William County had the third highest median household income and sixth highest individual poverty rate of the eight jurisdictions studied (Table 2-8). In percentage terms, the fastest growing employment sectors in King William County during the decade of the 1990s were mining (420 percent), agricultural services (91.8 percent), and wholesale trade (66.4 percent) (Table 2-10). The town of West Point is the only incorporated town in King William County.

Table 2-11 shows that employment in the region grew steadily during the 1990s and continued this growth trend in the post-2000 period. With growth in population and urban growth, the post-2000 period has continued the earlier trend of displacement of the farm economy by non-farm activity. Economic trends identified in the ESP EIS (NRC 2006a) have continued and are not significantly affected by including the details for three additional counties.

2.8.2.2 Transportation

A characterization of the transportation system is provided in the ESP EIS, Section 2.8.2.2 (NRC 2006a). Dominion reviewed highway plans within updated comprehensive county plans for Hanover, Louisa, and Spotsylvania Counties, and did not find any new information indicating a timetable for upgrades to existing routes (although interest in upgrades is still indicated) or new sources of funds for upgrades. The NRC staff has reviewed the record of Dominion's efforts to obtain new information concerning highway traffic counts, level-of-service information, and construction plans.

Specifically, The ESP EIS identifies U.S. Highway 522 and State Routes 208, 618, 652, and 700 as having a level-of-service (LOS) designation of B. State Route 606 has been designated a LOS generally of D or better. Dominion reported that they contacted the Virginia Department of Transportation (VDOT) in July 2007 regarding new and/or updated information on traffic counts and LOS information for these commuting routes leading to the NAPS site. VDOT responded in August 2007 that it did not have specific information on the LOS for these routes. In addition, no new traffic counts had been completed since preparation of the ESP EIS.

Road improvements for U.S. Highways 33 and 522 and SRs 22, 208, 606, 618, 652, and 700 are recommended in the Louisa County Draft Comprehensive Plan of 2001 and the Spotsylvania County Approved 2002 Comprehensive Plan. Traffic resulting from additional people commuting to the NAPS site would increase on these routes but would be alleviated with the implementation of a construction traffic management plan prior to the start of general plant construction and road improvements outlined in the comprehensive county plans. The Louisa County Comprehensive Plan was updated in 2006. This plan does not provide new and significant information on the schedule or funding of the recommended road improvements and is consistent with the conclusions provided in the North Anna ESP EIS.

While upgrading to SR 208 has been initiated, as projected in the ESP EIS, staff believes that no additional information has become available that would significantly change the description of the local road network or the ability of the jurisdictions in the region to upgrade them.

2.8.2.3 Property Taxes

A detailed characterization of property taxes is provided in the ESP EIS, Section 2.8.2.3 (NRC 2006a). Dominion did not present any new information since preparation of the ESP EIS.

2.8.2.4 Aesthetics and Recreation

A detailed characterization of aesthetics and recreation is provided in the ESP EIS, Section 2.8.2.4 (NRC 2006a). Dominion contacted officials in the area and determined that no noise complaints had been filed, and that the site remains screened from public view. Staff has reviewed this new information and believes that there is no significant change to site noise or visual aesthetics of the NAPS site.

2.8.2.5 Housing

A detailed characterization of housing in the area is provided in the ESP EIS, Section 2.8.2.5. (NRC 2006a) Dominion contacted county officials and determined that the issuance of housing permits in Louisa County is higher than reported in the ESP EIS (NRC 2006a). Updated information on building permit data was obtained from the Louisa County Community Development Director in July 2007. According to this source, more than 400 single-family housing permits have been issued each year since 2004. The number has fluctuated, as would be expected, with approximately 700 units in 2004, 800 in 2005, 600 in 2006. If trends continue, approximately 550 new building permits could be expected in 2007. These changes represent higher numbers than reported in the ESP EIS, and indicate an overall positive trend. The 2005 Orange County Comprehensive Plan (amended in both 2006 and 2007) (Orange County Comprehensive Plan 2007) indicates a 2005 housing stock of 13,436 units, 2082 more than in the year 2000. Data for housing in these additional counties is included in Tables 2-13 and 2-14, and updated data for 2006 in selected counties is included in Table 2-15. Except as discussed above, updated data were not available for the counties with lesser populations (Louisa, Orange, Caroline, and King William Counties). Though not all increased vacant housing stock would be appropriate housing for in-migrants drawn by the construction and operation of the proposed Unit 3, the available data show significant growth in the housing stock and available housing stock

Table 2-13. Housing Units and Housing Units Vacant (Available) by County – 1990 and 2000

	1990	2000	Approximate Percentage Change
Caroline County			
Total housing units	7292	8889	21.9
Occupied units	6631	8021	21.0
Owner occupied	5303	6571	23.9
Renter occupied	1328	1450	9.2
Vacant units	661	868	31.3
Hanover County			
Total housing units	23,727	32,196	35.7
Occupied units	22,628	31,121	37.5
Owner occupied	18,892	21,918	16.0
Renter occupied	3767	9203	44.3
Vacant units	1099	1075	-2.1
King Williams County			
Total housing units	4193	5189	23.8
Occupied units	3834	4846	26.4
Owner occupied	3114	4118	32.2
Renter occupied	720	728	1.1
Vacant units	359	343	-4.5

Sources: USCB 1990, 2000b.

(vacancies) in Hanover, Henrico, and Spotsylvania Counties and a continued increase in available stock in the City of Richmond, mainly because of population declines.

2.8.2.6 Public Services

A characterization of public services was provided in the ESP EIS, Section 2.8.2.6 (NRC 2006a). That analysis has been expanded to include the additional three downstream counties and new data that has become available since the ESP EIS was completed. The NRC staff has decided to further evaluate water consumption plans in Hanover, Caroline, and King William Counties.

Water Supply

Updated information on the major public water systems in the region is contained in Table 2-16.

Hanover County's water system provides water to about 19,292 water customers through 11 wells (one of which is currently out of service), two surface water treatment plants (one of which is currently out of service), and purchases from the City of Richmond and Henrico County. The Doswell Water Treatment Plant is rated at 15,142 m^3/d (4 MGD) and draws from

Table 2-14. Vacant Housing Units for Caroline, Hanover, and King William Counties – 2000

	Number	Percent of Vacant Units
Caroline County		
Vacant housing units	868	
For rent	92	10.6
For sale only	137	15.8
Rented or sold, not occupied	33	3.8
For seasonal, recreational or occasional use	273	31.5
For migratory workers	15	1.7
Other vacant	318	36.6
Hanover County		
Vacant housing units	1075	
For rent	253	23.5
For sale only	258	24.0
Rented or sold, not occupied	142	13.2
For seasonal, recreational or occasional use	73	6.8
For migratory workers	2	0.2
Other vacant	347	32.3
King Williams County		
Vacant housing units	343	
For rent	33	9.6
For sale only	50	14.6
Rented or sold, not occupied	31	9.0
For seasonal, recreational or occasional use	85	24.8
For migratory workers	1	0.3
Other vacant	143	41.7

Source: USCB 2000b.

the North Anna River. The South Anna Water Treatment Plant, rated at 7571 m^3/d (2.0 MGD), and drawing from the South Anna River is currently out of service, and would require substantial upgrades and rehabilitation before it could be returned to service. There are a total of 11 wells with a capacity of 4164 m^3/d (1.1 MGD), although the 2461 m^3/d (0.65 MGD) Garthright well facility is currently out of service. Hanover County receives additional water supplies through long-term contracts with the City of Richmond for 56,481 m^3/d (15 MGD) (for service to the Suburban Service Area) and Henrico County for 2934 m^3/d (0.775 MGD) (for service to the SR 33 area). The Henrico County contract extends through June 2014, and the City of

Table 2-15. Selected County Housing Statistics for 2006[(a)]

	Hanover County	Change Since 2000	Henrico County	Change Since 2000	Spotsylvania County	Change Since 2000	City of Richmond	Change Since 2000
Total housing units	37,033	4837	124,595	12,025	43,544	10,215	93,811	1529
Occupied units	35,000	3879	115,445	7324	41,381	10,073	81,193	-3336
Owner occupied	28,492	7024	78,757	7668	33,839	8104	37,339	-1669
Renter occupied	6508	-2695	36,688	-344	7542	1969	43,854	-1687
Vacant units	2033	958	9150	4701	2163	142	12,618	4885

(a) Data not available for all areas.
Sources: USCB 2006a; NRC 2006a.

Richmond contract extends through June 2035, with an additional 18,927 m^3/d (5 MGD) incremental capacity purchase available beginning in 2010. While groundwater resources are restricted by quality and quantity concerns, the county estimates that the incremental increase of 18,927 m^3/d (5 MGD) from the City of Richmond, along with other water sources, should be sufficient for the county through the 2020 to 2025 time period (Hanover County Comprehensive Plan 2007-2027, Section 3: Public Utilities 2007).

Caroline County is served by two systems, the Caroline County Utility System and the Milford Sanitary System. The Caroline County Utility System draws from six wells, with a capacity of 0.03 m^3/s (392 GPM). The Milford Sanitary System draws from two wells with a capacity of 0.009 m^3/s (135.5 GPM). The Towns of Bowling Green and Port Royal operate their own public water systems. There also are a number of private central water distribution systems scattered throughout the county, mostly associated with subdivision development. The three largest private systems draw 2194 m^3/d (0.5796 MGD), with 1802 m^3/d (0.476 MGD) drawn from surface water sources, while the rest rely on groundwater. While groundwater sources are most likely sufficient in the near future, Caroline County is beginning to explore surface water sources, including the Rappahannock, Mattaponi, and Pamunkey Rivers for long-term water needs (Caroline County Comprehensive Plan 2006-2026, Section 6: Public Facilities 2008). The Town of Bowling Green is served by four wells and three storage tanks totaling 1363 m^3 (360,000 gal) of storage (Town of Bowling Green 2005). The Town of Port Royal serves 199 people with one well with a pumping capacity of 0.005 to 0.007 m^3/s (80 to 110 GPM), producing about 74 m^3/d (19,600 GPD) (Port Royal Community Plan 2004).

Table 2-16. Major Public Water Supply Systems in Caroline, Hanover, Henrico, King William, Louisa, Orange, and Spotsylvania Counties

Water System	Source	Daily Capacity m^3/day (MGD)	Average Daily Use m^3/day (MGD)	Area Served
Henrico County	James River	NA	130,000 (35)	Henrico, Hanover and Goochland Counties
City of Richmond	James River	484,000 (128)	310,000 (83)	Richmond, Chesterfield, Hanover, and Henrico Counties
Louisa County Water Authority	Groundwater/NE Creek Reservoir	3800 (1)	1100 (0.3)	Towns of Louisa, Mineral, and some County residents
Town of Orange	Rapidan River	7600 (2)	5700 (1.5)	Town of Orange
Rapidan Service Authority	Groundwater	NA	75 (0.02)	Town of Grodonsville, plus 50 to 60 homes on Route 20
Wilderness Treatment Plant	Rapidan River	6100 (1.6)	1500 (0.4)	Town of Wilderness/Lake of the Woods
Spotsylvania County	Ni River	23,000 (6)	17,000 (4.5)	Supplies most residential, commercial, and industrial areas in the county
Hanover County	North Anna River, Ground Water, City of Richmond, Henrico County	(7.1), with purchase capacity of (15.775)	(3.59)	Hanover County
Caroline County	Groundwater	(527.5 gpm)	(330,000 GPD)	Caroline County minus Towns of Bowling Green and Port Royal
Town of Bowling Green	Groundwater	(189,000 GPD)	(140,000 GPD)	Town of Bowling Green, Rt. 2 corridor north to Rt. 631 and south to Maury Heights subdivision
Port Royal	Groundwater	(19,600 GPD)	(12,000 GPD)	Town of Port Royal
King William County	Groundwater	312,000 gallon water storage tanks	(530,000 GPD)	Central Garage Area, King William County Industrial Park, King William County Courthouse complex

NA = not available.
Sources: NRC 2002a; Hanover County Comprehensive Plan 2007 to 2027, Section 3: Public Utilities 2007; Caroline County Comprehensive Plan 2006 to 2026, Section 6: Public Facilities 2008; Town of Bowling Green 2005; County of Caroline 2006; Port Royal Community Plan 2004; King William County Comprehensive Plan. Chapter VI - Community Assets and Facilities 2003; City-Data.Com 2008.

King William County is primarily served by private wells, although there are three small public systems that draw from groundwater sources. These three areas are supplied by three storage tanks of 1134, 38, and 7.6 m^3 (300,000, 10,000, and 2000 gal) capacities that draw from wells. Only the 1134 m^3 (300,000 gal) storage tank is treated (King William County Comprehensive Plan. Chapter VI - Community Assets and Facilities 2003).

Police, Fire, and Medical

No new and significant information was identified for the counties discussed in the ESP EIS (NRC 2006a).

In Hanover County, there is no hospital, but there are medical facilities. The fire department is a combination of professional and volunteer personnel. The sheriff's department provides most of the law enforcement within the county.

In Caroline County, there is no hospital but there are medical facilities. The fire department is headed by a professional, but relies on volunteers for fire and rescue operations. A sheriff's department and state police officers assigned to the county provide police protection to the county; additionally, the Town of Bowling Green maintains its own police department.

The information for this section for the previously considered counties is provided in the ESP EIS, Section 2.8.2.6 (NRC 2006a). Dominion did not find any new information for those counties that would be likely to change the level of impacts previously stated in the ESP EIS.

2.8.2.7 Education

A detailed characterization on education is included in the ESP EIS, Section 2.8.2.7 (NRC 2006a). Updated information on public schools is included in this section.

Henrico County School District enrolled 47,958 students in the school year 2007 to 2008 (up 6965 from the 41,000 figure in the school year 2000 to 2001, as discussed in the ESP EIS) and has 44 elementary schools, 13 middle schools, 9 high schools, and 2 technical centers (Henrico County Public Schools 2008). Richmond City schools declined in enrollment from 27,237 in the school year 2000 to 2001 to 23,771 in the school year 2007 to 2008, a net loss of 3466 students (Virginia Department of Education 2008).

Louisa County Public Schools project an enrollment of 4695 in the school year 2008 to 2009 (up 463 from 4232 in 2000 to 2001 discussed in the ESP EIS), and are in the process of building a new elementary school (Louisa County Public Schools 2008). The new elementary school is currently scheduled to open in November 2009.

Orange County Public Schools enrolled 5167 students in the school year 2007 to 2008 (up 869 from 4200 discussed in the ESP EIS), with 5 elementary schools, 2 middle schools, and 1 high school (Virginia Department of Education 2008).

Spotsylvania County Public Schools enrolled 24,465 students in the 2007 to 2008 school year (up 3765 from the total of about 20,700 reported in the ESP EIS), with 16 elementary schools, 7 middle schools, 5 high schools, and 3 technical/alternative schools (Spotsylvania County Public Schools 2008).

Hanover County has 14 elementary, 1 alternative, 4 middle schools, and 4 high schools which service the needs of about 20,000 students (Hanover County Public Schools 2008).

Caroline County serves more than 4400 students with 4 elementary, 1 middle school, and 1 high school (Caroline County Public Schools 2008).

King William County annually instructs approximately 2800 students in its middle school, high school, and 2 elementary schools. King William County also offers an alternative school for at-risk students, as well as a providing a center specifically for adult education (King William County Public Schools 2008).

2.9 Historic and Cultural Resources

This section discusses the cultural background and the known and potential historic and cultural resources at the NAPS site and the immediate surrounding area.

2.9.1 Cultural Background

The area surrounding the NAPS site has a variety of prehistoric and historic Native American and historic Euro-American resources. For more specific details as to the variability and cultural context of these resources refer to the ESP EIS (NRC 2006a).

2.9.2 Historic and Cultural Resources at the NAPS Site

Previous cultural resource investigations at the NAPS site have established the presence of both historic and prehistoric (prior to European contact) resources. Several existing literature and database sources were consulted, along with direct contacts to several organizations.

Cultural resource investigations from 1969 to 2006 are referenced in the ESP EIS. The findings of these investigations were minimal with both the NAPS site boundary and the lake-bed area yielding few resources. The 2006 investigation for the ESP site reported no cultural resources with the exception of two previously recorded historic cemeteries (44LS0221 and 44LS0222).

One field investigation and associated background research was completed by The Louis Berger Group in 2007 for the COL ER. This investigation was completed to account for changes in cooling system design for the proposed Unit 3 site.

The newly identified resources include one isolated find of quartz debitage (labeled LA-3691-01), one historic cemetery (labeled 44LS0227), and one historic site (labeled 44LS0226) determined to be potentially eligible for the National Register of Historic Places. Through COL ER-related field investigation, and map verification at the COL site audit, it was determined that one of the previously identified cemeteries (44LS0222) had been mapped incorrectly in the ESP

ER, and both The Louis Berger Group and VDHR records had the cemetery placed in one of the NAPS site substation switchyards. The VDHR was notified and appropriate records will be corrected.

For a more detailed description of historic and cultural resources at the proposed Unit 3 site, refer to the ESP EIS (NRC 2006a).

2.9.3 Native American Consultation

Following the precedent established during the North Anna ESP process, the following groups were consulted in association with the COL for the proposed Unit 3.

- Chickahominy Indian Tribe
- Chickahominy Indians – Eastern Division
- Mattaponi Indian Tribe
- Monacan Indian Nation
- Nansemond Indian Tribe
- Pamunkey Indian Tribe
- Rappahannock Tribe
- Upper Mattaponi Indian Tribe
- Tuscacora Nation
- Virginia Council on Indians

In addition, further consultation with the Virginia Department of Historic Resources resulted in an additional six groups added to this list for consultation. Those groups were:

- United Keetoowah Band of Cherokee Indians in Oklahoma
- Catawba Indian Nation
- Eastern Band of Cherokee Indians in Oklahoma
- Shawnee Tribe
- Eastern Shawnee Tribe of Oklahoma
- Tuscarora Nation

2.10 Environmental Justice

Environmental justice refers to a Federal policy under which each Federal agency identifies and addresses, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority or low-income populations.[a] Through Executive Order, the Council on Environmental Quality (CEQ) has provided guidance for addressing environmental justice (CEQ 1997). Although it is not subject to the Executive Order, the Commission has voluntarily committed to undertake environmental justice reviews. On August 24, 2004, the Commission issued its policy statement on the treatment of environmental justice matters in licensing actions (69 FR 52040).

Section 2.10 of the ESP EIS (NRC 2006a) described the existing demographic and geographic characteristics of the proposed NAPS site and its surrounding communities. It offered a general description of minority and low-income populations within the region surrounding the site. The characterization in this section updates that discussion and considers any new data that available on minority and low-income populations. The characterization of populations of interest includes an assessment of “populations of particular interest or unusual circumstances” such as minority communities exceptionally dependent on subsistence resources or identifiable in compact locations, such as Native American settlements.

2.10.1 Analysis

The staff considered population data that have become available since the ESP EIS was prepared. The new data indicate that there has been growth in the minority and low-income populations, but do not provide any additional information concerning the locations of these populations. The best location indicator is still the 2000 Census of Population and the figures found in Section 2.10 of the ESP EIS (NRC 2006a). The data in the ESP EIS indicated that concentrations of minority and low-income populations exist in within an 80-km (50-mi) radius of the NAPS site.

(a) Minority categories are defined as American Indian or Alaskan Native; Asian; Native Hawaiian or other Pacific Islander; Black races; or Hispanic ethnicity; “other” may be considered a separate minority category. Low income refers to individuals living in households meeting the official poverty measure. To see the U.S. Census definition and values for 2000, visit the US Census website at: http://ask.census.gov/.

Repeating a summary of that analysis:

> Within 32 km (20 mi) of NAPS, a minority population is concentrated to the southwest of the site in Louisa County. Black minority populations exist within approximately 24 km to 48 km (15 mi to 30 mi) east-southeast of the site on Caroline County's boundary with Hanover County and extending to King William County. Between approximately 64 km (40 mi) and 80 km (50 mi) east of the ESP site, minority populations exist in Essex and Westmoreland Counties. A concentration of minority census block groups exists in Charles County (Maryland) and Prince William County (Virginia), east-northeast of the NAPS site. Between 64 km (40 mi) and 80 km (50 mi) southeast of NAPS, there is a concentration of minority census block groups in the Richmond area, and to the south-southwest a concentration in Buckingham, Fluvanna, Goochland, and Cumberland Counties. Minority populations also appear in Culpeper County northwest of the North Anna site. All minority block groups are more than 16 km (10 mi) from NAPS (NRC 2006a).

Concerning low-income populations, the ESP EIS reported:

> Census block groups containing low-income populations are concentrated in the City of Richmond. Also, Henrico and Chesterfield Counties, to the southeast between approximately 65 km and 80 km (40 mi and 50 mi) from the North Anna site, have low-income populations. Other areas of low-income populations include Buckingham County southwest of the site and Charlottesville.

The closer proximity low-income populations were located in the same locations (same census block groups) as the closer proximity minority populations, so none are within 16 km (10 mi) of the NAPS site. Based on the estimated property values around Lake Anna, it is unlikely that there is a concentration of low-income persons living at Lake Anna itself.

Table 2-17 shows the estimated changes in population, minority population, and low-income population for the nearest counties to the NAPS site since the 2000 Census.

Although detailed geographical estimates of the changes in minority and low-income status of populations are not available in the geographic detail available in the 2000 Census and used in the ESP EIS to identify minority and low-income populations, Table 2-17 indicates that at the county level, despite significant population growth, the overall picture concerning minority and low-income populations has not changed dramatically. Based on the data available, all of the

Table 2-17. Summary of County-Level Changes in Population and Minority and Low-Income Status of Populations near the NAPS Site, 2000 to 2006

Jurisdiction	Estimated Total Population 2006	Percent Minority 2006	Percent Minority 2000 Census	Percent Growth in Population 2000-2006	Percent Growth in Minority Population 2000-2006	Percent Low Income 2006	Percent Low Income 2000 Census
Caroline County	26,731	34.2%	38.1%	20.8%	8.3%	NA	9.4%
Hanover County	98,983	13.3%	12.3%	14.7%	23.6%	5.4%	3.6%
Henrico County	284,399	36.6%	32.3%	8.4%	23.0%	8.2%	6.2%
King William County	15,381	23.5%	26.7%	17.0%	3.1%	NA	5.5%
Louisa County	31,226	21.6%	23.9%	21.8%	10.4%	NA	10.2%
Orange County	31,740	16.8%	16.6%	22.6%	24.5%	NA	9.2%
City of Richmond	192,913	60.3%	62.2%	-2.5%	-5.5%	18.5%	21.4%
Spotsylvania County	119,529	23.9%	18.8%	32.2%	68.4%	5.7%	4.7%
Fredericksburg City	21,273	30.6%	28.9%	10.3%	17.0%	NA	15.5%
Virginia	7,642,884	31.3%	29.9%	8.0%	13.0%	10.0%	9.6%

Sources: USCB 2000a, 2000b; USCB 2006a, 2006b.

local jurisdictions shown in the table have grown faster than Virginia as a whole, with the exception of the City of Richmond, which continues to lose population. The Virginia minority population appears to have grown faster than the population as a whole, leaving Virginia with a larger percentage of minority individuals. The larger counties in the table (Hanover, Henrico, and Spotsylvania-Fredericksburg City) also appear to have followed this pattern, with slightly higher percentages of minorities, while Richmond and the smaller counties (Caroline, King William, and Louisa Counties) have slightly lower percentages. Orange County has remained approximately constant over the period. Virginia has a slightly greater percentage of low-income people in 2006 than it did in 2000. Richmond seems to have a lower percentage of low-income people, while the remaining larger counties have a greater percentage of low-income populations. No data are available for the smaller counties.

2.10.2 Scoping and Outreach

As part of the analysis in the ESP EIS (NRC 2006a) the staff conducted socio-economic interviews (NRC 2006c) with local officials including directors of social services and other contacts in the three counties surrounding the NAPS site (see Figures 2-4 and 2-5), and asked (1) whether the contact knew of any other areas containing minority and low-income populations that were not reflected in the map and (2) whether the contact knew of anyone who was

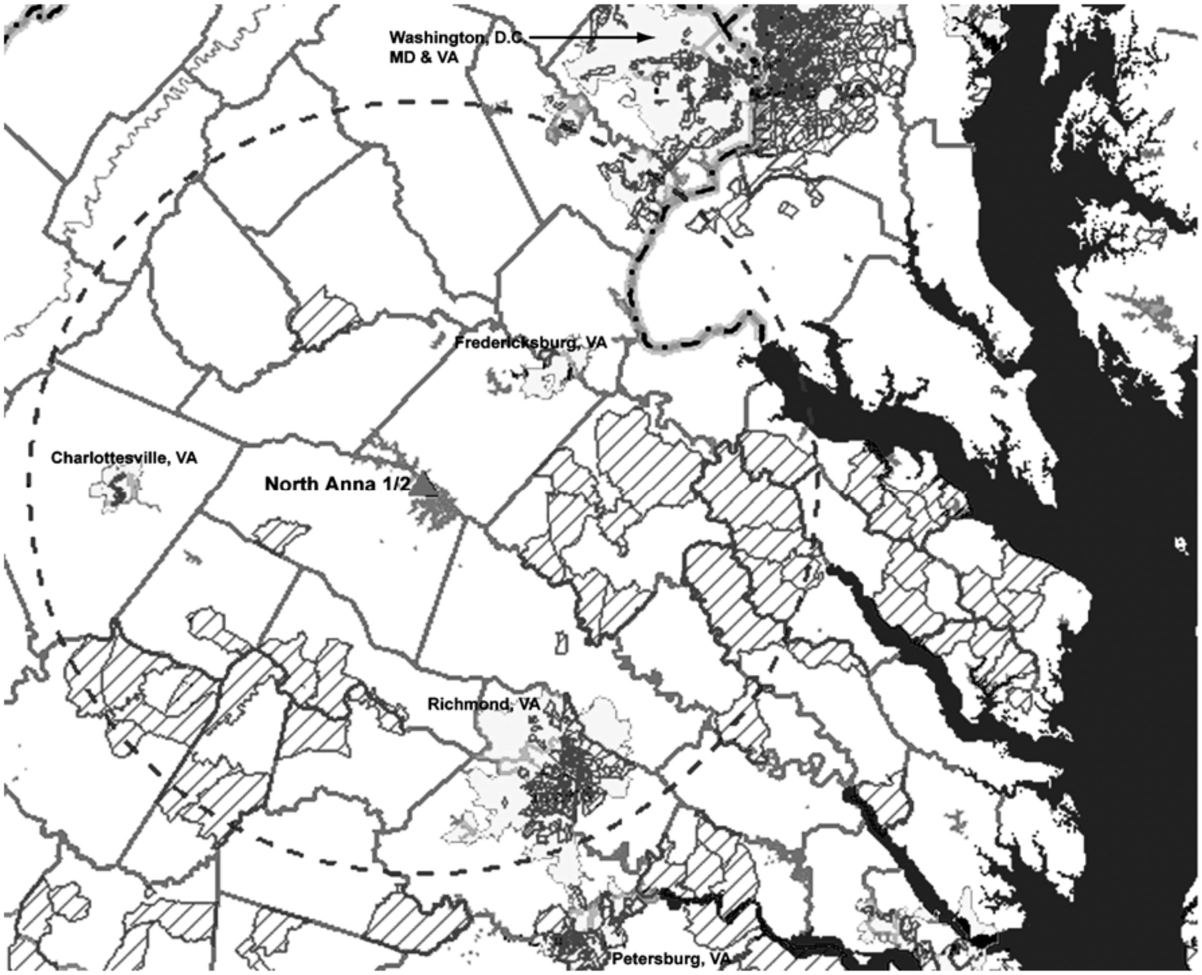

Figure 2-4. North Anna Census 2000 Environmental Justice Minority Populations (crosshatched areas) Within an 80 km (50 mi) Radius of the NAPS ESP Site (Dominion Nuclear North Anna, LLC 2006a)

practicing subsistence fishing or subsistence agriculture. No additional minority and low-income populations were identified and no subsistence activities were identified in this process. Accordingly, none were mentioned in the letter report. Moreover, no additional populations, resource dependencies, or activities such as subsistence fishing and agriculture and no populations of special interest such as migrant farm workers were identified in the scoping meetings, two full rounds of public meetings and public comments, or in responses to letters sent to the list of contacts in Appendix B of the ESP EIS. Thus, while the staff continued to look for and consider any new and significant information concerning environmental justice matters, the staff assumed as a working hypothesis that the

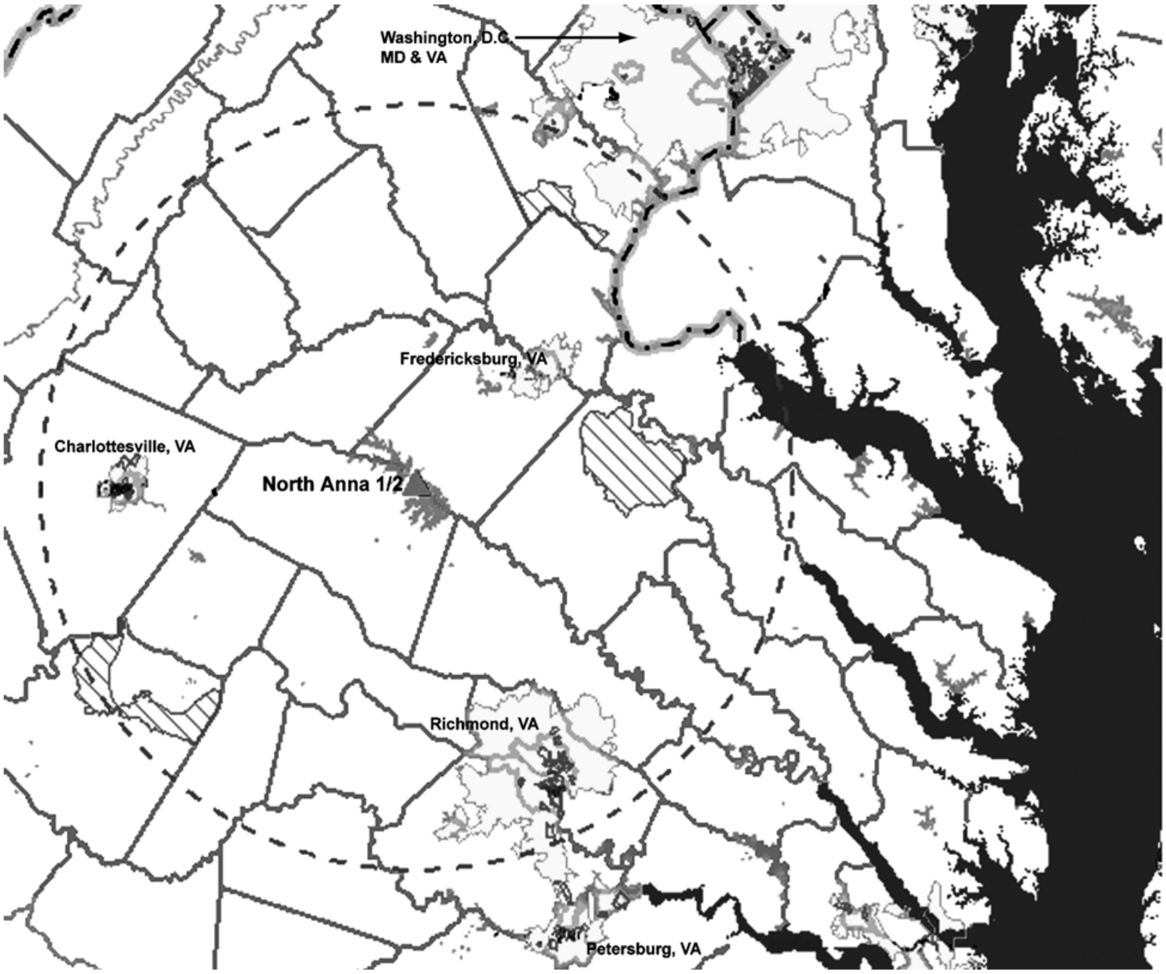

Figure 2-5. North Anna Census 2000 Environmental Justice Low Income Populations (crosshatched areas) Within an 80 km (50 mi) Radius of the NAPS ESP Site (Dominion Nuclear North Anna, LLC 2006a)

census block groups identified in Figures 2-4 and 2-5 of the ESP EIS and repeated in the SEIS marked the locations of the relevant minority and low-income populations.

Comments received in scoping for the proposed Unit 3 SEIS suggested that downstream counties along the North Anna River might be affected by the construction and operation of the proposed Unit 3. The analysis has been expanded to include downstream minority and low-income populations, particularly those who may be engaged in subsistence fishing in the North Anna and Pamunkey Rivers downstream from Lake Anna. A web search revealed that the Pamunkey Indians have a hatchery and a self-described subsistence fishery for shad on the Pamunkey River on their reservation near King William, Virginia.

2.10.3 Health Preconditions and Special Circumstances of the Minority and Low-Income Populations

The staff's outreach and scoping activity identified special socioeconomic and heath circumstances and potential pathways for disproportionate health and environmental impacts, which are analyzed in Sections 4.8, 4.9, 5.8, and 5.9. The staff gathered data on mortality statistics and selected disease and health outcomes statistics of the total and minority populations in 1999 and 2005 for the Commonwealth of Virginia and the jurisdictions most likely to be affected by the construction and operation of the proposed Unit 3, all within the 80-km (50-mi) radius of the NAPS site. Data are shown in Table 2-18. Local death rate and chronic condition data are not available by income level.

Table 2-18 shows that the death rates in the individual jurisdictions are volatile and do not follow any systematic relationship to time, ethnicity, or location. In general, the crude death-rate data depend on very small numbers, especially for infant deaths. Also, age-adjusted, death-rate data should be reported rather than crude death-rate data; however, adjustments could be made with the data available for the different population age structures statewide and those of the individual jurisdictions or for differences among ethnic groups.

2.10.4 Migrant Populations

The USCB defines a migrant worker as an individual employed in the agricultural industry in a seasonal or temporary nature and who is required to be absent overnight from their permanent place of residence. From an environmental justice perspective, there is a potential for such groups in some circumstances to be disproportionately affected by emissions in the environment. However, seasonal farm workers are rare in the counties surrounding the NAPS site. In addition, nothing is known about both the race and ethnicity of this population group or about how this picture may have changed since the 2002 Census of Agriculture.

2.10.5 Environmental Justice Conclusion

In the ESP EIS (NRC 2006a), the NRC staff found low-income and minority and low-income populations that exceeded the percentage criteria established for environmental justice analyses. Consequently, the staff performed additional analyses before making a final environmental justice determination. These analyses can be found in Chapter 4 of the ESP EIS for construction effects, and in Chapter 5 for operational effects. The staff determined that while new data available since the ESP EIS was prepared reveal some changes to the circumstances of the minority and low-income populations, these changes are unlikely to affect any conclusions previously reached concerning disproportionate adverse environmental impacts on these populations.

Table 2-18. Selected Health and Mortality Statistics for Minority and White Population in Selected Jurisdictions near North Anna, and the Commonwealth of Virginia, 1999 and 2006

	Resident Infant Mortality per 1000 Live Births			Crude Death Rate per 1000,000 Residents		Heart Attack Crude Death Rate per 1000,000 Residents		Cancer Crude Death Rate per 100,000 Residents	
	Black Infant Death Rate, Number of Deaths	**Hispanic Infant Death Rate, Number of Deaths**	**White Infant Death Rate, Number of Deaths**	**Black Death Rate, Number of Deaths**	**White Death Rate, Number of Deaths**	**Black Death Rate, Number of Deaths**	**White Death Rate, Number of Deaths**	**Black Death Rate, Number of Deaths**	**White Death Rate, Number of Deaths**
2005									
Caroline	No Deaths	No Deaths	No Deaths	861.0, 68	895.2, 155	177.3, 14	283.0, 189	253.2, 20	207.9, 36
Hanover	19.6, 2	No Deaths	3.3, 3	909.1, 88	738.1, 637	196.3, 19	185.4, 160	237.6, 23	185.4,160
Henrico	20.4, 24	3.5, 1	7.2, 18	541.5, 423	1021.4, 1911	101.1, 79	240.0, 449	139.5, 109	216.5, 405
King William	No Deaths	No Deaths	No Deaths	1053.3, 32	692.3, 79	296.2, 9	149.0, 17	197.5, 6	184.0, 21
Louisa	18.9, 1	No Deaths	6.1, 2	1298.9, 77	745.8, 178	303.6, 18	196.9, 47	320.5, 19	180.2, 43
Orange	No Deaths	No Deaths	6.0, 2	861.9, 35	1117.1, 90	147.7, 6	300.5, 78	246.2, 10	339.0, 38
City of Richmond	17.2, 30	9.7, 3	7.5, 9	1202.6, 1327	996.4, 794	261.0, 288	249.7, 149	251.0, 277	210.8,168
Spotsylvania	26.5, 5	No Deaths	6.8, 9	517.1, 90	535.9, 516	120.7, 21	129.8, 125	132.1, 23	122.5, 118
Fredericksburg City	20.6, 2	No Deaths	4.3, 1	977.1, 43	939.6, 149	181.8, 8	201.8, 32	340.8, 15	208.1, 33
Virginia	14.4, 319	5.2, 68	5.9, 427	762.3, 11753	799.7, 44940	178.5, 2752	199.0, 11993	177.5, 2736	192.4, 10, 821
1999									
Caroline	31.6, 3	No Deaths	5.5, 1	922.6, 86	860, 114	236.0, 22	NA	257.5, 24	NA
Hanover	11.9, 1	No Deaths	3.0, 3	723.6, 74	740, 518	156.5, 16	NA	146.7, 15	NA
Henrico	21.3, 22	10.5, 1	5.1, 12	728.0, 413	1010, 1821	218.6, 124	NA	167.4, 95	NA
King William	No Deaths	No Deaths	13.8, 2	696.8, 31	700, 62	134.9, 6	NA	247.2, 11	NA
Louisa	No Deaths	No Deaths	3.9, 1	810.0, 60	980, 171	256.5, 19	NA	121.5, 9	NA
Orange	No Deaths	No Deaths	No Deaths	587.8, 26	1200, 252	158.3, 7	NA	180.9, 8	NA
City of Richmond	16.5, 32	No Deaths	6.3, 6	1139.2, 1269	1370, 1034	271.1, 302	NA	255.8, 285	NA
Spotsylvania	No Deaths	No Deaths	4.1, 4	630.5, 70	680, 452	180.1, 20	NA	135.1, 15	NA
Fredericksburg City	21.5, 2	No Deaths	7.6, 2	952.6, 44	1150, 172	151.5, 7	NA	216.5, 10	NA
Virginia	12.9, 284	6.7, 37	5.6, 379	846.9, 11726	820, 42401	221.7, 3070	NA	198.5, 2479	NA

Note: Except for infant deaths, Hispanic death rates were not available for either year at the individual jurisdiction level. White rates were not available by cause at the jurisdictional level for 1999.
Sources: VDH 2002; VDH 2007b.

2.11 Related Federal Projects and Consultations

Related Federal projects and consultations are reviewed in Section 2.11 of the ESP EIS (NRC 2006a). The staff reviewed the possibility that activities of other Federal agencies might impact the issuance of a COL for proposed Unit 3. Any such activities could result in cumulative environmental impacts and the possible need for another Federal agency to become a cooperating or coordinating agency for preparation of this SEIS (10 CFR 51.10(b)(2)).

The Nuclear Regulatory Commission and the U.S. Army Corps of Engineers (USACE) revised their interagency agreement regarding environmental reviews for proposed nuclear plants as well as significant actions at existing plants in September 2008. Thus, the USACE will become a coordinating agency for this SEIS. Under the terms of the agreement, the NRC will be the lead NEPA agency for preparing the SEIS for NAPS site Unit 3 and will coordinate with the USACE to address Clean Water Act permitting requirements. The USACE will complete an independent permit decision regarding protection of U.S. waters and wetlands.

The NRC is required under Section 102(2)(C) of NEPA to consult with and obtain the comments of any other Federal agency that has jurisdiction by law or special expertise with respect to any environmental impact involved in the subject matter of the SEIS. During the course of preparing the SEIS, NRC consulted the U.S. Fish and Wildlife Service. Contact correspondence is included in Appendix B.

2.12 References

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

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

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

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

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

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3.0 Site Layout and Plant Description

The site for the proposed Unit 3 reactor is located in Louisa County in rural south central Virginia, within the current North Anna Power Station (NAPS) boundary. The site is situated approximately 64 km (40 mi) north-northwest of Richmond, Virginia. This chapter describes the approach Dominion Virginia Power and Old Dominion Electric Cooperative, collectively known as Dominion, used to identify the key site characteristics that the U.S. Nuclear Regulatory Commission (NRC) staff used to assess the environmental impacts of the proposed action. The site layout and existing facilities are discussed in Section 3.1. The plant design and power transmission system are discussed in Sections 3.2 and 3.3, respectively, and the list of references cited are in Section 3.4.

3.1 External Appearance and Site Layout

The NAPS site consists of two operating pressurized water reactors (Units 1 and 2), a shared turbine building, a switchyard, water intake and discharge structures, and support buildings. The site is located on the shores of Lake Anna. A radioactive waste disposal system, a fuel-handling system, the auxiliary structures, and other onsite facilities required for a complete nuclear power station are located on the NAPS site. The existing NAPS site development is shown in Figure 2-1. The operating licenses for Units 1 and 2 were renewed, and the units currently are authorized to operate through 2038 (Unit 1) and 2040 (Unit 2). The proposed Unit 3 would be located in a predominantly disturbed area in a west-southwest direction adjacent to the existing Unit 2 (see Figure 2-1).

Unit 3 will be the new Economic Simplified Boiling Water Reactor (ESBWR) design from General Electric-Hitachi Nuclear Energy; the ESBWR design has been submitted to the NRC for certification, and is undergoing review (GEH 2008). The facility will consist of the reactor and fuel building, the control building, a hot machine shop, a radwaste building, an electrical building, and a service building (Dominion 2007). The proposed reactor would have a rated thermal power level of 4500 megawatts thermal (MW(t)) (Dominion 2007). The NRC staff considered the current version of the ESBWR design and anticipated that the Unit 3 combined license (COL) application will be amended to reflect the current version of the ESBWR design. For the cooling system, Dominion has proposed a closed-cycle, combination wet and dry cooling tower system, with make-up water supplied from Lake Anna. Cooling system discharges from the proposed cooling tower blowdown will be sent to the existing NAPS Waste Heat Treatment Facility (WHTF) via the existing discharge canal.

3.2 Plant Description

The 4500 MW(t) ESBWR will use slightly enriched uranium fuel (i.e., 5 percent maximum concentration of uranium-235) with a maximum fuel burn-up rate of 62,000 MWd/MTU (Dominion 2007). The proposed Unit 3 would operate at an estimated gross electrical power output of approximately 1605 MW(e) and estimated net electrical power output between approximately 1425 MW(e) and 1510 MW(e) (Dominion 2007).

The reactor will use water for cooling, natural circulation for normal operations, and passive safety features. Natural circulation relies on the principle that hot water is less dense and will rise convectively through the reactor core while more dense cool water will flow to the bottom of the core, thus creating water circulation within the core (GEH 2007). The natural circulation process eliminates the need for recirculation pumps and associated piping. Passive safety features include the isolation condensers and the gravity-driven cooling system. The isolation condensers take steam from the vessel or the containment, condense the steam, transfer the heat to a water pool, and introduce the cooled water back into the vessel (Hinds and Maslak 2006). The gravity-driven cooling system consists of water pools above the reactor vessel that will re-flood the vessel when a very low water level is detected in the reactor (Hinds and Maslak 2006).

General Electric-Hitachi Nuclear Energy submitted an application to the NRC for final design approval and standard design certification for the ESBWR on August 24, 2005. By letter dated December 1, 2005, the application was accepted by the NRC for docketing. Docket number 52-010 has been assigned to the ESBWR, but the design has not yet been certified by the NRC. The amendment for the current version of the ESBWR design was submitted on June 1, 2008; the current revision is Revision 5 (GEH 2008).

3.2.1 Plant Water Use

The impacts of plant water use assessed in the early site permit environmental impact statement (ESP EIS) (NRC 2006) were based on the values of design parameters provided by Dominion in the ESP Environmental Report (ER) (Dominion Nuclear North Anna, LLC 2006). At the ESP stage, the staff's review of the design parameters was limited to an evaluation of whether the parameter values were reasonable. This section describes the consumptive and non-consumptive water uses of proposed Unit 3 and its associated water-treatment systems, based on information provided by Dominion in the ER submitted with its COL application (Dominion 2007). The factual plant-specific information was evaluated relative to the design parameters considered in the ESP review.

3.2.1.1 Plant Water Consumption

This section describes plant water-consumption demands, excluding those demands that are part of the normal and ultimate heat sink cooling system. In Section 3.3 of the COL ER (Dominion 2007), Dominion states that the water consumption associated with the proposed Unit 3 is unchanged from that reported in the ESP ER (Dominion Nuclear North Anna, LLC 2006) and evaluated in the ESP EIS (NRC 2006) for a single unit. Consumptive water demands associated with the Unit 3 cooling system are discussed in Section 3.4 of the ESP ER (Dominion Nuclear North Anna, LLC 2006). Non-cooling-system-related demands for potable water, demineralized water, and fire-protection water are relatively small compared to the consumptive cooling demands of the proposed Unit 3. The normal and maximum water demands for these systems are 41.3 L/s (655 gpm) and 210 L/s (3340 gpm), respectively (Dominion Nuclear North Anna, LLC 2006). Potable and other domestic water would be provided from groundwater wells, whereas the demineralized water and fire protection water would be supplied from Lake Anna.

3.2.1.2 Plant Water Treatment

This section describes the water treatment systems for the proposed Unit 3. Because a specific design had not been selected at the ESP stage, water treatment systems were not specified in the ESP ER (Dominion Nuclear North Anna, LLC 2006) or ESP EIS (NRC 2006). In Section 3.3.2 of the COL ER, Dominion (2007) provides factual information on water-treatment systems and chemical additives for various water sources and uses. Raw makeup water for the proposed Unit 3 cooling system and ultimate heat sink will be treated for biofouling, scaling, and suspended matter. Treatment is accomplished by injection of biocides (e.g., sodium hypochlorite, sodium bromide), anti-scalants, and dispersants at doses dependent on the flow rate and at appropriate points in the system.

Treatment of makeup water for ultra-pure water systems, such as the condensate and primary cooling systems, would employ technologies such as reverse osmosis and ultra-filtration. Water not used for cooling (e.g., fire protection, demineralized water makeup) is treated with clarifying agents (e.g., coagulants, settling agents) prior to filtration. The water quality of effluents from any water treatment would be regulated by a Virginia Pollutant Discharge Elimination System (VPDES) permit for the proposed Unit 3.

3.2.2 Cooling System

The proposed Unit 3 would use a closed-cycle, combination wet and dry cooling tower system. Makeup water to the Unit 3 circulating water system and service water cooling system would be obtained from Lake Anna. Blowdown water (i.e., recirculating water removed from the cooling system to reduce the buildup of contaminants, such as dissolved solids) from the cooling systems would be discharged to the existing plant WHTF discharge canal.

Based on the detailed plant system design, Dominion provided slightly revised values for water use parameters. These values were within the plant parameter envelope (PPE) values described in the COL ER (Dominion 2007) and provided in Appendix I of this SEIS. The plant would primarily use wet towers to cool Unit 3 during periods of relative water surplus, which are defined as periods when the water surface elevation of Lake Anna is at or above elevation 76.2 m (250 ft) above mean sea level (MSL). This cooling mode for the proposed Unit 3 is termed the Energy Conservation mode, and in this mode, the estimated makeup water flow rate is 1404 L/s (22,260 gpm) (Dominion 2007). When the elevation of Lake Anna is below 76.2 m (250 ft) MSL for a period of seven or more consecutive days, Unit 3 would be cooled with a closed-cycle, combination wet and dry cooling tower system to limit consumptive water use. Dominion terms this cooling mode the Maximum Water Conservation (MWC) mode; the estimated makeup water flow rate is 970 L/s (15,376 gpm) in MWC mode (Dominion 2007).

3.2.2.1 Description and Operational Modes

The operating modes for the proposed Unit 3 under normal operating and emergency shutdown conditions are described in detail in Section 3.2.2.1 of the ESP EIS (NRC 2006).

3.2.2.2 Component Descriptions

The following sections describe the intake, discharge, and heat-dissipation systems for the proposed Unit 3. Pursuant to Sections 316(a) and 316(b) of the Clean Water Act, Dominion is required to obtain approval from the Commonwealth of Virginia by documenting the plant design and conducting site-specific analyses regarding the impacts of the thermal discharges and operation of the intake systems on the Lake Anna aquatic environment.

Intake System

For the proposed Unit 3 intake system, water will be withdrawn from Lake Anna to supply circulating water, makeup water, fire-protection water, and demineralized water. The proposed location of the intake structure for Unit 3 is shown in Figure 2-1, and would be in approximately the same location as the intakes planned for the two additional power reactor units proposed at the time that NAPS Units 1 and 2 were licensed. The dimensions of the proposed intake structure to support operation of the proposed Unit 3 is 22 m (72 ft) long and approximately 20 m (60 ft) wide, which are slightly different than the dimensions described in the ESP ER (Dominion Nuclear North Anna, LLC 2006). Figures 3-1 and 3-2 show the plan view and side view, respectively, of the proposed arrangement of intake pumps and debris exclusion screens. The intake structure is designed to accommodate three makeup-water pumps, two station pumps, two screen-wash pumps, and two fire-water pumps. The maximum flow velocity into the trash racks (bar screens in Figure 3-1) at the intake structure opening is designed to be less than 0.15 m/s (0.5 ft/s). Three sets of dual-flow traveling screens are located upstream of the three makeup water pumps; each traveling screen has a 2.4 m (8 ft) wide basket and 2 mm

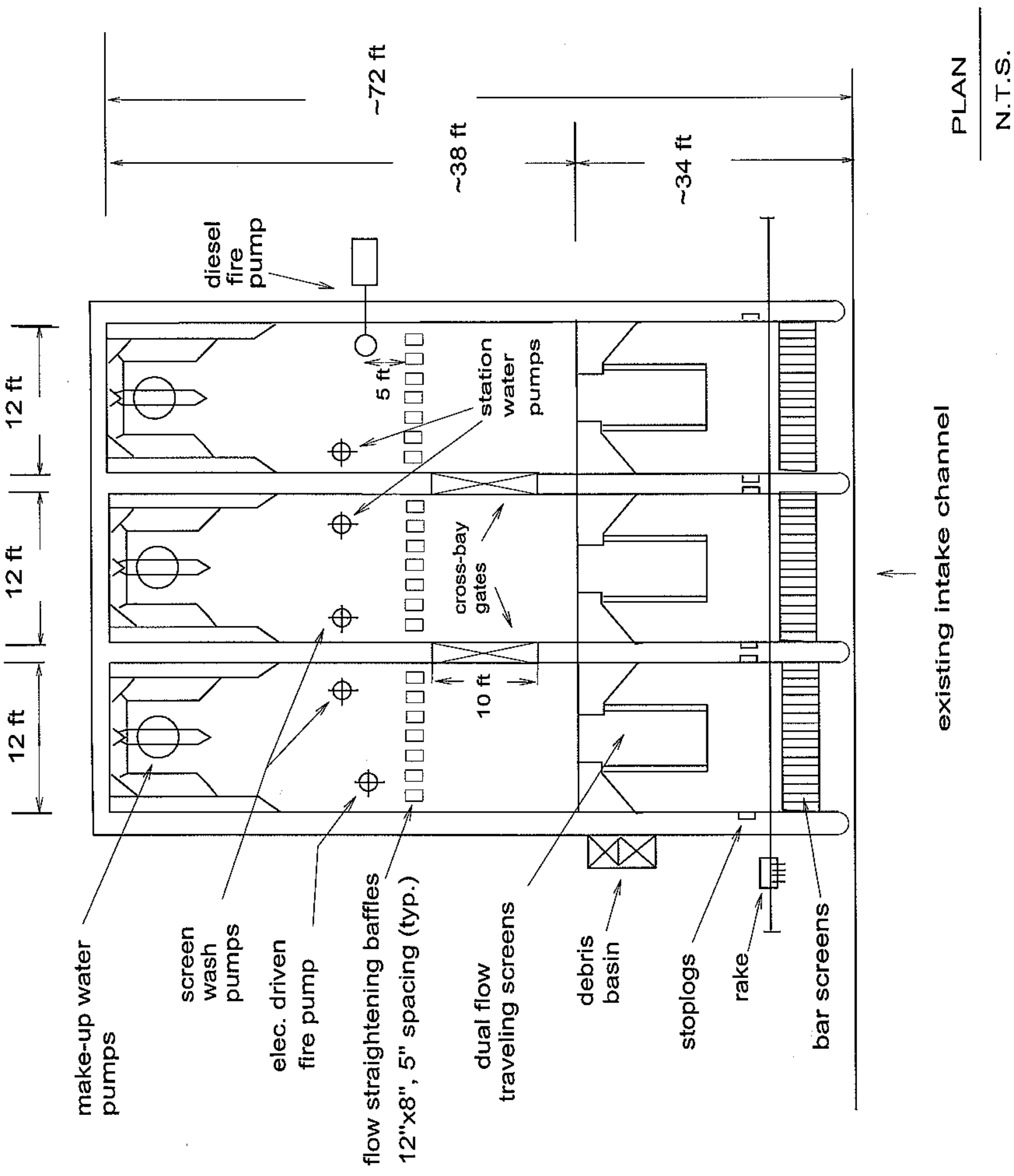

Figure 3-1. Plan View of NAPS Unit 3 Makeup Water Pump (Dominion 2008)

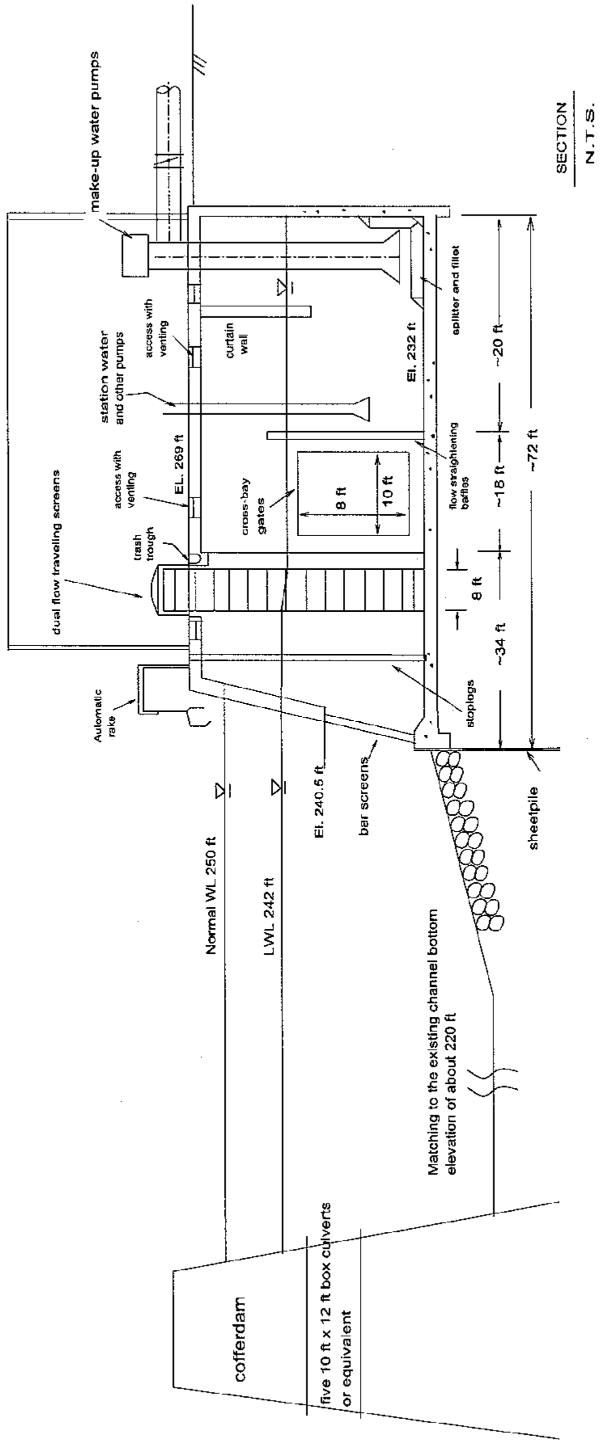

Figure 3-2. Side View of NAPS Unit 3 Makeup Water Pump Intake (Dominion 2008)

(0.08 in.) mesh (Dominion 2008). The screen-wash pumps, station pumps, and fire-water pumps are located between the traveling screens and the main makeup water pumps. Dominion expects no major modifications to the shoreline or the existing intake channel.

Since the ESP EIS was prepared, Dominion finalized designs for the intake channel entrance. The existing cofferdam would be modified by installation of five 3.05 m × 3.66 m (10 ft × 12 ft) box culverts (Figure 3-2) (Dominion 2008). The box culverts and intake channel are designed to keep flow velocities low to minimize entrainment of debris, aquatic life, and sediment. The flow velocity through the culverts is designed to be similar to the current velocity in Lake Anna, about 0.03 m/s (0.1 ft/s).

Discharge System

Based on the detailed plant system design, Dominion provided slightly revised values for water discharge parameters. These values were within the PPE values described in the COL ER (Dominion 2007) and provided in Appendix I of this SEIS. Blowdown discharge from the wet towers associated with the proposed Unit 3 would enter the WHTF via the discharge canal currently used by the existing Units 1 and 2. The proposed discharge structure would be located on the bank of the discharge canal adjacent to the discharge structure for the existing units. The maximum blowdown discharge from the proposed Unit 3 would be 351 L/s (5558 gpm), which is the discharge rate that was evaluated in the ESP EIS (NRC 2006). The discharge canal and WHTF canal system were designed to convey a flow of approximately 230,000 L/s (8000 cfs), and the maximum flow rate from the existing units is approximately 120,000 L/s (4300 cfs). Therefore, the existing discharge canal and WHTF system can easily accommodate the extra water discharged by the proposed Unit 3.

Heat Dissipation Systems

The condenser cooling and service water cooling systems reject heat to the atmosphere and to the WHTF. The condenser cooling needs of the proposed Unit 3 would be provided by a closed-cycle, combination wet and dry tower system. The percentage of excess heat dissipated by the dry towers would depend on the availability of water from Lake Anna and ambient environmental conditions. If excess water were available, Unit 3 would be cooled entirely using the wet towers. During times of drought and high humidity conditions, the majority of the Unit 3 waste heat would be dissipated by the dry towers. The service water system cooling needs of the proposed Unit 3 would be provided by a closed-cycle wet tower system.

3.2.3 Radioactive Waste Management System

Liquid, gaseous, and solid radioactive waste management systems will be used to collect and treat the radioactive materials produced as byproducts from the operation of the proposed Unit 3. These systems will process radioactive liquid, gaseous, and solid effluents to maintain releases within regulatory limits and at levels as low as reasonably achievable before being released to the environment.

Summary descriptions of the liquid, gaseous, and solid radioactive waste management systems for the ESBWR are presented in the following section. A more detailed description of these systems can be found in Chapter 11 of the ESBWR Design Control Document (GEH 2008).

3.2.3.1 Liquid Radioactive Waste-Management System

The liquid radioactive waste management system will be located in the radwaste building and will consist of the following subsystems: equipment drain, floor drain, chemical drain, and detergent drain. Wastes collected in tanks within the radwaste building will be processed on a batch basis. All liquid releases to the environment will be monitored and diluted as needed. These liquid releases will be discharged into the discharge canal that flows into the WHTF.

The equipment drain subsystem is composed of three collection tanks and a mobile reverse osmosis filtration system. The floor drain subsystem collects liquids from floor drain sumps in the reactor, turbine, and radwaste buildings. This subsystem is composed of two collection tanks, a mobile reverse osmosis filtration system, and an ion-exchange system. The chemical drain subsystem consists of one tank that collects laboratory wastes and decontamination solutions. The detergent drain subsystem collects waste water from the controlled laundry and personnel decontamination facilities. This subsystem is composed of two collection tanks and a mobile processing system. The liquid radwaste system will be designed to use tank-collection basins and pipe chases to limit unmonitored releases to the environment.

Filter media and ion-exchange resins will be used to concentrate radioactive materials during liquid radwaste processing. Sludge from the filters and ion exchange resins will be sent to the solid waste management system for additional processing.

The liquid radioactive effluent source term for North Anna Unit 3, taken from the ESBWR Design Control Document (GEH 2008), is presented in Section 5.9.1, Table 5.2 of this SEIS. The liquid radioactive effluent source term for the proposed Unit 3 is within the ESP PPE liquid radioactive effluent source term for the two original ESP units originally proposed; however, the source term exceeded the ESP PPE liquid effluent source term for a single ESP unit for several radionuclides. Dose calculation results presented in Section 5.9.2 show that all the dose projected to the maximally exposed individual (MEI) is within the design objectives in Title 10 of the Code of Federal Regulations (CFR) Part 50, Appendix I.

3.2.3.2 Gaseous Radioactive Waste-Management System

Gaseous radioactive effluents are released through the building ventilation systems and the off-gas system. The off-gas system contains activated charcoal absorber beds that delay the release of noble gases, thus allowing for decay of radioactive material during the holdup period. Releases from the off-gas system are monitored for radioactivity prior to release to the environment from the plant stack or vent. The ESBWR will have ventilation stacks in the reactor/fuel building, the turbine building, and the radwaste building.

The gaseous radiological effluent release source term for the proposed Unit 3 is within the ESP PPE gaseous effluent source term for the two ESP units; however, the source term exceeded the ESP PPE gaseous effluent source term for one ESP unit for several radionuclides. The ESBWR gaseous radioactive effluent source term for Unit 3 is presented in Section 5.9.1, Table 5.3 of this SEIS. The results of calculations presented in Section 5.9.2 show that all the projected dose to the MEI would be within the design objectives in 10 CFR Part 50, Appendix I.

3.2.3.3 Solid Radioactive Waste-Management System

The solid radwaste management system for the proposed Unit 3 will process, package, and temporarily store solid radwaste prior to shipment. This system is located in the radwaste building and is composed of the following subsystems: wet solid waste collection, mobile wet solid waste processing, mobile concentrate treatment, dry solid waste accumulation and conditioning, and container storage.

The wet solid waste collection system processes filter backwash sludge and ion-exchange bed resins from the liquid radwaste management system. The mobile wet solid waste processing subsystem consists of a dewatering station for high- and low-activity spent resins. Dry solid waste consists of air filters, paper and rags from contamination areas, contaminated clothing, contaminated tools, contaminated equipment parts, and solid laboratory wastes. The mobile processing systems are designed to be replaced as more efficient units are available. The radwaste building has storage space for a six-month supply of packaged waste.

The estimated solid radwaste volume for an ESBWR is within the ESP PPE solid radwaste volume for the two ESP units; however, the volume is more than the value identified in the ESP PPE for one unit. The ESP EIS (NRC 2006) specified a value of 256 m^3/yr (9041 ft^3/yr) for each unit, while Table 3.0-2 of the COL ER (Dominion 2007) shows a value of 474.7 m^3/yr (16,764 ft^3/yr) for the proposed Unit 3. The reason for this large difference in estimated radwaste volumes is the ESP estimate assumed compaction of the waste while the ESBWR estimate did not. Dominion (2007) notes the number of shipments based on the waste volume from the ESBWR Design Control Document (GEH 2008) remains well below the one-truck-shipment-per-day condition given in 10 CFR 51.52, Table S–4. The solid waste volume in the COL ER (Dominion 2007) was taken from Table 11.4-2 of the ESBWR Design Control Document (GEH 2008).

The estimated Unit 3 solid radwaste activity in the COL ER (Dominion 2007) was less than the value for one unit used in the ESP EIS (NRC 2006). The ESP EIS specified a value of ≤2700 Ci/yr for each ESP unit, while the COL ER (Dominion 2007) specified a value of 1718 Ci/yr for Unit 3.

3.2.4 Non-Radioactive Waste Management Systems

The following sections provide descriptions of the nonradioactive waste systems for the proposed Unit 3, including systems for waste streams involving chemicals, biocides, sanitary wastes, and other effluents. Dominion (2007) provided information on estimated concentrations of chemical effluents based on the ESBWR design. A separate sanitary waste system was identified for the proposed Unit 3. This is new information because the ESP application (Dominion Nuclear North Anna, LLC 2006) assumed the ESP units would share the sanitary waste system from Units 1 and 2.

3.2.4.1 Effluents Containing Chemical and Biocides

Chemicals and biocides will be employed in water treatment for various water systems at the proposed Unit 3 to include treatment of circulating water, service water, station water, and demineralized water. Effluent streams will also include pollutants (e.g., oil and grease, total suspended solids, and iron) from corrosion and wear of plant piping and equipment. Waste effluents from these systems will be regulated by the VPDES permit and will flow into the cooling tower blowdown sump. These effluents then will flow into the discharge canal where they will mix with circulating water from Units 1 and 2 and finally be discharged into the WHTF.

Maximum expected concentrations of free available chlorine, copper, sulfate, and total dissolved solids in the proposed Unit 3 cooling tower blowdown flow from the blowdown sump to the WHTF would be less than the PPE values identified in the ESP EIS (NRC 2006). While the expected iron concentration is slightly higher than the PPE value (2.4 mg/L [2.4 ppm] compared to the PPE value of 1 mg/L [1 ppm]); the Virginia Department of Environmental Quality has no water-quality standard for iron. Once mixed with the minimum liquid effluent discharge from Units 1 and 2, iron concentrations will be less than the 1 mg/L (1 ppm) PPE value.

Unit 3 effluent streams will contain low levels of chemicals and/or biocides used for water treatment. Since preparation of the ESP EIS, Dominion identified in Section 3.3.2 of the COL ER (Dominion 2007) likely water-treatment chemicals, their concentrations, and the points at which they will be injected during operation of the proposed Unit 3. None of the chemicals and/or biocides used for water treatment in the proposed Unit 3 will contain any of the

126 priority pollutants listed in 40 CFR 423, Appendix A. However, the effluent streams from the proposed Unit 3 will include some of these priority pollutants because they are already present in the waters of Lake Anna. Two effluent streams (i.e., the service water and circulating water cooling tower blowdown) will concentrate pollutants, resulting in copper and tributyltin (TBT) concentrations in the discharge canal greater than Virginia Surface Water Quality Criteria. The copper is from past mining operations, and TBT was used in paint for marine applications. The impacts of the copper and TBT concentrations is discussed in Section 5.3.

3.2.4.2 Sanitary System Effluents

Since preparation of the ESP EIS, Dominion (2007) has stated that a new sanitary waste treatment system would be built onsite for sanitary wastes generated during the construction and operation of the proposed Unit 3. The effluents of this system will comply with industry design standards, the Clean Water Act, the VPDES permit, and 9 VAC 25-790 (Sewage Collection and Treatment Regulations, Commonwealth of Virginia, State Water Control Board). Effluents will be monitored for contaminants including radioactive materials to verify compliance with regulatory standards.

Sanitary water and waste from the potable water and sanitary waste system will be transferred to the sewage treatment plant. This plant will process the sanitary water and waste to meet local and State regulations for effluent quality as specified in the VPDES permit (Dominion 2007). Treated water from the sewage treatment plant will be routed to the cooling tower blowdown sump, which flows into the discharge canal and finally the WHTF. Sludge from the plant will be transported to a licensed sanitary waste landfill for disposal (Dominion 2007).

Until the new sanitary waste treatment system is built, portable sanitary facilities will be employed during Unit 3 construction, including a centralized restroom and hand-wash trailers (Dominion 2007). Waste from these portable facilities will be removed and disposed of by a licensed sanitary waste disposal contractor (Dominion 2007).

3.2.4.3 Other Effluents

Non-radioactive gaseous wastes (e.g., exhaust from diesel-powered backup generators) and non-radioactive solid wastes (e.g., construction debris) would be handled in compliance with appropriate State and Federal regulations.

3.3 Power Transmission System

The North Anna ESP EIS (NRC 2006) indicated that no additional power transmission infrastructure would be required to support the addition of two additional units at NAPS, but that would be determined as the result of a detailed system load studies that would be performed once the in-service date for the new units was established. The study has since been performed in support of the COL application for the proposed Unit 3. The study results indicate that a new 500 kV transmission line would be required, along with other system reinforcements, to maintain grid reliability with the interconnection of the proposed Unit 3 into the existing transmission system (Dominion 2007). Information regarding the additional infrastructure is provided below.

An overhead conductor circuit would be required to connect the proposed Unit 3 to the existing 500-kV switchyard at NAPS. The existing switchyard would be extended to the north for construction of additional 230 kV electrical bays. These bays would connect with the existing transmission system through the existing switchyard.

Interconnection of the proposed Unit 3 will require several system reinforcements that were identified in the system load studies (Dominion 2007). The reinforcements include:

- replacement of existing 500 kV circuit breakers and other equipment with higher rated equipment
- addition of a 500 kV breaker in one of the half bays to support the new transmission line
- addition of another 230 kV bay parallel to the existing bay on the north side of the switchyard to support the auxiliary transformer feed to Unit 3.

Other modifications would be made to the east side of the existing 500 kV substation, including relocation of workshops and auxiliary buildings to make room for a new 500/230 kV intermediate switchyard. This new switchyard would provide the ability to step down the normal preferred power source from 500 kV to 230 kV.

A new or expanded control house for the switchyard would house new control and relay protection equipment. Some of the existing service systems would be expanded or modified, including grounding, raceway, lighting, AC/DC station service, and lighting protection.

The new 500 kV transmission line would be constructed from the NAPS substation to the Ladysmith switching substation located east of the NAPS site. The line is required to enhance grid reliability associated with the interconnection of the proposed Unit 3. The new transmission line would be installed in the existing NAPS-to-Ladysmith Substation right-of-way on new transmission towers located in proximity to the existing towers. The NAPS-to-Ladysmith Substation right-of-way is 84 m (275 ft) wide and 24 km (15 mi) long (NRC 2006).

Current National Electrical Safety Code (NESC) and transmission line standards will be followed in terms of tower separation, line installation, and clearance to ground. The same transmission line standards will be followed in terms of tower structural design parameters, number of conductors, height, materials, color, and finish. Marking for aircraft visibility will be consistent with the existing towers in the right-of-way. The new towers will be approximately 3.05 m (10 ft) taller than the existing towers in the right-of-way. The current NESC code requirements regarding electric-field-induced current at the ground level (NESC 2007) will be met.

The noise levels resulting from the new transmission line operations will be consistent with the existing transmission lines and in accordance with industry standards (IEEE 1992). The actual decibel noise level will be minimized by proper sizing of conductors and use of corona-free hardware (Dominion 2007).

3.4 References

9 VAC 25-790. 2004. "Sewage Collection & Treatment Regulations." *Virginia Administrative Code*, Richmond, Virginia.

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."

40 CFR Part 423. Code of Federal Regulations. Title 40, *Protection of the Environment*, Part 423, "Steam Electric Power Generating Point Source Category."

Clean Water Act. 33 USC 1251, et seq. (also referred to as the Federal Water Pollution Control Act.)

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GE-Hitachi Nuclear Energy (GEH). 2007. *Fact Sheet – Natural Circulation in ESBWR*. GEA-14842A (11/07). Accessed July 26, 2008 at http://www.gepower.com/prod_serv/products/nuclear_energy/en/downloads/natural_circulation_esbwr.pdf. Accession No. ML083250358.

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Institute of Electrical and Electronic Engineers (IEEE). 1992. *IEEE Standard for the Measurement of Audible Noise from Overhead Transmission Lines*. Std 656-1992. Accessed at ieeexplore.ieee.org/iel1/2867/5503/00211074.pdf. Accession No. ML083250548

National Electrical Safety Code (NESC). 2007. *Section 21, Rule 232.C.1.c.* Institute of Electrical and Electronics Engineers (IEEE), Piscataway, New Jersey.

U.S. Nuclear Regulatory Commission (NRC). 2006a. *Environmental Impact Statement for an Early Site Permit (ESP) at the North Anna ESP Site.* Final Report, NUREG-1811, Washington, D.C. Accession No. ML063480261 and ML063480263

4.0 Environmental Impacts of Construction

This chapter examines the environmental issues associated with site preparation and construction activities of the proposed Unit 3 at the North Anna Power Station (NAPS) as described in the application for a combined license (COL) submitted by Dominion Virginia Power (Dominion) and the Old Dominion Electric Cooperative (ODEC), collectively known as Dominion. A COL encompasses a construction permit and an operating license. As part of its COL application, Dominion submitted an environmental report (ER) (Dominion 2007a). The COL ER provides information used as the basis for the environmental review. The application references the early site permit (ESP) that was issued by the U.S. Nuclear Regulatory Commission (NRC) in November 2007 (NRC 2007). That permit is for approval of two additional nuclear units to be constructed on specific sites located within the boundaries of the NAPS. The basis for issuing that ESP was an environmental impact statement (EIS) that was prepared by the NRC staff in 2006 (NRC 2006).

In Sections 4.1 through 4.10 of this chapter, the NRC staff evaluates new and significant information regarding the potential impacts on land use; meteorology and air quality; water use and quality; terrestrial and aquatic ecosystems; socioeconomics; historic and cultural resources; environmental justice; nonradiological and radiological health effects; and applicable measures and controls that would limit the adverse impacts of construction of the proposed Unit 3. In accordance with Title 10 of the Code of Federal Regulations (CFR) Part 51, impacts have been previously analyzed as part of the ESP application (Dominion Nuclear North Anna, LLC 2006), and significance levels (i.e., SMALL, MODERATE, or LARGE) of potential adverse impacts were assigned to each analysis. In the socioeconomic area where the impacts of taxes are assessed, some of the impacts were considered beneficial and are stated as such. Possible mitigation of adverse impacts, where appropriate, is presented in Section 4.10. A summary of the construction impacts is presented in Section 4.11. Full citations for the references cited in this chapter are listed in Section 4.12. Cumulative impacts of construction and operation are discussed in Chapter 7. The technical analyses provided in this chapter support the results, conclusions, and recommendations presented in Chapter 10.

The staff relied on the mitigation measures and the required Federal, State, and local permits and authorizations presented in the ER in reaching its conclusion on the significance level of the adverse impacts. Because the NAPS site has an approved ESP, the significance levels of the potential adverse impacts for the various areas evaluation will remain the same as documented in the ESP EIS (NRC 2006) unless new and significant information has been identified that would modify the original significance level. The definition of new and significant information is documented in a *Federal Register* notice (72 FR 49352). The staff relied on the infrastructure upgrades planned by the counties, cities, and towns, such as road and school expansions, in assigning the original significance levels to the impacts. Failure to implement such infrastructure upgrades may result in larger impact levels.

4.1 Land-Use Impacts

This section provides information on land-use impacts associated with construction of the proposed Unit 3 at the NAPS site, in the vicinity of the site, and in any transmission line rights-of-way that might be affected.

4.1.1 The Site and Vicinity

The proposed Unit 3 will be located southwest of the existing Units 1 and 2 and entirely within the existing NAPS site. There are no zoning regulations currently applicable to the site.

As reported in Section 4.1.1 of the ESP EIS (NRC 2006), all construction activities for the proposed Units 3 and 4, including ground-disturbing activities, would occur within the existing NAPS site boundary. In the ESP EIS, the staff concluded that the land-use impacts of construction would be SMALL, and additional mitigation was not warranted.

The ER that Dominion submitted as part of its COL application states that some offsite land-use impacts could occur (Dominion 2007a). These impacts could occur in conjunction with road improvements (e.g., repairs, widening, and/or filling in low areas) needed for transportation of large components from either West Point or Walkerton, Virginia (Dominion 2007a). Any such impacts are likely to benefit the roads. The only other new information identified by the NRC staff relating to construction land-use impacts is that Dominion now proposes to construct and operate only one new nuclear unit (Unit 3) instead of the two units (Units 3 and 4) considered in the ESP EIS (NRC 2006), a change that would reduce land-use impacts. The staff determined that the changes in the information related to land use are minor and have no potential to change the staff's impact characterization in the ESP EIS.

The staff did not identify information that was both new and significant related to the construction impacts on land use through its evaluation of the information provided by Dominion and the NRC staff's own independent review. The staff concludes that the land-use impacts of construction would remain SMALL, and additional mitigation is not warranted.

4.1.2 Offsite Transmission Line Rights-of-Way

Section 4.1.2 of the ESP EIS (NRC 2006) states that no additional transmission lines or rights-of-way would be needed to transmit the power generated by new generating units at the NAPS site. The only new information identified by the staff related to Section 4.1.2 is that Dominion's COL ER states that based on a 2007 study by PJM Interconnection (Dominion 2007a), a new

500-kV transmission line from the North Anna substation to the Ladysmith switching substation would be needed to provide grid stability with the interconnection of proposed Unit 3 (Dominion 2007a). The new transmission line would be installed on new towers in the existing NAPS to Ladysmith Substation right-of-way, which runs to the east from the NAPS site. The existing right-of-way is approximately 84 m (275 ft) wide and 24 km (15 mi) long. Because the new transmission line would be built entirely within the existing right-of-way, with no widening required, the staff concludes that the changes in the information related to land use are minor and have no potential to change the staff's impact characterization in the ESP EIS.

The staff did not identify information that was both new and significant related to the transmission line construction impacts on land use through its evaluation of the information provided by Dominion and the NRC staff's own independent review. The staff concludes that the land-use impacts of construction in the offsite transmission line right-of-way would remain SMALL, and additional mitigation is not warranted.

4.2 Meteorological and Air Quality Impacts

In its ESP EIS (NRC 2006), NRC noted that during construction activities on the NAPS ESP site, some minor air-quality impacts would be expected. The likely sources of these air-quality impacts would be fugitive dust emissions from general construction activities and the potential for elevated ambient air-quality levels caused by transportation emissions from the vehicles and equipment used by the workforce used in construction.

In Appendix J of its ESP EIS (NRC 2006), the NRC notes that the 5000 workers needed to construct Units 3 and 4 would be divided into two 10-hour shifts. Using an assumption of 1.8 workers per commuter vehicle, 2800 additional vehicles per day would travel to and from the NAPS site while construction activities are ongoing. It was noted previously that the overall impact on air quality levels was difficult to estimate because of the timing of construction activities and actual location of the workers that would be employed during construction. The ESP EIS (NRC 2006) also says that Dominion would develop methods for enhancing the use of multi-passenger vans to reduce the number of vehicles on the road at any given time. This issue was discussed during the site audit in April 2008, and Dominion stated that it still anticipates developing a plan prior to the start of construction.

Because the COL application is for a single unit instead of the two units addressed in the ESP EIS (NRC 2006), it is anticipated that fewer construction workers would be required at any one time. Thus, the potential air quality impacts would be less than originally estimated for the ESP application. Given the continued commitment by Dominion to develop a traffic management plan and current air quality conditions within the region, the initial conclusion reached in the ESP EIS (NRC 2006), SMALL, remain the same and additional mitigation beyond the currently planned actions is not warranted.

4.3 Water-Related Impacts

This section describes the potential water-related impacts associated with construction of the proposed Unit 3 at the NAPS site. An overview of two proposed new units (Units 3 and 4) and a detailed discussion of construction-related impacts on water use and water quality are provided in Section 4.3 of the ESP EIS (NRC 2006). Dominion's COL application (Dominion 2007a) is for construction of only one unit (Unit 3), using the Economic Simplified Boiling-Water Reactor (ESBWR) design with a closed-loop hybrid cooling system that employs wet and dry cooling depending on operating conditions (see description in Chapter 3 of this SEIS). In the following sections, the NRC staff summarizes the impacts described in the ESP EIS (NRC 2006), evaluates new information available for review since preparation of the ESP EIS, and determines whether there are any changes to the impact levels determined at the ESP stage.

4.3.1 Hydrological Alterations

The information and associated impacts for this section are provided and resolved in Section 4.3.1 of the ESP EIS (NRC 2006). Based on the staff's analysis, construction-related impacts of hydrological alterations were considered to be SMALL. Information available since preparation of the ESP EIS includes changes to onsite drainage, changes to the cofferdam and the design of the intake structure, and a proposed new transmission line.

Excavation, fill, and grading operations that will occur during construction of the proposed Unit 3 would alter two of three ephemeral streams on the NAPS site, and possibly one or more wetlands. The COL ER (Dominion 2007a) provided new information on the specific locations of the plant buildings within the NAPS ESP site and indicated that the expected impacts to two ephemeral streams will occur in slightly different locations than were evaluated in the ESP EIS (Streams B and C instead of Streams A and B, Figure 2.4-5 of ESP ER [Dominion Nuclear North Anna, LLC 2006]). The COL ER (Dominion 2007a) also stated that a new transmission line would be installed in the existing NAPS to Ladysmith transmission line right-of-way, but on new towers located close to the existing towers (see Figure 2.2). The existing right-of-way crosses several wetlands.

These impacts to onsite drainage and the transmission line right-of-way would be localized temporary construction impacts. Wetland delineations and jurisdictional determinations of the upland landscape and submerged lake areas that would be impacted by construction would be required in order to submit an application for a Section 404 Permit application to the U.S. Army Corps of Engineers (USACE). The USACE permitting process ensures that impacts of construction are limited by requiring the appropriate construction best management practices (BMP). The applicant proposes a combination of avoiding wetlands and shorelines where practicable, and employing BMPs (e.g., hand clearing trees and brush and limiting disturbance of soil within 30 m [100 ft] of stream or ditch, removing materials placed in streams for temporary crossings, controlling erosion) to limit hydrological alterations and the impacts of construction on streams and wetlands. Dominion currently has not obtained a Section 401 certification from the Commonwealth of Virginia for construction activities at the NAPS site.

The ESP EIS evaluated a 21 m (70 ft) long and 21 m (70 ft) wide intake structure to support the combination wet and dry cooling tower for Unit 3 (NRC 2006). In response to a NRC request following receipt of the COL application, Dominion provided information on refinements to the design of the cooling system intake structure. The proposed new intake structure is slightly longer (i.e., 21.9 m [72 ft] long) and narrower (i.e., approximately 18 m [60 ft] wide) to accommodate three pumps with debris exclusion equipment (Dominion 2008a). The structure location remains the same as that proposed in the ESP, in a cove crossed by a cofferdam just west of the intake for the existing Units 1 and 2 (Figure 2-1).

Dominion (2008a) has specified the method to allow water access from Lake Anna to the intake channel by installing five 3 × 3.7 m (10 × 12 ft) box culverts through the existing cofferdam. Dominion expects no major modifications to the shoreline or the existing intake channel. The box culverts and bottom elevation of the channel of approximately 67 m (220 ft) relative to mean sea level are designed to keep flow velocities low to minimize entrainment of debris, aquatic life, and sediment (Dominion 2007a). The COL design intake flow velocities at the culverts, in the intake channel, and at the intake pumps are within the plant parameter envelope evaluated values during the ESP environmental review. Implementing BMPs for dredging would minimize the potential for sediment to enter the lake during modification of the cofferdam. Any impacts of dredging would be localized and temporary. Before initiation of any shoreline modification or dredging activities, Dominion would be required to obtain a 404 Permit from the USACE.

The staff did not identify information that was both new and significant related to construction impacts resulting from hydrological alterations in its evaluation of new information provided by Dominion and the staff's own independent review. The staff concludes that impacts of hydrological alterations from construction of the proposed Unit 3 at the NAPS site would remain SMALL, and further mitigation beyond the actions stated is not warranted.

4.3.2 Water-Use Impacts

The information and associated impacts for this section are provided and resolved in Section 4.3.2 of the ESP EIS (NRC 2006). The staff did not identify information that was both new and significant related to water use during construction in its evaluation of new information provided by Dominion and the staff's own independent review. The staff concludes that impacts on water use from construction of the proposed Unit 3 at the NAPS site would remain SMALL, and further mitigation is not warranted.

4.3.3 Water-Quality Impacts

The information and associated impacts for this section are provided and resolved in Section 4.3.3 of the ESP EIS (NRC 2006). Based on the staff's analysis, construction-related impacts on water quality were considered to be SMALL. New information available since preparation of the ESP EIS includes the construction of one new unit instead of two new units, and specific information on the location of the new unit. Water-quality impacts for the construction activities would be similar to those associated with other large industrial construction projects: that is, the impacts would be generally localized and temporary in nature. The impacts of construction on water quality are anticipated to be similar to or less than those described in the ESP EIS.

The NRC staff did not identify information that was both new and significant related to water-quality impacts of construction through its evaluation of information provided by Dominion and its own independent review. The staff concludes that water quality impacts resulting from construction of the proposed Unit 3 at the NAPS site would remain SMALL, and further mitigation is not warranted.

4.4 Ecological Impacts

This section describes the potential impacts of construction of the proposed Unit 3 on the ecological resources at the NAPS COL site and discusses terrestrial and aquatic ecosystems impacts, and threatened and endangered species.

4.4.1 Terrestrial Ecosystem Impacts

The information and associated impacts for this section are provided and resolved in Section 4.4.1 of the ESP EIS (NRC 2006). Based on the staff's analysis, construction-related impacts to terrestrial ecosystems were considered to be SMALL. Information available since preparation of the ESP EIS includes a detailed description of the layout for the proposed Unit 3, and the proposed NAPS to Ladysmith switching substation transmission line.

Much of the proposed construction site for the proposed Unit 3 consists of dirt roads, cleared areas, parking lots, buildings, and other areas recovering from prior disturbance. Because of past development or use, undisturbed habitats are absent in this area. The current site layout indicates that the approximately 49 ha (120 ac) will be permanently altered by the construction of permanent facilities, and approximately 36 ha (90 ac) will be disturbed for temporary construction facilities (Dominion 2008a). The areas not permanently disturbed would be available for other uses after construction is complete.

In the ESP EIS (NRC 2006), the NRC reported that approximately 32 ha (80 ac) of forested habitat would be lost because of construction of the Units 3 and 4. The current plant design and layout for Unit 3 only indicate that approximately 50 ha (125 ac) of forested habitat would be lost (Dominion 2008a). All of this habitat is relatively recent regrowth and contains no unique or sensitive plant species or communities. No important animal species are likely to occur within the area, and it represents a very small percentage of the similar habitat in the site vicinity. Therefore, although the amount of forested habitat lost is likely to be greater than reported in the ESP EIS, the NRC staff has determined that this information does not change the staff's conclusion that impacts to forested habitats would be SMALL.

The ESP EIS also indicated that approximately 2.7 ha (6.68 ac) of wetlands, 1676 linear m (5500 linear ft) of streams covering an area of approximately 0.19 ha (0.46 ac), and approximately 1.0 ha (2.49 ac) of open water were within the proposed construction footprint (NRC 2006). According to the current site layout, the expected impact will be less (Dominion 2008a). The layout will include 15 m (50 ft) buffers around many of the wetland areas, thus avoiding impacts. Permanent disturbance may be limited to less than 0.2 ha (0.5 ac) of non-tidal wetland, and less than 244 linear m (800 linear ft) of stream within the COL site footprint (Dominion 2008a). Dominion has indicated that it would avoid watercourses and wetlands to the extent practicable during construction, and that it would be required to comply with any wetland protection or mitigation measures attached to any permits issued by USACE or the Virginia Department of Environmental Quality (VDEQ). Dominion has been considering, in conjunction with the Virginia Department of Game and Inland Fisheries (VDGIF) and the USACE, mitigation that may be appropriate for the impacts that do occur to wetlands and stream losses on the site. Mitigative actions have not been determined but might include the purchase of wetland or stream credits from an approved mitigation bank, supplemented by onsite stream preservation through the establishment of conservation easements. Because the impacts are bounded by the impacts considered in the ESP EIS, and because Dominion will be working with State and Federal agencies to mitigate for the impacts that do occur, the staff's conclusion that impacts to on-site wetlands are SMALL has not changed.

The new transmission line will be constructed in the existing North Anna to Ladysmith right-of-way. No additional clearing of forested vegetation will be required for construction of this transmission line, and existing access roads would be used for inspection and maintenance activities in the right-of-way. Where possible, Dominion expects to place towers adjacent to existing towers, and will avoid placement of towers in wetlands or other sensitive habitats (Dominion 2007a). Land clearing would be limited to that necessary to accommodate the new tower foundations, and Dominion would follow established procedures and BMPs to minimize impacts and to restore vegetative communities. Only hand-clearing would be used within 30 m (100 ft) of streams or creeks and BMPS for erosion and sedimentation control would be followed. If Dominion follows the procedures that are described in its COL ER (Dominion 2007a), minimal construction impacts are anticipated.

In the COL ER (Dominion 2007a), Dominion represented that it would implement construction mitigation measures. These measures would include instituting construction BMPs for erosion and dust control, noise abatement, and proper equipment maintenance; restricting the timing of activities to minimize impacts to resources such as breeding birds; and adhering to applicable permit conditions (see ESP EIS Appendix J). Dominion delineated the wetlands and streams on the proposed construction site for Unit 3, has designed the current layout to minimize impacts to wetlands and streams, and would adhere to any permit conditions or mitigation requirements developed by the USACE or the VDEQ. The staff reviewed the potential impacts of constructing the proposed Unit 3 on terrestrial ecological resources, including loss of habitat, loss of wetlands, noise, dust emissions, and avian collisions. The staff did not identify information that was both new and significant related to the construction impacts on terrestrial resources through its evaluation of information provided by Dominion and the NRC staff's own independent review. The staff concludes that the impact to terrestrial resources would remain SMALL, and additional mitigation beyond that described above is not warranted.

4.4.2 Aquatic Ecosystem Impacts

The information and associated impacts for this section are provided and resolved in Section 4.4.2 of the ESP EIS (NRC 2006). Based on the staff's analysis, construction related impacts to aquatic ecosystems were considered to be SMALL. Information available since preparation of the ESP EIS provides a description of the design of the proposed Unit 3 intake, the proposed NAPS-Ladysmith transmission line, and additional information on the possible presence of polychlorinated biphenyls (PCB) in the vicinity of the intake.

The design evaluated during the ESP environmental review process assumed the new water intake structure would be 21 m (70 ft) long and 21 m (70 ft) wide, and would house trash racks, traveling screens, and intake pumps. Recent information provided by Dominion (Dominion 2008a) confirms that the intake structure will be located at the end of a cove on the south shore of Lake Anna near Harris Creek and immediately west of the cove that houses the intake structure for Units 1 and 2, which is the location originally planned for the intake of the two additional units proposed during the early 1980s. To supply water to the proposed Unit 3, Dominion now indicates five box culverts, each with a width of 3.7 m (12 ft) and a height of 3.1 m (10 ft), will be installed in the existing cofferdam to allow water from Lake Anna to flow toward Unit 3 through the existing approach channel in Lake Anna (Dominion 2008a). Because of the limited quantity of water required for the proposed Unit 3, Dominion (2008a) states that no major modifications to the existing shoreline or dredging in the approach channel will be needed.

As described in the ESP EIS (NRC 2006), a temporary loss of benthic habitat and the displacement or loss of benthic organisms is expected to occur as a result of construction activities associated with the new intake. As a result, fish and mobile benthic organisms inhabiting the intake channel and the lake near the intake channel may temporarily leave the area during construction. In addition, in-water activities may temporarily increase turbidity, leading to a localized reduction in primary productivity from a decrease in light penetration and potential smothering of periphyton and aquatic macrophytes in the intake channel. The staff believes these impacts would be temporary, and the aquatic environment would recover soon after construction is completed. In response to a request by the staff, Dominion has confirmed that it is committed to employing BMPs related to erosion and sediment control, including the use of turbidity curtains, sheet piling, or other approved methods of protection between the intake bay for Unit 3 and the Lake Anna Reservoir (Dominion 2008b). These controls also would reduce the impact of other construction-related activities, such as accidental fuel spills into the reservoir or siltation into streams or watercourses adjacent to the proposed Unit 3 cooling tower. Prior to any in-water activities associated with the construction of the intake structure, Dominion would be required to obtain a Clean Water Act Section 404 Permit from the USACE, and work closely with the VDEQ to ensure that the water quality and aquatic resources of Lake Anna are protected during construction.

As described in Section 4.4.1, no additional clearing of forested vegetation will be required for construction of the new NAPS to Ladysmith transmission line in the existing right-of-way, and existing access roads will be used. Only hand-clearing would be used within 30 m (100 ft) of streams or creeks and BMPs for erosion and sedimentation control would be followed. To the extent possible, tower bases will avoid wetlands and stream crossings.

During the staff's review of information associated with construction impacts to aquatic resources, Dominion confirmed that a small quantity of transformer oil containing low levels of PCBs was spilled near the intake in 1981 as the result of a fire in a turbine building. Immediately after the spill, a containment boom was deployed, and the cleanup was coordinated with the Commonwealth of Virginia. Because of this event, it is possible that PCB compounds are present in the sediments near the intake, but the concentrations probably are small because the transformer oil spilled was classified as "non-PCB" material based on 1981 U.S. Environmental Protection Agency (EPA) criteria (Dominion 2008c). In 1979, EPA considered transformer fluid with less than 50 ppm of PCBs to be "non-PCB" material, and this criterion continues to be used today to classify electrical equipment containing these compounds (40 CFR Part 761). In 2006, the VDEQ analyzed sediment samples collected in Lake Anna in the vicinity of NAPS and in the WHTF, and did not detect any PCBs in those sediments (VDEQ 2007). Thus, because it is likely that the concentrations of PCBs in the sediment near the intake are very low, the staff believes that if appropriate BMPs are employed during construction of the Unit 3 intake, the risk of re-suspending PCB compounds is small and adverse environmental effects are unlikely during construction. In addition, recent information from Dominion (Dominion 2008a) indicates that no dredging would be required in the approach channel, further reducing the likelihood of sediment re-suspension.

Based on an independent review of existing and new information, the staff identified no information that was both new and significant. The staff concludes that the impacts to aquatic resources from the construction of the proposed Unit 3 cooling system and proposed transmission line are expected to be localized and temporary. Additionally, no planned construction activities would be expected to impact the fisheries or any of the biological communities of the North Anna River. Thus, the conclusion of SMALL impact reached by the staff in the ESP EIS (NRC 2006) is still valid, and further mitigation beyond the actions stated above is not warranted.

4.4.3 Threatened and Endangered Species

The information and associated impacts for this section are provided and resolved in Section 4.4.3 of the ESP EIS (NRC 2006). Based on the staff's analysis, construction-related impacts to threatened or endangered species were considered SMALL. Information available since preparation of the ESP EIS includes the Federal delisting of the bald eagle, and several changes to the State-listed endangered or threatened species, as described in Section 2.7.

Since preparation of the ESP EIS (NRC 2006), the bald eagle (*Haliaeetus leucocephalus*) has been removed from the list of species protected under the Federal Endangered Species Act (72 FR 37346), but it is still listed as Threatened by the Commonwealth of Virginia, and is afforded continued protection by the Federal Bald and Golden Eagle Protection Act. The U.S. Fish and Wildlife Service issued management guidelines that provide suggested buffers to avoid harassment of eagles (USFWS 2008). Generally, most construction activities that occur beyond 201 m (660 ft) from a nest would not be considered harassment under these guidelines, and blasting or other very loud noises beyond about 0.8 km (0.5 mi) from a nest would not be considered harassment. Dominion has confirmed that the nearest bald eagle nest is in the Contrary Creek drainage, approximately 3.2 km (2 mi) west of the NAPS site (Dominion 2008b).

As described in Section 2.7.1.3, no Federally or State-listed species are known to exist within or near the NAPS to Ladysmith transmission line right-of-way. Therefore, impacts to threatened or endangered species are unlikely to occur due to the installation of additional towers and transmission lines within the existing right-of-way.

As described in Section 5.4.3.2 of the ESP EIS (NRC 2006), Dominion has monitored fish populations in Lake Anna and the North Anna River for more than 25 years. No Federally listed fish species has been collected in any of these monitoring studies, nor has any listed species been observed in creel surveys or occasional special studies conducted by Dominion. No range of any Federally or State-listed fish species includes Lake Anna or the North Anna River, and none is believed to occur in counties adjacent to Lake Anna or the North Anna River (i.e., Caroline, Hanover, Louisa, Orange, and Spotsylvania Counties). As stated in the ESP EIS, according to the VDGIF and Virginia Department of Conservation and Recreation databases, one Federally listed mussel species (dwarf wedge mussel [*Alasmidonta heterodon*]), and one mussel species (fluted kidneyshell [*Ptychobranchus subtentum*]) that is a candidate for Federal listing, occur in counties that border Lake Anna or the North Anna River. Neither of these species, nor the State-listed Atlantic pigtoe (*Fusconaia masoni*) had been found in Lake Anna or the North Anna River, or its tributaries during the development of the ESP EIS (NRC 2006). The State-listed green floater (*Lasmigona subviridis*) and Virginia Piedmont water boatman (*Sigara depressa*) were reported to occur in the upper Pamunkey River watershed. Neither species were found in Lake Anna or the North Anna River during either pre-impoundment surveys or more recent routine monitoring surveys.

Based on the staff review of information provided by Dominion in the COL ER (Dominion 2007a) and meetings with Commonwealth of Virginia resource managers, the staff identified no information that was both new and significant, and concludes that the assessment of impact associated with threatened and endangered species during the construction of the proposed Unit 3 are still valid. Based on this information, the staff concludes that the effect of construction on threatened and endangered species would remain SMALL, and mitigation is not warranted.

4.5 Socioeconomic Impacts

This section evaluates the social and economic impacts to the surrounding region as a result of constructing a new nuclear powered electricity generating unit (Unit 3) at the NAPS site. This evaluation assesses the impacts of construction and the demands on the surrounding region that could result from the smaller workforce needed to construct the proposed Unit 3 only, rather than the two units (Units 3 and 4) considered in the ESP EIS (NRC 2006). Construction activities involving one unit rather than two units are assumed to last up to 5 years and require 2500 to 3500 workers, compared to the 5000 workers assumed for the ESP EIS (Dominion 2008a). The evaluation also assesses the visual impacts of constructing the new plant structures for the proposed Unit 3.

Dominion expects the workforce to be maintained for most of the construction period. This construction workforce would be in addition to the 1000 personnel currently employed at the site and crews involved in intermittent outage activities.

4.5.1 Physical Impacts

Construction activities at the proposed Unit 3 site could cause temporary and localized physical impacts including, but not limited to noise, odor, vehicle exhaust emissions, and fugitive dust. Dominion does not expect significant vibration and shock impacts during construction because of the strict restriction or control of such activities onsite (Dominion Nuclear North Anna, LLC 2006). This section qualitatively addresses those potential impacts that may affect people, buildings, roads, and recreational facilities (such as Lake Anna).

4.5.1.1 Workers and the Local Public

The information and associated impacts for this section are provided and resolved in Section 4.5.1.1 of the ESP EIS (NRC 2006). Based on NRC's independent review and Dominion's representation that it would undertake mitigation measures, the staff concludes that the overall physical impacts to workers and the local population are SMALL, and further mitigation beyond the mitigation actions stated above is not warranted.

The new information available since preparation of the ESP EIS does not suggest that construction activities will be any larger in scale, any noisier, or any more intrusive visually than previously documented. Therefore, the staff concludes that the impacts would remain SMALL.

4.5.1.2 Buildings

The information and associated impacts for this section are provided and resolved in Section 4.5.1.2 of the ESP EIS (NRC 2006). Because the nearest offsite building is about 910 m (3000 ft) from the proposed Unit 3 construction site, the staff concludes that the overall physical impacts to offsite buildings would be SMALL, and mitigation is not warranted.

The new information available since the ESP EIS was published does not suggest that construction activities will be any larger in scale, any noisier, or any more intrusive visually or otherwise than previously suggested. Therefore, the staff concludes that the impacts would remain SMALL.

4.5.1.3 Roads

The information and associated impacts for this section are provided and resolved in Section 4.5.1.3 of the ESP EIS (NRC 2006). Based on Dominion's representation that it would develop and implement a traffic management plan and the staff's independent review, the staff concludes that the overall physical impacts to local roadways would be temporary and SMALL, and additional mitigation beyond the actions stated above is not warranted.

Dominion remains committed to developing and implementing a traffic management plan for Unit 3. Because the currently contemplated construction workforce for one unit is 2500 to 3000 workers rather than the 5000 workers anticipated for construction of two units documented in the ESP EIS, the impact on roads from commuter traffic is expected to be less. The impact from heavy hauling also should be significantly less, because the proposed Unit 3 would still require roughly half the materials and structures be hauled during the construction period. The amount of equipment needed probably would be less but not half, because only one unit would be built but the original concept contemplated reuse of some equipment on the second unit as the first proceeded to completion. The staff believes that the impact would be less than that described in the ESP EIS and would remain SMALL and temporary.

4.5.1.4 Aesthetics and Recreation

The information and associated impacts for this section are provided and resolved in Section 4.5.1.4 of the EIS ESP (NRC 2006). As part of its COL application (Dominion 2007a), Dominion performed a visual impact study to determine the visual impact of the proposed Unit 3 when it becomes operational; however, Dominion also addressed the visual impacts of construction. The staff's review of the visual impact study concludes that the added visual impacts of construction are temporary and that the aesthetic impact will continue to be SMALL.

As discussed in Section 3.7 of the COL ER (Dominion 2007a), construction of Unit 3 would require a new 500-kV transmission line to be installed in the existing North Anna to Ladysmith right-of-way. As discussed in Section 2.4 of the COL ER (Dominion 2007a), part of this transmission line would cross Lake Anna and other waterways and wetlands. During installation of the new transmission line, access to Lake Anna and the other subject waterways would be temporarily restricted from recreational use. Based on the Dominion's representation that the limitation will be temporary in nature, and full use of the recreational areas would be restored upon completion of the installation, the staff concludes that the overall physical impact resulting from installation of the transmission line would be SMALL, and mitigation is not warranted.

Because visual impacts of construction, such as water turbidity from localized dredging and fugitive dust, would be temporary and would be controlled pursuant to Commonweath regulations and Dominion's representation that it would develop and implement a dust control plan (see Section 4.2.1), and the points from which they could be observed from the lake would be limited, the staff concludes that the visual impacts of construction on Lake Anna and the surrounding area would remain SMALL, and further mitigation is not warranted.

4.5.2 Demography

The information and associated impacts for this section are provided and resolved in Section 4.5.2 of the ESP EIS (NRC 2006). Based on its representation that (1) most construction workers would be expected to come from within the region and (2) the number of construction workers who might relocate to the region would be a small percentage of the larger population base, the staff concludes that the impacts of construction on increases in population within the region would remain SMALL, and mitigation is not warranted.

4.5.3 Community Characteristics

This section evaluates the social and economic impacts to the surrounding region as a result of constructing Unit 3 at the NAPS ESP site. Dominion provided new information on the workforce and costs of the proposed Unit 3. The evaluation assesses impacts of this new information concerning construction and demands placed by the workforce on the surrounding region. Construction activities are assumed to last up to 5 years and employ 2500 to 3500 workers

(Dominion 2008a). Dominion expects this size workforce to be maintained for most of the construction period (Dominion Nuclear North Anna, LLC 2006). This construction workforce would be in addition to the 1000 personnel currently employed at the site to support the operation of Units 1 and 2.

4.5.3.1 Economy

The information and associated impacts for this section are provided and resolved in Section 4.5.3.1 of the ESP EIS (NRC 2006). The staff reviewed the impacts of construction of the proposed Unit 3 on the economy of the region and concludes that the magnitude of the economic impacts would be diffused in the larger economic bases of Henrico and Spotsylvania Counties and the City of Richmond. The economic impacts would be more noticeable for the smaller economic bases of Orange and Louisa Counties. Based on the positive aspects of the proposed construction on the regional economies and the workforce availability, the staff concludes that the impacts on the economy are mostly positive. In terms of representing adverse effects, the staff concludes that the impact would continue to be SMALL BENEFICIAL to up to MODERATE BENEFICIAL for Louisa and Orange Counties, and mitigation is not warranted.

4.5.3.2 Taxes

The information and associated impacts for this section are provided and resolved in Section 4.5.3.3 of the ESP EIS (NRC 2006). The staff reviewed the income taxes generated on wages and salaries of Unit 3 construction workers and Dominion corporate profits as well as sales and use taxes, most of which represent beneficial sources of income for the Commonwealth and some of which would benefit the counties in the region. Property tax paid by contractors and by Dominion would directly benefit Louisa County. The overall impacts from real and personal property taxes on the region would continue to be SMALL BENEFICIAL to MODERATE BENEFICIAL for Louisa County, and mitigation is not warranted.

4.5.4 Infrastructure and Community Service Impacts

Infrastructure and community services include transportation, recreation, housing, public services, and education.

4.5.4.1 Transportation

The information and associated impacts for this section are provided and resolved in Section 4.5.3.2 of the ESP EIS (NRC 2006). Based on its independent review and Dominion’s representation that it would develop and implement a traffic management plan, the NRC staff concluded in the ESP EIS that if the planned upgrades and improvements to the road systems in the region are implemented, the temporary impacts of construction on transportation in the region would be SMALL to MODERATE, and further mitigation beyond the actions stated above would not be warranted.

New information that has become available since preparation of the ESP EIS indicates that the transportation infrastructure situation has not changed significantly. There are no new traffic data that would better identify the change in the level of service on key road segments; and no new sources of funding have been identified to speed plans to improve the local road network. The only significant change is that the proposed Unit 3 would require a much smaller labor force than posited in the ESP EIS, thus reducing the traffic congestion associated with construction. However, the NRC staff believes that the impacts in the region would remain SMALL to MODERATE.

4.5.4.2 Recreation

The information and associated impacts for this section are provided and resolved in Section 4.5.3.4 of the ESP EIS (NRC 2006). Based on the expectation that the mitigative measures discussed earlier (e.g., traffic management, road improvements, and best construction management practices to minimize water-quality impacts) are implemented, the staff concludes that the impacts of construction on the recreational use of Lake Anna would remain SMALL to MODERATE, and further mitigation is not warranted.

4.5.4.3 Housing

The information and associated impacts for this section are provided and resolved in Section 4.5.3.5 of the ESP EIS (NRC 2006). Because of the overall availability of housing in Henrico and Spotsylvania Counties and the City of Richmond and assuming that the housing pattern follows past experience, the staff concluded that the overall impacts of construction on housing in these areas would be SMALL, and mitigation is not warranted.

The staff further concluded that housing impacts to Orange and Louisa Counties could be MODERATE if significantly more workers than expected move to these counties' where a shortage of rental housing currently exists. Increased housing construction to meet this potential need is not likely because of the short duration of Unit 3 construction activities.

New information that has become available since preparation of the ESP EIS indicate that the available housing stock has grown in the local jurisdictions and that the in-migrating labor force will be smaller than contemplated in the ESP EIS(NRC 2006). Therefore, it is likely that the regional impact of Unit 3 construction activities on housing should remain SMALL. However, it is still likely that housing impacts could still rise to MODERATE in Orange and Louisa Counties if significantly more workers than expected move to these counties.

4.5.4.4 Public Services

The information and associated impacts for this section are provided and resolved in Section 4.5.3.6 of the ESP EIS (NRC 2006). Based on the current availability of services and additional taxes that would affect the financial demand for additional services, the staff concluded that the impact on the demand for public and related services as a result of construction would be SMALL, and mitigation is not warranted. New information available since the ESP EIS was published does not change this conclusion.

4.5.4.5 Education

The information and associated impacts for this section are provided and resolved in Section 4.5.3.7 of the ESP EIS (NRC 2006). Based on the overall availability of educational facilities in Henrico, Spotsylvania, Orange, and Louisa Counties and the City of Richmond and assuming that the housing pattern follows past experience, the staff concluded that the impacts of construction on educational resources would be SMALL to MODERATE, and mitigation is not warranted.

Information available on the area since preparation of the ESP EIS indicates a continuation of general population growth and increases in school enrollment in all jurisdictions except the City of Richmond. The workforce employed to construction the proposed Unit 3 may accelerate the demand for additional school space but will not fundamentally change the demand. New schools will be needed in any case. For example, the Louisa County public school system has been planning construction for a new elementary school in response to growth in the area for several years. There was an increase in Louisa County school enrollment from 3926 to 4361 students from 1997 to 2006. The new elementary school is scheduled to open in November 2009.

In view of the fact that the number of construction workers for the proposed Unit 3 is considerably smaller than the number contemplated in the ESP EIS, the impact on schools also is likely to be smaller. However, the range of impacts is still likely to remain SMALL to MODERATE.

4.5.5 Summary of Socioeconomic Impacts

As described in the ESP EIS (NRC 2006), adverse socioeconomic impacts resulting from construction of the Unit 3 range from SMALL to MODERATE, and beneficial impacts range from SMALL to MODERATE.

4.6 Historic and Cultural Resources

The National Environmental Policy Act of 1969 (NEPA) requires Federal agencies to take into account the potential effects of their undertakings on the cultural environment, including archaeological sites, historic buildings, and traditional places important to local populations. The National Historic Preservation Act of 1966 (NHPA), as amended through 2000, also requires Federal agencies to assess impacts to those resources if they are eligible for listing on the National Register of Historic Places (such resources are referred to as "Historic Properties" in the NHPA). As outlined in 36 CFR 800.8, "Coordination with the National Environmental Policy Act of 1969," the NRC coordinated compliance with Section 106 of the NHPA in meeting the requirements of NEPA.

Constructing a new unit can affect either known or undiscovered cultural resources. Therefore, in accordance with the provisions of NHPA and NEPA, the NRC is required to make a reasonable and good faith effort to identify historic properties in the area of potential effect and, if present, determine if any significant impacts are likely to occur. Identification is to occur in consultation with the State Historic Preservation Officer (SHPO), American Indian Tribes, interested parties, and the public. If significant impacts are possible, efforts should be made to mitigate them. As part of the NEPA/NHPA integration, if no historic properties (i.e., places eligible for listing on the National Register of Historic Places) are present or affected, the NRC is required to notify the SHPO before proceeding. If it is determined that historic properties are present, the NRC is required to assess and resolve adverse effects of the undertaking.

As explained in Section 2.9.2 of this supplemental environmental impact statement (SEIS), cultural resource identification efforts indicate the presence of three historic cemeteries and one historic site in the proposed Unit 3 site. Two of these cemeteries (44LS0221 and 44LS0222) were identified in the ESP ER (Dominion Nuclear North Anna, LLC 2006). The third cemetery and the historic site were identified in a November 7, 2007 letter from the SHPO to Dominion (VDHR 2007). Dominion has planned construction activities to avoid all four cultural resource locations (Dominion 2008a). The SHPO indicated that given the scope of the project as presented to the Virginia Department of Historic Resources on October 11, 2007 (Dominion 2007b), letter to Dominion dated November 7, 2007 (VDHR 2007), and avoidance of all four sites (44LS0221, 44LS0222, 44LS0226, and 44LS0227) during construction and operation of the new facilities, the project will not negatively affect historic properties.

In the ESP EIS (NRC 2006), the staff determined the impacts from construction on historic and cultural resources would be SMALL. The newly identified cultural resources (i.e., cemetery-44LS0227 and historic site-44LS0226) were determined to be new and significant information. The historic site was determined to be potentially eligible for the National Register of Historic

Places, thus making its discovery significant. In addition, both cultural resources were identified by the SHPO as resources that should be avoided, making discovery of the cemetery significant as well.

Dominion has made commitments to address the following concerns (Dominion 2008a):

1. A commitment or management plan for evaluating sites found during surveys for eligibility to National Register of Historic Places if avoidance is not the planned action.
2. A written procedure for establishing protective barriers for all historic sites found that were eligible for the National Register of Historic Places if avoidance is the planned action.
3. If avoidance of located (National Register Eligible) sites is planned, provide a written commitment to do so and schedule for fencing or other physical barrier as a double check.
4. If avoidance is not the planned action, a commitment or management plan for mitigation of (National Register Eligible) sites to be destroyed during construction.
5. Written commitment/management practices for addressing cultural resources for future ground disturbing work at the NAPS site.
6. Written commitment or management plan for contacting the Virginia Department of Historic Resources in case of an inadvertent or "post review" discovery.
7. Provide the commitment/management practices for the new cemetery (identified) on the NAPS site.

In Dominion's letter response to the SHPO's November 7, 2007 letter (Dominion 2008d), Dominion committed to avoidance of all four cultural resources of concern defined by the SHPO (i.e., 44LS0221, 44LS0222, 44LS0226, and 44LS0227). Even with the discovery of new and significant information, it is the staff's conclusion that the potential construction impacts on historic and cultural resources would remain SMALL based on this commitment.

Any revised project activities or a change in scope would need to consider the potential impacts of plant construction on both known and unknown historic and archaeological resources at NAPS. Lands not previously surveyed would require investigation by a professional archaeologist prior to any ground-disturbing activities in the future. Any changes to these procedures or project plans should be developed in consultation with the SHPO. Mitigation might be warranted in the event of an inadvertent discovery.

4.7 Environmental Justice

The staff evaluated whether the health or welfare of minority and low-income populations at those census blocks identified in Section 2.10 of this COL EIS could be disproportionately affected by the potential impacts of constructing Unit 3 at the NAPS site. A detailed characterization of the Environmental Justice analysis is contained in the ESP EIS (NRC 2006).

In the ESP EIS, only three areas – local traffic, housing, and education – were identified where adverse impacts during construction of Units 3 and 4 would be classified as greater than SMALL. The analysis documented in the ESP EIS considered impacts under any conditions for any offsite population (including minority and low-income populations) in the area affected by the proposed units.

Traffic congestion in the immediate vicinity of the plant could increase, but this effect would not have a disproportionate and adverse impact on minority and low-income populations because these populations typically live at some distance from the plant site and not on the main commuting routes as shown in Figures 2-6 and 2-7) ESP EIS (NRC 2006). The cost of renting housing in Orange and Louisa Counties might escalate if construction workers crowded into those counties, which is not expected. It is doubtful that the impact would disproportionately fall on the diffuse (i.e., unmapped) minority and low-income individuals in these counties; rather, if it happened at all, all population groups would be affected to some extent, and the distribution of impact would be uncertain. If large numbers of construction workers' children crowded into the public schools of Orange and Louisa Counties, which is not expected, these schools could become more crowded, but the entire populations of these counties would be proportionately affected. After this detailed consideration, as briefly stated in Section 4.7 of the ESP EIS, the NRC staff concluded that there were no environmental pathways by which the identified minority or low-income persons were likely to suffer disproportionate and adverse environmental or health impacts as a result of construction.

Based on new information provided by Dominion in its COL ER (Dominion 2007a) concerning the lower construction employment and Dominion's continued commitment to develop and implement mitigation plans, and NRC's independent review, the staff concludes that offsite impacts of construction of the proposed Unit 3 at the NAPS site to minority and low-income populations would remain SMALL, and mitigation is not warranted.

4.8 Nonradiological Health Impacts

The following sections summarize the results of the NRC staff's assessment of nonradiological health impacts for construction of the proposed Unit 3 at the NAPS site. Physical impacts of construction on public and occupational health, including dust, vehicle emissions, noise, and transportation of materials and personnel, are summarized.

4.8.1 Public and Occupational Health

As discussed in the ESP EIS (NRC 2006), Dominion will develop and implement a dust control program to minimize fugitive dust exposure to the public. Dominion will control exhaust emissions from construction equipment in accordance with Federal, State, and local emission requirements.

In general, human health risks for construction workers and personnel working onsite would be expected to be dominated by occupational injuries (e.g., falls, electrical shock, asphyxiation, etc.) to workers engaged in activities such as construction, maintenance, and excavation. Historically, actual injury and fatality rates at nuclear reactor facilities have been lower than the average U.S. industrial rates. In the COL ER (Dominion 2007a), Dominion reports that the average construction workforce for the proposed Unit 3 will be about 2500 to 3500 workers.

No new and significant information was identified related to public and occupational health during construction activities for the proposed Unit 3. This was based on the staff's review of information in ESP EIS (NRC 2006), the ESP ER (Dominion Nuclear North Anna, LLC 2006), the COL ER (Dominion 2007a), and associated documentation provided by and discussions with representatives of Dominion during an April 2008 site audit. Thus, the impact level remains SMALL, and additional mitigation is not warranted.

4.8.2 Noise impacts

No changes were identified in Dominion's plans for construction that would result in new and significant findings for the impact of noise during construction. During the April 2008 site audit, NRC staff was shown the results of a modeling study showing that noise levels at the Exclusion Area Boundary (EAB) would be less than 65 dBz. As a check on the plausibility of this modeling effort, the NRC staff reviewed guidance published by the Federal Highway Administration's (FHWA) Office of Natural and Human Environment (FHWA 2006). This report addresses a variety of noise sources associated with construction. It notes that noise is an inevitable byproduct of construction, and that there is a history of assessment techniques, some simple and others requiring highly specialized codes, that take a number of factors into account. Some of the additional factors, which are discussed in Section 6.2 of this SEIS, include:

- multiple pieces of construction equipment working either independently or simultaneously
- refined characterization of noise emission (e.g., impulsive or steady)
- distance from each piece of equipment to each receptor
- influence of time-of-day (daytime, evening, or nighttime)
- expected duration of the work
- ground characteristics between the equipment and the receptors

- attenuation caused by constructed or natural barriers
- potential shielding or reflective effects of nearby buildings
- meteorological effects on noise propagation.

To evaluate the reasonableness of Dominion's assertion that noise will not be a problem during construction, the NRC staff noted that blasting associated with construction was estimated to be 94 dBA[a] at 15 m (50 ft) from the source. As a rough guide to sound reduction, the FHWA estimates that sound levels measured from a point source decrease at a rate of 6 dBA per doubling of distance (FHWA 2006). Therefore, at the EAB (870 m [2854.9 ft], per the plant parameter envelope considered in the ESP ER (Dominion Nuclear North Anna, LLC 2006), the noise level at the EAB would be reduced by approximately six doublings resulting in a noise reduction of 36 dBA, or a noise level of 94-36 = 58 dBA, which is comparable with or slightly less than the 65 dBA limit required for other construction activities at the EAB.

Based on information provided by Dominion and the staff's own independent review, the staff concludes the impact would remain SMALL, and mitigation beyond that currently planned is not warranted.

4.8.3 Impacts of Transporting Construction Materials and Personnel to the Proposed Unit 3 Site

Nonradiological health impacts of transporting construction materials and personnel to the proposed Unit 3 site were calculated using the general approach used to calculate nonradiological health impacts of transporting fuel and waste. This is new information that was not in the published ESP EIS (NRC 2006), but later included in response to questions during the hearing process.

Construction material requirements were based on information taken from the ESP ER (Dominion Nuclear North Anna, LLC 2006) and the COL ER (Dominion 2007a). A new 1000-MW(e) unit requires up to 150,000 m^3 (200,000 yd^3) of concrete and 14,000 MT (15,000 tons) of structural steel (Dominion Nuclear North Anna, LLC 2006). In the COL ER, Dominion estimates 2 million linear m (6.5 million linear ft) of cable for a single 1300-MW(e) unit

(a) FHWA (2006) notes that the unit of "noise" relevant to this problem is the A-weighted decibel, or dBA, where A is a weighting factor that gives more weight to the frequencies to which the human ear is most sensitive, and dB is the standard decibel.

and up to 84,000 linear m (275,000 linear ft) of piping greater than 6.4 cm (greater than 2.5 in.) in diameter would be required (Dominion 2007a). Other assumptions included:

- Shipment capacities were 10 m^3 (~13 yd^3) of concrete per shipment, 10 MT (11 tons) of structural steel, and 300 lineal m (1000 lineal ft) of piping and cable per shipment.
- The number of construction workers was estimated at 3500. This value represents the peak workforce for construction (Dominion 2007a). At an average of 1.8 persons/vehicle, there would be about 1950 vehicles per day (NRC 2006). Each person was assumed to travel to and from the NAPS site 250 days per year. A four-year construction period for the proposed Unit 3 was assumed in the COL ER (Dominion 2007a).
- Average shipping distances for construction materials were assumed to be 64 km (40 mi) one way. This assumption was based on the approximate one-way shipping distance from Richmond, Virginia, to the NAPS site. The average commute distance for construction workers was assumed to be 32 km (20 mi) one way.
- Accident, injury, and fatality rates for construction materials were taken from Table 4 in the report entitled *State-Level Accident Rates for Surface Freight Transportation: A Reexamination* (Saricks and Tompkins 1999). Rates for the Commonwealth of Virginia were used for construction material shipments, typically transported in heavy-combination trucks. Impacts associated with commuter traffic (i.e., workers traveling to and from the proposed Unit 3 construction site) were derived from *Virginia Traffic Facts* (DOT 2008a).

The estimated nonradiological impacts of transporting construction materials to the proposed Unit 3 site and of transporting construction workers to/from the site are shown in Table 4-1. Nonradiological impacts are dominated by transport of construction workers to/from the proposed Unit 3 site. The total annual construction fatalities represents less than a 2 percent increase above the 15 traffic fatalities that occurred in Louisa County in 2007 (DOT 2008b). This represents a small increase relative to the current traffic fatality risks in the area surrounding the proposed Unit 3 construction site. Therefore, the staff concludes that the impacts of transporting construction materials and workers to the NAPS Unit 3 site would be SMALL, and mitigation is not warranted.

4.8.4 Summary of Nonradiological Health Impacts

The NRC staff performed an evaluation of the estimated injuries and fatalities that might be incurred during transport of materials and workers to and from the proposed Unit 3 construction site. Impacts were determined to be SMALL. No new and significant information was identified related to nonradiological health impacts during construction activities for the proposed Unit 3 during the staff’s review. The staff’s evaluation consisted of a review of the information in the

Table 4-1. Impacts of Transporting Workers and Construction Materials to/from the Proposed Unit 3 Site

	Accidents per Year	Injuries per Year	Fatalities per Year
Workers	34	15	0.23
Materials			
Concrete	0.66	0.30	0.0045
Rebar	0.059	0.027	0.0004
Cable	0.085	0.039	0.00059
Piping	0.0036	0.0017	0.000025
Total - Construction	34	16	0.24

ESP EIS (NRC 2006), the ESP ER (Dominion Nuclear North Anna, LLC 2006), the COL ER (Dominion 2007a), and associated documentation and discussions with representatives of Dominion during an April 2008 site audit.

4.9 Radiological Health Impacts

The sources of radiation exposure to construction workers include exposures from direct radiation, gaseous radioactive effluents, and liquid radioactive waste discharges from routine operations at the existing NAPS Units 1 and 2 during the site preparation and construction phase of the proposed Unit 3.

4.9.1 Direct Radiation Exposures

In its ESP ER, Dominion identified two principal sources of direct radiation exposure from the existing NAPS Units 1 and 2: (1) the boron recovery tank and (2) the low-level contaminated storage area (Dominion Nuclear North Anna, LLC 2006). The Independent Spent Fuel Storage Installation (ISFSI) was also noted to be an additional source of direct radiation exposure. The staff's evaluation identified no additional sources of direct radiation.

Dominion estimated direct radiation exposure to the construction workers from existing Units 1 and 2 by assuming the construction worker was located at the west protected area fence (i.e., the location closest to the ESP site/the proposed Unit 3 construction site) (Dominion Nuclear North Anna, LLC 2006). Protected area thermoluminescent dosimeter (TLD) measurements at this location were used to estimate the construction worker dose. An average annual TLD reading of 0.56 mSv/yr (56 mrem/yr) was used as the basis for the estimated dose evaluation documented in the ESP ER (Dominion Nuclear North Anna, LLC 2006). This value was based on TLD readings from 1996 through 2002. When corrected for worker occupancy (2080 hr/yr), Dominion estimated 0.13 mSv/yr (13 mrem/yr) to the construction worker from the existing Units 1 and 2. The staff reviewed the area TLD data for the west protected area fence location from 2003 to 2007. The average annual TLD reading for these years was 0.76 mSv/yr

(76 mrem/yr) (Dominion 2008b), which was a 35 percent increase over the average readings from 1996 to 2002. When corrected for worker occupancy, these exposures would result in an estimated annual construction worker dose from Units 1 and 2 of 0.18 mSv/yr (18 mrem/yr). The information on the recent area TLD data was new but not significant as discussed in Section 4.9.4 of this SEIS.

Dominion estimated the direct radiation dose to the construction worker from the ISFSI to be 9.8×10^{-2} mSv/yr (9.8 mrem/yr) based on a fully loaded facility (Dominion Nuclear North Anna, LLC 2006). This dose was calculated at the center of the ESP site (488 m [1600 ft] from the ISFSI). This calculation remains valid for construction workers for the proposed Unit 3 as it also represents the approximate center of the Unit 3 site.

The total direct radiation dose estimate to the construction worker is 0.28 mSv/yr (28 mrem/yr). This compared to a dose estimate of 0.23 mSv/yr (23 mrem/yr) from the ESP evaluation (NRC 2006).

4.9.2 Radiation Exposures from Gaseous Effluents

Dominion used the estimated total body dose, skin dose, and critical organ dose to the maximally exposed individual from gaseous effluents in annual radioactive effluent release report for 2001 (VEPCo 2002) as a basis to estimate the construction worker dose from gaseous effluents (Dominion Nuclear North Anna, LLC 2006). In the ESP EIS, the NRC staff determined this approach to be acceptable (NRC 2006). The staff reviewed annual effluent release reports from recent years (VEPCo 2006, 2007, 2008) and found the 2001 dose to be typical. The estimated total effective dose equivalent (TEDE) from gaseous effluents documented in the ESP ER was 2.1×10^{-3} mSv/yr (0.21 mrem/yr) (Dominion Nuclear North Anna, LLC 2006).

4.9.3 Radiation Exposures from Liquid Effluents

Dominion used the estimated whole body dose and critical organ dose to the maximally exposed individual from liquid effluents in the annual radioactive effluent release report for 2001 (VEPCo 2002) as a basis to estimate the construction worker dose from liquid effluents (Dominion Nuclear North Anna, LLC 2006). In the ESP EIS, the NRC staff determined this approach to be acceptable in NRC (2006). The staff reviewed annual effluent release reports from recent years (VEPCo 2006, 2007, 2008) and found the 2001 dose to be typical. The estimated TEDE from liquid effluents documented in the ESP ER (Dominion 2006) was 9.8×10^{-3} mrem/yr (0.98 mrem/yr).

4.9.4 Total Dose to the Construction Workers

The total annual dose to the construction worker was estimated to be 0.29 mSv (29 mrem), which is the sum of the three pathways: (1) direct radiation, (2) gaseous effluents, and (3) liquid effluents. This dose compared to a dose estimate of 0.24 mSv/yr (24 mrem/yr) from the ESP EIS (NRC 2006). The dose is primarily from the direct exposure pathway, with the doses from liquid and gaseous effluents being small. The revised estimate is new but not significant, as it is well within both the dose limits to individual members of the public found in 10 CFR 20.1301 and occupational dose limits to workers found in 10 CFR 20.1201. The annual dose limit to an individual member of the public is 1 mSv (100 mrem) TEDE. The annual occupational dose limit to workers is 0.05 Sv (5 rems) TEDE.

To obtain the estimated annual collective dose to the construction workers, the annual estimated dose to one construction worker was multiplied times the maximum number of construction workers (i.e., 3500) documented in the COL ER (Dominion 2007a). The estimated maximum annual collective dose to construction workers was estimated to be of 1.02 person-Sv (102 person-rem). This compares to the approximately 10.5 person-Sv (1050 person-rem) dose the construction workers would receive from natural background radiation (i.e., 3500 workers times 300 mrem/yr) (NCRP 1987).

4.9.5 Summary of Radiological Health Impacts

Based on the Dominion estimate of dose to construction workers and the NRC’s independent review, the staff found the doses to be well within NRC exposure limits designed to protect the public health, even if workers exceed the 2080 hrs/yr occupancy factor. Therefore, the staff concludes that the impacts of radiological exposures to construction workers would remain SMALL, and mitigation is not warranted.

4.10 Measures and Controls to Limit Adverse Impacts During Construction

Measures and controls to limit adverse impacts during construction were addressed in Section 4.10 of the ESP EIS (NRC 2006). These measures and controls have been incorporated into the Environmental Protection Plan for the site that is included as Appendix 1A of the COL ER (Dominion 2007a). That plan also includes the following new mitigation measures and controls, which were outlined in Section 4.6 of the COL ER:

- The new transmission lines would be located in an existing transmission line right-of-way and constructed under current practices and procedures applicable to new transmission lines.

- Land-clearing activities to accommodate construction of the new transmission tower foundations would be controlled by existing Dominion transmission line procedures, good construction practices, established BMPs, and applicable regulations.
- Once construction of the transmission lines has been completed, Dominion would restore disturbed areas by the most appropriate means, including restoring all damaged property to its original condition to the satisfaction of the property owner.
- As a safety precaution, during the construction of the transmission lines, access to the transmission line right-of-way will be restricted.
- Clearing methods will be conducted in a manner to protect nature resources and control erosion and siltation of streams. Special procedures would be used for clearing trees and brush within 30 m (100 ft) of a stream or ditch with running water.
- Potential impacts to streams and creeks would be mitigated by performing work related to stream crossings in accordance with standards and specifications by the Commonwealth of Virginia. Materials used for temporary crossings of streams and creeks would be removed and the landscape restored upon completion of the construction activities.
- Soil disturbances would be avoided or reduced to the extent possible within 30 m (100 ft) of streams and ditches with running water. Erosion and sedimentation control measures would be implemented to reduce runoff and erosion.
- To the extent practicable, construction would avoid alterations to shoreline and wetland areas. If wetland areas will be impacted, appropriate Commonwealth and Federal agencies will be contacted and necessary permits and approvals will be obtained prior to construction activities that would impact the wetland areas.
- Dust suppression techniques would be utilized along with good equipment maintenance practices to reduce airborne emissions from construction-related activities.
- The discovery of potential historic or cultural resources will result in a stop work and appropriate procedures will be followed to notify the Virginia Department of Natural Resources.

4.11 Summary of Construction Impacts

Impact level categories identified during the evaluation of the ESP application are documented in Table 4-1 of the ESP EIS (NRC 2006). In that table, the expected environmental impact levels for each category are designated as SMALL, MODERATE, or LARGE. The staff's review of information available during the site audit and from other information sources did not identify any information that would change the designation for any of the categories in Table 4-1. Some impacts, such as the addition of tax revenue from Dominion for the local economies, are still likely to be beneficial impacts to the community even though only one new nuclear unit will be constructed compared to two nuclear units evaluated for the ESP application (Dominion Nuclear North Anna, LLC 2006).

4.12 References

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

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

40 CFR Part 761. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 761, "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions."

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5.0 Environmental Impacts of Operation

This chapter examines environmental issues associated with operation of the proposed Unit 3 nuclear reactor at the North Anna Power Station (NAPS) site for an initial 40-year period as described by Dominion Virginia Power (Dominion) and the Old Dominion Electric Cooperative, collectively known as Dominion. As part of its application for a combined license (COL), which encompasses a construction permit and an operating license, Dominion submitted an Environmental Report (ER) that discussed the environmental impacts of station operation (Dominion 2007a). This chapter is divided into 13 sections. Sections 5.1 through 5.12 discuss the potential operational impacts on land use, meteorology and air quality; water, terrestrial and aquatic ecosystems; socioeconomics; historic and cultural resources; environmental justice; nonradiological and radiological health effects; postulated accidents; global warming, climate change, and greenhouse gas impacts; and applicable measures and controls that would limit the adverse impacts of station operation during the 40-year operating period.

In accordance with Title 10 of the Code of Federal Regulations (CFR) Part 51, impacts have been analyzed and a significance level of potential adverse impacts (i.e., SMALL, MODERATE, or LARGE) has been assigned to each analysis. In the area of socioeconomics related to taxes, the impacts may be considered beneficial and are stated as such. Because the site has an approved early site permit (ESP), the significance level of the potential adverse impact for the various areas evaluated will remain the same as documented in the ESP environmental impact statement (EIS) (NRC 2006) for the NAPS site unless new and significant information has been identified that would modify the original significance level. The definition of new and significant information is documented in a *Federal Register* notice (72 FR 49352). The U.S. Nuclear Regulatory Commission (NRC) staff's determination of significance levels is based on the assumption that the mitigation measures identified in the ER or activities planned by various Commonwealth and county governments, such as infrastructure upgrades, as discussed throughout this chapter, are implemented. Failure to implement these upgrades might result in a change in significance level. Possible mitigation of adverse impacts also is presented, where appropriate. A summary of these impacts is presented in Section 5.13. The references cited in this chapter are listed in Section 5.14.

5.1 Land-Use Impacts

Sections 5.1.1 and 5.1.2 contain information regarding land-use impacts associated with operation of proposed Unit 3 at the NAPS site. Section 5.1.1 discusses land-use impacts at the NAPS site and in the vicinity of the site. Section 5.1.2 discusses land-use impacts with respect to offsite transmission line rights-of-way.

5.1.1 The Site and Vicinity

Operational land-use impacts at the NAPS site and in the vicinity of the site are described in Section 5.1.1 of the ESP EIS (NRC 2006). The only new information identified by the staff related to Section 5.1.1 is that only one new nuclear unit is now planned by Dominion for the NAPS site. This information reduces land-use impacts at the site and does not change the impact characterization in Section 5.1.1 of the ESP EIS.

The staff did not identify information that was both new and significant related to operations impacts on land use through its evaluation of the information provided by Dominion and the NRC staff's own independent review. The staff concludes that the land-use impacts of operations would remain SMALL, and additional mitigation is not warranted.

5.1.2 Offsite Transmission Line Rights-of-Way

Operational land-use impacts associated with offsite transmission line rights-of-way are discussed in Section 5.1.2 of the ESP EIS (NRC 2006). The only new information identified by the staff related to Section 5.1.2 is that Dominion's COL ER states that a 2007 study by PJM Interconnection, LLC (Dominion 2007a) concluded that a new 500-kV transmission line from NAPS to the Ladysmith Substation would be needed for grid stability with the interconnection of the proposed Unit 3 (Dominion 2007a). The new transmission line would be installed on new towers in the existing NAPS to Ladysmith right-of-way, which runs to the east from the NAPS site. The right-of-way is approximately 84 m (275 ft) wide and 24 km (15 mi) long. Because the new transmission line would be built entirely in the existing right-of-way, with no widening, the staff concludes that the changes in the information related to land use are minor, and have no potential to change the staff's impact characterization in the ESP EIS.

The NRC staff did not identify information that was both new and significant related to the operations impacts on land use through its evaluation of the information provided by Dominion and the staff's own independent review. The staff concludes that the land-use impacts of operating offsite transmission line rights-of-way would remain SMALL, and additional mitigation is not warranted.

5.2 Meteorological and Air Quality Impacts

As noted in the ESP EIS (NRC 2006), the proposed cooling systems for NAPS include a closed-cycle, combination wet and dry cooling system for the proposed Unit 3. The meteorological and air quality impacts from operation of the proposed Unit 3 would be limited to those resulting from the cooling system and periodic pollutant emissions from auxiliary boilers and generators that support the proposed Unit 3.

ESP EIS (NRC 2006) notes that significant chemical interaction of the cooling tower plume and pollutants emitted onsite or in the vicinity of the plant are not anticipated. In general, the approach to minimizing the potential for contact with cooling tower drift is to limit parking or work activities in the vicinity of the cooling towers. Air quality impacts from routine releases other than the cooling system would be limited to nonradiological pollutants emitted during the operation of auxiliary boilers and emergency generators, and emissions from onsite service vehicles. With regard to air quality impacts for criteria pollutants, given the distance from the Prevention of Significant Deterioration Class I areas (see the Clean Air Act, Section 169A, and 40 CFR Part 51, Subpart P) and the short duration of emissions, the resulting impacts on local ambient air quality levels or visibility in the Class I areas are estimated to be negligible.

The impact of transmission lines on air quality was addressed in Section 5.2 of the ESP EIS (NRC 2006). Since preparation of the ESP EIS, Dominion has determined that additional transmission lines will be required to support the operation of the proposed Unit 3. This is considered new information, but the impact on air quality is not considered to be significant given the anticipated size of the additional lines, the length of the lines, and the results of a previous evaluation of transmission lines on air quality (NRC 1996). In addition, because only one unit is being constructed, the anticipated emission of pollutants from auxiliary boilers and emergency generators will be less than anticipated in the ESP EIS.

The NRC staff did not identify information that was new and significant related to the operational impacts on meteorology and air quality through its evaluation of the information provided by Dominion and the staff’s own independent review. The staff concludes that the meteorology and air quality impacts of operation would remain SMALL, and additional mitigation is not warranted.

5.3 Water-Related Impacts

This section describes the potential water-related impacts associated with operation of the proposed Unit 3 at the NAPS site. An overview of two proposed units (Units 3 and 4) and a detailed discussion of operations-related impacts on water use and water quality are provided in Section 5.3 of the ESP EIS, with supporting analysis in Appendix K of ESP EIS (NRC 2006). Dominion’s COL application (Dominion 2007a) is for construction of only one unit (Unit 3), using the Economic Simplified Boiling-Water Reactor (ESBWR) design with a closed-loop hybrid cooling system that employs wet and dry cooling depending on operating conditions (see description in Chapter 3 of this supplemental EIS (SEIS). In the following sections, the NRC staff summarizes the impacts described in the ESP EIS, evaluates new information available for review since preparation of the ESP EIS, and determines whether there are any changes to the impact levels determined at the ESP stage.

5.3.1 Hydrological Alterations

The information and associated impacts for this section are provided and resolved in Section 5.3.1 of the ESP EIS (NRC 2006). Based on the staff's analysis, operations-related impacts of hydrological alterations were considered to be SMALL. New information available since preparation of the ESP EIS includes changes to onsite drainage and to the cofferdam design. The NRC staff reviewed the onsite drainage plan and determined that it was adequate to manage stormwater runoff. The cofferdam design will not appreciably alter the flow regime in the vicinity of the intake.

The NRC staff did not identify information that was both new and significant to operation-related impacts from hydrologic alterations in its evaluation of information provided by Dominion and the staff's independent review. The staff concludes that impacts of hydrological alterations from operation of the proposed Unit 3 would remain SMALL, and further mitigation beyond the actions stated is not warranted.

5.3.2 Water-Use Impacts

The information and associated impacts for this section are provided and resolved in Section 5.3.2 of the ESP EIS (NRC 2006). The staff concluded that water-use impacts caused by operation of the proposed Unit 3 would be SMALL in normal years and MODERATE in drought years. New information available since preparation of the ESP EIS includes updated withdrawal rates, consumptive water use, and blowdown flowrates.

Based on the bounding parameters provided in the ESP application (Dominion Nuclear North Anna, LLC 2006a), the NRC staff performed an independent assessment of the water budget of Lake Anna and the North Anna River downstream of the lake (NRC 2006). Based on more-detailed information from Dominion, the consumptive water use for the proposed Unit 3 is within the plant parameter envelope (PPE) range stated in the ESP application.

The staff did not identify information that was both new and significant to operation-related impacts to water use in its evaluation of information provided by Dominion and the staff's independent review. The staff concludes that water-use impacts caused by operation of the proposed Unit 3 would remain SMALL in normal years and MODERATE in drought years.

5.3.3 Water-Quality Impacts

The information and associated impacts for this section are provided in Section 5.3.3 of the ESP EIS (NRC 2006). In the ESP EIS, the staff concluded that water-quality impacts resulting from operation of the proposed Unit 3 were unresolved but were expected to be SMALL. The water-quality impacts were unresolved at the ESP stage because without a specific design, Dominion could not provide specific information on water treatment systems. However, adequate information was available at the ESP stage to evaluate the thermal impacts. Based on the small discharge rate (< 2 percent) of Unit 3 blowdown relative to the discharge rate of the existing units, the staff determined that the incremental thermal impact of Unit 3 would be negligible (NRC 2006). The NRC staff did not identify information that was both new and significant related to thermal discharges to Lake Anna. Thus, the staff concluded that impacts of releases during proposed Unit 3 operation on the thermal aspect of water quality remain SMALL.

New information available since preparation of the ESP EIS includes additional information on the ambient water quality in Lake Anna, a description of plant water treatment methods and chemical additives, blowdown flowrates, and expected chemical concentrations in the plant discharge.

The COL ER (Dominion 2007a) describes the chemical additives in the water treatment system and expected concentrations of pollutants in effluent associated with Unit 3. In its COL ER, Dominion stated that the onsite sanitary waste treatment system will comply with industry design standards and its effluent will be regulated and monitored under a Virginia Pollutant Discharge Elimination System (VPDES) permit and 9 VAC 25-790 (Sewage Collection and Treatment Regulations, Commonwealth of Virginia, State Water Control Board). Treated effluent from the proposed new sanitary plant would be combined with Unit 3 plant discharges in the blowdown sump before discharging to the Waste Heat Treatment Facility (WHTF) (Dominion 2007a). As discussed in Section 3.2.4.1 of this SEIS, Unit 3 plant effluent (service water and circulating water cooling tower blowdown) will contain low levels of chemicals and/or biocides that are used for water treatment. None of these chemicals will contain any of the 126 priority pollutants listed in 40 CFR 423, Appendix A.

The effluent streams from the proposed Unit 3 will include some of these priority pollutants because they are already present in the ambient waters of Lake Anna. Evaporation of water during operation of Unit 3 is expected to concentrate pollutants four to nine times relative to ambient lake water (Dominion 2007a). Although the estimated effluent concentrations of most pollutants did not exceed state water-quality criteria, copper (from past mining operations) and tributyltin (used in paint for marine applications) in Lake Anna are already at or above water-quality criteria. Therefore, evaporation during operation of the proposed Unit 3 would likely concentrate these chemicals enough to exceed water-quality criteria before being released into the discharge canal. However, once the proposed Unit 3 discharge is released, it will be rapidly diluted with the much larger volume of water discharged from Units 1 and 2. This dilution would occur in the discharge canal and before entering the WHTF. Additional dilution would occur in the WHTF and Lake Anna.

Discharge water-quality parameters for the proposed Unit 3 is within (equal to or less than) the range of PPE values evaluated for the ESP. Based on the above assessment of the current operational parameters for the proposed Unit 3, the NRC staff concludes that the impacts of operating the proposed Unit 3 on water quality would remain SMALL. Pollutant discharges would be regulated under a VPDES permit issued by the Commonwealth of Virginia.

5.4 Ecological Impacts

This section describes the potential impacts to ecological resources from the operation of the proposed Unit 3 and discusses impacts to terrestrial and aquatic ecosystems and to threatened and endangered species.

5.4.1 Terrestrial Ecosystem

The information and associated impacts for this section are provided and resolved in Section 5.4.1 of the ESP EIS (NRC 2006). Based on the staff's analysis, operations-related impacts to terrestrial ecosystems were considered to be SMALL. Information available since preparation of the ESP EIS include updated analyses of the potential impacts of salt drift, vapor plumes, fogging and icing, and noise associated with operation of the cooling towers, as well as information about the operation and maintenance impacts associated with the new transmission line connecting the NAPS site to the Ladysmith Substation.

5.4.1.1 Cooling Tower Impacts on Terrestrial Ecological Resources

Salt Drift

Dominion evaluated the potential effects of salt deposition, vapor plumes, fogging, and icing using the Seasonal and Annual Cooling Tower Impacts (SACTI) computer code, which is a system of computer programs initially written and assembled by the Argonne National Laboratory for the Electric Power Research Institute (ANL 1984). Salt deposition effects to surrounding vegetation were evaluated in the ESP EIS (NRC 2006). At that time, it was estimated that deposition would be less than 1 kg/ha/month, and the staff concluded that impacts resulting from this deposition would be minimal. During the site audit in April 2008, the staff reviewed the results from updated simulations of the salt deposition based on the currently proposed tower design, and found that deposition rates were still well below levels considered to be damaging to vegetation. In addition, the staff determined that there are no important species or habitats as defined by NRC (2000a). Therefore, the staff found no new and significant information regarding salt drift, and concludes that salt drift effects on surrounding vegetation would remain SMALL, and mitigation is not warranted.

Vapor Plumes and Icing

The staff evaluated the environmental impact of fogging, icing, and vapor plumes in the ESP EIS (NRC 2006). In the ESP EIS, the staff determined that operation of the cooling tower would have a minimal effect on fogging, icing, and vapor plumes. Since the preparation of the

ESP EIS, the staff reviewed the results from updated simulations based on the proposed design of the cooling tower, and determined that the ESP EIS analysis was bounding on the current potential impacts. Therefore, the staff's conclusion that the potential impacts of fogging, icing, and vapor plumes will remain SMALL remains unchanged, and mitigation is not warranted.

5.4.1.2 Noise

Maximum noise levels from the operation of the reactors and combination wet and dry cooling towers would be similar to current noise levels at the NAPS site to which local species are adapted. In the ESP EIS (NRC 2006), the staff determined that noise levels at the NAPS site are occasionally as high as 100 decibels (measured at the security fence during outages), but they are typically less than 80 to 85 decibels, which is the level at which birds and small mammals are startled or frightened (Golden et al. 1979). More likely, the noise level would be 65 dBa or lower, and noise levels from operation of the cooling towers would be less than 65 decibels at the exclusion area boundary. Since the preparation of the ESP EIS, Dominion reassessed the potential noise levels based on the proposed cooling tower design and the proposed service water towers, and found that the maximum noise level is still less that 65 dBa. The staff reviewed the reanalysis and found that the new information regarding noise levels does not change the staff's conclusion that noise impacts to terrestrial ecological resources would remain SMALL, and mitigation is not warranted.

5.4.1.3 Avian Collisions

The heights of the proposed facilities presented in the COL ER (Dominion 2007a), including the reactor building and the cooling towers, are within the PPE evaluated in the ESP EIS (NRC 2006), and the staff found no new information regarding avian collisions at the NAPS site. Dominion continues to follow a migratory bird protection program, including protection of nests and reporting of bird (especially raptor) strikes and other events (Dominion 2001). Therefore, the staff found that new information regarding the height of the proposed facilities does not change the staff's conclusions that impacts to bird populations from collisions with heat dissipation and other facility structures would remain SMALL, and mitigation is not warranted.

5.4.1.4 Shoreline and Riparian Habitat

The staff evaluated the potential impacts to the shoreline of Lake Anna and the North Anna River downstream from the NAPS site in the ESP EIS (NRC 2006). In that analysis, the staff determined that Lake Anna would, on occasion, experience extended periods of lowered lake elevation and discharge to the North Anna River, but these events would not have long-lasting impacts to the shoreline and riparian plant and animal communities. Dominion is monitoring the impacts of lake level changes on shoreline and wetland vegetation as part of its Instream Flow Incremental Methodology (IFIM) monitoring program. The estimated water budget for the proposed Unit 3 is within the range of values evaluated in the ESP EIS; therefore, the staff's conclusion that impacts regarding shoreline and riparian habitat would be SMALL is unchanged, and mitigation is not warranted.

5.4.1.5 Transmission Line Rights-of-Way

The vegetation in the existing NAPS to Ladysmith transmission line right-of-way is managed primarily through a combination of selective cutting and herbicide treatments, with about 10 percent of the right of way being mowed. Dominion has procedures in place to protect sensitive habitat areas such as wetlands, and stream crossings, and it attempts to maintain vegetative buffers in these areas. Although no rare or sensitive plant species are known to occur within the NAPS to Ladysmith transmission line right-of-way, Dominion has procedures in place to ensure that such species are identified and avoided, or modified treatment practices are used to avoid adverse impacts. These modified vegetation treatments are developed in cooperation with the Virginia Department of Conservation and Recreation (VDCR) Natural Heritage Program (NRC 2002).

The right-of-way for the transmission line from NAPS to the Ladysmith Substation has been maintained as a transmission line right-of-way for a number of years, and the addition of another set of towers and conductors within the existing right-of-way is not likely to significantly alter the maintenance practices or impacts. Therefore, the staff concludes that the effect of maintenance of the transmission line right-of-way on terrestrial resources would be SMALL, and mitigation is not warranted.

5.4.1.6 Summary of Terrestrial Ecosystems Impacts

The staff considered potential impacts to terrestrial ecological resources of operating the proposed Unit 3, including salt drift; fogging; icing; noise; avian collisions; changes to shoreline, riparian, and wetland habitat; and transmission line rights-of-way. The staff did not identify information that was both new and significant related to the operation impacts on terrestrial resources through its evaluation of information provided by Dominion and the staff's own independent review. The staff concludes that the operational impacts on terrestrial ecological resources of Unit 3, and the maintenance of the NAPS to Ladysmith transmission right-of-way would remain SMALL, and mitigation is not warranted.

5.4.2 Aquatic Impacts

The information and associated impacts for this section are provided and resolved in Section 5.4.2 of the ESP EIS (NRC 2006). Based on the staff's analysis, the impacts associated with the operation of the proposed units would increase impingement and entrainment losses by up to 3 percent relative to the losses related to operation of the existing Units 1 and 2. Thermal impacts (cold shock, heat stress) and physical impacts to aquatic resources related to operation of the originally proposed Units 3 and 4 were expected to be negligible because of the negligible increase in water withdrawal and heat load attributable to Unit 3. The staff also determined that although the operation of the originally proposed Units 3 and 4 would increase the percentage of time that the reservoir surface elevation would be at or below 75.6 m (248 ft) above mean sea level, the associated flow reductions over the North Anna Dam would not likely occur during critical spawning periods for downstream fish communities. The staff's overall conclusion was that impacts on Lake Anna and downstream aquatic communities would be SMALL and mitigation would not be warranted (NRC 2006). The staff reviewed information made available since preparation of the ESP EIS as it relates to impacts of operation on aquatic resources to determine whether changes to the previously determined impact levels were warranted.

5.4.2.1 Intake and Discharge Systems

As described in Section 3.4, the intake design proposed by Dominion since preparation of the ESP EIS includes the installation of five box culverts in the existing cofferdam, each with a width of 3.7 m (12 ft) and a height of 3.1 m (10 ft). The proposed intake structure, as described by Dominion (2008a), will include three pump/screen bays, each equipped with a trash rack and a dual-flow traveling screen that includes a 2.4-m (8-ft)-wide basket with 2-mm (0-08 in.) mesh size. The maximum flow velocity into the trash racks at the intake structure opening is designed to be less than 0.15 m/sec (0.5 ft/sec). The flow velocity through the box culverts connecting Lake Anna with the intake approach channel is designed to be approximately 0.03 m/s (0.1 ft/s), similar to the velocity in Lake Anna. This is intended to minimize entrainment of debris, sediment, and aquatic life. The approach channel is designed to slow the flow to approximately 0.003 m/s (0.01 ft/s) before water reaches the pump screens. The design flow velocity at the pump screens is less than 0.15 m/s (0.5 ft/s). Based on this design, shoreline erosion and other physical impacts (scouring, increased turbidity) associated with operation of the proposed Unit 3 intake are expected to be negligible. Similarly, the maximum blowdown rate for the proposed Unit 3 (350 L/s [12.4 cfs]) is essentially unchanged from the ESP estimates of the COL ER (Dominion 2007a). Therefore, the physical impacts associated with discharges from the proposed Unit 3 intake are still considered to be negligible.

5.4.2.2 Impingement and Entrainment

Based on the information in the COL ER (Dominion 2007a), the maximum makeup water flow rates for the proposed Unit 3 is expected to be 971 L/s (15,376 gpm) under Maximum Water Conservation mode, and 1407 L/s (22,260 gpm) under Energy Conservation mode. Recent information from Dominion (Dominion 2008a) confirms these estimates, and indicates the addition of the proposed Unit 3, as described in Dominion (2007a; 2008a), will increase water withdrawal from Lake Anna by approximately 1 percent compared to the current withdrawals by Units 1 and 2. A similar conclusion was reached in the ESP EIS (NRC 2006).

As described in Section 5.4.2 of the ESP EIS (NRC 2006), Dominion determined that the operation of Unit 3 at 100-percent pumping capacity would increase average yearly impingement losses from Lake Anna from 182,440 individuals due to operation of Units 1 and 2 to 187,880 with the addition of the proposed Unit 3, or approximately 3 percent (NRC 2006). Similarly, overall yearly entrainment during spawning months would increase from about 149 million larvae to about 153 million larvae, or approximately 2 percent (NRC 2006). Using this information, the staff concluded in the ESP EIS that the impacts of both impingement and entrainment of Unit 3 operations in addition to the losses from Units 1 and 2 would be negligible (NRC 2006).

The NRC staff reviewed environmental monitoring data for Lake Anna and the North Anna River made available since preparation of the ESP EIS. These data were derived from reports that include a summary of existing conditions and an evaluation of trends over at least a 10-year period (Dominion Nuclear North Anna, LLC 2006b; Dominion 2007b, 2008b). The results of the staff review are presented in Section 2.7.2 and suggest that the fish populations of Lake Anna and the North Anna River have generally remained stable over the past decade. Because the makeup water requirements for the proposed Unit 3 are within the PPE values described in the ESP ER (Dominion Nuclear North Anna, LLC 2006a), and no new and significant information concerning the impacts of impingement and entrainment on aquatic resources was found, the staff concludes that the estimates of impingement and entrainment losses developed during the ESP process are still valid. Thus, impingement and entrainment impacts associated with the operation of the proposed Unit 3 would remain SMALL.

5.4.2.3 Aquatic Thermal Impacts

In the COL ER (Dominion 2007a), Dominion provided revised data on the thermal releases associated with the operation of the proposed Unit 3 cooling system. These data indicated that the proposed Unit 3 blowdown water temperature is expected to be a maximum of 38°C (100°F). This blowdown temperature is identical to the PPE value described in the ESP ER (Dominion Nuclear North Anna, LLC 2006a). Thus, the staff's conclusion stated in the ESP EIS that the thermal impacts of the proposed Unit 3 are SMALL is still valid, and mitigation is not warranted.

5.4.2.4 Downstream Impacts

Because the existing biological communities in the North Anna River downstream of the dam experience a wide variation in seasonal and even daily river flows, most resident species are able to tolerate the stressful conditions associated with periodic low-flow events. Further, based on the independent analyses of flow alterations conducted by the staff, changes in flow regimes associated with the operation of the proposed Unit 3 are not expected to affect spawning fish because spawning events generally occur during the spring and early summer when low-flow conditions are unlikely. For these reasons, the staff concluded in the ESP EIS (NRC 2006) that impacts associated with the operation of Unit 3 on aquatic resources downstream of the North Anna Dam would not be significant.

Since preparation of the ESP EIS, the staff has reviewed the revised the water budget provided by Dominion, evaluated the North Anna River low-flow monitoring study results presented in Dominion (2004), and reviewed the NAPS IFIM study plan that describes current work being performed by Dominion to evaluate the effects of flow on the aquatic resources of the North Anna River. Based on a review of the new water budget provided by Dominion since the ESP EIS (Dominion Nuclear North Anna, LLC 2006a) was prepared, the staff concludes that the expected flow reductions at the North Anna Dam developed during the ESP process are still valid. Thus, the staff estimates that the percentage of time the surface elevation of Lake Anna would be below 75.6 m (248 ft) above mean sea level would increase from approximately 6 percent when only Units 1 and 2 are operating (baseline conditions) to 11 percent when Units 1, 2, and 3 are operating. This will increase the number of days that 0.6 m^3/s (20 cfs) releases are required from approximately 22 to 40 days per year. Decreased flows are expected to occur primarily in the late summer and early fall, and will not coincide with fish spawning in downstream locations. In 2004, Dominion published the *North Anna Low Flow Monitoring Report*, which summarized the results of physio-chemical and biological monitoring conducted on the North Anna River in response to period of low flow from December 2001 to November 2002, which resulted from a regional drought. The study found that fish and invertebrate assemblages observed during the drought were similar to those observed during surveys when more normal flow predominated, suggesting the system is tolerant of low-flow conditions, as described above.

As described in Section 2.7.2, as a condition of the ESP process, Dominion agreed to conduct an IFIM study of the North Anna River below the dam to determine whether reductions in water releases associated with the operation of Unit 3 would affect downstream resources. Based on the study design described in EA (2007), the study uses hydrologic information combined with observations of substrate and cover in a model that integrates these habitat characteristics with habitat requirements of key species, to estimate “weighted usable area” over a range of stream flows. As proposed, the study does not include the collection of biota. Rather, it relies on habitat suitability criteria for a variety of species of interest, and evaluates flow regimes that are representative of baseline conditions (operation of Units 1 and 2 only), the addition of the proposed Unit 3 under normal operations and maximum water conservation mode, and flow alterations under three-unit operation with an increase in reservoir surface elevation from 76.2 m (250 ft) to 76.3 m (250.3 ft) above mean sea level. The IFIM study is underway, but is not yet complete. Because the IFIM study results are primarily intended to inform decisions on reservoir management and relies on modeling rather than biological observations to reach conclusions, the staff believes the IFIM study results can be used to assess cumulative impacts to aquatic resources in the North Anna River, and will review the IFIM study results as soon as they are available.

Based on the previous results presented in the ESP EIS (NRC 2006), an evaluation of new information, including the low-flow monitoring report and the IFIM study plan described above, the staff concludes that the impacts associated with operations at the NAPS site and the proposed Unit 3 on downstream aquatic communities would not be significant. This conclusion is consistent with the conclusion reached in the ESP EIS (NRC 2006). Thus, downstream impacts are expected to remain SMALL. As described above, potential revisions to the Lake Level Contingency Plan may be required by the Commonwealth of Virginia based on the results of the IFIM study.

5.4.2.5 Summary of Aquatic Impacts

The aquatic plants and animals present in Lake Anna represent a balanced aquatic community. Studies of the aquatic resources in the lake suggest that these populations have remained stable as the reservoir has matured. Because of the demand for public fishing, state resource agencies in cooperation with Dominion have stocked the lake with both predator and prey species, and will continue to manage and monitor the lake collaboratively. An example of this is Dominion’s commitment to perform a preliminary investigation of mussel populations in Lake Anna to determine if mussel species should be included in the lake monitoring plan (Dominion 2008c). Similarly, the North Anna River below the dam supports a diverse assemblage of fish and invertebrates that are adapted to the flow regimes of the river and are tolerant of extreme conditions. Dominion continues to monitor these downstream resources, shares the information with Commonwealth resource agencies, and has recently agreed to add a new study component that will evaluate smallmouth bass populations below the dam (Dominion 2007b).

The NRC staff conducted an assessment of the current operational parameters for the proposed Unit 3 cooling system described in the COL ER (Dominion 2007a) and a review of new information. Because the staff did not identify information that was both new and significant, the conclusions for shoreline erosion, scouring, increased turbidity, entrainment, impingement, and thermal impacts are unchanged from those presented in the ESP EIS (NRC 2006). Consistent with those findings, the staff concludes that the aquatic impacts to Lake Anna and the downstream communities from the operation of Unit 3 would remain SMALL and mitigation is not warranted.

5.4.3 Threatened and Endangered Species

The information and associated impacts for threatened and endangered species are provided and resolved in Section 5.4.3 of the EPS EIS (NRC 2006).

5.4.3.1 Terrestrial Species

The information and associated impacts for this section are provided and resolved in Section 5.4.3 of the ESP EIS (NRC 2006). Based on the staff's analysis, operations-related impacts to threatened or endangered species were considered to be SMALL. Information made available since preparation of the ESP EIS includes the Federal delisting of the bald eagle (*Haliaeetus leucocephalus*), and several changes to the State list of endangered or threatened species as described in Section 2.7.

Since preparation of the ESP EIS (NRC 2006), the bald eagle has been removed from the list of species protected under the federal Endangered Species Act (72 FR 37346), but it is still listed as Threatened by the Commonwealth of Virginia, and is protected by the Federal Bald and Golden Eagle Protection Act. The U.S. Fish and Wildlife Service (USFWS) has issued management guidelines (USFWS 2008b) that provide suggested buffers to avoid harassment of eagles. In general, most construction activities that occur beyond 660 feet from a nest would not be considered harassment under these guidelines, and blasting or other very loud noises beyond about 0.8 km (0.5 mi) from a nest would not be considered harassment. Dominion stated previously (Dominion Nuclear North Anna, LLC 2006b) that it follows nest site protection guidelines provided by the USFWS and the Virginia Department of Game and Inland Fisheries (VDGIF) (USFWS and VDGIF 2000), in which the primary management zone is 229 m (750 ft). Dominion has confirmed (Dominion 2008a) that the nearest bald eagle nest is in the Contrary Creek drainage, approximately 3.2 km (2 mi) west of the NAPS site; this nest is not likely to be affected by the operation of the proposed Unit 3.

Three Federally listed threatened or endangered plant species have been identified as potentially occurring within the NAPS site transmission line rights-of-way. These species include the small whorled pogonia (*Isotria medeoloides*), swamp pink (*Helonias bullata*), and the sensitive joint-vetch (*Aeschynomene virginica*). Each of these species requires wetland habitats with specific soil types, which are not found within the NAPS to Ladysmith transmission line right-of-way. In its assessment of the potential impacts of continued operation of the existing Units 1 and 2 at NAPS, the staff concluded that continued operation and maintenance of the transmission lines and rights-of-way would not adversely impact these plant species (NRC 2002). Because no changes to the maintenance practices within the transmission line rights-of-way are anticipated to result because of the addition of another transmission line to support the proposed Unit 3, there would be no change to the potential impact of operation and maintenance of the transmission lines or rights-of-way on these or any other threatened or endangered plant species.

The staff evaluated the potential impacts of operation of the proposed Unit 3, including operation of the plant, cooling system, and transmission system. The staff did not identify information that was both new and significant related to the operation impacts on terrestrial threatened or endangered species through its evaluation of information provided by Dominion and the staff's own independent review. Based on this evaluation, the staff concludes that the impacts of operating the proposed NAPS Unit 3 on terrestrial threatened and endangered species would remain SMALL, and mitigation is not warranted.

5.4.3.2 Aquatic Species

During the review process for the COL application (Dominion 2007a), the staff reviewed the COL ER and other information provided by Dominion since preparation of the ESP EIS, met with Virginia DEC personnel, reviewed scoping comments associated with the COL action, and searched relevant threatened and endangered databases.

As described in Section 2.7.2.2, the staff determined that two additional species, the green floater (mussel) (*Lasmigona subviridis*) and the Virginia Piedmont waterboatman (aquatic insect) (*Sigara depressa*), could occur in the upper Pamunkey River watershed based on information available on the VDCR Natural Heritage website (VDCR 2008). Neither species occurs on USFWS species lists by county (USFWS 2008a). Based on the information provided to the staff by Dominion in support of the COL action, none of the species listed in Section 2.7.2.2, Table 2-4, have been observed or collected in Lake Anna or the North Anna River during pre-impoundment surveys or in more recent routine monitoring surveys. Therefore, there would be no impact on any of the listed mussel species due to operation of an additional unit at NAPS.

The staff did not identify any new and significant information suggesting that the distribution of aquatic threatened and endangered species in the regions encompassing Lake Anna or the North Anna River has changed since preparation of the ESP EIS (NRC 2006), or that the list of identified or candidate species has changed. Therefore, the staff concludes that the determination of SMALL impact to aquatic threatened and endangered species is still valid.

5.5 Socioeconomic Impacts

This section describes the socioeconomic impacts from operating the proposed Unit 3 at the NAPS site, and from the activities and demands of the operating workforce on the surrounding region. Socioeconomic impacts include potential impacts on individual communities, the surrounding region, and minority and low-income populations.

5.5.1 Physical Impacts

This section assesses the potential physical impacts on the nearby communities that could result from the operation of the proposed Unit 3 at the NAPS site. Potential impacts discussed include noise, odors, exhausts, thermal emissions, and visual intrusions. Dominion plans to manage these physical impacts to comply with applicable Federal, Commonwealth, and local environmental regulations (Dominion Nuclear North Anna, LLC 2006a). Dominion does not expect operation of the proposed Unit 3 to significantly affect the NAPS site and its vicinity (Dominion Nuclear North Anna, LLC 2006a). The staff's evaluation is discussed in the following subsections.

5.5.1.1 Workers and the Local Public

The information and associated impacts for this section are provided and resolved in the ESP EIS, Section 5.5.1.1 (NRC 2006). The staff evaluated the information provided by Dominion and notes that most of the local public is located well away from the NAPS site, and onsite impacts to site workers can be mitigated. Based on these considerations and its own independent review, the staff concluded in the ESP EIS that the overall physical impacts of station operation to workers and the local public were SMALL, and additional mitigation beyond the actions discussed in the ESP EIS was not warranted. New information available since the ESP EIS was prepared does not change this conclusion.

5.5.1.2 Buildings

The information and associated impacts for this section are provided and resolved in the ESP EIS, Section 5.5.1.2 (NRC 2006). Because operational activities at the proposed Unit 3 are not expected to impact any offsite buildings, most of which are located well away from the NAPS ESP site boundaries, the staff concludes that any offsite physical impacts from station operation to buildings would remain SMALL, and mitigation is not warranted.

5.5.1.3 Roads

The information and associated impacts for this section are provided and resolved in the ESP EIS, Section 5.5.1.3 (NRC 2006). Based on the staff assumption that any needed upgrades to the regional road system would have been made in conjunction with, or as a result of, the construction of the proposed Unit 3, and that the number of operating personnel would be significantly fewer than the number of construction personnel, the staff concludes that the physical impacts of station operation on the road system would remain SMALL, and mitigation is not warranted.

5.5.1.4 Aesthetics and Recreation

The information and associated impacts for this section are provided and resolved in the ESP EIS, Section 5.5.1.4 (NRC 2006). Because the proposed Unit 3 would be located in the existing NAPS boundary and the visual aspects of the site to offsite viewers would be limited by screening and topography, and based on information provided by Dominion (Dominion Nuclear North Anna, LLC 2006a) and its independent review, the staff concludes that the aesthetic impacts from the operation of Unit 3 would remain SMALL. There would be an elevated steam plume from the operation of the Unit 3 cooling towers; the staff concludes that the visual impacts would be quite noticeable at times, especially during the winter (periodic MODERATE visual impact). On an annual basis, however, this impact would be limited to about 10 percent of the year and would have the least impact from mid-spring to early fall when outdoor recreation is most likely to occur. In addition, the staff identified that during severe drought conditions, the operation of the proposed Unit 3 would have an impact on the water levels by slightly adding to the duration and extent of shoreline mud flats that could be exposed; the staff concludes that these visual aesthetic impacts would temporarily be MODERATE. Because of the temporary and infrequent nature of the impacts, mitigation is not warranted.

Since the ESP EIS was prepared, confirmatory noise and visual aesthetic studies were performed by Dominion (2007a). To satisfy the commitment made in the ESP EIS (NRC 2006), a confirmatory analysis of the noise levels associated with the cooling towers was performed, using the location of the towers, the topography of the area in the vicinity of the towers, and manufacturer's data typical of the towers selected for the proposed Unit 3. The methodology used was the same as that used in the analysis reported in the ESP ER (Dominion Nuclear North Anna, LLC 2006a). The confirmatory analysis concluded that the noise level reported in the ESP ER, associated with the cooling towers, remained bounding. Therefore, the impact level for noise remains SMALL.

Regarding visual impacts, the principal visible Unit 3 structures that can be seen from the access road are the hybrid and dry cooling towers, which because of their low profile are mostly obscured behind a line of trees adjacent to the access road. From the Units 1 and 2 intake area (from the lake), the proposed Unit 3 facilities blend in with the existing Units 1 and 2 buildings. The visual effect will be approximately the same from other directions where the existing Units 1 and 2 are visible. The proposed Unit 3 profile is of a similar shape and size as that of Units 1 and 2. The Unit 3 cooling towers are designed to abate the vapor plumes, and a confirmatory analysis was conducted by Dominion with the closed-cycle, combination wet and dry cooling towers, using manufacturer's data representative of the proposed Unit 3 cooling tower design. The method used to estimate the impact of operating the cooling towers was again the SACTI system of computer programs (ANL 1984). The confirmatory analysis confirmed that the previous visual aesthetic effect discussed in the ESP EIS (NRC 2006) remained bounding; that is, the impact would be no larger than that contained in the ESP EIS. The ESP EIS concluded that for most of the year, the visual aesthetic impact would be SMALL, rising to MODERATE approximately 10 percent of the time. In summary, the visual impact to the public from the proposed Unit 3 buildings will be similar to the visual impact from the existing Units 1 and 2, and the impact from the vapor plume will be no larger than that reported in the ESP EIS. Thus, the aesthetic impact will continue to be SMALL, rising to MODERATE no more than 10 percent of the time. Significant mitigation has been undertaken to minimize the temporary and infrequent visible vapor plume. No additional mitigation measures or controls are warranted.

As described in Section 2.7.2, as a condition of the ESP, Dominion agreed to conduct an IFIM study of the North Anna River below the dam to determine whether reductions in dam releases associated with the operation of Unit 3 would affect downstream resources. Based on the study design described in EA (2007), a portion of the study will evaluate the potential impacts of changes in Lake Anna surface elevations on the functionality of existing docks and boat ramps. Limited interviews with owners and users of docks and boat ramps were conducted in order to consider the perceived impacts associated with historic events when lower than normal lake levels were experienced. In addition, the effect of North Anna River flow changes below Lake Anna on canoeing will be evaluated. No results are yet available from the IFIM study, but results will be evaluated by NRC staff when they become available.

5.5.2 Demography

The information and associated impacts for this section are provided and resolved in the ESP EIS, Section 5.5.2 (NRC 2006). There are currently 1000 personnel employed at the NAPS site for the existing Units 1 and 2. Approximately 500 additional permanent workers would be required for the operation of the proposed Unit 3 (Dominion 2008b). This is less than the 720 new workers assumed in the analysis conducted for the ESP EIS, Section 5.5.2. As an upper-bound estimate, the staff continued to assume that these 500 workers would relocate into the area with their families (i.e., none of the new workers already lived in the area). The 500 additional employees would translate into an increase in population of about 1900 to the region, assuming each new employee represents a family of four (Dominion Nuclear North Anna, LLC 2006a).

The staff evaluated the impacts of station operation on increases in population and determined that while the additional operating personnel are expected to come from outside the region, their small numbers, when considering the population base of each jurisdiction, would not significantly increase the base population within each jurisdiction. Most new jobs created through the multiplier effect are expected to go to workers who already reside in the region. Based on these considerations, the staff concludes that the any adverse impacts of station operation on increases in the regional population would remain SMALL, and that mitigation is not warranted.

5.5.3 Community Characteristics

This section evaluates the social and economic impacts to the surrounding region as a result of operation of the proposed Unit 3 at NAPS site. The evaluation assesses impacts of operation and of those demands placed by the workforce on the surrounding region during a 40-year operating period. Dominion expects to employ up to an additional 500 workers to operate the proposed Unit 3 (Dominion 2008b). This is in addition to the 1000 personnel currently employed at the site.

5.5.3.1 Economy

The information and associated impacts for this section are provided and resolved in the ESP EIS, Section 5.5.3.1 (NRC 2006). The staff reviewed the generally positive impacts of station operation on the economy of the region and concludes that the impacts (including tax receipts; see Section 5.5.3.2) would be small everywhere except potentially in Louisa and Orange Counties, where the impacts could be moderate. The magnitude of the economic impacts would be diffused in the larger economic bases of Henrico and Spotsylvania Counties and the City of Richmond; whereas, within the smaller economic bases of Orange and Louisa Counties, the economic impacts would be more noticeable. Based on the effects of station operation on the regional economies, the staff concludes that the impacts would continue to be SMALL BENEFICIAL to MODERATE BENEFICIAL (Louisa and Orange Counties).

5.5.3.2 Taxes

The information and associated impacts for this section are provided and resolved in the ESP EIS, Section 5.5.3.3 (NRC 2006). The staff independently evaluated the effect of taxes from income on wages and salaries of the proposed Unit 3 operational workers, and sales, use, and property taxes on these employees and on Dominion’s corporate profits, most of which represent beneficial sources of income for the Commonwealth and some of which would benefit the counties in the region. Property tax paid by Dominion would directly benefit Louisa County. At $3000 per installed kW(e), the proposed Unit 3 would increase the potential property tax base in Louisa County by $4 billion; at $4000 per installed kW(e), Unit 3 would increase the potential property tax base by $6 billion. This compares with an assessed valuation of $1.7 billion for Dominion in Louisa County in the fiscal year ending June 30, 2007 (Louisa County 2007a). Dominion (2007a) estimated that annually during the operations period, Unit 3 directly or indirectly would generate approximately $14.8 million in state taxes, $3.5 million in local property taxes, and $24 million in local sales and use taxes. The Louisa County combined operations and capital improvements budget is about $91 million for fiscal years 2007 to 2008 (Louisa County 2007b). Based on its independent review of the overall impacts from income, sales and use, and property taxes, the staff concludes that the beneficial impact level would continue to range from SMALL BENEFICIAL on the region to LARGE BENEFICIAL for Louisa County.

5.5.4 Infrastructure and Community Service Impacts

Infrastructure and community services include transportation, recreation, housing, public services, and education.

5.5.4.1 Transportation

The information and associated impacts for this section are provided and resolved in the ESP EIS, Section 5.5.3.2 (NRC 2006). Based on the staff's assumption that transportation network improvements would be made during the construction phase to accommodate the much larger construction workforce and that Dominion would implement a traffic management plan, as needed, the staff concludes that the overall impacts of station operation on transportation would be SMALL, and further mitigation is not warranted. New information since the ESP EIS was prepared indicates that although the overall population in the region of the NAPS site is growing more rapidly than estimated in the ESP EIS, the operations workforce for Unit 3 will be smaller than contemplated in the ESP EIS (500 workers rather than 720). The NRC staff continues to believe that any modifications that would be found necessary to relieve congestion on the local roads would have been made at the construction stage because of the much larger workforce involved (2500 to 3000 workers). Thus, the staff believes that transportation impacts during operations would continue to be SMALL.

5.5.4.2 Recreation

The information and associated impacts for this section are provided and resolved in the ESP EIS, Section 5.5.3.4 (NRC 2006). Based on the individual aspects of recreational activities in the vicinity of the NAPS site, if the normal operating level of Lake Anna remains at 76.2 m (250 ft), the staff concludes that the recreational impacts resulting from operations at the proposed Unit 3 would be SMALL most of the time, but could be MODERATE during the infrequent periods of extreme droughts. Although significantly impacted on a temporary basis during droughts (e.g., boating safety, usability of boathouses, and property values are concerns expressed by the public, based partly on experiences during droughts that occurred in 2001 to 2002 drought and in 2005), Lake Anna recreation does continue during droughts, and most of the impacts result from the lowering of lake levels by the drought itself, not by NAPS operations. As described in Section 5.3, addition of operations at the proposed Unit 3 would change the frequency or depth of low water levels created by droughts, but not by enough to change the overall conclusion reported in the ESP EIS that adverse impacts on recreation would be temporary and MODERATE. Therefore, mitigation is not warranted.

If the normal operating level of Lake Anna is raised 15 to 30 cm (6 to 12 in.), modification of residential and marina boat ramps and docks may be necessary; this action could result in a MODERATE impact depending on how modifications are implemented. Typically, these types of modifications are temporary in nature; thus, mitigation is not warranted,

As a condition of the ESP, Dominion agreed to conduct an IFIM study. The study will include identifying the flows necessary to maintain recreational uses of the North Anna River below Lake Anna. The results of that study are expected to be made public in December 2008.

The staff believes that when the results of the IFIM study are released, impacts of plant operations on recreation downstream of Lake Anna would be temporary and remain at most MODERATE, occurring mainly during drought periods and then only incrementally to the effects of the drought itself. This is a similar conclusion to that reached for Lake Anna recreation activities.

5.5.4.3 Housing

The information and associated impacts for this section are provided and resolved in the ESP EIS, Section 5.5.3.5 (NRC 2006). Based on the existence of a sufficient supply of houses in all price ranges within Henrico and Spotsylvania Counties and the City of Richmond, the staff concludes that the impacts of station operation on housing would be SMALL in these areas, and mitigation is not warranted. Because of its proximity to the NAPS site, the housing market within Orange and Louisa Counties could experience a temporary shortage that would increase housing prices and could create a moderate impact in the short term. However, eventually over the 40-year operating life of the proposed Unit 3, the supply of housing would increase to meet demand. Therefore, the staff concluded the long-term impacts of station operation in Orange and Louisa Counties would remain SMALL, and mitigation is not warranted.

Information concerning the regional housing market that has become available since the ESP EIS was prepared suggests that although the regional population is increasing more rapidly than discussed in the ESP EIS, construction of new housing has more than kept pace. Based on estimates in Section 2.8, housing vacancies have actually increased since the 2000 Census despite the increased rate of growth. The NRC staff continues to believe that the supply of housing would increase as needed to meet demand during operations and that the impact of operations at the proposed Unit 3 on housing would continue to be SMALL.

5.5.4.4 Public Services

The information and associated impacts for this section are provided and resolved in the ESP EIS, Section 5.5.3.6 (NRC 2006). Based on the information provided by Dominion and the staff's independent review of the local and regional water and wastewater treatment capacities; the police, fire, and medical facilities; and the demand for social and related services, the staff concludes that any increase in demand for these services by an increase in the operations workforce for the proposed Unit 3 would remain SMALL, and mitigation is not warranted. The increase in employment associated with station operation could have beneficial impacts, which could reduce the demand for social services, while the increase in tax revenue could help with the infrastructure and resource requirements from potential increase in demand for other services (e.g., police and fire protection services).

Information concerning the regional housing market that has become available since the ESP EIS was prepared suggests that although the regional population is increasing more rapidly than discussed in the ESP EIS, there has not been an adverse impact on the availability of public services. With respect to water needs, only Hanover County draws water from the North Anna River (15 MLD [4 MGD]), although Caroline County is considering the downstream Pamunkey River as a potential source of water. Hanover County estimates that the incremental increase of 19 MLD (5 MGD) in 2010 from the City of Richmond, along with other water sources, should be sufficient for the county through the 2020 to 2025 time period (see Section 2.8.3). The staff concludes that any increase in demand for water services by an increase in the operations workforce would remain SMALL, and mitigation is not warranted.

5.5.4.5 Education

The information and associated impacts for this section are provided and resolved in the ESP EIS, Section 5.5.3.7 (NRC 2006). Based on the information provided by Dominion and the staff's independent review of the local and regional educational facilities, the staff concluded that the impact on education as a result of station operation would remain SMALL, and mitigation is not warranted.

5.5.5 Summary of Socioeconomic Impacts

As described in the ESP EIS (NRC 2006), adverse socioeconomic impacts range from SMALL to MODERATE, and beneficial impacts range from SMALL to LARGE. Information concerning the regional housing market that has become available since the ESP EIS was prepared suggests that although the regional population is increasing more rapidly than discussed in the ESP EIS, there has not been an adverse impact on the availability of public services. Based on its independent analysis of the information that has become available since the ESP EIS was prepared, the staff believes that there is no reason to change the impact levels reported in the ESP EIS for socioeconomic impacts during operations at the proposed Unit 3. The staff expects adverse socioeconomic impacts range to remain from SMALL to MODERATE, and beneficial impacts range from SMALL to LARGE.

5.6 Historic and Cultural Resource Impacts

The National Environmental Policy Act (NEPA) of 1969, as amended requires Federal agencies to take into account the potential effects of their undertakings on the cultural environment, which includes archaeological sites, historic buildings, and traditional places important to local populations. The National Historic Preservation Act of 1966, as amended through 2000 (NHPA), also requires Federal agencies to consider impacts to those resources if they are eligible for listing on the National Register of Historic Places (such resources are referred to as "Historic Properties" in NHPA). As outlined in 36 CFR 800.8, "Coordination with the National Environmental Policy Act of 1969," the NRC coordinated compliance with Section 106 of the NHPA in meeting the requirements of NEPA.

The NRC has determined that evaluating the suitability of a potential COL for the proposed Unit 3 within the existing NAPS site is an undertaking that could possibly affect either known or potential historic properties that may be located at the site. Therefore, in accordance with the provisions of NHPA and NEPA, the NRC is required to make a reasonable and good faith effort to identify historic properties in the areas of potential effect and, if present, determine if any significant impacts are likely to occur. Identification is to occur in consultation with the State Historic Preservation Officer (SHPO), American Indian tribes, interested parties, and the public. If significant impacts are possible, efforts should be made to mitigate them. As part of the NEPA/NHPA integration, if no historic properties (i.e., places eligible for listing on the National Register of Historic Places) are present or affected, the NRC is required to notify the SHPO before proceeding. If it is determined that historic properties are present, the NRC is required to assess and resolve adverse effects of the undertaking.

For specific historic and cultural information on the NAPS site, see Section 2.9.2. As explained in Section 4.6, cultural resource identification efforts indicate the presence of three historic cemeteries and one historic site in the proposed Unit 3 site. Two of these cemeteries (44LS0221 and 44LS0222) were identified in the ESP ER (Dominion Nuclear North Anna, LLC 2006a). The third cemetery and the historic site were identified in the COL ER (Dominion 2007a).

In the ESP EIS, the staff determined the impacts from the operation of any new facilities on historic and cultural resources would be SMALL. Such activities would include ground and other routine maintenance, construction of auxiliary buildings, etc. The newly identified cultural resources (cemetery-44LS0227 and historic site-44LS0226) were determined to be new and significant information. The historic site was determined to be potentially eligible for the National Register of Historic Places, thus making its discovery alone significant. Both cultural resources were identified by the SHPO as resources that should be avoided, making discovery of the cemetery significant as well.

As part of the site audit, the staff inquired as to commitments regarding several concerns, including the protection of significant resources. These concerns are described in Section 4.6.

In Dominion's response to the SHPOs November 7, 2007 letter (Dominion 2008f), Dominion committed to avoiding all four cultural resources of concern defined by the SHPO (44LS0221, 44LS0222, 44LS0226, and 44LS0227). Even with the discovery of the new and significant information, based on the commitment from Dominion, the staff concludes that the potential impacts of operations at the proposed Unit 3 on historic and cultural resources would remain SMALL.

Any revised project activities or a change in scope would need to consider the potential impacts of plant construction and operation on both known and unknown historic and cultural resources at NAPS. Lands not previously surveyed would require investigation by a professional archaeologist prior to any ground-disturbing activities in the future. Any changes to these procedures or project plans should be developed in consultation with the SHPO. Mitigation might be warranted in the event of an unanticipated discovery.

5.7 Environmental Justice Impacts

The staff evaluated whether the health or welfare of minority and low-income populations at those census blocks identified in Section 2.10 of this SEIS could be disproportionately affected by the potential impacts of operations at the proposed Unit 3 at the NAPS site. An analysis of environmental justice is contained in the ESP EIS (NRC 2006).

During plant operations, as shown in the ESP EIS, Chapter 5, the only environmental effects during normal operations that might adversely affect any offsite population and that were greater than SMALL were water use, visual aesthetics, and recreation. The MODERATE water use impact (occurring only during severe drought) could adversely affect customers of the Hanover County water utility, but this impact would fall proportionately on all customers. Visual aesthetics could be adversely affected by the proposed additional units, cooling, towers, and plumes, but most of the residents of affected viewshed are not in minority populations (based on ESP EIS Figure 2-6 plus the scoping process) or the low-income population (based on Lake Anna lakeside housing prices and ESP EIS Figure 2-7). Based on the staff's interviews with the local officials and other contacts in the area, adverse impacts on recreation during severe drought at Lake Anna and the North Anna River downstream of the dam would not fall disproportionately on any particular population group, and recreators on Lake Anna are not known to be either disproportionately within minority or low-income populations. Although some minority and low-income populations live along the Pamunkey River farther downstream, impacts on fisheries that far downstream would be very small and are not expected to adversely affect these populations. If an accident were to occur, if there were any offsite impact at all, it is likely that minority or low-income populations would not be the most affected because of, their relatively distant location. Accordingly, the staff concludes, as stated in Section 5.7 of the ESP EIS, that there were no environmental pathways by which minority and low-income populations would be disproportionately and adversely affected during operations at the proposed Unit 3.

Based on information provided by Dominion and its own independent review, the staff concludes that offsite impacts of operations at the proposed Unit 3 to minority and low-income populations would remain SMALL, and mitigation is not warranted.

5.8 Nonradiological Health Impacts

This section addresses the nonradiological health impacts of operating the proposed Unit 3 at the NAPS site. Health impacts to the public from the cooling system, noise generated by unit operations, and electromagnetic fields are discussed. Nonradiological health impacts also are evaluated for workers at the proposed Unit 3. Health impacts from radiological sources during operations are discussed in Section 5.9.

5.8.1 Public Health (effects of thermophilic organisms)

The information and associated impacts to public health affected by thermophilic organisms are provided and resolved in Section 5.8.1 of the ESP EIS (NRC 2006). Based on the staff's analysis, impacts to members of the public from the effects of thermophilic organisms were considered to be SMALL. However, there was a commitment by Dominion to continue exploring options with Virginia Department of Environmental Quality (VDEQ) and Virginia Department of Health (VDH) to "communicate information related to existing risks to local residents" from thermophilic microorganisms, particularly *Naegleria fowleri* (NRC 2006). Information available since preparation of the ESP EIS include an unpublished study of the presence of *N. fowleri* in Lake Anna (Jamerson et al. 2008), discussions with representatives of the Lake Anna Civic Association as well as with VDEQ and VDH personnel, and recent publications by the Centers for Disease Control and Prevention (CDC).

In 2007, the Lake Anna Civic Association commissioned a study with Dr. Marciano-Cabral, Virginia Commonwealth University, to determine the presence of *N. fowleri* in the Lake Anna reservoir. *N. fowleri* causes the rare but nearly always fatal disease called primary amebic meningoencephalitis (PAM). Infection results from water containing *N. fowleri* entering the nose, followed by migration of the amoeba to the brain via the olfactory nerve (CDC 2008). There have been cases of PAM reported in Virginia, but not in Lake Anna. In 2007, the disease was brought to the attention of the public when there were a total of six fatal cases of PAM reported from Arizona, Florida, and Texas (CDC 2008).

During the summer of 2007, Dr. Marciano-Cabral and her staff sampled 16 locations across Lake Anna. Of the surface-water samples collected from 16 locations, 9 locations were found to be positive for *N. fowleri* based on an analysis using nested polymerase chain reaction assays. However, total amoeba counts, inclusive of *N. fowleri*, never exceeded 12 per 50 mL (1.7 ounce) of lake water at any site. No correlation was obtained between the conductivity, dissolved oxygen, temperature, and pH of water and the presence of *N. fowleri*. Although the organism is known to exist in the lake, no cases of PAM have been reported. It is postulated that predation by other protozoa and invertebrates and disturbance of water surface from recreational activities maintain the number *N. fowleri* at a low level in Lake Anna (Jamerson et al. 2008). This study is consistent with other studies suggesting the presence of this organism throughout most water bodies found in the southern states (CDC 2008).

Representatives of Dominion and several state agencies have been discussing options for warning recreational users of Lake Anna of the risks associated with swimming in the warm waters of lake. As a result of these discussions, a process for monitoring water temperature at Lake Anna State Park was conducted during the summer months of 2008. According to

Douglas Graham, Virginia Department of Conservation and Recreation (VDCR), lifeguards at the Lake Anna State Park swimming beach were instructed to take water temperature readings twice each week. The samples were taken in 0.6 m (2 ft) of water and at a depth of 0.3 m (1 ft). If the temperature readings approached 35ºC (95ºF), then the lifeguards were to post a notice with facts about *N. fowleri* for park visitors to be aware of this issue. Because water temperatures in the swimming area did not reach 35ºC (95ºF), no notices were posted.

The CDC and the Council of State and Territorial Epidemiologists (CSTE) have formed a workgroup to review future actions related to *N. fowleri* and to improve risk communication for health-care providers and the public. In a 2008 report, they considered the posting of warning signs. In general, the workgroup stated that because of the "… location and number of amoebae in the water can vary over time, environmental sampling, testing, and posting of warning signs are unlikely to be effective in preventing infections." They went on to state that "… warning signs posted on selected lakes might create a misconception that those bodies of water not posted with warnings are free from *N. fowleri.*" In conclusion, the workgroup felt that "… recreational water users should always assume a low level of risk is associated with entering all warm freshwaters in southern tier states" (CDC 2008).

Based on a review of recent information collected at Lake Anna, the actions of state agencies, and the general increase in information for the public about risks for recreational activities concerning *N. fowleri*, the staff concludes that there is a extremely low level of risk associated with contracting PAM and that the impacts of operations at the proposed Unit 3 will not significantly affect water temperatures in the WHTF or Lake Anna. The staff concludes that the determination of SMALL for impacts to public health is still valid.

5.8.2 Occupational Health

Occupational health impacts were resolved as SMALL in the ESP EIS (NRC 2006). The staff did not identify any new and significant information in this area during its evaluation for the proposed Unit 3. Occupational health impacts would be less based on fewer workers onsite during operations of the proposed Unit 3 compared to the two units assessed in the ESP EIS (500 workers for Unit 3 compared to 720 workers for two ESP units); therefore, health impacts would be fewer.

In the ESP EIS (NRC 2006), the NRC noted that actual injury and fatality rates at nuclear reactor facilities have been lower than the average U.S. industrial rates. Review of safety trends since issuance of the ESP EIS verified that this trend has continued.

5.8.3 Noise Impacts

The ESP application from Dominion (Dominion Nuclear North Anna, LLC 2006a) reported results from the CADNA/A Program predicting peak noise levels of less than 65 dBz along the exclusion area boundary (EAB) associated with the operation of the new cooling tower. In the ESP EIS (NRC 2006), the staff assessed the expected noise levels during the operation of the proposed reactors and concluded that the levels would be less than 65 dBz, which is the level at which little effect is expected, per guidance defined in NUREG-1437 (NRC 1996). The staff concurs with the conclusions previously stated in the ESP EIS (NRC 2006) that the potential impacts of noise resulting from the operation of an additional cooling system would be small, and the only mitigation that might be necessary would be the use of ear-protection devices for workers in the vicinity of the tower.

5.8.4 Acute Effects of Electromagnetic Fields

The World Health Organization (WHO 2002) has reviewed the biological effects from electromagnetic fields (EMF) exposure to various parts of the electromagnetic spectrum and concluded that exposures below the limits recommended in the guidelines by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) do not appear to have any known consequences on health, although it notes that there are still key areas in need of further research before a final assessment can be made. Another study (Bailey 2002) reviewed the historical basis for EMF exposure limits and concludes there is no need for lower limits. Given the uncertainties associated with this area of concern and that the transmission lines carrying the additional power of the proposed Unit 3 would not exceed the NESC criteria for electric shock, the staff concurs with the previous assessment that the effects of EMF would remain SMALL.

5.8.5 Chronic Effects of Electromagnetic Fields

This issue was considered unresolved in the ESP EIS (NRC 2006), because conclusive information was not available. The new information that does exist (WHO 2005) continues to indicate the results are not conclusive. Those considered electromagnetic hypersensitive (EHS), on the order of several individuals per million, report disorders that also are associated with multiple chemical sensitivities that are associated with low-level environmental exposures. This indicates the disorder could be the result of environmental factors unrelated to exposure to electromagnetic fields. While the staff will continue to monitor on-going work in this area, the impact of chronic exposure of electromagnetic fields must be considered SMALL given the insignificant number in the general population that could be considered EHS. No additional mitigation beyond general awareness is warranted.

5.8.6 Impacts of Transporting Operations Personnel to the Site

Nonradiological health impacts of transporting personnel to the proposed Unit 3 were calculated using the same general approach as that used to calculate nonradiological health impacts of transporting fuel and waste. This is new information that was not included when the ESP EIS was prepared (NRC 2006), but was later developed as part of the hearing process. The assumptions used in calculating impacts are discussed below.

- The number of workers needed to operate the proposed Unit 3 are estimated to be about 500 personnel (Dominion 2007a). An additional 1000 temporary workers are estimated to be needed for refueling outages (Dominion 2007a).
- The average commute distance for operations and outage workers is assumed to be 32 km (20 miles) one way.
- An average of 1.8 persons/vehicle is assumed (NRC 2006).
- Each operations worker is assumed to travel to and from the site 250 times/yr. Each outage worker is assumed to travel to and from the site 60 times/yr.
- Impacts (i.e., accidents, injuries, and fatalities) associated with commuter traffic (i.e., workers traveling to and from the proposed Unit 3 site) are derived from Virginia Traffic Facts 2007 (DOT 2008a).

The estimated impacts of transporting operations and outage workers to/from the proposed Unit 3 are shown in Table 5-1. The total annual traffic fatalities during operations, including both operations and outage personnel, represents less than a 1 percent increase above the 15 traffic fatalities that occurred in Louisa County in 2007 (DOT 2008b). This represents a small increase relative to the current traffic fatality risk in the area in the vicinity of the proposed Unit 3. The staff concludes that the expected impact remains SMALL, and mitigation is not warranted.

Table 5-1. Nonradiological Impacts of Transporting Workers to/from the Proposed Unit 3 Site

	Accidents per Year	**Injuries per Year**	**Fatalities per Year**
Permanent Workers	4.8	2.2	0.033
Outage Workers	2.3	1.1	0.016
Total	7.1	3.3	0.049

5.8.7 Summary of Nonradiological Health Impacts

The staff evaluated health impacts to the public and the workers from the cooling systems, noise generated by operations at a single unit, acute and chronic impacts of EMFs at the higher power levels, and transporting operations and outage workers to/from the proposed Unit 3. Health risks to workers are expected to be dominated by occupational injuries at rates below the average U.S. industrial rates. Health impacts to the public and workers from thermophilic microorganisms, noise generated by operations at the proposed Unit 3, and acute and chronic impacts of EMFs would be minimal. Based on the information provided by Dominion and the staff's own independent review, the staff concludes that the potential impacts of nonradiological effects resulting from the operation of the proposed Unit 3 would remain SMALL, and mitigation is not warranted.

5.9 Radiological Impacts of Normal Operations

This section addresses the radiological impacts of normal operations of the proposed Unit 3 including a discussion of the estimated radiation dose to a member of the public and to the biota present in the proximity of the proposed unit. Estimated doses to workers at the proposed Unit 3 also are discussed. New information in the COL ER (Dominion 2007a) regarding the location of the nearest receptors for the maximally exposed individual necessitated the re-evaluation of doses to the public.

5.9.1 Exposure Pathways

During normal operation, small quantities of radiological materials are released to the environment through gaseous and liquid effluents. Dominion Nuclear North Anna, LLC (2006a) stated in its ESP ER that the contribution to direct radiation exposure from new reactor designs would be negligible. The exposure pathways to humans are described in Regulatory Guides 1.109,1.111, and 1.113 (NRC 1977a,b,c).

The annual liquid radiological effluent release source term for the proposed Unit 3 was taken from Dominion's COL ER (Dominion 2007a), and is presented in Table 5-2. The annual gaseous radiological effluent release source term for the proposed Unit 3 was provided by Dominion (2008a) and is presented in Table 5-3. Both the liquid and gaseous source terms were derived from the ESBWR Design Control Document (DCD) (GEH 2008). The impacts from the liquid and gaseous releases and direct radiation were evaluated by considering the probable pathways to individuals, populations, and biota near the proposed Unit 3. The highest doses from the major exposure pathways were evaluated for a given receptor.

The proposed Unit 3 would release liquid effluents into the WHTF through the discharge canal used for the operating units. The liquid pathways considered were the same as those evaluated for the ESP ER (Dominion Nuclear North Anna, LLC 2006a) and included ingestion of aquatic food, ingestion of drinking water, exposure to shoreline sediment, and exposure to water through boating, swimming, and other activities.

The gaseous pathways considered in the COL ER (Dominion 2007a) were external exposure to the airborne plume, external exposure to contaminated ground, inhalation of airborne activity, and ingestion of contaminated agricultural products. The ESBWR design has three gaseous effluent release points: (1) reactor/fuel building stack, (2) turbine building stack, and (3) radwaste building stack (GEH 2008). The dose calculation estimates to the maximally exposed individual (MEI) from gaseous effluents was conservatively assumed to be a ground-level release. The release point was the plant facility boundary that encompassed the three stacks (see Figure 5-1). Dominion conservatively assumed that each receptor type (i.e., nearest resident, nearest meat animal, and nearest vegetable garden) was at the location of the closest receptor. The closest receptor was the nearest residence located 1.20 km (0.74 mi) northwest of the proposed Unit 3 (Dominion 2008d). Dominion's evaluation, which is summarized in Section 5.9.2.2 of this SEIS, conservatively assumed the closest receptors to be located in the direction of the maximum atmospheric dispersion factors (or χ/Qs (1.2 km [0.74 mi] east-southeast of the proposed Unit 3), which will maximize the dose to the MEI. The maximum D/Q value was located at the same distance in the NNE direction (Dominion 2008e). This D/Q value was used in dose evaluation. The staff judged these assumptions to be bounding.

Table 5-2. Liquid Effluent Release Source Term from Proposed Unit 3[(a)]

Radionuclide	Release (Ci/yr)	Radionuclide	Release (Ci/yr)	Radionuclide	Release (Ci/yr)
H-3	1.4×10^{1}	Y-93	1.2×10^{-3}	La-142	3.0×10^{-5}
N-24	5.1×10^{-3}	Zr-95	2.0×10^{-5}	Ce-141	7.0×10^{-5}
P-32	4.2×10^{-4}	Nb-95	2.0×10^{-5}	Ce-143	3.0×10^{-5}
Cr-51	1.3×10^{-2}	Mo-99	3.0×10^{-3}	Pr-143	9.0×10^{-5}
Mn-54	1.6×10^{-4}	Tc-99m	5.5×10^{-3}	W-187	2.4×10^{-4}
Mn-56	1.3×10^{-3}	Ru-103	4.0×10^{-5}	Np-239	1.1×10^{-2}
Fe-55	2.3×10^{-3}	Ru-105	1.7×10^{-4}		
Fe-59	7.0×10^{-5}	Te-129m	9.0×10^{-5}		
Co-58	4.4×10^{-4}	Te-131m	1.0×10^{-4}		
Co-60	9.0×10^{-4}	Te-132	2.0×10^{-5}		
Cu-64	1.3×10^{-2}	I-131	4.2×10^{-3}		
Zn-65	4.5×10^{-4}	I-132	8.2×10^{-4}		
Zn-69m	9.2×10^{-4}	I-133	2.1×10^{-2}		
Br-83	9.0×10^{-5}	I-134	4.0×10^{-5}		
Sr-89	2.2×10^{-4}	I-135	5.4×10^{-3}		
Sr-90	2.0×10^{-5}	Cs-134	6.8×10^{-4}		
Sr-91	1.2×10^{-3}	Cs-136	4.1×10^{-4}		
Sr-92	2.9×10^{-4}	Cs-137	1.8×10^{-3}		
Y-91	1.4×10^{-4}	Ba-139	4.0×10^{-5}		
Y-92	1.1×10^{-3}	Ba-140	8.2×10^{-4}		

Source: Dominion 2007a.

Table 5-3. Gaseous Effluent Release Source Term from Proposed Unit 3[(a)]

Radionuclide	Release (Ci/yr)	Radionuclide	Release (Ci/yr)	Radionuclide	Release (Ci/yr)
H-3	7.6×10^{1}	Sr-92	1.2×10^{-4}	Xe-133	1.1×10^{3}
C-14	1.4×10^{1}	Y-90	2.2×10^{-6}	Xe-135m	5.9×10^{2}
Na-24	1.5×10^{-4}	Y-91	4.6×10^{-5}	Xe-135	7.6×10^{2}
P-32	3.5×10^{-5}	Y-92	1.0×10^{-4}	Xe-137	7.6×10^{2}
Ar-41	3.8×10^{-2}	Y-93	1.9×10^{-4}	Xe-138	6.2×10^{2}
Cr-51	4.9×10^{-3}	Zr-95	1.2×10^{-3}	Cs-134	4.9×10^{-3}
Mn-54	4.1×10^{-3}	Nb-95	6.5×10^{-3}	Cs-136	4.1×10^{-4}
Mn-56	3.0×10^{-4}	Mo-99	4.6×10^{-2}	Cs-137	7.3×10^{-3}
Fe-55	1.3×10^{-3}	Tc-99m	5.9×10^{-5}	Cs-138	2.3×10^{-5}
Fe-59	5.4×10^{-4}	Ru-103	2.7×10^{-3}	Ba-140	2.1×10^{-2}
Co-58	1.1×10^{-3}	Ru-106	3.8×10^{-6}	La-140	3.5×10^{-4}
Co-60	8.6×10^{-3}	Rh-103m	9.5×10^{-8}	Ce-141	7.0×10^{-3}
Ni-63	1.3×10^{-6}	Rh-106	1.2×10^{-10}	Ce-144	3.5×10^{-6}
Cu-64	1.9×10^{-4}	Ag-110m	2.7×10^{-6}	Pr-144	4.3×10^{-9}
Zn-65	8.6×10^{-3}	Sb-124	1.4×10^{-4}	W-187	3.5×10^{-5}
Kr-83m	2.3×10^{-3}	Te-129m	4.3×10^{-5}	Np-239	2.2×10^{-3}
Kr-85m	1.8×10^{1}	Te-131m	1.5×10^{-5}		
Kr-85	1.4×10^{2}	Te-132	3.8×10^{-6}		
Kr-87	3.8×10^{1}	I-131	2.3×10^{-1}		
Kr-88	5.7×10^{1}	I-132	1.6×10^{0}		
Kr-89	3.8×10^{2}	I-133	1.1×10^{0}		
Rb-89	5.4×10^{-6}	I-134	3.0×10^{0}		
Sr-89	4.1×10^{-3}	I-135	1.6×10^{0}		
Sr-90	2.7×10^{-5}	Xe-131m	4.1×10^{0}		
Sr-91	1.8×10^{-4}	Xe-133m	5.1×10^{-3}		

Source: Dominion 2008a

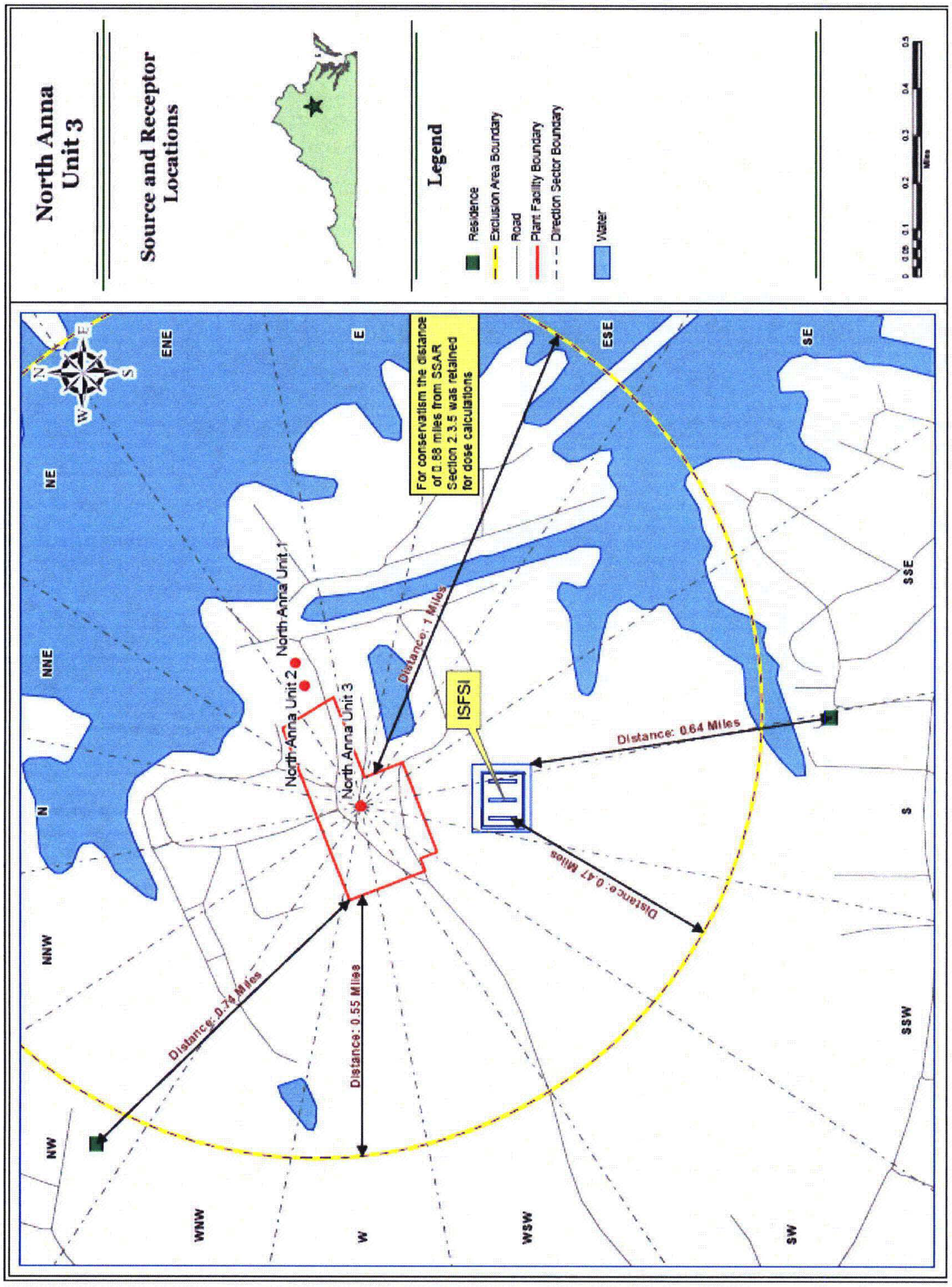

Figure 5-1. Source and Receptor Locations (Dominion 2008d)

In its ESP review (NRC 2006), the NRC staff identified another airborne release pathway, the release to the atmosphere of tritium incorporated in water vapor resulting from evaporation of cooling water from the proposed Unit 3 closed-cycle, combination wet and dry cooling system. Units 1 and 2 release tritium to the Lake Anna, which will be used as feedwater to the Unit 3 cooling system. The proposed Unit 3 will release tritium to Lake Anna at lower levels than the existing Units 1 and 2 (i.e., 14 Ci/yr). Units 1 and 2 released 1164 Ci of tritium to Lake Anna in 2007 (VEPCo 2008b).

This pathway no longer needs to be considered per NRC Regulatory Issue Summary 2008-03 (NRC 2008). This regulatory summary stated that water containing radioactive material returned from the environment can be used by the licensee and returned to the environment without being considered a new radioactive material effluent release. The basis for this determination is that the licensee has already accounted for this radioactive material when the effluent was originally released. The licensee must evaluate whether subsequent use, possession, or release introduces a new significant dose pathway to a member of the public. A significant dose pathway would be one that contributes 10 percent or more of the total effluent dose. In the ESP EIS (NRC 2006), the staff evaluated dose impacts for the ESP reactor design and estimated doses to be <10 percent of the total gaseous effluent dose. The dose to the MEI at the nearest residence was estimated to be small, 1.2×10^{-4} mSv/yr (1.2×10^{-2} mrem/yr), in the ESP EIS (NRC 2006). The estimated doses from operation of Units 1 and 2 and the proposed Unit 3 would be less because the ESBWR will release less tritium to Lake Anna via the liquid effluent pathway when compared to the proposed ESP units. The ESBWR proposed for Unit 3 is estimated to release 14 Ci/yr of tritium while the two ESP units were estimated to release 1700 Ci/yr of tritium.

5.9.2 Radiation Doses to Members of the Public

The dose to the MEI was calculated from both the liquid and gaseous effluent release pathways (Dominion 2008a), and a collective whole body dose was calculated for the population within 80 km (50 mi) of the proposed Unit 3.

5.9.2.1 Liquid Effluent Pathway

The liquid effluent source term for the ESBWR (see Table 5-2) was taken from the COL ER (Dominion 2007a) and is bounded by the PPE liquid effluent source term for the two proposed ESP units. In the COL ER (Dominion 2007a), doses to the MEI were recalculated using the ESBWR liquid effluent source term. All other parameters, including the effluent discharge rate, the dilution factor for discharge, and the transit time, to the receptor were the same as those used in the ESP ER calculation (Dominion Nuclear North Anna, LLC 2006a). A description of these parameters can be found in Appendix H of the ESP EIS (NRC 2006).

Liquid pathway doses to the MEIs were calculated for Unit 3 liquid effluents by Dominion (2007a) and the staff using the LADTAP II computer program (Strenge et al. 1986). Results are presented in Table 5-4. Estimated doses were lower than those calculated for the MEI in the ESP ER

Table 5-4. Estimated Liquid Pathway Doses for MEIs at Lake Anna from Unit 3 Liquid Effluents

Pathway	Total Body Dose (mSv/yr)[(a)]	Thyroid Dose (mSv/yr)[(a)]	Bone Dose (mSv/yr)[(a)]
Fish	7.8 × 10^{-4} [7.9 × 10^{-4}][l]	N/A[b]	1.2 × 10^{-2} [1.2 × 10^{-2}]
Invertebrate	8.3 × 10^{-5} [8.4 × 10^{-5}]	N/A[b]	6.5 × 10^{-4} [6.6 × 10^{-4}]
Drinking water	4.1 × 10^{-5} [4.1 × 10^{-5}]	1.8 × 10^{-3} [1.8 × 10^{-3}]	5.6 × 10^{-5} [5.7 × 10^{-5}]
Shoreline recreation	3.0 × 10^{-5} [3.0 × 10^{-5}]	3.0 × 10^{-5} [3.0 × 10^{-5}]	3.0 × 10^{-5} [3.0 × 10^{-5}]
Swimming	1.2 × 10^{-6} [1.2 × 10^{-6}]	1.2 × 10^{-6} [1.2 × 10^{-6}]	1.2 × 10^{-6} [1.2 × 10^{-6}]
Boating	1.5 × 10^{-6} [1.5 × 10^{-6}]	1.5 × 10^{-6} [1.5 × 10^{-6}]	1.5 × 10^{-6} [1.5 × 10^{-6}]
Total	9.4 × 10^{-4} [9.5 × 10^{-4}]	1.8 × 10^{-3} [1.8 × 10^{-3}]	1.3 × 10^{-2} [1.3 × 10^{-2}]
Age group receiving maximum dose	Adult	Infant	Child

(a) Multiply mSv/yr times 100 to obtain mrem/yr.
(b) Thyroid dose is not applicable because infants are assumed not to consume fish and invertebrates.
(c) The staff's estimates are shown in brackets [ ].
Source: Dominion 2007a

(Dominion Nuclear North Anna, LLC 2006a) for one ESP unit; therefore, the ESP evaluation was bounding. The calculated maximum annual total body dose was 9.4 × 10^{-4} mSv (9.4 × 10^{-2} mrem) to the adult. The calculated maximum annual thyroid dose was 1.8 × 10^{-3} mSv (0.18 mrem) to the infant. The calculated maximum annual bone dose was 1.3 × 10^{-2} mSv (1.3 mrem) to the child. The staff performed an independent evaluation of liquid pathway doses and found similar results. The staff determined that all input parameters used in Dominion's calculations were appropriate. Results of the staff's independent evaluation are presented in Table 5-4.

5.9.2.2 Gaseous Effluent Pathway

The gaseous effluent source term for the ESBWR (see Table 5-3) was taken from Dominion (2008a) and is bounded by the PPE gaseous effluent source term for the two proposed ESP units. Doses to the MEIs were recalculated using the ESBWR gaseous effluent source term. In addition, as discussed in Section 5.9.1, Dominion (2007a) conservatively assumed all three of MEI receptor locations (i.e., nearest residence, meat cow, and vegetable garden) to be at a single bounding location (1.2 km [0.74 mile] east-southeast from the facility boundary). Other parameters including meat and vegetable production rates and consumption factors were unchanged from those used in the ESP evaluations (Dominion Nuclear North Anna, LLC 2006a; NRC 2006). A description of these parameters can be found in Appendix H of the ESP EIS (NRC 2006).

Gaseous pathway doses to the MEIs were calculated for the proposed Unit 3 by Dominion using the GASPAR II computer program (Strenge et al. 1987) at the nearest site boundary and the nearest receptor location. Doses from the milk pathway were not calculated as there were no milk cows or goats located within an 8-km (5-mi) radius of the ESP site (Dominion Nuclear North Anna, LLC 2006a).

Gaseous pathway doses to the MEIs calculated by Dominion (2008a) for the proposed Unit 3 are presented in Table 5-5. Doses were lower than those calculated for the MEIs in the ESP

Table 5-5. Gaseous Pathway Doses for MEIs

Location	Pathway	Total Body Dose (mSv/yr)[(a)]	Thyroid Dose (mSv/yr)[(a)]	Skin Dose (mSv/yr)[(a)]
Nearest Site Boundary (1.4 km (0.88 mi) ESE)				
	Plume[(e)]	1.6×10^{-2} [1.6×10^{-2}][d]	1.6×10^{-2} [1.6×10^{-2}]	4.0×10^{-2} [4.0×10^{-2}]
	Inhalation (Adult)	9.1×10^{-5} [9.1×10^{-5}]	6.8×10^{-3} [6.8×10^{-3}]	N/A [(f)]
	Inhalation (Teen)	9.7×10^{-5} [9.7×10^{-5}]	8.9×10^{-3} [8.9×10^{-3}]	N/A
	Inhalation (Child)	9.1×10^{-5} [9.1×10^{-5}]	1.1×10^{-2} [1.1×10^{-2}]	N/A
	Inhalation (Infant)	5.5×10^{-5} [5.5×10^{-5}]	9.8×10^{-3} [9.8×10^{-3}]	N/A
Nearest Garden (1.2 km [0.74 mi] ESE)[(b)]				
	Vegetable (Adult)	3.7×10^{-3} [3.7×10^{-3}]	4.0×10^{-2} [4.0×10^{-2}]	N/A
	Vegetable (Teen)	5.8×10^{-3} [5.8×10^{-3}]	5.5×10^{-2} [5.5×10^{-2}]	N/A
	Vegetable (Child)	1.3×10^{-2} [1.4×10^{-2}]	1.1×10^{-1} [1.1×10^{-1}]	N/A
Nearest Residence (1.2 km [0.74 mi] ESE)				
	Plume[(e)]	3.2×10^{-3} [3.2×10^{-3}]	3.2×10^{-3} [3.2×10^{-3}]	6.5×10^{-3} [6.5×10^{-3}]
	Inhalation (Adult)	9.9×10^{-5} [9.9×10^{-5}]	7.2×10^{-3} [7.2×10^{-3}]	N/A
	Inhalation (Teen)	1.0×10^{-4} [1.0×10^{-4}]	9.3×10^{-3} [9.3×10^{-3}]	N/A
	Inhalation (Child)	9.6×10^{-5} [9.6×10^{-5}]	1.1×10^{-2} [1.1×10^{-2}]	N/A
	Inhalation (Infant)	5.8×10^{-5} [5.8×10^{-5}]	1.0×10^{-2} [1.0×10^{-2}]	N/A

Table 5-5. (contd)

Location	Pathway	Total Body Dose (mSv/yr)(a)	Thyroid Dose (mSv/yr)(a)	Skin Dose (mSv/yr)(a)
Nearest Meat Cow (1.2 km [0.74 mi] ESE)(b)				
	Meat (Adult)	1.3×10^{-3} [1.3×10^{-3}]	2.6×10^{-3} [2.6×10^{-3}]	N/A
	Meat (teen)	1.1×10^{-3} [1.1×10^{-3}]	2.0×10^{-3} [2.0×10^{-3}]	N/A
	Meat (Child)	2.0×10^{-3} [2.0×10^{-3}]	3.4×10^{-3} [3.5×10^{-3}]	N/A
Nearest Garden/Residence/Meat Cow (1.2 km [0.74 mi] ESE)				
	I(c)			
	Adult	8.3×10^{-3} [8.3×10^{-3}]	5.3×10^{-2} [5.3×10^{-2}]	6.5×10^{-3} [6.5×10^{-3}]
	Teen	1.0×10^{-2} [1.0×10^{-2}]	7.0×10^{-2} [7.0×10^{-2}]	6.5×10^{-3} [6.5×10^{-3}]
	Child	1.9×10^{-2} [1.9×10^{-2}]	1.3×10^{-1} [1.3×10^{-1}]	6.5×10^{-3} [6.5×10^{-3}]
	Infant	3.3×10^{-3} [3.3×10^{-3}]	1.4×10^{-2} [1.3×10^{-2}]	6.5×10^{-3} [6.5×10^{-3}]

(a) Multiply mSv/yr times 100 to obtain mrem/yr.
(b) No infant doses were calculated for the vegetable and meat pathways because the doses that infants receive from their diet would be bounded by the dose calculated for the child.
(c) The "All" pathways dose is the sum of the dose for nearest garden, nearest residence, and nearest meat cow for each age group (adult, teen, child, and infant) plus the dose from the plume exposure pathway.
(d) The staff's estimates are shown in brackets [ ].
(e) Includes dose from plume and ground deposition pathways.
(f) N/A means not applicable
Source: Dominion 2008e

ER (Dominion Nuclear North Anna, LLC 2006a) for one ESP unit; therefore, the ESP evaluation was bounding. The staff performed an independent evaluation of gaseous pathway doses and found similar results. All input parameters used in Dominion's calculations were judged by the staff to be appropriate. Parameters that changed were the annual gaseous effluent source term and the atmospheric dispersion factors because of the change in receptor locations. Results of the staff's independent evaluation also are presented in Table 5-5.

5.9.2.3 External Radiation Pathway

External radiation doses to the public from the ESBWR for the proposed Unit 3 would be negligible (Dominion 2007a). The primary source of external radiation would be nitrogen-16. The estimated annual dose at 800 m (2624 ft) from the plant was 5.93×10^{-6} mSv

(5.93×10^{-4} mrem) (GEH 2008). The nearest member of the public would be at the nearest residence (1200 m [3937 ft]), which is farther away and would have a smaller annual dose.

5.9.3 Impacts to Members of the Public

This section describes the staff's evaluation of the estimated impacts from radiological releases and direct radiation of the proposed Unit 3. The evaluation addresses doses from operations to the MEI located at the proposed Unit 3 site boundary and the population dose (collective dose to the population within 80 km [50 mi]) around the proposed Unit 3 site.

5.9.3.1 Maximally Exposed Individual

In Section 5.4.2 of the COL ER (Dominion 2007a), Dominion stated that whole body and organ dose estimates to the MEI from liquid and gaseous effluents for the proposed Unit 3 were within the design objectives of 10 CFR Part 50, Appendix I, and were bounded by the dose estimates calculated for one ESP unit (Dominion Nuclear North Anna, LLC 2006a; NRC 2006). The design objectives of 10 CFR Part 50, Appendix I are applicable to each reactor unit. Doses to whole body and maximum organ at Lake Anna from liquid effluents were well within the 0.03 mSv/yr (3 mrem/yr) and 0.1 mSv/yr (10 mrem/yr) Appendix I design objectives, respectively. Doses at the site boundary from gaseous effluents were well within the Appendix I design objectives of 0.1 mGy/yr (10 mrad/yr) gamma in air, 0.2 mGy/yr (20 mrad/yr) beta in air, 0.05 mSv/yr (5 mrem/yr) dose to the whole body, and 0.15 mSv/yr (15 mrem/yr) dose to the skin. In addition, the dose to the thyroid was within the 0.15 mSv/yr (15 mrem/yr) Appendix I design objectives. A comparison of dose estimates for the proposed Unit 3 to the Appendix I design objectives is presented in Table 5-6. The staff completed an independent evaluation of compliance with Appendix I design objectives and found similar results. The staff's results also are shown in Table 5-6.

In Section 5.4.2 of the COL ER (Dominion 2007a), Dominion stated that estimated doses from liquid and gaseous effluents to the MEI at the site boundary from the existing Units 1 and 2 and the proposed Unit 3 combined were well within the regulatory standards of 40 CFR Part 190 and are bounded by the dose estimates calculated for the ESP units and the existing Units 1 and 2. The dose from the existing units included the gaseous and liquid effluent pathways as well as external dose from three fully loaded pads at the Independent Spent Fuel Storage Installation (ISFSI) and Units 1 and 2. The estimated annual dose at the nearest site boundary (0.76 km [0.47 mi] SSW of the ISFSI) was calculated to be 0.036 mSv/yr (3.6 mrem) (Dominion 2008e). The nearest residence is located farther from the ISFSI (1.0 km [0.64 mi] SSE) and would result in a lower estimated annual dose. These data are summarized in Table 5-7. Dominion (2008d) conservatively assumed the annual external dose at the site boundary from Units 1 and 2 to be 0.01 mSv/yr (1 mrem). The staff performed an independent evaluation of cumulative dose and found similar results. The staff's results also are shown in Table 5-7.

Table 5-6. Comparison of MEI Dose Estimates from Liquid and Gaseous Effluents to 10 CFR Part 50, Appendix I, Design Objectives

Pathway/Type of Dose	Dominion (a)	Appendix I Design Objectives(b)
Liquid effluents		
• Whole body dose	0.00094 mSv/yr [0.00095](d)	0.03 mSv/yr
• Maximum organ dose	0.013 mSv/yr [0.013]	0.1 mSv/yr
Ga□ffluentsluents (noble gasesIly)(c)		
• Gamma air dose	0.022 mGy/yr [0.022]	0.1 mGy/yr
• Beta air dose	0.025 mGy/yr [0.025]	0.2 mGy/yr
• Whole body dose	0.016 mSv/yr [0.014]	0.05 mSv/yr
• Skin dose	0.04 mSv/yr [0.039]	0.15 mSv/yr
Gaseous effluents (radioiodines and particulates)		
• Organ dose (thyroid)	0.11 mSv/yr [0.13]	0.15 mSv/yr

(a) Multiply mSv/yr (or mGy/yr) times 100 to obtain mrem/yr (or mrad/yr).
(b) Design objectives are for each light-water-cooled nuclear power reactor (10 CFR Part 50, AppeIx I).
(c) Dose at site boundary (0.88 mi ESE).
(d) The staff's estimates are shown in brackets [ ].
Source: Dominion 2008a and Dominion 2008e

Table 5-7. Comparison of MEI Dose Estimates from Liquid and Gaseous Effluents from Existing Units 1 and 2 and the Proposed Unit 3 to 40 CFR Part 190 Standards

Type of Dose	Unit 3 – Liquid (mSv/yr)	Unit 3 – Gaseous (mSv/yr)	Unit 3 Total (mSv/yr)	Existing Units 1 and 2 (mSv/yr)(b)	Site Tol (mSv/yr)(c)	40 CFR 190 Standards (mSv/yr)
Whole body dose equivalent	0.00094 [0.00095](f)	0.019 [0.019]	0.02 [0.02]	0.05(e) [0.046]	0.069 [0.066]	0.25
Thyroid dose	0.0018 [0.0018]	0.13 [0.13]	0.13 [0.13]	0.051(e) [0.051]	0.18 [0.18]	0.75
Dose to another organ (bone)	0.013 [0.013]	0.08 [0.079](d)	0.092 [0.092]	0.051(e) [0.051]	0.14 [0.14]	0.25

(a) Multiply mSv/yr (or mGy/yr) times 100 to obtain mrem/yr (or mrad/yr).
(b) Includes dose from gaseous and liquid effluents and external dose from ISFSI.
(c) Total dose from Units 1 and 2 and proposed Unit 3.
(d) Equals sum of the bone dose for nearest garden, nearest residence, and nearest meat cow for each age group (adult, teen, child, and infant) plus the dose from the plume exposure pathway.
(e) These estimates were derived from 2001 effluent release report as included in Dominion Nuclear North Anna, LLC (2006a). Estimates were typical of those from more recent effluent release reports.
(f) The staff's estimates are shown in brackets [ ].
Source: Dominion 2008e Table

5.9.3.2 Population Dose

Dominion (2008a) estimated a collective whole body dose within 80 km (50 mi) of the proposed Unit 3 to be 0.087 person-Sv/yr (8.7 person-rem/yr) as shown in Table 5-8. This estimate was bounded by the population dose estimate from one ESP unit (Dominion Nuclear North Anna, LLC 2006a) of 0.28 person-Sv/yr (28 person-rem). The staff performed an independent evaluation of population doses and found similar results. The staff's results also are shown in Table 5-8. The estimated 0.087 person-Sv/yr (8.7 person-rem/yr) from the proposed Unit 3 compares to approximately 8400 person-Sv (person-rem/yr) to same population from natural background radiation. The collective dose from natural background radiation was calculated by using the 80-km (50-mi) population data of 2.8 million and a collective dose rate of 3.0 mSv/person/yr (300 mrem/ person/yr) from natural background radiation. The National Council on Radiation Protection (1987) specifies an annual dose of 3.0 mSv/person (300 mrem/person) in the United States from natural background radiation. Section 5.9.3.2 of the ESP EIS (NRC 2006) discussed the health impacts of the estimated small population dose from the proposed ESP units, which would bound the impacts of the proposed Unit 3.

Table 5-8. Collective Total Body (Population) Dose within 80 km (50 mi) of the Proposed Unit 3

Pathway	Dose (person-Sv/yr)[(a)]
Liquid	0.01 [0.01] [(b)]
Gaseous (noble gases)	0.015 [0.012]
Gaseous (iodines and particulates)	0.0088 [0.0098]
Gaseous (H-3 and C-14)	0.053 [0.053]
TOTAL	0.087 [0.085]

(a) Multiply person-Sv/yr times 100 to obtain person-rem/yr.
(b) Staff's estimates are shown in brackets [ ].
Source: Dominion 2008a

5.9.3.3 Summary of Radiological Impacts to the Public

The staff evaluated the health impacts from routine gaseous and liquid radiological effluent releases from the proposed Unit 3 at the NAPS site. Based on the information provided by Dominion and the staff's own independent evaluation, the staff concludes there would be no observable health impacts to the public from normal operation of the proposed Unit 3; therefore, the radiological health impacts would be SMALL, and additional mitigation beyond the ALARA program is not warranted.

5.9.4 Occupational Doses to Workers

The estimated annual occupational dose from operations at the proposed Unit 3 is 79.5 person-rem. This estimate was taken from the ESBWR DCD (GEH 2008). The occupational dose estimate from one ESP unit was 150 person-rem (Dominion Nuclear North Anna, LLC 2006a) and bounds the revised estimate for the ESBWR.

The staff concludes that the health impacts from occupational radiation exposure would remain SMALL based on individual workers receiving less than the 10 CFR 20.1201 dose limit and the collective occupational dose being typical of that experienced in current light water reactors; therefore, mitigation is not warranted.

5.9.5 Impacts to Non-Human Biota

In its COL ER, Dominion (2007a) estimated doses to fish, invertebrates, algae, muskrat, raccoon, heron, and duck (referred to as surrogate species) from the proposed Unit 3. New information for the COL evaluation included the use of the ESBWR effluent release source term for biota dose estimates instead of the PPE source term used in the ESP evaluation.

Table 5-9 presents the estimated dose to the surrogate species for the liquid and gaseous effluent pathways Dominion (2008a). Dominion Nuclear North Anna, LLC used the same input parameters as provided in its ESP ER (2006a) with the exception of the revised liquid and gaseous effluent source terms. A detailed listing of the parameters used in the biota dose calculation can be found in Appendix H of the ESP EIS (NRC 2006). The nearest biota was assumed to located 0.40 km (0.25 mi) east-southeast of Unit 3. This is the same biota location that was evaluated for the ESP. Dose estimates for the proposed Unit 3 were lower than the dose estimates in the ESP ER (Dominion Nuclear North Anna, LLC 2006a) for one ESP unit. Therefore, the ESP evaluation was bounding. The staff performed its own independent evaluation (see Table 5-9) and reached the same conclusion.

The staff reviewed the available information relative to the radiological impact on biota from the routine operation of the proposed Unit 3 and concludes the impacts would remain SMALL, and mitigation is not warranted.

5.9.6 Radiological Monitoring

The staff reviewed the radiological monitoring program (REMP) proposed for the ESP units in its ESP EIS (NRC 2006) and determined that the current monitoring program for Units 1 and 2 would be adequate for the proposed ESP units. This evaluation is found in Section 5.9.6 of the ESP EIS.

Table 5-9. Estimated Biota Doses from Proposed Unit 3

Biota	Dose from Liquid Effluents (mGy/yr)[(a)(b)]	Dose from Gaseous Effluents (mGy/yr)[)(a)(c)]
Fish	3.3×10^{-2} [3.5×10^{-2}][(d)]	N/A
Invertebrates	1.2×10^{-1} [1.2×10^{-1}]	N/A
Algae	1.7×10^{-1} [1.8×10^{-1}]	N/A
Muskrat	2.1×10^{-1} [2.3×10^{-1}]	2.0×10^{-1} [1.5×10^{-1}]
Raccoon	6.2×10^{-3} [6.4×10^{-3}]	2.0×10^{-1} [1.5×10^{-1}]
Heron	9.9×10^{-2} [1.0×10^{-1}]	2.0×10^{-1} [1.5×10^{-1}]
Duck	2.1×10^{-1} [2.3×10^{-1}]	2.0×10^{-1} [1.5×10^{-1}]

(a) Multiply mGy/yr times 100 to obtain mrad/yr.
(b) Staff estimates are in [ ].
Sources: Dominion 2008a; Dominion 2007a

The staff's new and significant information review identified new information regarding groundwater sampling. Dominion now performs additional groundwater sampling around Units 1 and 2 and the ISFSI in support of the Nuclear Energy Institute (NEI) Ground Water Protection Initiative. These results are summarized in the annual effluent monitoring report and annual environmental operating report for 2006 and 2007 (VEPCo 2007a, 2007b, 2008a, 2008b). Samples were analyzed for tritium and a few locations for gamma emitters and strontium-89/90. VEPCo (2008a) reported that tritium results were indicative of lake-to-groundwater communication and not indicative of a leak from a radioactive system. Additional groundwater sampling will be performed around the proposed Unit 3 as part of the NEI Ground Water Protection Initiative.

Dominion (2007a) has endorsed the NEI 07-09 Template entitled "Generic FSAR Template Guidance for Offsite Dose Calculation Manual (ODCM) Program Description." This template presents the generic elements of the REMP to include the means to monitor and quantify radiation and radioactivity levels in the environs of a plant associated with gaseous and liquid effluent releases and contribution of direct external radiation from contained sources of radioactive materials in tanks, equipment, and buildings. The staff has concluded that applicants who implement the elements of the NEI 07-09 Template will have the basis for an acceptable REMP.

The staff did not identity information that was both new and significant related to radiological monitoring through its evaluation of the information provided by Dominion and the staff's own independent review. The staff concludes that the current radiological monitoring program for Units 1 and 2 would be adequate to establish the radiological impacts to the environment related to the construction and operation of the proposed Unit 3 at the NAPS site.

5.10 Environmental Impacts of Postulated Accidents

The impacts of postulated accidents of new reactors at the NAPS ESP site were considered by the NRC staff in its review of Dominion's application for an ESP. The impacts identified in that review were determined to be of SMALL significance (NRC 2006). The applicable accident source terms listed in Appendix B of ESP-003 (NRC 2007a) do not bound the accident source terms for the ESBWR. Consequently, the staff is updating its review of potential impacts for postulated accidents, taking into account the changes in source terms. Consequence estimates are based on the ESBWR DCD currently under review pursuant to 10 CFR Part 52.

The term "accident," as used in this section, refers to any off-normal event not addressed in Section 5.9 that results in release of radioactive materials into the environment. The focus of this review is on events that could lead to releases substantially in excess of permissible limits for normal operations. Normal release limits are specified in 10 CFR Part 20, Appendix B, Table 2.

Numerous features combine to reduce the risk associated with accidents at nuclear power plants. Safety features in the design, construction, and operation of the plants, which comprise the first line of defense, are intended to prevent the release of radioactive materials from the plant. There are additional measures designed to mitigate the consequences of failures in the first line of defense. These include the NRC's reactor site criteria in 10 CFR Part 100, which require the site to have certain characteristics that reduce the risk to the public and the potential impacts of an accident, and emergency preparedness plans and protective action measures for the site and environs, as set forth in 10 CFR 50.47, 10 CFR Part 50, Appendix E, and NUREG-0654/FEMA-REP-1 (NRC 1980). All of these safety features, measures, and plans make up the defense-in-depth philosophy to protect the health and safety of the public and the environment.

This section discusses (1) the types of radioactive materials, (2) the paths to the environment, (3) the relationship between radiation dose and health effects, and (4) the environmental impacts of reactor accidents, both design basis accidents (DBAs) and severe accidents. The environmental impacts of accidents during transportation of spent fuel are discussed in Chapter 6.

Radioactive material exists in a variety of physical and chemical forms. The majority of the material in the fuel is in the form of nonvolatile solids. However, there is a significant amount of material that is in the form of volatile solids or gases. The gaseous radioactive materials include the chemically inert noble gases (e.g., krypton and xenon), which have a high potential for release. Radioactive forms of iodine, which are created in substantial quantities in the fuel by fission, are volatile. Other radioactive materials formed during the operation of a nuclear power plant have lower volatilities and, therefore, have lower tendencies to escape from the fuel than the noble gases and iodines.

Radiation exposure to individuals is determined by their proximity to radioactive material, the duration of their exposure, and the extent to which they are shielded from the radiation. Pathways that lead to radiation exposure include (1) external radiation from radioactive material in the air, on the ground, and in the water; (2) inhalation of radioactive material; and (3) ingestion of food or water containing material initially deposited on the ground and in water.

Radiation protection experts conservatively assume that any amount of radiation exposure may pose some risk of causing cancer or a severe hereditary effect and that the risk is higher for higher radiation exposures. Therefore, a linear, no-threshold response model is used to describe the relationship between radiation dose and detriments such as cancer induction. The BEIR VII report (NRC 2006) recently published by the National Research Council (2006) supports the linear, no-threshold dose response theory. Simply stated, any increase in dose, no matter how small, results in an incremental increase in health risk. This theory is accepted by the NRC as a conservative model for estimating health risks from radiation exposure, recognizing that the model probably overestimates those risks.

Physiological effects are clinically detectable should individuals receive radiation exposure resulting in a dose greater than about 25 rem over a short period of time (hours). Doses of about 250 to 500 rem received over a relatively short period (hours to a few days) can be expected to cause some fatalities.

5.10.1 Design Basis Accidents

The review of DBAs is described in Section 5.10.1 of the ESP EIS (NRC 2006). The review of environmental impacts of postulated accidents in the ESP EIS assumed the location of two new nuclear units at the NAPS ESP site with the following reactor design options: ABWR, AP1000, and ESBWR. The DBA analyses of the ESP EIS (NRC 2006) are based on Revision 1 of the ESBWR DCD (General Electric 2006). The COL application submitted by Dominion (2007a) is for one new ESBWR based on Revision 4 of the ESBWR DCD (GEH 2007). Since Revision 0 of the COL application was prepared, the ESBWR applicant has submitted Revision 5 to the DCD (GEH 2008) to the NRC for review. Dominion has indicated that it plans to revise its COL ER to adopt Revision 5 of the ESBWR DCD (Dominion 2008a). Therefore, the evaluation of consequences of DBAs presented here is based on the source terms from Revision 5 of the DCD. The calculation approach used by Dominion for its COL application is consistent with the approach described in the ESP EIS (NRC 2006) and is summarized below.

Dominion evaluated the potential consequences of postulated accidents to demonstrate that an ESBWR could be constructed and operated at the NAPS site without undue risk to the health and safety of the public (Dominion 2007a). These evaluations used a set of surrogate DBAs that are representative for the reactor design being considered for the NAPS site and site-specific meteorological data. The set of accidents covers events that range from relatively high probability of occurrence with relatively low consequences to relatively low probability with high consequences. Consideration is given to one additional accident type (Cleanup Water Line Break with Pre-Incident Iodine Spike) that was not included in Revision 1 of the ESBWR DCD (General Electric Company 2006).

The analyses in the ESP EIS (NRC 2006) assumed the accident releases occurred from the location within the area surrounding the two proposed units that resulted in the greatest dose. The single unit proposed in the COL application is situated entirely within the two-unit area assumed in the ESP application, so the previous EAB and low-population zone (LPZ) distances remain valid for the COL application. Potential consequences of DBAs are evaluated following procedures outlined in regulatory guides and standard review plans. Potential consequences of accidental releases depend on specific radionuclides released, radionuclide release rates, and meteorological conditions. Methods for evaluating potential accidents are based on guidance in Regulatory Guide 1.183 (NRC 2000b).

Meteorological conditions are represented in these consequence analyses by atmospheric dispersion factors, also referred to as χ/Qs. Acceptable methods of calculating χ/Qs for DBAs from meteorological data are set forth in Regulatory Guide 1.145 (NRC 1983). For environmental reviews, consequences are evaluated assuming realistic meteorological conditions. The meteorological data set used for this review is the same set as used in the ESP EIS (NRC 2006).

Table 5-10 lists χ/Qs pertinent to the environmental review of DBAs for the NAPS site. The first column lists the time periods and boundaries for which χ/Q and dose estimates are considered. For the exclusion area boundary, the postulated DBA dose and its atmospheric dispersion factor are calculated for a short-term (i.e., 2 hours), and for the LPZ, they are calculated for the course of the accident (i.e., 30 days [720 hours]) composed of four time periods.

Table 5-10. Atmospheric Dispersion Factors for NAPS COL Site DBA Calculations

Time Period and Boundary	χ/Q (s/m^3)
0 to 2 hr, Exclusion area boundary	3.34×10^{-5}
0 to 8 hr, Low population zone	2.17×10^{-6}
8 to 24 hr, Low population zone	1.50×10^{-6}
1 to 4 d, Low population zone	1.20×10^{-6}
4 to 30 d, Low population zone	9.00×10^{-7}
Source Dominion 2007a	

In Table 7.1-1 of the COL ER (Dominion 2007a), the second column lists the χ/Qs presented. The χ/Qs match those presented in Table 5-14 of the ESP EIS (NRC 2006) that were developed using the site meteorological information discussed in ESP ER Section 2.7 (Dominion Nuclear North Anna, LLC 2006a) and Section 2.3 of the ESP EIS (NRC 2006), and the EAB and LPZ distances.

The staff confirmed the meteorological data used by Dominion and the method used to calculate the atmospheric dispersion factors matched those evaluated in the ESP EIS (NRC 2006). Based on the previous reviews, the staff concludes that the χ/Qs for the NAPS site are acceptable for use in evaluating potential environmental consequences of postulated DBAs for the ESBWR design at the NAPS site.

Table 5-11 lists the set of DBAs considered and presents estimates of the environmental consequences of each accident in terms of total effective dose equivalent (TEDE), which is the sum of the committed effective dose equivalent from inhalation and the deep dose equivalent from external exposure.

Table 5-11. DBA Doses for an ESBWR Reactor

		TEDE in Sv[(a)]		
Accident	**Standard Review Plan Section**[(b)]	**EAB**	**LPZ**	**Safety Review Criterion**
Main steam line break	15.6.4			
Pre-incident iodine spike		4.8×10^{-4}	3.1×10^{-5}	2.5×10^{-1}[(c)]
Equilibrium iodine activity		2.8×10^{-5}	1.8×10^{-6}	2.5×10^{-2}[(d)]
Loss-of-coolant accident	15.6.5	1.5×10^{-3}	6.2×10^{-3}	2.5×10^{-1}[(c)]
Feedwater system pipe break	15.2.8			
Pre-incident iodine spike		4.5×10^{-5}	4.3×10^{-6}	2.5×10^{-1}[(c)]
Equilibrium Iodine activity		3.3×10^{-6}	2.2×10^{-7}	2.5×10^{-2}[(d)]
Failure of small lines carrying primary coolant outside containment	15.6.2			
Pre-incident iodine spike		3.8×10^{-3}	5.9×10^{-4}	2.5×10^{-1}[(c)]
Equilibrium iodine activity		3.7×10^{-6}	3.8×10^{-5}	2.5×10^{-2}[(d)]
Fuel handling	15.7.4	6.9×10^{-4}	4.5×10^{-5}	6.3×10^{-2}[(d)]
Cleanup water line break	NA [(e)]			
Pre-incident iodine spike		1.3×10^{-3}	8.3×10^{-5}	2.5×10^{-1}[(c)]
Equilibrium iodine activity		7.5×10^{-5}	4.9×10^{-6}	2.5×10^{-2}[(d)]

(a) To convert Sv to rem, multiply Sv by 100.
(b) NUREG-0800 (NRC 2007b).
(c) 10 CFR 52.79(a)(2) and 10 CFR 100.21 criterion.
(d) Standard Review Plan criterion.
(e) There is no applicable SRP section.

The DBAs listed in Table 5-11 are the same as those being considered in the design certification; therefore, the staff concludes that the set of DBAs is appropriate. In addition, the staff independently reviewed the calculation of the consequences of the DBAs in Revision 5 of the ESBWR DCD and found the calculations to be correct. Table 5-11 reflects the DBA consequences, accounting for site-specific χ/Qs.

There are no environmental criteria related to the potential consequences of DBAs. Consequently, the review criteria used in the staff's safety review of DBA doses are included in Table 5-11 to illustrate the magnitude of the calculated environmental consequences (TEDE doses). In all cases, the calculated TEDE values are considerably smaller than the TEDE doses used as safety review criteria. Therefore, the staff concludes that with respect to DBAs, the NAPS site is environmentally suitable for operation of an ESBWR.

Summary of DBA Impacts

The NRC staff reviewed the DBA analysis in the COL ER (Dominion 2007a), which is based on analyses performed for design certification of the ESBWR design with adjustment for NAPS site-specific characteristics. The results of the staff evaluation indicate that the environmental risks associated with DBAs, if an ESBWR were to be located at the NAPS site, would be small.

The staff concludes that the environmental consequences of DBAs for an ESBWR reactor at the North Anna ESP site would remain SMALL.

5.10.2 Severe Accidents

Dominion performed analyses of the potential environmental impacts of severe accidents as part of its application for an ESP. These analyses included an assessment of the potential impacts of severe accidents for the Advanced Light-Water Reactor (ALWR) designs (ABWR, AP1000, and ESBWR). The NRC staff reviewed and evaluated the results of the Dominion analyses and, after its review, presented the results in its ESP EIS (NRC 2006). In the ESP EIS, the NRC staff concluded that the probability-weighted consequences of the severe accidents for an ALWR reactor at the North Anna ESP site were of SMALL significance.

The COL application submitted by Dominion (2007a) is for one new ESBWR unit based on Revision 4 of the ESBWR DCD (GEH 2007). As part of its assessment of new and significant information for the COL application, Dominion reviewed the severe accident consequence analysis in the ESP EIS. Although changes in the ESBWR design constitute new information, Dominion concluded that the information was not significant. During its site audit, the NRC staff reviewed the Dominion analysis.

Since preparation of Revision 0 of the COL application, the ESBWR applicant has submitted Revision 5 to the DCD (GEH 2008) to the NRC for review. Dominion has indicated that it plans to revise its COL ER to adopt Revision 5 of the ESBWR DCD (Dominion 2008a). For new information to be ‘‘significant,’’ it must be material to the issue being considered; that is, it must have the potential to affect the finding or conclusions of the NRC staff’s evaluation of the issue (72 FR 49352). This new information has the potential to affect the staff conclusions related to severe accidents. Therefore the staff has limited its severe accident review to evaluation of the effects of changes in source term and core damage frequency based on Revision 5 of the DCD.

The staff compared the reactor core inventories, release fractions, and core damage frequencies, from ESBWR DCD Revision 5 with those considered in the ESP EIS. The small changes in inventories, release fractions, and core damage frequencies, tend to offset each other. In Section 5.10.2.1 of the ESP EIS, the staff analysis shows that the risks associated with the ESBWR were several orders of magnitude lower than the risks associated with the Commission’s safety goals (51 FR 30028). Based on these changes, the staff estimates that the probability-weighted consequences of severe accidents are no more than a factor of 4 greater than those reported in Table 5-20 of the ESP EIS.

The staff determined that the changes in the information related to the impact of severe accidents are minor when compared to the Commission’s safety goals. The staff concludes that probability-weighted consequences of severe accidents for an ESBWR reactor at the North Anna ESP site would remain SMALL. Mitigation is discussed in the following section.

5.10.3 Severe Accident Mitigation Alternatives

Severe accident mitigation alternatives (SAMAs) include design alternatives intended to reduce the likelihood or consequences of reactor accidents that are more severe than DBAs. They also include procedural and training alternatives to achieve the same objectives. The purpose of the evaluation of SAMAs is to determine whether there are severe accident mitigation design alternatives (SAMDAs), procedural modifications, or training activities that can be justified to further reduce the risks of severe accidents (NRC 2000b).

Appendix M contains a detailed review of the General Electric-Hitachi Nuclear Energy, LLC and Dominion SAMA analyses and presents the staff conclusions related to the NAPS site-specific analysis. After reviewing the Dominion analysis and performing its independent evaluation, the staff concludes that there are no ESBWR SAMDAs that would be cost beneficial at the NAPS site. The staff further concludes that detailed consideration of procedural SAMAs should be deferred until procedures and training programs are being developed. The staff has a reasonable expectation that risk mitigation measures will be considered when procedures and training programs are developed and that procedure development will be completed prior to loading fuel.

5.10.4 Summary of Postulated Accident Impacts

The staff evaluated the environmental impacts from DBAs and severe accidents for an ESBWR at the NAPS site. Based on the information provided by Dominion and NRC's own independent review, the staff concludes that the potential environmental impacts (risks) from postulated accidents from the operation of the proposed ESBWR would remain SMALL, and mitigation is not warranted.

5.11 Global Warming, Climate Change, and Greenhouse Gas Impacts

This section provides information on contemporary issues related to global warming, climate change and greenhouse gas emissions associated with the operation of the proposed Unit 3. Air quality impacts from operations are addressed in Section 5.2 of the SEIS.

The greenhouse effect is a naturally occurring process, whereby certain gases, such as water vapor, carbon dioxide, methane, and other trace gases in the atmosphere absorb and emit infrared radiation back to the earth's surface. Without these so-called greenhouse gases, the earth's atmosphere would be significantly colder and the planet would be uninhabitable. When discussing global warming, increases in carbon dioxide are generally of primary concern, because carbon dioxide has a long lifetime in the atmosphere and it is very effective at absorbing in an infrared band (12 pm to 16 pm) that would otherwise be transparent to this energy.

Human activity over the past century has been increasing carbon dioxide concentrations in the atmosphere, and the concern is that the additional carbon dioxide is enhancing the greenhouse effect and causing the earth's atmosphere to warm. Although water vapor also is an important greenhouse gas, the lifetime for water vapor in the atmosphere is just a few days. This rapid turnover means that even if human activity is directly adding to or removing water vapor from the atmosphere, there would be no slow buildup of water vapor in a similar manner as with carbon dioxide. Water vapor concentration in the atmosphere is mainly a function of temperature and any additional increase in concentration, for example, from a cooling tower, is rapidly lost. The amount of carbon dioxide in the atmosphere, however, is determined by a balance between sources (e.g., transportation or industrial activity) and sinks (e.g., vegetative photosynthesis) and any increase in concentration from human activity can take hundreds of years for levels to return to pre-industrial levels even if all future carbon emissions ceased.

Increased carbon dioxide emissions to the environment are generally attributed to the consumption of fossil fuels, whether for industrial use, such as an energy-intensive manufacturing facility, or personal use, such as for the automobile. Nuclear power plants do not emit carbon dioxide in large quantities during the operation of the facility for the production of electricity. Emissions are principally from auxiliary boiler operation and standby diesel generator testing. However, fossil fuels are often used as part of the infrastructure needed to operate a nuclear power facility, primarily for the manufacture of the fuel that is used in the facility. A high percentage of the energy used in the uranium fuel cycle is consumed in the enrichment stage of the fuel cycle. The estimate of future nuclear fuel needs, current feedstock supplies, and the quality of uranium ore will have a direct bearing on the mining stage through the enrichment stage of the fuel cycle.

Accounting for the uranium fuel cycle, the NRC estimates that the energy needed for the fuel's life cycle for one year of operation of a 1000 MW(e) light water reactor would be about 5 percent of the net output of the reactor (see 10 CFR 51.51, Table S–3, and Table 6-1 of ESP EIS (NRC 2006)). The U.S. Department of Energy (DOE) estimated that the carbon emissions that would be displaced if nuclear power plants replaced coal-based electricity generation would be about 2.1 million metric tons per year for every unit of approximately 1000 MW(e) (Hagen et al. 2001). Therefore, using the DOE estimate and the 5 percent factor, approximately 105,000 MT (115,747 tons) of carbon would be produced for every 1000 MW(e) assuming a nuclear power plant was operating for the entire year. If the equivalent electricity were generated by alternative or renewable energy sources, then this quantity could be reduced, and if a combination of conservation and alternative energy sources were considered, the amounts could be reduced even further. The staff has evaluated energy alternatives and their associated impacts in Chapter 9.

With the increasing interest in the nuclear power program in the United States, advancements in power reactor technology and uranium enrichment technology, the total carbon emissions that may result from the fuel cycle may differ from those described above. Depending on the number of existing nuclear power units that are considered for license renewal and the number of new nuclear power plant units that are contemplated, the need for new fuel resources is likely to be an important variable in this assessment.

The staff considered the potential impact of climate change on water supply. The staff considered both the United States Global Change Research Program National Assessment (USGCRP 2000) and the Intergovernmental Panel on Climate Change AR4 Synthesis Report (IPCC 2007). Both studies agree on predicted increases in temperature. However, precipitation estimates in the climate models suggest either an increase in precipitation or precipitation remaining about the same as present. While there is general agreement in the scientific community that some change in climate is occurring, considerable uncertainty remains in the magnitude and direction of some of the changes. In light of these uncertainties, balancing society's need for electricity and water under an altered climate is not now feasible and would amount to speculation.

The impacts of global warming and climate change from the operation of the proposed Unit 3 at the NAPS site are negligible at the global level. The need for power analysis is addressed in

Chapter 8; the results of the need for base-load capacity analysis indicate that there is currently a need for additional base-load capacity within the Dominion Zone. Consequently, the environmental impacts associated with the effects of greenhouse gas emissions from the operation of a base-load power plant are unique between a fossil fuel and nuclear plant. The carbon emissions that would be displaced if nuclear power plants replaced coal-based electricity generation would be about 2.1 million MT/yr (2.31 million tons/yr) for every unit of approximately 1000 MW(e). Therefore, the impacts from the effects of greenhouse gas emissions from the proposed Unit 3 at the NAPS site are SMALL beneficial by comparison to the fossil fuel base-load alternative.

5.12 Measures and Controls to Limit Adverse Impacts During Operation

The general measures and controls on which the staff relied in its evaluation of environmental impacts during operation of a single new unit at the NAPS site include applicable permits and authorizations required at the Federal, State, and local levels as listed in Table 1.2.1 of the COL ER (Dominion 2007a) as well as the mitigation actions contained in Environmental Protection Plan (EPP) included in Chapter 1 of the COL ER (Dominion 2007a). The main focus of EPP includes:

- compliance with the applicable Federal, Virginia, and local laws, ordinances, and regulations that prevent or minimize adverse environmental impacts (e.g., solid waste management, erosion and sediment control, air emission control, noise control, storm water management, spill response and cleanup, hazardous material management)
- compliance with applicable requirements of permits and licenses required for operation (e.g., National Pollutant Discharge Elimination System and Virginia Pollutant Discharge Elimination System [VPDES] permits and operating license requirements)
- compliance with Dominion procedures applicable to environmental control and management.

Dominion also evaluated the measures and controls listed in Section 5.10 of the COL ER (Dominion 2007a) and considered them feasible from both a technical and economic standpoint. Dominion expects these measures and controls to be adequate for avoiding or mitigating potential adverse impacts associated with operation of the proposed Unit 3. These measures and controls include:

- non-radioactive effluents, including sanitary waste and blowdown from the proposed Unit 3 cooling towers, will be controlled by limits established in the VPDES permit
- the new and separate Unit 3 sanitary waste treatment systems will be governed by applicable regulations and permits

- operation of a dechlorination system to neutralize chlorine in the circulating water and plant service water cooling tower blowdown before discharge to the WHTF and eventually to the North Anna Reservoir

If these measures and controls are implemented, the staff concludes that impacts resulting from operational activities will be mitigated.

5.13 Summary of Operational Impacts

Expected impact level categories are denoted in Table 5-22 of the ESP EIS (NRC 2006). These levels are designated as SMALL, MODERATE, or LARGE as a measure of their expected adverse impacts, if any. There is one addition to the original estimates in Table 5-22. The impact from global warming that was not evaluated in the ESP EIS (NRC 2006), but was evaluated as part of the SEIS with information provided in Section 5.11. The estimated impact is SMALL and mitigation action is not warranted.

5.14 References

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

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

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

10 CFR Part 52. Code of Federal Regulations, Title 10, *Energy*, Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants."

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

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

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

40 CFR Part 423. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 423, "Steam-Electric Power Generating Point Source Category."

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6.0 Fuel Cycle, Transportation, and Decommissioning

This chapter addresses the environmental impacts from (1) the uranium fuel cycle and solid waste management, (2) transportation of radioactive material, and (3) decommissioning for the proposed Unit 3 at the North Anna Power Station (NAPS) site. As part of its application, for a combined license (COL), Dominion Virginia Power and Old Dominion Electric Cooperative, collectively known as Dominion, submitted an Environmental Report (ER) (Dominion 2007) that discussed the environmental impacts of transporting radioactive materials (Section 3.8), of the uranium fuel cycle (Section 5.7), and of decommissioning (Section 5.9). In accordance with Title 10 of the Code of Federal Regulations (CFR) Part 51, impacts have been analyzed and a significance level of potential adverse impacts (i.e., SMALL, MODERATE, or LARGE) has been assigned to each analysis. Since the NAPS site has an approved early site permit (ESP), the significance levels of the potential adverse impacts for the various areas evaluated will remain the same as documented in the ESP environmental impact statement (EIS) (NRC 2006) for the NAPS site unless new and significant information has been identified that would modify the original significance level. The definition of new and significant information is documented in a *Federal Register* notice (72 FR 49352). The NRC staff's determination of significance levels is based on the assumption that the mitigation measures identified in the ER or activities planned by various State and County governments, such as infrastructure upgrades, as discussed throughout this chapter, are implemented. Failure to implement these upgrades might result in a change in significance level.

There were several unresolved issues identified in the ESP EIS related to this chapter (see Appendix J of the ESP EIS) (NRC 2006). Environmental impacts from uranium fuel cycle activities other than light water reactors (LWR) were not resolved; however, this is not applicable because the Economic Simplified Boiling-Water Reactor (ESBWR) design for the proposed Unit 3 is an LWR design. Environmental impacts from transportation of gas-cooled reactor fuels were not resolved, but again, this is not applicable because the ESBWR is an LWR design. Finally, decommissioning was identified as an unresolved issue in the ESP EIS. The environmental review on decommissioning was deferred to the COL stage per the ESP EIS, and is presented in Section 5.9 of the COL ER (Dominion 2007) and Section 6.3 of this supplemental EIS (SEIS).

6.1 Fuel Cycle Impacts and Solid Waste Management

The NRC staff reviewed fuel cycle impacts in Section 6.1 of its ESP EIS (NRC 2006), and concluded that the environmental impacts of the uranium fuel cycle for advanced LWR reactors would be SMALL and mitigation is not warranted.

The staff's review for proposed Unit 3 did not identify any new and significant information regarding fuel cycle impacts and solid waste management. The uranium fuel cycle impacts are scaled to Table S–3 impacts found in 10 CFR Part 51.51(a) based on reactor power level. Table S–3 provides the environmental impacts from uranium fuel cycle operations for a model 1000-MW(e) LWR operating at 80-percent capacity with a 12-month fuel-loading cycle and an average fuel burnup of 33,000 MWd/MTU. Per 10 CFR 51.51(a), the staff considers the impacts in Table S–3 to be acceptable for the 1000 MW(e) reference reactor and for adequately bounding fuel cycle impacts associated with the proposed Unit 3.

For the ESP EIS plant parameter envelope, the reactor power level was 9000 MW(t). This power level corresponded to 3040 MW(e) (NRC 2006). The proposed Unit 3 would be a 4500 MW(t) ESBWR (Dominion 2007) with a corresponding net electrical rating of 1520 MW(e). Therefore, the uranium fuel cycle impacts from the ESP EIS (NRC 2006) would bound the Unit 3 impacts. Unit 3 impacts would be one-half of the impacts presented in the ESP EIS (NRC 2006) or approximately 1.9 times the impacts presented in Table S–3.

Dominion can no longer dispose of Class B and C low-level waste (LLW) at the Energy Solutions site in Barnwell, South Carolina; however, Class A LLW can be shipped to the Energy Solutions site in Clive, Utah. Dominion is investigating alternative disposal pathways to include (1) compaction and storage at offsite vendor location until disposal is secured, and (2) blending of waste types with subsequent disposal at the Energy Solutions site in Utah. The NRC staff examined the impact of Barnwell's closure in Volume II, Section 3.11.3 of the ESP EIS (NRC 2006) and determined that environmental impacts associated with interim storage of LLW at nuclear power plants were not significant, as discussed in Section 6.4.4.2 of NUREG-1437 (NRC 1996). No new and significant information was identified regarding low-level waste disposal..

The staff did not identify any new information regarding uranium fuel cycle and solid waste management impacts through its evaluation of the information provided by Dominion and the staff's own independent review. The staff concludes that the impacts would remain SMALL, and mitigation is not warranted.

6.2 Transportation of Radioactive Materials

The ESP EIS (NRC 2006) provided a detailed analysis of the radiological impacts of transporting fuel and radioactive waste to and from the NAPS ESP site and alternative sites. The analysis used standard methods and data supplemented by site-specific and reactor-specific information to estimate radiological impacts. The ESP EIS stated that, "Because of the conservative approaches and data used to calculate impacts, actual environmental effects are not likely to exceed those calculated in the EIS." Based on this statement and the impacts calculated in the EIS, the staff concluded that, " … the environmental impacts of transportation of fuel, and radioactive wastes to and from the North Anna ESP site would be SMALL, and would be consistent with the environmental impacts associated with transportation of materials, personnel, fuel, and radioactive wastes from current-generation reactors presented in Table S–4 of 10 CFR 51.52."

This SEIS addresses new and significant information about fuel and waste transportation that has arisen since preparation of the ESP EIS. It also addresses a commitment made in the ESP EIS to address the impacts of spent fuel assembly crud on the impacts of spent fuel transportation accidents.

6.2.1 Impacts of Crud on Spent Fuel Transportation Accident Impacts

The ESP EIS identified some technical areas that would require further confirmation at the COL stage. One was the impact of "crud" and activation products on spent fuel transportation accident risks. Activation product inventories were included in the ESP EIS for the ESBWR but not for other Advanced Light Water Reactor (ALWR) types. Because Dominion has chosen the ESBWR as its reactor type, this technical area is resolved. However, the impacts of crud on spent fuel transportation accident risks were not considered in the ESP EIS. Therefore, an analysis was conducted to determine if including crud could significantly affect the conclusion about the magnitude of the spent transportation accident impacts presented in this SEIS.

Fuel assembly crud is radioactive material deposited on the external surfaces of fuel rods. At the time the ESP EIS was prepared, the quantities and characteristics of crud deposited on advanced LWR spent fuel assemblies was not known. However, since that time, Dominion has investigated and provided information in their COL ER (Dominion 2007) that the estimated cobalt-60 inventory in ESBWR crud would be 568 Ci/MTU. The NRC staff also evaluated the cobalt-60 activity in crud and estimated 584 Ci/MTU. These estimates are relatively consistent, so to be conservative, the NRC estimate of 584 Ci of cobalt-60 per MTU of spent fuel will be used in this SEIS.

A RADTRAN 5 analysis was conducted by the NRC staff to evaluate the effect of the crud contribution to spent fuel transportation accident impacts. RADTRAN 5 (Weiner et al. 2006) is the computer code that was used in the ESP EIS to calculate radiological impacts of transporting fuel and waste to and from the ESP site and alternative sites. Two RADTRAN 5 runs were made for the COL SEIS to determine the contribution of crud to the radiological impacts of accidents during transport of spent fuel. A newer version of RADTRAN was used in this analysis that was used in the ESP EIS. One RADTRAN run was performed with no crud in the source term (i.e., the source term is the same as that used in the ESP EIS and includes the cobalt-60 activation product inventory). The second RADTRAN run assumed only the crud source term and modeled it as having different release characteristics than activation products (activation products are created by neutron activation of stable elements within structural elements of the fuel assembly). Because crud forms on the external surfaces of fuel rods, it is more easily released to the spent fuel shipping cask cavity than activation products. Release characteristics were tailored to the specific physical and thermal characteristics of fuel assembly crud. Crud release fractions, dispersible fractions, and respirable fractions were taken from Sprung et al. (2000) and are presented in Table 6-1.

The results of the staff's analysis are as follows:

- spent fuel without crud: 2.4×10^{-5} person-Sv/reference-reactor year
- crud only: 5.6×10^{-6} person-Sv/reference-reactor year
- total (spent fuel plus crud): 2.9×10^{-5} person-Sv/reference-reactor year.

Based on the above information, including the crud contribution, the fission and activation products in spent fuel increase the potential accident impact by about 24 percent. Using the same health effects model that was used in the ESP EIS (730 fatal cancers, non-fatal cancers, and severe hereditary effects per 10,000 person-Sv), the total detriment associated with this population dose is about 2×10^{-6} fatal cancers, non-fatal cancers, and severe hereditary effects per year. The NRC staff concludes that these impacts are SMALL compared to the fatal cancers, non-fatal cancers, and severe hereditary effects that would be expected to occur annually in the same population from natural sources of radiation. The inclusion of fuel assembly crud in the spent fuel transportation accident risk analysis did not change this conclusion.

6.2.2 Nonradiological Impacts

This section provides an analysis of the nonradiological impacts of transporting fuel and waste to and from the proposed reactor site.

Nonradiological impacts are the human health impacts projected to result from traffic accidents involving shipments of fuel and waste to and from the NAPS site; they do not consider radiological or hazardous characteristics of the cargo. Nonradiological impacts include the projected number of traffic accidents, injuries, and fatalities that could result from shipments of unirradiated fuel to the site and return shipments of empty containers from the site, shipments of empty spent fuel and radioactive waste shipping containers to the site, and loaded shipping containers to offsite disposal facilities.

Table 6-1. Release Characteristic for Spent Fuel Assembly Crud

Severity Category	Severity Fraction[a]	Release Fraction[b]
1	1.53×10^{-8}	2.0×10^{-3}
2	5.88×10^{-5}	1.4×10^{-3}
3	1.81×10^{-6}	1.8×10^{-3}
4	7.49×10^{-8}	3.2×10^{-3}
5	4.65×10^{-7}	1.8×10^{-3}
6	3.31×10^{-9}	2.1×10^{-3}
7	0[c]	3.1×10^{-3}
8	1.13×10^{-8}	2.0×10^{-2}
9	8.03×10^{-11}	2.2×10^{-3}
10	0[c]	2.5×10^{-3}
11	1.44×10^{-10}	2.0×10^{-3}
12	1.02×10^{-12}	2.2×10^{-3}
13	0[c]	2.5×10^{-3}
14	7.49×10^{-11}	6.4×10^{-3}
15	0[c]	5.9×10^{-3}
16	0[c]	3.3×10^{-3}
17	0[c]	3.3×10^{-3}
18	5.86×10^{-6}	2.5×10^{-3}
19	0.99993	0

(a) Severity fractions are the conditional probabilities that, given the occurrence of an accident, the mechanical and thermal conditions experienced by a spent fuel shipping cask are within the conditions defined by the Severity Category. See Sprung et al. (2000) for detailed information about the derivation of these data. Generic steel-depleted uranium-steel cask designs were assumed for the severity fractions. This is the same set of severity fractions that was used in the ESP FEIS.

(b) RADTRAN 5 also models the fraction of the released particulate material that is small enough to be dispersible in prevailing wind conditions and the fraction that is respirable. For this analysis, these parameters were set to 1.0 (i.e., 100 percent dispersible and 100 percent respirable).

(c) The “0” values for certain severity fractions indicate the conditional probability of an accident that results in the mechanical and thermal accident conditions defined by the severity category is 0.0. The severity categories with “0” values were retained in the table for consistency with the source document (Sprung et al. 2000).

Nonradiological impacts are calculated using accident, injury, and fatality rates from published sources. The rates (i.e., impacts per vehicle-km traveled) are then multiplied by estimated travel distances for workers and materials. The general formula for calculating nonradiological impacts is:

Impacts = (unit rate) × (round-trip shipping distance) × (annual number of shipments)

In this formula, impacts are presented in units of the number of accidents, number of injuries, and number of fatalities per year. Corresponding unit rates (i.e., impacts per vehicle-km traveled) are used in the calculations.

Accident, injury, and fatality rates were taken from Table 4 in ANL/ESD/TM-150, *State-Level Accident Rates for Surface Freight Transportation: A Reexamination* (Saricks and Tompkins 1999). Nationwide median rates were used for shipments of unirradiated fuel (3200 km one-way shipping distance) and radioactive wastes (800 km one way). State-specific accident, injury, and fatality rates were used for shipments of spent fuel. State-by-state shipping distances were obtained from TRAGIS outputs (Johnson and Michelhaugh 2003). The data are representative of traffic accident, injury, and fatality rates for heavy truck shipments similar to those to be used to transport radioactive material to/from the NAPS site.

The nonradiological accident impacts for transporting fuel and waste to and from the NAPS site (and return shipments of empty shipping containers) are shown in Table 6-2. The nonradiological impacts associated with the WASH-1238 (USAEC 1972; NRC 1975) reference LWR also are shown for comparison purposes. Note that the nonradiological impacts for the proposed Unit 3 ESBWR are significantly smaller than for the reference LWR in WASH-1238. This difference is due entirely to the smaller number of shipments for the proposed Unit 3 ESBWR.

6.2.3 Conclusions

An independent confirmatory analysis was conducted in the ESP EIS (NRC 2006) of the impacts under normal operating and accident conditions of transporting fuel and wastes to/from an ESBWR proposed for the NAPS site. To make comparisons to Table S–4, the environmental impacts are normalized to a reference reactor year. The reference reactor is an 1100-MW(e) reactor that has an 80-percent capacity factor, for a total electrical output of 880 MW(e) per year. The environmental impacts can be adjusted to calculate impacts per site by multiplying the normalized impacts by the ratio of the total electric output for the proposed NAPS ESBWR to the electric output of the reference reactor.

Table 6-2. Annual Nonradiological Impacts of Transporting Fuel and Waste to and From the NAPS Site, Normalized to the Reference LWR

Reactor, Radioactive Material	Average Annual Shipments	One-Way Shipping Distance, km	Annual Nonradiological Impacts (Normalized to reference LWR)		
			Accidents per Year	**Injuries per Year**	**Fatalities per Year**
Reference LWR (WASH-1238)					
Unirradiated fuel	6.3	3200	1.1×10^{-2}	7.7×10^{-3}	3.7×10^{-4}
Spent fuel	60	4391	1.1×10^{-1}	9.6×10^{-2}	5.6×10^{-3}
Radioactive waste	46	800	2.1×10^{-2}	1.4×10^{-2}	6.8×10^{-4}
TOTAL	112.3		1.4×10^{-1}	1.2×10^{-1}	6.7×10^{-3}
North Anna ESBWR					
Unirradiated fuel	4.1	3200	7.3×10^{-3}	4.9×10^{-3}	2.4×10^{-4}
Spent fuel	41	4391	7.5×10^{-2}	6.5×10^{-2}	3.9×10^{-3}
Radioactive waste	26	800	1.2×10^{-2}	7.9×10^{-3}	3.8×10^{-4}
TOTAL	71.1		9.4×10^{-2}	7.8×10^{-2}	4.5×10^{-3}

This SEIS reflects information included in the ESP EIS and addresses new and significant information about fuel and waste transportation that has arisen since preparation of the ESP EIS. This SEIS also addresses a commitment made in the ESP EIS to provide additional information about the effects on spent fuel transportation accident impacts of spent fuel assembly crud. It was determined that including the impacts of potential releases of crud in a severe transportation accident would not affect the NRC staff conclusion in the ESP EIS that transportation impacts are SMALL and would be consistent with the environmental impacts associated with transportation of fuel and radioactive wastes to/from current-generation reactors presented in Table S–4 of 10 CFR 51.52.

6.3 Decommissioning

At the end of the operating life of a power reactor, NRC regulations require that the facility undergo decommissioning. Decommissioning is the safe removal of a facility from service and the reduction of residual radioactivity to a level that permits termination of the NRC license. The regulations governing decommissioning of power reactors are found in 10 CFR 50.75 and 50.82. The issue of decommissioning was deferred from the evaluation undertaken for the ESP (NRC 2006).

An applicant for a COL is required to certify that sufficient funds will be available to ensure radiological decommissioning at the end of power operations. As part of its COL application for the proposed Unit 3 on the NAPS site, Dominion included a Decommissioning Funding Assurance Report (Dominion 2007). Dominion will establish an external sinking funds account to accumulate funds for decommissioning. The staff reviewed this report and determined that it complied with the requirements in 10 CFR 50.33(k) and 50.75(b).

Environmental impacts from the activities associated with the decommissioning of any reactor before or at the end of an initial or renewed license are evaluated in the *Generic Environmental Impact Statement for Decommissioning of Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors* (GEIS-DECOM), NUREG-0586, Supplement 1 (NRC 2002). Environmental impacts of the DECON, SAFSTOR, and ENTOMB decommissioning methods are evaluated in the GEIS-DECOM. A COL applicant is not required to identify a decommissioning method at the time of the COL application. The NRC staff's evaluation of the environmental impacts of decommissioning presented in the GEIS-DECON, identifies a range of impacts for each environmental issue for a range of different reactor designs. The staff has no reason to believe that the impacts discussed in GEIS-DECOM are not bounding for reactors deployed after 2002.

Therefore, the staff relies upon the bases established in GEIS-DECOM and concludes the following:

1. Doses to the public would be well below applicable regulatory standards regardless of which decommissioning method considered in GEIS-DECOM is used.

2. Occupational doses would be well below applicable regulatory standards during the license term.

3. The quantities of Class C or greater than Class C wastes generated would be comparable or less than the amounts of solid waste generated by reactors licensed before 2002.

4. Air quality impacts of decommissioning are expected to be negligible at the end of the operating term.

5. Measures are readily available to avoid potential significant water quality impacts from erosion or spills. The liquid radioactive waste system design includes features to limit release of radioactive material to the environment, such as pipe chases and tank collection basins. These features will minimize the amount of radioactive material in spills and leakage that would have to be addressed at decommissioning.

6. Ecological impacts of decommissioning are expected to be negligible.

7. Socioeconomic impacts would be short-term and could be offset by decreases in population and economic diversification.

The staff determined that decommissioning activities would result in a SMALL impact.

6.4 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."

72 FR 49352. "Licenses, Certifications, and Approvals for Nuclear Power Plants." Vol. 72, No. 166. August 28, 2007.

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7.0 Cumulative Impacts

Dominion Virginia Power and Old Dominion Electric Power, collectively known as Dominion, applied for a combined license (COL) to construct and operate an Economic Simplified Boiling-Water Reactor (ESBWR) at the North Anna Power Station (NAPS). In its COL application (Dominion 2007), Dominion provided information on the impacts of this action to the U.S. Nuclear Regulatory Commission (NRC). When evaluating the potential cumulative impacts of constructing and operating the proposed ESBWR, which has been designated Unit 3, the NRC staff considers past, present, and future actions. Past actions are those related to the existing NAPS operating units (i.e., Units 1 and 2). Present actions are those related to resources at the time of the COL application for the proposed Unit 3 until the start of construction. Future actions are those that are reasonably foreseeable through construction and operation of the proposed Unit 3, including decommissioning. The geographical area over which past, present, and future actions could contribute to cumulative impacts depends on the type of action considered and is described below for each impact area.

The impacts of the proposed action, as described in Chapters 4 and 5 of this supplemental environmental impact statement (SEIS), are combined with other past, present, and reasonably foreseeable future actions in the vicinity of NAPS site that would affect the same resources impacted by the proposed Unit 3, regardless of what agency (Federal or non-Federal) or person undertakes such actions. These combined impacts are defined as “cumulative” in Title 40 of the Code of Federal Regulations (CFR) Subpart 1508.7, and include impacts that individually are minor but collectively would be significant when considered over a period of time. An action that may have a SMALL impact when considered individually could be part of a combination of actions that have a MODERATE or LARGE impact when considered collectively. Likewise, for a resource that is regionally declining or imperiled, even a SMALL individual impact could be important if it contributes to or accelerates the overall resource decline.

7.1 Land-Use

Cumulative land-use impacts are discussed in Section 7.1 of the NAPS early site permit (ESP) EIS (NRC 2006). The staff did not identify information that was both new and significant through its evaluation of information provided by Dominion and its own independent review related to cumulative land-use impacts. Accordingly, the staff concludes that cumulative land use-impacts would remain SMALL, and mitigation is not warranted.

7.2 Air Quality

The NAPS site is located in Louisa County, Virginia, which is not included among those counties designated by the U.S. Environmental Protection Agency (EPA) as being in Nonattainment for the 8-Hour Ozone National Ambient air Quality Standards (VDEQ 2007a). Orange County, which also abuts Lake Anna, also is not on the list of areas designated for nonattainment. While adjacent Spotsylvania County is designated as being in nonattainment, it has received a Deferment of Official Nonattainment Designation. However, the Virginia Department of Environmental Quality (VDEQ 2007b) is reviewing the air quality information and will make a recommendation to the EPA on what areas may not meet the 8-hour standard. Although Louisa County and surrounding counties were not in violation of the former standards, the final status of all regions in Virginia will not be determined by EPA until 2010.

Cumulative air quality impacts are discussed in Section 7.2 of the ESP EIS (NRC 2006). The staff did not identify information that was both new and significant through its evaluation of information provided by Dominion and its own independent review related to cumulative air quality impacts. Accordingly, the staff concludes that cumulative air quality impacts would remain SMALL, and mitigation is not warranted.

7.3 Water Use and Quality

Information and associated impacts for water use are provided in Sections 4.3, 5.3, and 7.3 of the ESP EIS (NRC 2006). The geographic area in which cumulative impacts on water use were evaluated includes Lake Anna, the Waste Heat Treatment Facility (WHTF), and the North Anna River downstream of the North Anna Dam. In the ESP EIS, NRC staff concluded that future development was unlikely to appreciably alter the hydrology of Lake Anna, and that cumulative water-use impacts would be SMALL except during drought periods when the impacts would be MODERATE. In its ESP review, the NRC staff conducted an independent water budget assessment based on the plant parameter envelope (PPE) values described in the ESP Environmental Report (ER) (Dominion Nuclear North Anna, LLC 2006) and provided in Appendix I the ESP EIS. This independent water budget assessment considered the combined impacts of the existing Units 1 and 2 and the proposed Unit 3 on Lake Anna and the North Anna River downstream of the dam.

The NRC staff reviewed the specific Unit 3 plant design and operation parameters relating to water use provided by Dominion in the COL ER (Dominion 2007) and determined that the parameters were within the PPE range evaluated in the ESP application. The NRC staff did not identify information that was both new and significant related to the cumulative impacts to water use through both its evaluation of information provided by Dominion and the NRC staff's own independent review. The staff concludes that the cumulative impacts to water use associated with the construction and operation of the proposed Unit 3 would remain SMALL except during drought periods, when the impacts would be MODERATE. Resolution of any future conflicts over water use during drought periods would fall within the regulatory authority of the Commonwealth of Virginia. Basic approaches considered by the staff to mitigate water-use conflicts include alternative operation of the proposed Unit 3, and alternative operating procedures for the North Anna Dam. Another approach considered during the ESP evaluation was alternative cooling system designs, which were discussed and resolved in Section 8.2 of the ESP EIS (NRC 2006).

Information and associated impacts for water quality are provided in Sections 4.3, 5.3, and 7.3 of the ESP EIS (NRC 2006). In the ESP EIS, NRC staff concluded that cumulative water-quality impacts were unresolved but were anticipated to be SMALL (NRC 2006). Water-quality impacts were unresolved at the ESP stage, because without a specific design, Dominion could not provide specific information on water treatment systems. In the COL ER (Dominion 2007), Dominion provided additional information regarding plant water treatment systems, lake water quality, and specific discharge flow rates. The proposed Unit 3 discharge water-quality parameters were within (equal to or less than) the range of PPE values evaluated for the ESP. The discharge rate from the proposed Unit 3 is small (< 2 percent) relative to the existing units' discharge; therefore, the relative contribution from Unit 3 discharge to thermal impacts on the WHTF and Lake Anna also would be small.

Dominion provided data indicating that two priority pollutants, copper and tributyltin, occur in the ambient water of Lake Anna at concentrations near or above the state water-quality criteria values. These pollutants are not associated with the operation of Units 1 and 2, but would be concentrated by operation of the proposed Unit 3 because of evaporation. The proposed Unit 3 would discharge effluents into the discharge canal that will likely exceed water-quality criteria for copper and tributyltin. However, the proposed Unit 3 would constitute a small portion of the discharge canal flow relative to the discharges from Units 1 and 2, and therefore, the concentration of the proposed Unit 3 effluent will be rapidly diluted. Further dilution would occur in the WHTF and Lake Anna. Based on this information, the NRC staff concluded that the cumulative water-quality impacts associated with the proposed Unit 3 would remain SMALL. Pollutant discharges would be regulated under a Virginia Pollutant Discharge Elimination System permit issued by the Commonwealth of Virginia (VDEQ 2007c).

7.4 Terrestrial Ecosystem

The information and associated impacts for this section are provided and resolved in Section 7.4 of the ESP EIS (NRC 2006). Based on the staff's analysis, the cumulative impacts of the construction and operation of the proposed Unit 3 along with interactions with past, present, and future actions could contribute to adverse cumulative impacts to terrestrial resources. For the purposes of this analysis, the geographic area in which adverse cumulative effects on terrestrial resources, such as wildlife populations and habitat areas, includes the areas around Lake Anna, within the North Anna ESP site, and within the existing transmission line rights-of-way, including the proposed NAPS to Ladysmith transmission line. The staff concluded in the ESP EIS that construction and operation of the proposed Units 3 and 4 would have SMALL cumulative impacts on terrestrial resources (NRC 2006). Except for the continued development of land in the vicinity of NAPS and Lake Anna that results in the loss of wildlife habitat, the staff is not aware of any other significant cumulative impacts to terrestrial resources. The proposed NAPS to Ladysmith transmission line would be in an existing right-of-way already subject to the vegetative maintenance program and would not result in a significant change to the cumulative impacts of transmission line operations.

The staff did not identify information that was both new and significant related to the cumulative impacts to terrestrial resources through its evaluation of information provided by Dominion and the NRC staff's own independent review. The staff concludes that the cumulative impacts associated with the construction and operation of the proposed Unit 3 would remain SMALL, and additional mitigation is not warranted.

7.5 Aquatic Ecosystem

The information and associated impacts for this section are provided and resolved in Section 7.5 of the ESP EIS (NRC 2006). Based on the staff's analysis, the cumulative impacts of the construction and operation of the proposed Unit 3 along with interactions with past, present, and future actions could contribute to adverse cumulative impacts to aquatic resources. For the purposes of this analysis, the geographic area of interest includes Lake Anna, the WHTF and the North Anna River downstream of the North Anna Dam. The staff concluded in the ESP EIS that construction and operation of the proposed Units 3 and 4 would have SMALL cumulative impacts on aquatic resources (NRC 2006).

Potential cumulative impacts include development that results in habitat loss and nonpoint pollution, recreational activity in or near the lake and river, potential alterations to the fish communities of Lake Anna resulting from changes in Virginia Department of Game and Inland Fisheries management practices, increased fishing pressure, natural environmental stressors, and short- or long-term changes in precipitation and temperature. The proposed NAPS to Ladysmith transmission line is within an existing right-of-way that already is subject to the vegetative maintenance program; therefore, no significant change to the cumulative impacts of transmission line operations would occur.

The staff did not identify information that was both new and significant related to the cumulative impacts to aquatic resources through its evaluation of information provided by Dominion and the NRC staff's own independent review. The staff concludes that the cumulative impacts associated with the construction and operation of the proposed Unit 3 would be SMALL, and additional mitigation is not warranted.

7.6 Socioeconomics, Environmental Justice, Historic and Cultural Resources

The information and associated impacts for this section are provided and resolved in Section 7.6 of the ESP EIS (NRC 2006).

The staff reviewed the information in the ESP EIS (NRC 2006), Dominion's COL ER (Dominion 2007), other information made available since the publication of the ESP EIS, and its conclusion remain the same that under some circumstances, construction and operation of the proposed Unit 3 could make a detectable adverse contribution to the cumulative effects associated with some socioeconomic issues, including aesthetics and recreation. The individual impacts range from MODERATE ADVERSE to LARGE BENEFICIAL as described in the ESP EIS.

The staff did not identify information that was both new and significant related to the cumulative impacts to unusual resource dependencies or practices through which minority or low-income populations would be disproportionately affected. As a result, cumulative impacts of environmental justice would remain SMALL.

The staff did not identify information that was both new and significant related to the cumulative impacts to historic and cultural resources through its evaluation of information provided by Dominion and the NRC staff's own independent review. Dominion has indicated it would implement the existing NAPS procedures to ensure that either known or newly discovered potential historic and cultural sites would not be inadvertently impacted during onsite activities that involve land disturbances (Dominion 2007). The staff concludes that the cumulative historic and cultural resources impacts associated with the construction and operation of the proposed Unit 3 would remain SMALL, and additional mitigation is not warranted.

7.7 Nonradiological Health

In Section 5.8.1 of this SEIS, the health impacts of operating the existing Units 1 and 2 and the proposed Unit 3 at the NAPS site were evaluated regarding the ambient temperature of Lake Anna and the potential formation of thermophilic microorganisms. The evaluation shows that the addition of the proposed Unit 3 is not likely to increase populations of thermophilic microorganisms beyond the levels normally occurring.

Health risks to workers can be expected to be dominated by occupational injuries at rates below the average U.S. industrial rates. Health impacts to the public and workers from noise, dust emissions, acute electromagnetic fields, and transportation also were evaluated and found to be SMALL, and mitigation is not warranted.

The ESP EIS (NRC 2006) considered the health impacts from chronic exposure to electromagnetic fields to be unresolved because of a lack of conclusive health effects information. The NRC staff notes that health impacts are still inconclusive. They will continue to monitor ongoing work in the area, but consider the impact to be SMALL given the insignificant number in the general population that could be hypersensitive to electromagnetic fields.

The staff concludes that the cumulative impacts resulting from construction of the proposed Unit 3 and operation of Units 1, 2, and 3 at the NAPS site on nonradiological health would remain SMALL, and mitigation is not warranted.

7.8 Radiological Impacts of Normal Operation

The information and associated impacts for radiological impacts of normal operation were resolved in Section 7.8 of the ESP EIS (NRC 2006). As described in Section 5.9 of this SEIS, the public and occupational doses predicted from the proposed operation of proposed Unit 3 on the NAPS site are well below regulatory limits and standards.

The staff did not identify information that was both new and significant related to the cumulative impacts to radiological impacts of operation of the proposed Unit 3 and existing Units 1 and 2. Therefore, the impact would remain SMALL, and mitigation is not warranted.

7.9 Severe Accidents

The environmental impacts of potential severe accidents for an ESBWR, the reactor type proposed by Dominion for the new Unit 3 at the NAPS site, are discussed in Sections 5.10.2 and 5.10.3 of this SEIS.

The risk associated with an ESBWR, in addition to the risk associated with the existing Units 1 and 2, is the sum of the risks for the three individual reactors. The population dose risk for Units 1 and 2 is reported to be about 2.5×10^{-1} person-Sv/Ryr (NRC 2006), while the population dose risk for a single ESBWR is reported to be about 3.3×10^{-5} person-Sv/Ryr (NRC 2006). The combined risk for the existing two units plus the proposed ESBWR unit remains at about 2.5×10^{-1} person-Sv/Ryr; therefore, the addition of an ESBWR does not significantly increase risk. Similar conclusions are obtained when other risks, such as cost risk, early fatalities, and decontamination areas, are evaluated. As a result, the staff concludes that the cumulative severe accident impacts associated with constructing and operating an ESBWR at the NAPS site would be SMALL, and mitigation is not warranted.

7.10 Fuel Cycle, Transportation, and Decommissioning

Cumulative impacts of the uranium fuel cycle and solid waste management are discussed in Section 7.9 of the ESP EIS (NRC 2006). The staff did not identify information that was both new and significant through its evaluation of information provided by Dominion and its own independent review; accordingly, the staff concludes that cumulative impacts for the uranium fuel cycle and solid waste management would remain SMALL, and mitigation is not warranted.

Cumulative impacts of transportation of radioactive materials also are discussed in Section 7.9 of the ESP EIS (NRC 2006). In Section 6.2 of this SEIS, the NRC staff evaluated two new issues (i.e., the impact of crud on the surface of spent fuel rods and the nonradiological impacts of transporting unirradiated fuel, spent fuel, and radioactive waste) but determined that these were not new and significant and would not change the impact level of SMALL found in the ESP EIS. Accordingly, the staff concludes that cumulative transportation impacts would remain SMALL, and mitigation is not warranted.

Cumulative impacts of decommissioning were not resolved in Section 7.9 of the ESP EIS because the evaluation of decommissioning was deferred to the COL stage. The environmental impacts of decommissioning the proposed Unit 3 are discussed in Section 6.3 of this SEIS. The staff reviewed the impacts in the *Generic Environmental Impact Statement for Decommissioning of Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors (GEIS-DECOM),* NUREG-0586, Supplement 1 (NRC 2002) and determined they would bound the impacts for reactors deployed after 2002. Accordingly, the staff concludes that cumulative decommissioning impacts would be SMALL, and mitigation is not warranted.

7.11 Staff Conclusions and Recommendations

The staff considered the potential impacts resulting from construction and operation of a single additional nuclear unit together with the past, present, and future actions in the NAPS site area. For the duration of the proposed action (i.e., the construction period plus 40 years of operation), the evaluation took into account the potential impacts from factors known or likely to affect the environment. This included considering conditions at the site and surrounding vicinity from past, present, and future human activities.

For each impact area, except socioeconomics, the staff concludes the potential cumulative impacts resulting from construction and operation generally would remain SMALL, and additional mitigation is not warranted. For socioeconomics, the staff found individual impacts would remain in the ranges of MODERATE ADVERSE to LARGE BENEFICIAL.

7.12 References

40 CFR Part 190. Code of Federal Regulations, Title 40, *Protection of Environmen*t, Part 190, “Environmental Radiation Protection Standards for Nuclear Power Operations.”

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

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8.0 Need for Power

In a combined license (COL) application, an applicant must address the need for power if it was not resolved as part of an early site permit (ESP) proceeding. Dominion Virginia Power (DVP) and Old Dominion Electric Cooperative (ODEC), collectively known as Dominion, have submitted an application to the U.S. Nuclear Regulatory Commission (NRC) for a COL to construct and operate a new nuclear power reactor (Unit 3) at the North Anna Power Station (NAPS). Dominion elected to defer consideration of the need for power to the COL stage and, therefore, included a discussion of need for power in its COL application (Dominion 2007).

Sections 8.0 through 8.4 of NRC's Standard Review Plans for Environmental Reviews for Nuclear Power Plants (NUREG-1555) (NRC 2000) guide the staff's review of the need for power analysis. The guidance in NUREG-1555 is limited because of changes in the regulatory structure that were occurring as this guidance was being revised. Deregulation of the electricity markets has had a significant impact on the analysis of the need for power. Applicants may be power generators rather than traditional utilities; therefore, analysis of the need for power must be sufficiently flexible to accommodate various applicant types. Because of deregulation in the bulk sales markets for electricity, the advent of independent power producers, and the increased use of purchases and exchanges of electricity among utilities to meet demand, the demand for electricity by ultimate consumers and customers within a utility's service area is increasingly not being met by the utility's own generating resources. Trading of electricity is further facilitated by the Federal Energy Regulatory Commission's final rule, promulgated in 61 FR 21540, requiring all public utilities that own, control, or operate facilities used for transmitting electricity in interstate commerce to file open-access, nondiscriminatory transmission tariffs that contain minimum terms and conditions on nondiscriminatory service.

The term "relevant service area" is used here to indicate any region to be served by the proposed facility, whether or not it corresponds to a traditional utility service area. "Relevant service area" is a situation-specific concept and must be defined on a case-by-case basis. Affected states or regions may prepare a need for power evaluation and assessment of the regional power system for planning or regulatory purposes. A need for power analysis may also be prepared by a regulated utility and submitted to a regulatory authority, such as a state public utility commission. The NRC staff would review the evaluation and determine if it is (1) systematic, (2) comprehensive, (3) subject to confirmation, and (4) responsive to forecasting uncertainty (NRC 2000). As outlined in NUREG-1555, if the need for power evaluation is found to be acceptable, no additional independent review by the NRC is needed. However, the data may be supplemented by information from other sources such as the Energy Information Agency, Federal Energy Regulatory Commission, and the North American Electric Reliability Council. In the case of the proposed Unit 3 at the NAPS site, Dominion has defined a relevant service area corresponding to PJM Interconnection LLC's PJM South Region (also known as the Dominion Zone, which is further described in Section 8.1). This area comprises most of the Commonwealth of Virginia and the northeastern part of the State of North Carolina (see Figure 8.1).

8.1 Description of the Power System

Dominion is one of about 500 members of PJM Interconnection, LLC. PJM is a regional transmission organization (RTO) headquartered in Valley Forge, Pennsylvania, that coordinates the movement of wholesale electricity in all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and the District of Columbia. PJM operates as a federally regulated RTO to manage the region's wholesale electricity market and ensure supply for the regional high-voltage transmission system, in part by telling power producers how much energy should be generated and by adjusting import and export transactions (PJM 2008b).

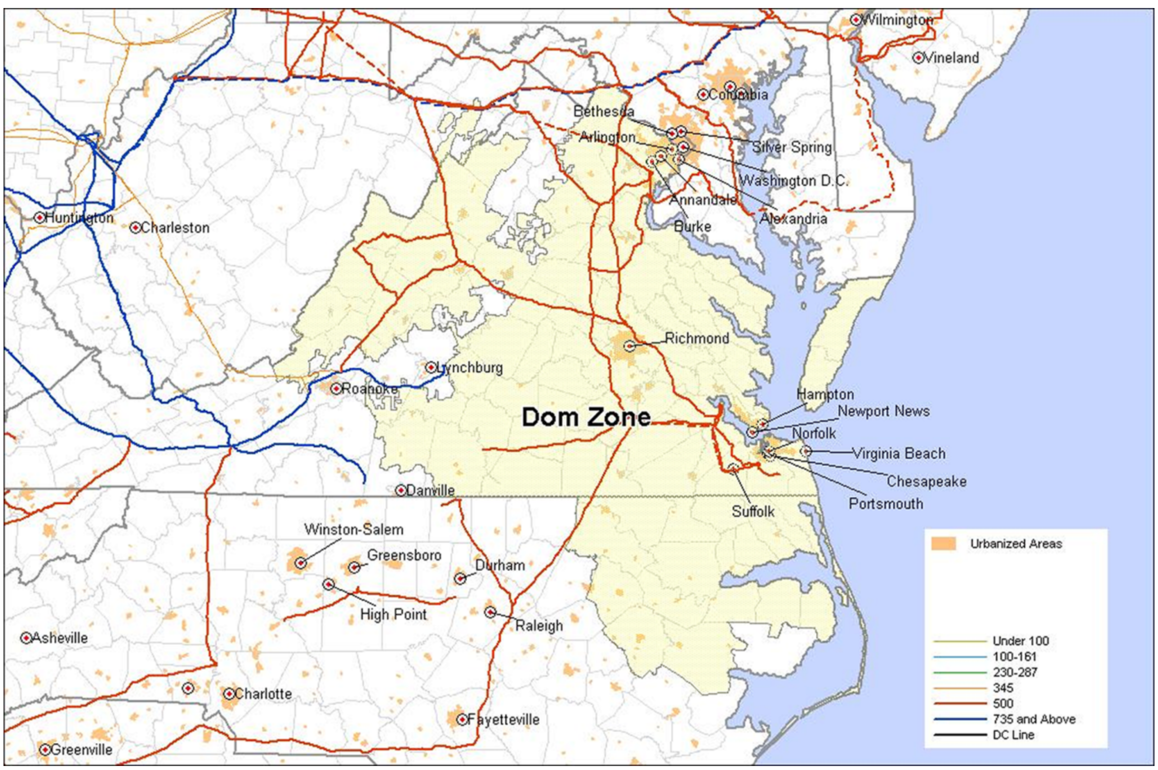

Figure 8-1. Map of PJM South (the Dominion Zone), Showing Major Transmission Lines into the Dominion Zone (Dominion 2007)

Dominion joined PJM in May 2005 and transferred control (but not ownership or operations) of its transmission facilities to the RTO. Also, Dominion separated its electric generation and traditional customer delivery businesses (referred to now as "load serving entity," or "LSE") into two distinct operations within PJM's system. The Dominion Zone currently is co-terminous with the power system control area of Dominion and includes the electric distribution service territories of DVP, ODEC, North Carolina Electric Cooperatives (NCEMCS), and other municipals. DVP operates as an LSE in the Dominion Zone (Dominion 2007). DVP serves approximately 90 percent of the electric load in the Dominion Zone, including both peak demand and total energy requirements. ODEC also serves a small percentage of the Dominion Zone load through its nine members that distribute electrical services in the Virginia mainland. ODEC's service territories either abut or overlap Dominion's territories (Dominion 2007).

DVP's service territory in Virginia accounts for over 80 percent of its total load and includes many of the fastest-growing counties in the State. DVP also serves the northeastern corner of North Carolina, excluding several municipalities, and has native-load obligations throughout its service territory in Virginia and North Carolina (Dominion 2007).

8.2 Power Demand/Integrated Resource Planning

Need for power is an intricate part of all integrated resource planning, and is a derivative of load demand forecasting. Integrated resource planning can be thought of as a process of planning to meet users' needs for electricity services in a way that satisfies multiple objectives with limited resources. Broad objectives can include, but are not limited to, the following:

- conforming to national, regional, State, and local development objectives
- ensuring that all households and businesses have access to electricity services
- maintaining reliability of supply
- minimizing the short-term or long-term economic costs of delivering electricity services
- minimizing the environmental impacts of electricity supply and use
- enhancing energy security by minimizing the use of external resources
- providing economic benefits.

Integrated resource planning is built on principles of comprehensive analysis. Traditional methods of electric resource planning focused on "supply-side" projections only for such things as construction of generation, transmission, and distribution facilities. Integrated resource planning considers a full range of feasible supply-side and demand-side options, and assesses them against a common set of planning objectives.

Integrated resource planning provides an opportunity for electric planners to address complex issues in a structured, inclusive, and transparent manner. At the same time, it provides a chance for interested parties both inside and outside the planning region to review, understand, and provide additional input.

The steps in the integrated resource planning process generally are to:

- establish objectives
- survey historical energy use patterns and develop load-demand forecasts
- investigate electricity supply options
- investigate demand-side management measures
- prepare and evaluate supply plans
- prepare and evaluate demand-side management (DSM) plans
- integrate supply-side and demand-side plans into candidate integrated resource plans
- select the preferred plan.

8.3 Power Demand/Integrated Resource Planning in the PJM Region

PJM has primary responsibility for integrated resource planning in the prospective service area for the proposed Unit 3 at NAPS. It administers a long-term PJM Regional Transmission Expansion Planning Process (RTEPP) and the Reliability Pricing Model (RPM), which provide a long-term price signal for existing and new generating capacity resources to ensure reliability for the PJM control area (Dominion 2007). In accordance with NRC guidance, such independent integrated planning efforts by regional, State, or other public authorities are to be treated with deference so far as the need for power analysis is concerned (68 FR 55905). The NRC only evaluates the integrated resource plan or demand forecast to see if it meets basic requirements for methodological quality. It does not substitute its judgment concerning the need for power for that of the applicant, regulatory bodies such as state public utility commissions, and regional coordinating bodies, such as Independent Service Operators (NRC 2000, Section 8.2.1).

In determining the need for power, PJM considers the reserve margin needed to ensure reliable system operation and supply of power. The reserve margin helps ensure that there will be sufficient generating resources available to meet the load, while providing allowance for generating facilities that may be unavailable due to planned or forced outages (Dominion 2007).

PJM’s Reliability Assurance Agreement (RAA) among Load Serving Entities in the PJM Region obligates DVP to own or procure an amount of capacity to maintain overall system reliability.

PJM performs a technical analysis on an annual basis that calculates the appropriate generating capacity, including the reserve margin required to meet the RAA-defined reliability criteria. This technical analysis is based on a loss-of-load expectation (LOLE) of one day in 10 years. This standard is also the standard adopted by the Regional Reliability Organization—South Eastern Reliability Council (SERC) and the Reliability First Corporation (RFC), which is the regional reliability organization that covers much of the PJM market. After review and receipt of comments from the Planning Committee, the RAA-Reliability Committee approved a 15-percent installed reserve margin (IRM) target for the PJM region. This region-wide IRM target is used for RPM and is the basis for allocating a capacity obligation to each LSE within PJM based on that LSE's share of the PJM summer peak load (Dominion 2007).

Each LSE is responsible for installing or purchasing capacity, on a daily basis, to meet its obligation. The rationale for imposing capacity obligations on PJM LSEs is that installation of generating capacity requires time, coordination of electric system resources, and financial backing and, therefore, must be planned for in advance of need (Dominion 2007).

To balance the requirements of buyers and loads with offers of suppliers and, by so doing, manage the reliability of the system over the long term, PJM administers an RPM annual market for capacity. This capacity market is designed to provide a price signal to ensure that the long-term peak requirements of the PJM system can be met by available capacity resources, consistent with the RTEPP (Dominion 2007).

The Dominion Zone is one of the 23 Locational Deliverability Areas (LDA) in PJM. These 23 LDAs, are identified by PJM as " … constrained areas that have a limited ability to import capacity due to physical limitations of the transmission system, voltage limitations or stability limitations." Capacity to serve LSEs in constrained areas, such as the Dominion Zone, must be located within the constrained area or the LSE must enter into a bilateral transaction for capacity into the constrained area with another entity through Capacity Transfer Rights (CTRs) (Dominion 2007).

A defining characteristic of each LDA is its transfer capability with adjacent electric transmission networks. Through the RTEPP planning exercise, PJM identifies each LDA's capacity emergency transfer limit (CETL) and capacity emergency transfer objective (CETO), where CETL is the actual emergency import capability, expressed in megawatts, of the sub-area, and CETO is the import capability required for the sub-area to meet the approved LOLE negligible level of one day in 25 years, a higher standard than the one-in-10-year requirement for generation. PJM specifies the CETL and CETO for the Dominion Zone to be approximately 3100 MW(e) and 1155 MW(e), respectively. Even with the new Meadow Brook to Loudoun 500-kV transmission line sponsored by Dominion and other baseline transmission upgrades included in the PJM RTEPP, PJM believes that additional transmission system expansion and new generating sources will still be required to meet expected peak load supply requirements in the Dominion Zone beyond 2012 (PJM 2007b; PJM 2008d).

8.4 Assessment of Need for Power

Dominion's need for power analysis relied on base-load growth projections based on historical growth observed by Dominion in the Dominion Zone. Demand forecasts specific to ODEC's service territory were not available, but the Dominion assumed that ODEC has a similar electric demand profile to its own, given that Dominion and ODEC operate in overlapping and contiguous service territories (Dominion 2007).

As a regulatory agency responsible for safety, NRC does not have regulatory or oversight responsibility for the cost to the consumer of power generated in nuclear plants that it regulates. However, the cost of power is overseen by several other agencies. The Dominion Zone is subject to oversight from four separate entities with respect to reserve margin standards, system reliability, and planning, as described in this section. These four entities are the PJM independent RTO, which operates the regional wholesale electricity market; the Virginia State Corporation Commission (Virginia-SCC), which regulates electric rates and service within Virginia and issues certificates of public convenience and necessity (CPCN) for individual electricity generating facilities that are proposed to serve customers in Virginia; the North Carolina Utilities Commission (NCUC), which regulates electricity rates and service in North Carolina and issues CPCNs for individual electricity-generating facilities that are proposed to serve customers in North Carolina; and the SERC region of the North American Electric Reliability Corporation, which promotes, regulates, and enforces and resolves disputes concerning reliability and adequacy arrangements among the power-supply systems in its region (Dominion 2007).

The Virginia-SCC must consider and rule on the application for the CPCN that Dominion must file for the proposed Unit 3. Under Virginia Code §56-580.D, a utility must demonstrate to the Virginia-SCC that a proposed facility (1) will have no material adverse effect upon reliability of electrical service provided by any regulated public utility, (2) is required by the public convenience and necessity, and (3) is not otherwise contrary to the public interest. In 2007, the Virginia General Assembly amended the Virginia Utility Electric Regulation Act, Code of Virginia (Virginia General Assembly 2007) to accommodate the new legislation designed to ensure reliable and adequate supply of electricity. Part of this legislation requires each electric utility, such as Dominion, to file periodically with the Virginia-SCC its 10-year plan for its projected generation and transmission requirements to serve its native load, including how the utility will obtain such resources, their capital requirements, and the anticipated sources of such funding (Virginia Code § 56-585.1.A.3). As prescribed by the Virginia General Assembly, the Virginia-SCC also has the responsibility to fix, for each Virginia public utility, just and reasonable rates that it may charge for its services to its customers. The Virginia-SCC also has authority over the manner in which the utility companies provide service to their customers and requires public utilities to provide reasonable and reliable service and to adopt safety rules and regulations for the protection of the public.

The NCUC requires all public utilities to first obtain a certificate of public convenience and necessity from the NCUC before beginning the construction or operation of any utility plant or system in North Carolina or acquiring ownership or control thereof. In August 2007, the Governor of North Carolina signed into law Senate Bill 3 (North Carolina General Assembly 2007, Session Law 2007-397). Under the law, for generation facilities constructed outside of North Carolina, a utility seeking rate recovery must file a petition with the NCUC, and if need is shown, the NCUC will approve an estimate of construction costs and construction schedule if the plant is intended to serve North Carolina customers. The new law also contains provisions regarding review of the development costs for nuclear generation. As a general rule, the NCUC has the responsibility under the law to fix, for each North Carolina public utility, the rates that it may charge for its services to its customers. These rates are required to be just and reasonable and fair both to the public utility and to its customers. In addition, the NCUC has authority over the manner in which the utility companies provide service to their customers and requires public utilities to provide reasonable and reliable service and to adopt safety rules and regulations for the protection of the public.

Finally, the service territories of DVP and ODEC are located in the VACAR sub-region of the SERC region (Eastern Virginia and all of North Carolina). SERC is responsible for proposing and enforcing reliability standards within the SERC region based on authority delegated to it from the North American Electric Reliability Corporation. SERC also is responsible for promoting and improving the reliability, adequacy, and critical infrastructure of the bulk power supply systems in the SERC region. SERC promotes the development of reliability and adequacy arrangements among the power supply systems; administers a regional compliance and enforcement program to achieve the reliability benefits of coordinated planning and operations; and provides a mechanism to resolve disputes on reliability issues (Dominion 2007).

8.4.1 Programs Affecting Demand

Electricity demand can be influenced by DSM programs that are essentially interventions in the market to promote the adoption of more efficient end uses and to change consumer behavior. Because much of the focus of PJM and other planners is on meeting summer peak demand, most existing programs in the region target peak demand rather than base-load energy consumption. Because this analysis is for the proposed Unit 3 at NAPS, which would provide base-load power, the impact of this analysis is on the impact of DSM programs on energy requirements, rather than peak demand. Dominion discussed several existing and proposed DSM programs in its discussion of the need for power in the Dominion Zone.

PJM's Emergency Load Response Program is designed to encourage customers to reduce load during an emergency event in exchange for compensation from PJM. However, these programs focus on reducing peak demand, and Dominion believes that they will have virtually no impact on base-load requirements. Dominion itself offers several tariff-based DSM options for both residential and non-residential customers and DSM education programs, which are designed to educate customers and promote energy efficiency and/or conservation. With the exception of the education programs, which are focused on capital improvements, the typical DSM programs are designed to reduce consumption during times of peak demand and focus on reliability (Dominion 2007).

In 2007, the Virginia General Assembly passed House Bill 3068 and Senate Bill 1416, which were signed into law by Virginia's Governor. One of the goals for the year 2022 of " … reducing the consumption of electric energy by retail customers … " in Virginia by 10 percent of the electric energy consumed by retail customers in 2006. Furthermore, it directs the Virginia-SCC to conduct a proceeding to (1) determine whether the 10-percent electric energy consumption reduction goal can be achieved cost effectively through the operation of such programs and, if not, determine the appropriate goal for the year 2022 relative to base year 2006; (2) identify the mix of programs that should be implemented in the Commonwealth to cost-effectively achieve the defined electric energy consumption reduction goal by 2022, including but not limited to DSM, conservation, energy efficiency, real-time pricing, and consumer education; (3) develop a plan for the development and implementation of recommended programs, with incentives and alternative means of compliance to achieve such goals; (4) determine the entity or entities that could most efficiently deploy and administer various elements of the plan; and (5) estimate the cost of attaining the energy consumption reduction goal (Virginia Code Commission 2007).

The legislation indicates that these programs may include activities by electric utilities, public or private organizations, or both electric utilities and public or private organizations. The Virginia-SCC submitted its findings and recommendations to the Governor and General Assembly on December 14, 2007. The staff study concluded that the 10 percent reduction envisioned in the legislation was possible, but that the investments and impacts would likely be substantial (Virginia-SCC 2007). In response to this directive by the General Assembly, the Virginia-SCC staff and interested parties (including Dominion) are working to develop a long-term energy conservation plan for Virginia (which is separate from the Virginia Energy Plan discussed in this section).

In July 2007, Dominion announced that it had formed a conservation group " … to encourage a renewed customer interest in energy efficiency … " (Dominion 2008). The conservation group " … will explore new technologies and techniques for residential and business customers to reduce their impact on the environment and help them reduce their demand for electricity … " Dominion also has identified pilot programs, which are described below, to gauge customer interest in and response to certain conservation, energy efficiency, education, demand response, and load-management initiatives in Virginia (Dominion 2007).

Dominion's current conservation and DSM programs focus on customer education and provide rate incentives for load reductions during peak periods, including a number of pilot programs, all of which are subject to approval by the Virginia-SCC. If approved and fully implemented, Dominion estimates that their distributed generation/load curtailment pilot will run through 2014.

Further, if approved as submitted in the pilot filing and depending on whether it is fully implemented and well-received, the program may have up to an estimated 100-MW impact on peak load during that time (Dominion 2007). Dominion also is a partner in the U.S. Environmental Protection Agency/U.S. Department of Energy ENERGY STAR program, to promote the purchase and use of energy-efficient products and appliances and energy-efficient building practices for new homes.

As previously noted, the Virginia legislature set the goal of reducing electricity use in 2022 by 10 percent of the 2006 retail consumption through a mix of conservation, energy efficiency, load management, and DSM programs. This same goal was considered by the 10-year comprehensive Virginia Energy Plan (VDMME 2007), which was issued by the Commonwealth of Virginia Department of Mines, Minerals, and Energy on September 12, 2007. The Virginia Energy Plan refers to calculations based on studies in other states that show that Virginia, with a concerted private, public, and non-profit investment in energy efficiency and conservation activities, has an achievable cost-effective electric energy reduction potential of 14 percent over the next 10 years, scaled back to a 10-percent goal. The Virginia Energy Plan acknowledges that Virginia has no established funding source for energy efficiency and conservation programs and that most states with a successful history of efficiency programs provide significant funding resources. The plan also acknowledges " … that utilities and consumers together would have to invest an average of approximately $300 million per year over the 15-year life of the program ($100 to $120 million by electric utilities, matched by $180 to $200 million by consumers)" (VDMME 2007). Although these targets and the means of reaching them are uncertain, Dominion believes that, even with complete success in achieving the 10-percent conservation goal, Unit 3 is still necessary to meet the growth in base-load demand. Dominion's need for power analysis gives full credit for reduction in load growth embodied in Virginia's goals and still finds that a need for power exists.

8.4.2 Comparison of PJM/Dominion Studies with NRC Criteria

Dominion has relied on PJM studies and reports in which the need for power is evaluated. According to NUREG-1555, an NRC independent evaluation of the need for power may not be needed if the NRC determines that the State/region-prepared evaluation is (1) systematic, (2) comprehensive, (3) subject to confirmation, and (4) responsive to forecasting uncertainty. Each of the NUREG-1555 criteria is addressed below with respect to the collective PJM reports.

8.4.2.1 Systematic

PJM has a systematic process for load forecasting. The forecast was developed using accepted techniques and employs a range of economic, calendar, weather, and weather variables (including solar). The PJM load forecasts are based on a multiple variable ordinary least squares regression using economic and calendar variables for each of the 23 LDAs in PJM Manual 19 (PJM 2008c). An overview discussion of PJM's load forecasting process follows. The PJM Load Forecast Model (PJM 2007a) produces a 15-year monthly forecast of unrestricted peaks assuming “normal” weather (i.e., average weather) for each PJM zone and the RTO, as well as unrestricted energy forecasts for the same sub-areas. The models for peak demand and energy use the same explanatory variables. Forecasts are developed for each zone’s non-coincident peak and the zone’s share of the PJM coincident peak. Econometric models are supplemented with a Monte Carlo simulation to derive a distribution of forecasts over a wide range of weather conditions. Calendar effects are captured by specifying the days of the week, month of the year, holidays, hours of daylight and Daylight Savings Time. Holiday seasonal lighting load is reflected using a trend variable. Weather is reflected in the models as temperature-humidity index and heating and cooling degree-days. As a final step in the forecasting process, the PJM Load Forecast is reviewed by the Load Analysis Subcommittee, and presented to the Planning Committee for endorsement. Final approval is received from the PJM Board of Managers.

Because the PJM model did not provide a forecast of base-load demand, Dominion derived an estimate of base-load demand and growth rate that they considered to be fully consistent with the peak demand forecasted by PJM for the Dominion Zone. Dominion estimated the 2006 base-load demand in the Dominion Zone by reviewing historical PJM integrated hourly loads for the zone, sorting the 8760 hourly loads (i.e., 24 hours × 365 days) in declining order to create the load duration curve and selecting the 65th percentile hour load equal to 9538 MW(e) as the proxy for the 2006 base-load demand. Dominion assumed that this base-load demand would continue to grow at a compound annual growth rate of 2.4 percent, equal to the compound annual growth rate observed in historical Dominion weather-normalized average hourly sales over the 5-year period from 2002 to 2006. Dominion’s review of its historical weather-normalized peak load over the same 5-year period from 2002 to 2006 revealed a compound annual growth rate of 1.9 percent, which is was the same as PJM’s forecasted peak load growth.

The NRC staff examined the PJM methodology and assumptions and found that they are systematic and are well documented. Given the PJM peak load forecast, the NRC staff concludes that Dominion’s derivation of the base-load forecast is a reasonable approach and also is well documented.

8.4.2.2 Comprehensive

PJM evaluated a large set of model parameters and model specifications. Measures of macroeconomic and demographic activity are included in the forecast model, representing total national, state, or metropolitan areas, depending upon their predictive value. The consumer price of power is not currently used as an explanatory variable in the model. The economic model specification uses Gross Metropolitan Area Product for Metropolitan Statistical Areas as economic drivers for the individual PJM zone (Richmond, Virginia Beach and Roanoke in the Dominion Zone model).

The PJM non-coincident peak forecasting model specification consists of over 50 independent variables. In PJM's forecasting approach, while the parameter estimates do not vary by month, they do vary across the 18 electric distribution company zones. A range of different model specifications were evaluated, and the preferred specification was selected based on its superior performance according to accepted statistical techniques. Specifically, the preferred model specification was chosen based on model back-casting performance after reviewing several alternative specifications. The PJM Load/Energy Forecasting Model White Paper (PJM 2007a) served as documentation of the implemented peak and energy forecast models as well as other methods and specifications that were tested, but not adopted.

In PJM's scenarios and assumptions, the NRC staff note that the assessments focus on peak capacity because of its importance to the transmission system. For example, a large part of the modeling effort addresses the effects of weather being included in an appropriate manner. As a result, Dominion was forced to make its own derivative assessment of the need for base-load power. In addition, it does not appear that the PJM assessment takes into account some of the potential factors that may affect base-load demand in the future. For example, the assessment does not take into account conservation programs that are not contracted DSM programs directed at energy conservation (which affects base-load demand) rather than demand response (which affects peak demand). The assessment also does not include factors such as long-term fuel availability and price; nor does it include global climate change and its probable influence on both electricity demand and the cost of generating electricity by various technologies. Finally, it does not include the potential for new sources of demand such as electric vehicles, growing sources of demand such as home entertainment systems and standby power loads for a variety of residential and commercial equipment, and disruptive technological change.

The Dominion estimate of need for base-load power addresses DSM and conservation appropriately by giving no credit for DSM in reducing the base-load demand but giving 100 percent credit to Virginia's 10-percent conservation goal. The NRC staff believes that most of the omitted factors listed above are likely to add to the need for power. Fuel availability and price uncertainties are likely to take the form of cost increases for natural gas because of increasingly limited availability and price increases for coal-fired generation resulting from substitution of coal for natural gas (if there is no national future climate policy) or impacts of carbon reductions (if there is a national climate policy). Climate change itself is likely to add to the demand for cooling residential and commercial buildings (which would increase the demand for electricity), as would electric vehicles and increased standby demands.

The NRC staff examined the PJM methodology and Dominion's forecast derived with the assistance of the PJM methodology and found that when taken together these forecasts were thorough. While the methodology did not include several factors discussed above, these factors are likely to increase the need for power. Thus, the NRC staff concludes that the methodology is comprehensive.

8.4.2.3 Subject to Confirmation

The PJM load forecast and the forecast results are subject to confirmation by multiple parties. The load forecast is a critical element of the process used to establish the capacity obligations of each LSE, which represent significant financial obligations. Thus, the load forecast receives considerable scrutiny from PJM members to ensure that it represents a reliable estimate of future peak loads and bases upon which to evaluate future capacity requirements. The load forecast must meet the forecasting standards of the RAA and PJM Manual 19 (PJM 2008c). The Load Analysis Subcommittee (LAS) is a member oversight group that monitors each load forecast produced by PJM.

Under PJM Manual 19, the PJM Load Forecast is reviewed by the LAS, and presented to the Planning Committee for endorsement. The LAS is composed of representatives from electrical distribution companies that are members of PJM. Final approval is given by the PJM Board of Managers. A member of the Planning Committee may submit an appeal detailing an issue and outlining a solution for a review of part of or the entire forecast, which will be forwarded by the Chair of the Planning Committee to PJM, upon a vote of the Committee. Thus, there are at least two levels of internal review in the planned process of each PJM forecast, including rights of internal appeal.

The historical PJM load forecast also has been confirmed independently by the Brattle Group, which was hired by PJM to provide an independent assessment of the load forecast (The Brattle Group 2006). PJM was prompted to conduct this independent evaluation of the model because, among other issues, the 2006 peak load forecast understated the actual peak by 9.36 percent. Weather conditions for the summer 2006 peak were extreme, and when the PJM load forecast was re-simulated using those actual weather and economic conditions, the forecast error was only 0.7 percent. The Brattle Group concluded that " … the model is doing a good job of forecasting peak demand and the main source of error is weather [*i.e., the difference between long-term average weather and actual weather*]" (Dominion 2007). The NRC staff note that the uncertainty of ±0.7 percent, if applied to Dominion's forecast of base-load demand, is equivalent to 70 MW(e), which is far less than the output of Unit 3.

Looking forward, in its *2008 Annual Energy Outlook*, the Energy Information Administration (EIA) forecast that electricity consumption for the SERC region will grow at a compounded annual rate of 1.2 percent per year, which is significantly less than the 1.9 percent per year projected for the Dominion Zone by PJM. However, SERC has come to the following conclusions, which are more in line with the PJM forecast (SERC 2007):

- Projected peak demand will increase at 2.08 percent annually through 2016.
- Electricity demand will increase 1.7 percent annually through 2016.
- Firm capacity margins will be 13 to 15 percent through 2016, which is a requirement imposed on SERC's members to maintain system reliability.

The 2007 Virginia Energy Plan (VDMME 2007) projects that growth rates of peak electricity demand in Virginia during the period from 2005 and 2016 to range from about 0.5 percent per year (in a scenario with aggressive conservation savings of 14 percent of 2006 consumption) to about 1.9 percent per year (in a scenario without conservation programs in place). The latter projection is the one most comparable with the PJM forecast and is very similar. Dominion accounts for conservation programs in determining the need for Unit 3, working from the PJM forecast and then subtracting the impact of the conservation programs.

The NRC staff finds that the load forecast has been subjected to confirmation and confirmed by other regional forecasts.

8.4.2.4 Responsive to Forecasting Uncertainty

The historical predictive capability of the PJM load forecast for the Dominion Zone is indicated by its adjusted R-Squared of 0.961, indicating that over 96 percent of the dependent variable's (i.e., load) variance from the mean is explained by the regression's independent variables and specified parameter estimates. The Brattle Group review of the peak-demand forecast methodology indicates that the primary source of forecast error and uncertainty are the differences between projected average weather conditions used in the forecast and actual weather conditions. PJM addressed the forecast uncertainty associated with weather through the use of a Monte Carlo simulation based on actual weather conditions. As such, the forecast methodology and forecast results adequately account for forecast uncertainty concerning weather and coincident/non-coincident peaks. The Monte Carlo simulation, however, currently does not include uncertainty, such as the rates of increase in population and economic activity, in the economic variables. Moreover, while the consumer price of electricity has not been included in the PJM models, future increases in the cost of generating electricity in the Dominion Zone arising from adding new generating facilities to the base rate have an unknown potential for dampening load growth and, therefore, delaying the need for base-load capacity.

The NRC staff concludes that the methodology was not fully responsive to forecast uncertainty. Therefore, the staff conducted sensitivity testing of growth rate in peak demand within the Dominion Zone and impact of increases in the average cost of power (see Section 8.4.3.2).

8.4.3 Need for NAPS Unit 3

8.4.3.1 Need for Base-Load Capacity

For the purpose of estimating the specific need for base-load capacity that would be provided by Unit 3, Dominion defined base-load capacity in its ER to include generating units with a capacity factor of 65 percent or greater, which they state is consistent with the base-load definitions assumed by the Edison Electric Institute (EEI) and California Senate Bill 1368. The current base-load demand in the Dominion Zone was estimated by reviewing 2006 historical PJM integrated hourly loads for the Dominion Zone, sorting the year's 8760 hourly loads in declining order to create the load duration curve shown, and then selecting the 65th percentile hour load equal to 9538 MW(e) as the proxy for 2006 base-load demand. Over the years from 1997 to 2006, Dominion's base-load requirement grew by over 2000 MW(e), based on analysis of Dominion weather-normalized annual energy sales. Over the same period, Dominion reported that there has been virtually no development of additional base-load resources in the Dominion Zone, because only combined cycles and combustion turbines have been added since 1997 (Dominion 2007).

To estimate the unit availability rates shown above for hydroelectric and nuclear sources, Dominion reviewed historical state-level generation and capacity data published by the EIA, which showed that historically, nuclear units in Virginia operated at a 93 percent average capacity factor in 2005, while hydroelectric units operated with a 25 percent average capacity factor. Because hydroelectric and nuclear units are typically dispatched before other technology types based on lower variable costs, these capacity factors were used as proxy values for hydroelectric and nuclear generation availability rates. Coal-fired and biomass units were both assumed to have a 90 percent availability rate. Availability rates for the typical intermediate and peaking technology types (i.e., gas/oil fired and pumped storage) were assumed to be equal to 1 minus the 5-year average Equivalent Forced Outage Rate as published by PJM in its *2001-2005 Generating Unit Statistical Brochure* (PJM 2006a) Dominion considered this a conservative approach and believed that it likely overstates the amount of intermediate and peaking capacity available, as the approach does not account for planned maintenance outages for intermediate and peaking capacity (Dominion 2007).

Based on EIA data, the Commonwealth of Virginia imported approximately 38 percent of Virginia's total state-wide electric consumption in 2006 (DOE/EIA 2007). The District of Columbia, Delaware, Maryland, and New Jersey also rely heavily on imported power and compete with Virginia for available power supplies from West Virginia, Pennsylvania, and Illinois. North Carolina is less reliant on imports, but does import approximately 12 percent of the annual electricity consumed (DOE/EIA 2007).

8.4.3.2 Other Potential Sources of Capacity

Dominion currently contracts for 2089 MW(e) of capacity through existing Power Purchase Agreements (PPAs). All of this capacity comes from generation located within the Dominion Zone: Half of this contracted capacity is from coal-fired, base-load plants, with 809 MW(e) scheduled to expire by end of 2015, 379 MW(e) of which is base-load power. Relying on the future availability of long-term PPAs from developers of new base-load resources in other regions outside Virginia introduces uncertainty as to capacity and energy supply for Dominion. Dominion has an obligation to meet the demands of its native-load customers, and the Virginia General Assembly has made the policy determination to promote the construction of base-load generation for this purpose. Other power project developers may not have energy and capacity available to provide to Dominion in the future. There also may be competition for the available long-term, base-load PPAs among the other load centers surrounding the Dominion Zone.

In addition to concerns of long-term supply assurance, reliance on power imported from other states increases demand on west-to-east transmission capabilities, resulting in heightened vulnerability to transmission-related interruptions. The U.S. Department of Energy has identified the Atlantic coastal area from Metropolitan New York southward through northern Virginia as one of two Critical Congestion Areas within the United States (DOE 2006). Virginia's reliance on imported power increases its vulnerability to transmission-related interruptions. PJM, in its 2006 RTEPP, raises concerns over its aging transmission infrastructure; more than 50 percent of the 188 500/230-kV transformers in service in the PJM system are 30 years old or older. Over the last several years, the PJM system has experienced an increasing number of transformer failures and degradation of older transformers (PJM 2006b).

As of May 23, 2008, there were no announced plans for generator deactivations in the Dominion Zone (PJM 2008a). However, there are extensive retirements of older-generation facilities in nearby, interconnected regions that call into question the availability of future electricity imports as current contracts expire. As of May 23, 2008, deactivations accounting for 1696 MW(e) of electric power are planned in PJM for the period 2010 through 2012. The facilities included in the deactivation plan are all 35 years or older and are located in Illinois, New Jersey, Delaware, and the District of Columbia, (PJM 2008a). Approximately 31 percent of the coal-fired generating capacity currently installed in PJM is from units that will be 50 years or older in 2015. This is equivalent to approximately 20,252 MW(e) of electric power (Dominion 2007). However, to be conservative, Dominion's estimate of the demand for Unit 3 generation does not count the additional power plants that would have to be constructed to replace retiring facilities. The impact of any potential base-load capacity retirements both in and out of the Dominion Zone is conservatively excluded from the need for base-load capacity analysis.

As shown in Table 8-1, the results of the need for base-load capacity analysis indicate that there is currently a need for additional base-load capacity within the Dominion Zone. Unit 3 is not anticipated to be in service until 2015, by which time the base-load capacity deficiency is

Table 8-1. Dominion's Estimated Need for Base-Load Capacity from NAPS Unit 3

Values Shown in MW(e), Unless Otherwise Noted	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2022	CAGR 2007–2022
Base-load demand														
Base-load demand – 65% percentile hour [1]	9763	9993	10,229	10,470	10,717	10,970	11,229	11,494	11,765	12,043	12,327	12,618	13,851	2.40%
DSM% reduction from 2006 consumption [2]	0.00%	0.00%	0.00%	1.00%	1.21%	1.47%	1.78%	2.15%	2.61%	3.16%	3.83%	4.64%	10.00%	
DSM base-load MW reduction	-	-	-	(95)	(116)	(140)	(170)	(205)	(249)	(302)	(365)	(443)	(954)	
Base-load demand – DSM adjusted base-load supply	9763	9993	10,229	10,375	10,602	10,830	11,059	11,289	11,516	11,741	11,961	12,175	12,897	
Base-load supply														
Base-load installed capacity - availability adjusted	8621	8621	8621	8621	8621	8621	8621	8621	8621	8621	8621	8621	8621	
Planned base-load additions - availability adjusted														
Coal	17	17	17	35	74	644	644	644	644	644	644	644	644	
Nuclear	--	--	--	195	265	325	325	325	325	325	325	325	325	
Subtotal-planned base-load additions	17	17	17	230	338	969	969	969	969	969	969	969	969	
Total base-load capacity supply	8638	8638	8638	8851	8960	9590	9590	9590	9590	9590	9590	9590	9590	
Base-load capacity surplus/(deficiency)	(1125)	(1355)	(1591)	(1524)	(1642)	(1241)	(1470)	(1699)	(1926)	(2151)	(2372)	(2585)	(3308)	

(a) Based on analysis of Dominion Zone 2006 historical actual hourly load data. Assumes base-load demand will increase at same compounded annual growth rate observed in Virginia Electric Power Company historical weather-normalized average sales for 2002 through 2006.
(b) DSM% Savings in Year (T) = 3E-170e^(0.1919*T).
Source: Dominion 2007

projected to be over 1900 MW(e), even after including capacity supplied by Dominion's Virginia City facility, other planned base-load capacity projects in the Dominion Zone, and conservatively assuming that DSM targets established by the Commonwealth of Virginia and existing PJM programs will reduce base-load demand. This additional need for base-load capacity is greater than the potential capacity that would be available from the proposed Unit 3 and could be even greater if DSM savings are less than the above conservative base-load estimates or if not all planned base-load projects are built. Thus, even conservatively assuming that DSM measures are adopted and that they actually reduce Dominion's base-load requirements (a highly unlikely event given that DSM programs most often reduce peak load), there is still a need for nearly 2000 MW(e) of base-load capacity by 2015 for Dominion to meet its service obligations to native-load customers. As a result of these projections, Dominion is seeking approvals for the Virginia City facility as well as Unit 3 to assure it can meet the reliability requirements of the Virginia-SCC and PJM.

NRC staff has reviewed the PJM 2008 forecast (PJM 2008e) and note that the forecasted average rate of peak demand growth in the Dominion Zone has declined from 1.9 percent shown in the 2007 forecast to 1.8 percent, a decline of about 5.3 percent in the growth rate. If this adjustment also is made to Dominion's base-load demand forecast, the growth rate in base-load demand would be 2.27 percent per year, and the demand for 1900 MW(e) would occur in 2016, which is one year later than shown in Table 8-1.

The NRC staff expects that an increase in the average cost of power (and therefore, the consumer price of power) in the Dominion Zone resulting from the addition of NAPS Unit 3 would be at most approximately 5 percent, given the potential for high overnight capital cost of $4000 per installed kW (see Section 10.6.2.1 of this SEIS). This increase is unlikely to reduce demand by more than 5 percent, which would delay by less than one year the need for Unit 3 in the Dominion Zone base-load generating mix.

8.4.3.3 Need for Reserve Margin

Dominion also provided an analysis of installed reserve margins for the Dominion Zone. It assumed that all proposed projects in the Dominion Zone included in the PJM Generation Interconnection Queue (totaling 6515 MW(e) in September 2007) would be built, with the exception of the proposed Unit 3. This is a conservative assumption because it does account for the probability that they might not all be built. A developer can withdraw from the interconnection queue process at any time (Dominion 2007). Similar to the need for base-load capacity analysis presented above, the impact of any potential retirements both in and out of the Dominion Zone is conservatively excluded from the calculation of installed reserve margins.

Table 8-2. Determination of Installed Reserve Margin

Values Shown in MW(e), Unless Otherwise Noted	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2022	CAGR 2007-2022
Summer peak demand [1]	19,167	19,583	19,956	20,347	20,746	21,110	21,519	21,923	22,334	22,769	23,222	23,619	25,320	1.9%
Installed summer capacity [2]	21,613	21,613	21,613	21,613	21,613	21,613	21,613	21,613	21,613	21,613	21,613	21,613	21,613	
Planned capacity additions [3]	148	738	1873	4023	4141	4839	4899	4919	4919	4919	4919	4919	4919	
Maximum import capability (CETL) [4]	3100	3100	3100	3100	3100	3100	3100	3100	3100	3100	3100	3100	3100	
Total capacity supply	24,861	25,451	26,586	28,736	28,854	29,552	29,612	29,632	29,632	29,632	29,632	29,632	29,632	
Calculated % reserve margin (with imports)	29.7%	30.0%	33.2%	41.2%	39.1%	40.0%	37.6%	35.2%	32.7%	30.1%	27.6%	25.5%	17.0%	
Calculated % reserve margin (without imports)	13.5%	14.1%	17.7%	26.0%	24.1%	25.3%	23.2%	21.0%	18.8%	16.5%	14.3%	12.3%	4.8%	

(a) PJM Load Forecast 2007b.
(b) PJM-Dominion Zone Installed Capacity as of 1/1/2007; Source: PJM 2007b EIA-411 Data.
(c) PJM Generation Interconnection Queue as of 9/13/2007.
(d) Order on Rehearing and Clarification and Accepting Compliance Filing, Federal Energy Regulatory Commission, Docket No ER05-1410-002 June 25, 2007.
Source: Dominion 2007

The reserve margin calculation (expressed as percentage) was defined in the Dominion analysis as follows:

> Reserve Margin = (Estimated Generated Capability + Import Capability – Estimated Peak-Load Responsibility) ÷ Estimated Peak-Load Responsibility

As shown in Table 8-2, the projected installed reserve margin (IRM), excluding import capacity, would fall to 14.3 percent by 2017, which is below the 15 percent IRM planning standard currently approved by PJM (PJM 2007a). Thus, without the additional base-load generating capacity from Unit 3 in 2015, the Dominion Zone would be relying heavily on imported power for reliability.

There is a current need for base-load capacity in the Dominion Zone, and base-load capacity requirements in the Dominion Zone are projected to increase by 2000 MW(e) by 2015 and by 4000 MW(e) by 2022. To meet its base-load requirements, Dominion has received approval for two base-load generating units: (1) NAPS Unit 3 and (2) a 585-MW(e) coal facility known as the Virginia City facility because it will be located in Virginia City, Virginia. The Virginia City facility will allow the supplemental use of opportunity fuels, such as biomass and waste coal, for up to a total of 20 percent of the plant's output (Dominion 2008). The Virginia City facility will be located in PJM's American Electric Power Zone, but is included in the need for power analysis in Section 8.4 for completeness because it is being developed by Dominion to provide base-load power to the Dominion Zone. Within the Dominion Zone itself, the proposed NAPS Unit 3 is the only major base-load facility with a generating capacity greater than 1000 MW(e) currently under study in the PJM Generation Interconnection Queue.

Dominion's need for power analysis assumes that Dominion's Virginia City facility and all proposed base-load capacity projects in the Dominion Zone currently included in the PJM Generation Interconnection Queue will be built, with the exception of the proposed NAPS Unit 3, which they exclude to see if there is need for the generating capacity provided by the proposed Unit 3. This is a conservative assumption because it does not take into account the probability that not all projects in the queue may be built. A developer can withdraw from the interconnection queue process at any time.

The impact of any potential base-load capacity retirements both in and out of the Dominion Zone is conservatively excluded from the need for base-load capacity analysis. NRC staff note that in Dominion's analysis, it was conservatively assumed that the DSM targets established in the Legislation and Virginia Energy Plan will be met in full, and it is further assumed that base-load demand will be reduced by those target levels. These conservative assumptions overstate the impact to base-load demand because typical DSM programs serve to reduce peak-load demand.

The analysis is based on an assumption that over the 13 consecutive years, from 2010 to 2022, the realized percent savings in base-load energy consumption will increase exponentially each year to meet the targeted 10-percent reduction in electric energy by 2022. These assumptions are made for both Dominion's Virginia and North Carolina service territories in the Dominion Zone (Dominion 2007)

As shown in Table 8-1, the results of the need for base-load capacity analysis indicate that there is currently a need for additional base-load capacity within the Dominion Zone. Unit 3 is not anticipated to be in-service until 2015, by which time the base-load capacity deficiency is projected to be over 1900 MW(e), even after including generating capacity supplied by Dominion's Virginia City facility, other planned base-load capacity projects in the Dominion Zone, and conservatively assuming that DSM targets established by the Commonwealth of Virginia and existing PJM programs will reduce base-load demand. This additional need for base-load generating capacity is greater than the potential capacity that would be available from the proposed Unit 3 and could be even greater if DSM savings are less than the above conservative base-load estimates or if not all planned base-load projects are built. Thus, even assuming that DSM measures are adopted and that they actually reduce Dominion's base-load requirements (a highly unlikely event given that DSM programs most often reduce peak load) there is still a need for nearly 2000 MW(e) of base-load capacity by 2015 for Dominion to meet its service obligations to native-load customers. As a result of these projections, Dominion is seeking approvals for the Virginia City facility and Unit 3 to assure it can meet the reliability requirements of the Virginia-SCC and PJM.

8.5 Conclusions

The NRC staff finds that Dominion has submitted a forecast and analysis of the need for power in the Dominion Zone of PJM, of which it is a member. Dominion then used this forecast and assessment as the basis for its own assessment of the need for base-load generating capacity to provide electricity in the Dominion Zone and for an assessment of the need for NAPS Unit 3, allowing for other potential source of base-load generation. The NRC staff reviewed the PJM need for power and determined it is (1) systematic, (2) comprehensive, and (3) subject to confirmation. While the NRC staff did not find that the need for power analysis was fully responsive to forecasting uncertainty, the staff conducted additional sensitivity analysis that indicated that neither likely increases in the cost of power nor uncertainties in the base-load forecast would significantly change Dominion's conclusion concerning the need for power. The NRC staff therefore accepts the need for power evaluation.

The NRC staff has considered the past, present, and planned power-producing capability and the predicted load demands from Dominion's assessment, the *Annual Energy Outlook* (DOE/EIA 2008), and the SERC. The NRC staff has concluded that Dominion's detailed prediction of its future load demand is a reasonable basis for planning for the period from 2007 to 2022 and that Dominion cannot expect to satisfy a significant portion of that demand load by aggressive conservation, deferral of the retirement of existing generating units, additional electric purchases from neighboring producers, or the addition of planned non-nuclear units, all of which are already included in Dominion's forecast.

Based on this analysis, the staff concludes that there is a justified need for power in the Dominion zone of the PJM region.

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9.0 Alternatives to the Proposed Action

The U.S. Nuclear Regulatory Commission (NRC) staff's review of alternative sites was conducted as part of the early site permit application environmental impact statement (ESP EIS) for the North Anna Power Station (NAPS) (NRC 2006). That review determined that none of the proposed alternative sites were environmentally preferable to the proposed NAPS site. No additional discussion of this topic is required in a supplement to an ESP EIS that is prepared for a COL application as described in 10 CFR 51.92(e)(3). Therefore, evaluation of alternative sites is not required for submittal of a combined license (COL) for the NAPS site that does not exceed two additional nuclear units. Discussions of alternatives to the proposed action are provided in Chapters 8 and 9 of the ESP EIS. The alternatives discussed are the no-action alternative (Section 8.1), system design alternatives (Section 8.3), and alternative sites (Sections 8.3 through 8.8).

Because Dominion Virginia Power and Old Dominion Electric Cooperative (ODEC), collectively known as Dominion, chose to defer providing information regarding energy alternatives in the ESP application, energy alternatives are evaluated as part of the COL environmental review and are reported in Section 9.2 of this supplemental environmental impact statement (SEIS). Section 9.3 provides information regarding alternatives to the system designs.

9.1 No-Action Alternative

For purposes of a COL application, the no-action alternative refers to a scenario in which the NRC would deny Dominion's application for a COL. Upon such a denial, the construction and operation of a new nuclear generating unit at the NAPS ESP site in accordance with Title 10 of the Code of Federal Regulations (CFR) Part 52 would not occur. There would be no environmental impacts at the NAPS site associated with not issuing the COL, except the impacts associated with activities not within the definition of construction at 10 CFR Subparts 50.10(a) and 51.4. At the same time, the benefits associated with the proposed action would not occur.

If the COL application is denied, the power would still be needed as discussed in Chapter 8 of this SEIS. Dominion would have a variety of options for meeting power needs including constructing a new nuclear power plant at another site, constructing a coal-fired or natural gas-fired plant at the NAPS site or at another site, and pursuing one or more of the other energy alternatives discussed in Sections 9.2.1 and 9.2.3 of this SEIS. There would be environmental impacts associated with each of these options that would occur at the site of implementation.

9.2 Energy Alternatives

Energy alternatives were not evaluated for the ESP site because the NRC determined that they need not be addressed in an ESP permit. Therefore, the issue was considered unresolved at the ESP stage, as noted in Appendix J of the ESP EIS (NRC 2006).

The objective of Dominion in seeking a COL for the proposed Unit 3 at the NAPS site is to secure a site for new base-load electric power generation. The generated power would be used by Dominion Virginia Power to maintain a reliable, stable supply of electricity within its power system control area. The Dominion Zone is currently co-terminous with the power system control area of Dominion Virginia Power and includes the electric distribution service territories of Dominion Virginia Power, ODEC, North Carolina Electric Cooperatives, and other municipal entities (Dominion 2007).

This section examines the potential environmental impacts associated with alternatives to construction of a new base-load nuclear generating facility. Section 9.2.1 discusses energy alternatives not requiring new generating capacity, and Section 9.2.2 discusses the alternatives requiring new generating capacity. Other alternatives are discussed in Section 9.2.3, and 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 at the NAPS site.

For analysis of energy alternatives, Dominion assumed a target value of 1500 MW(e) electrical output (Dominion 2007). The staff also used this level of output in analyzing energy alternatives.

9.2.1 Alternatives Not Requiring New Generating Capacity

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

- Purchase the needed electric power from other suppliers
- Reactivate retired power plants
- Extend the operating life of existing power plants
- Implement conservation or demand-side management (DSM) programs.

The option of purchasing electricity from neighboring utilities or resources outside of the Dominion Zone is limited by both transmission import capability as well as other demand centers competing for the same electricity (Dominion 2007). Virginia currently relies on over 3000 MW(e) of imports from neighboring regions, which is close to the transmission system's 3100 MW(e) maximum transfer limit into the Dominion Zone (Dominion 2007). Significant incremental electricity imports on a firm base-load basis would require major transmission system upgrades or reliance on an already strained transmission system (Dominion 2007). Even with the new Meadow Brook to Loudoun 500-kV transmission line sponsored by Dominion and other base-line transmission upgrades included in the PJM Interconnection regional transmission expansion planning process, PJM Interconnection believes that additional transmission system expansion and new generating sources will still be required to meet expected peak-load supply requirements in the Dominion Zone beyond 2011 (Dominion 2007). In addition, any upgrades to enable a power import comparable to the generation of proposed Unit 3 would need to cross multiple utility service territories and may prove to be cost prohibitive (Dominion 2007). Based on the issues discussed above, the staff concludes that purchasing 1500 MW(e) of base-load power from other suppliers is not a reasonable alternative to the proposed action.

If power to replace the capacity of Dominion's proposed Unit 3 were to be purchased from sources within the United States or from a foreign country, the generating technology likely would be one of those described in NUREG-1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS)* (e.g., coal, natural gas, or nuclear) (NRC 1996). The description of the environmental impacts of other electricity-generating technologies described in the GEIS is representative of the impacts associated with the construction and operation of a new generating unit at the NAPS site. Under the purchased-power alternative, the environmental impacts of power production would still occur but would be located elsewhere within the region or nation, or in another country. The environmental impacts of coal-fired and natural gas-fired generating plants are discussed in Section 9.2.2.

If the purchased-power alternative were to be implemented, a major environmental unknown would be whether new transmission lines would be required. The construction of new transmission lines could have both environmental and aesthetic consequences, particularly if new transmission line rights-of-way were needed. The staff concludes that the local environmental impacts from purchased power would be SMALL when existing transmission line rights-of-way are used and could range from SMALL to LARGE if new rights-of-way are required. The environmental impacts of power generation would depend on the generation technology and location of the generation site and, therefore, are unknown.

Nuclear power facilities are initially licensed by the NRC for a period of 40 years. The operating license can be renewed for up to 20 years, and NRC regulations provide for the possibility of additional license renewal. Dominion currently operates four nuclear power units in Virginia. Two are located at the NAPS site and two are located at the Surry site. NRC has renewed the operating licenses for each of the four units for an additional 20 years. The environmental impacts of continued operation of a nuclear power plant are significantly less than construction of a new plant. However, continued operation of an existing nuclear plant does not provide additional generating capacity.

Retired generating plants, predominately coal-fired and natural gas-fired plants that potentially could be reactivated, would ordinarily require extensive refurbishment. Such plants would typically be old enough to have economic difficulty meeting current environmental requirements. The staff concludes that reactivation of retired power plants would not be a reasonable alternative to the proposed action. The environmental impacts of any refurbishment scenario are bounded by the impacts associated with coal-fired and natural gas-fired alternatives (see Section 9.2.2 of this SEIS).

There currently are no planned generating-plant retirements scheduled in the Dominion Zone through 2021 (Dominion 2007). The staff concludes that extending the life of existing generating plants would not be a reasonable alternative to the proposed action.

Improved energy efficiency can cost less than construction of new generating capacity and provide a hedge against market, fuel, and environmental risks. Dominion has a conservation group to encourage a renewed customer interest in energy efficiency (Dominion 2007). Dominion offers several DSM options for both residential and commercial customers (Dominion 2007). The programs focus on customer education and also provide rate incentives for load reductions during peak demand periods (Dominion 2007). Dominion is also a partner in the U.S. Environmental Protection Agency (EPA)/U.S. Department of Energy (DOE) ENERGY STAR program to promote the purchase and use of energy-efficient products and appliances and energy-efficient building practices for new homes (Dominion 2007).

ODEC currently owns approximately 11.6 percent of Units 1 and 2 at NAPS and would also be a partial owner of the proposed Unit 3. ODEC is a wholesale power supplier to 12 locally owned and controlled electric distribution cooperatives in Virginia, Maryland, and Delaware. It does not offer energy-efficiency or DSM programs, but its member cooperatives do offer such programs. The following electric cooperatives are members of ODEC: A&N, BARC, Choptank, Community, Delaware, Mecklenburg, Northern Neck, Northern Virginia, Prince George, Rappahannock, Shenandoah Valley, and Southside (ODEC 2008).

The need for power discussion in Chapter 8 of this SEIS accounts for conservation and DSM programs (see Section 8.4.1). The staff concluded in Section 8.5 that there is a justified need for power in the region of interest, even with implementation of conservation and DSM programs.

The staff believes it would be unreasonable for an applicant to request a COL if (1) the power could be purchased from other electricity suppliers at a reasonable cost, (2) the power could be obtained by reactivating one or more retired generating plants or by extending the life of one or more existing generating plants, or (3) conservation or DSM programs could make the additional power from the proposed new nuclear unit unnecessary.

Based on the preceding discussion, the staff 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 DSM programs are not reasonable alternatives to the proposed action which would provide new base-load power generation capacity.

9.2.2 Alternatives Requiring New Generating Capacity

In keeping 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 generating unit at the NAPS site should be limited to analysis of discrete power-generation sources and those power-generation technologies that are technically reasonable and commercially viable (NRC 1996). The current mix of base-load power generation options in Virginia is one indicator of the feasible choices for power generation technology within the Commonwealth.

This section discusses the environmental impacts of energy alternatives to the proposed action that would require Dominion to construct new generating capacity. The discussion in Section 9.2.2 is limited to the individual alternatives to base-load nuclear power generation that appear to the staff to be viable: coal-fired and natural gas-fired generation. The impacts discussed in this section are estimates based on present technology.

The staff assumed that (1) new generation capacity would be located at the NAPS site for the coal-fired and natural gas-fired alternatives; (2) the cooling system proposed by Dominion for the proposed Unit 3 (closed-cycle with a combination of wet and dry towers) would be used for plant cooling; and (3) the existing transmission line rights-of-way serving NAPS would be adequate to serve a new coal-fired or natural gas-fired generating plant, but a new transmission line within an existing right-of-way would be needed as discussed in Section 2.2.2 of this SEIS.

Each year, the Energy Information Administration (EIA), a component of DOE, issues an annual energy outlook. In its *Annual Energy Outlook 2008* (DOE/EIA 2008), the EIA reference case projects that coal-fired capacity would account for approximately 40 percent of total electricity-generating capacity additions between 2007 and 2030. Coal-fired plants generally are used to meet base-load requirements. The EIA projects that between 2007 and 2030, natural gas-fired plants would account for approximately 36 percent of new capacity additions. It projects that renewable energy sources would account for approximately 6 percent of new capacity additions during the period and that new nuclear plants would account for approximately 18 percent (DOE/EIA 2008). The EIA projections are based on the assumption that providers of new generating capacity would seek to minimize cost while meeting applicable environmental requirements.

9.2.2.1 Coal-Fired Generation

For the coal-fired generation alternative, the staff assumed construction of three supercritical pulverized coal-fired units, each with a net capacity of 507 MW(e). These assumptions are consistent with Dominion's COL application. Supercritical pulverized coal-fired plants are similar to conventional pulverized coal-fired plants except they operate at slightly higher temperatures and higher pressures, which allows for greater thermal efficiency. Supercritical coal-fired plants are commercially proven and represent an increasing proportion of new coal-fired power plants. The coal-fired plant is assumed to have an operating life of 60 years (Dominion 2008a).

The staff 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. In spite of the these advantages, the staff concludes that, at present, a new IGCC plant is not a reasonable alternative to a 1500-MW(e) nuclear power-generation facility for the following reasons: (1) IGCC plants are more expensive than comparable pulverized coal plants (NETL 2007), (2) existing IGCC plants have considerably smaller capacity that the proposed 1500-MW(e) nuclear plant, (3) system reliability of existing IGCC plants has been lower than that of pulverized-coal plants, (4) the existing IGCC plants have had an extended (though ultimately successful) shakedown period (NPCC 2005), and (5) a lack of overall plant performance warranties for IGCC plants has hindered commercial financing (NPCC 2005). For these reasons, IGCC plants are not considered further in this SEIS.

It is assumed that eastern bituminous coal and lime (calcium oxide or calcium hydroxide) or limestone (calcium carbonate) for a supercritical pulverized coal-fired plant would be delivered to the plant by train. Dominion estimates that the plant would consume approximately 3 to 3.8 million MT (3.3 to 4.2 million tons) per year of pulverized coal (Dominion 2008a). Lime or limestone, used in the scrubbing process for control of sulfur dioxide (SO_2) emissions, is 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. Dominion estimates that approximately 71,000 to 508,000 MT (78,000 to 560,000 tons) per year of limestone would be used for flue gas desulfurization (Dominion 2008a).

Air Quality

The impacts on air quality from coal-fired generation would vary considerably from those of nuclear generation because of emissions of SO_2, nitrogen oxides (NO_x), carbon monoxide (CO), particulate matter (PM), and hazardous air pollutants such as mercury (Hg). In its COL application, Dominion assumed a coal-fired plant design that would minimize air emissions through a combination of boiler technology and post-combustion pollutant removal. Dominion estimates that the coal-fired alternative emissions for SO_2, NO_x, CO, PM, Hg, and volatile organic compounds (VOC) would be approximately as follows (Dominion 2007, 2008a):

SO_2 – 3777 MT (4163 tons)/yr
NO_x – 1888 MT (2081 tons)/yr
CO – 4248 MT (4683 tons)/yr
PM_{10} – 853 to 1932 MT (940 to 2130 tons)/yr
$PM_{2.5}$ – 490 to 1125 MT (540 to 1240 tons)/yr
Hg – 0.34 to 0.85 MT (0.37 to 0.94 tons)/yr
VOC – 165 MT (182 tons)/yr.

PM_{10} is particulate matter with a diameter equal to or less than 10 microns (40 CFR 50.6), and $PM_{2.5}$ is particulate matter with a diameter equal to or less than 2.5 microns (40 CFR 50.7).

A new coal-fired plant at the NAPS site would also have unregulated carbon dioxide (CO_2) emissions of approximately 12.2 million MT (13.5 million tons) per year that could contribute to global warming (Dominion 2007).

The acid rain requirements of the Clean Air Act capped the nation's SO_2 emissions from power plants. Dominion would need to obtain sufficient pollution credits either from a set-aside pool or purchases on the open market to cover annual emissions from the plant. The market-based allowance system used for SO_2 emissions is not used for NO_x emissions.

A new coal-fired generation plant at the NAPS site would likely need a prevention of significant deterioration permit and an operating permit from the Virginia Department of Environmental Quality (VDEQ). The plant would need to comply with the new source performance standards (NSPS) for such plants in 40 CFR 60, Subpart Da. 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).

The EPA has various regulatory requirements for visibility protection in 40 CFR 51, Subpart P, including a specific requirement for review of any new major stationary source in an area designated as in-attainment or unclassified for criteria pollutants under the Clean Air Act (40 CFR 51.307(a)). 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. The NAPS site is in an area designated as in-attainment or unclassified for all criteria pollutants (40 CFR 81.347).

Section 169A of the Clean Air Act (42 USC 7401) establishes 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 ensure no degradation in visibility for the least visibility-impaired days over the same period (40 CFR 51.308(d)(1)). 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. The only mandatory Class I Federal area within 80 km (50 mi) of the NAPS is Shenandoah National Park, which is within approximately 68 km (42 mi) of NAPS (NRC 2006).

The fugitive dust emissions from construction activities would be mitigated using best management practices; such emissions would be temporary.

The GEIS (NRC 1996) did not quantify emissions from coal-fired power plants, but suggested that air impacts would be substantial. It also mentioned global warming from unregulated CO_2 emissions and acid rain from SO_2 and NO_X emissions as potential impacts (NRC 1996). Adverse human health effects, such as cancer and emphysema, have been associated with the byproducts of coal combustion. Overall, the staff concludes that air quality impacts from new coal-fired generation at the NAPS would be MODERATE. The impacts would be clearly noticeable, but would not destabilize air quality.

Waste Management

The GEIS (NRC 1996) and the NRC's experience from operating license renewal analyses indicate that coal combustion generates waste in the form of ash, and equipment for controlling air pollution generates additional ash, spent selective catalytic reduction (SCR) catalyst, and scrubber sludge. Dominion estimates that a coal-fired plant would generate approximately 100,000 to 428,000 MT (110,000 to 472,000 tons) per year of ash (Dominion 2008a). Dominion would expect to recycle approximately 25 percent of the ash for such uses as construction fill material, mine reclamation, and raw material in manufacturing of cement products (Dominion 2008a). The coal plant would also generate approximately 112,000 to 805,000 MT (123,000 to 887,000 tons) per year of scrubber sludge with potential uses as synthetic gypsum in wall board and cement manufacturing (Dominion 2008a). Dominion estimates that landfill disposal of the ash and scrubber sludge over a 60-year plant life would require approximately 36 to 211 ha (90 to 521 ac) (Dominion 2008a).

In May 2000, EPA issued a “Notice of Regulatory Determination on Wastes from the Combustion of Fossil Fuels” (65 FR 32214). EPA concluded that some form of national regulation was warranted to address coal combustion waste products because of health concerns. Accordingly, EPA announced its intention to issue regulations for disposal of coal-combustion waste under Subtitle D of the Resource Conservation and Recovery Act of 1976.

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 and groundwater quality, but with appropriate management and monitoring, it would not destabilize any resources. After closure of the waste site and re-vegetation, the land could be available for other uses. Construction-related debris would be generated during plant construction activities.

For the reasons stated above, the staff 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

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).

Regulatory agencies, including the EPA and State 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 staff concludes that the human health impacts from radiological doses and inhaled toxins and particulates generated from coal-fired generation would be SMALL.

Other Impacts

Approximately 121 ha (300 ac) would need to be converted to industrial use for the plant power block, and coal-storage area (Dominion 2007). Offsite land-use changes also would occur in an undetermined coal mining area to supply coal for the plant and for landfill disposal of ash and scrubber sludge. In the GEIS, the staff estimated that approximately 8900 ha (22,000 ac) would be needed for coal mining and waste disposal to supply a 1000 MW(e) coal-fired power plant over its operating life (NRC 1996). Overall, the staff concludes that land-use impacts would be MODERATE.

The impacts on water use and quality from constructing and operating a coal-fired plant at the NAPS would be comparable to the impacts associated with a new nuclear plant as discussed in Sections 4.3 and 5.3 of the ESP EIS (NRC 2006). All discharges would be regulated by the VDEQ through a Virginia Pollutant Discharge Elimination System permit. Indirectly, water quality could be affected by acids and mercury from air emissions. In the GEIS, the staff determined that some erosion and sedimentation would likely occur during construction of new facilities (NRC 1996). Overall, the staff concludes that the water-use and water-quality impacts would be SMALL to MODERATE.

The coal-fired generation alternative would introduce ecological impacts from construction and new incremental impacts from operations. The impacts could include wildlife habitat loss and fragmentation, reduced productivity, and a local reduction in biological diversity. The impacts could occur at the NAPS site and at the sites used for coal and limestone mining. Disposal of waste products could affect water quality and the aquatic environment. The impacts on threatened and endangered species would be similar to the impacts from a new nuclear facility located at the NAPS site. Overall, the staff concludes that the ecological impacts would be MODERATE.

Socioeconomic impacts would result from the approximately 2000 workers needed to construct the plant and 200 workers to operate it, demands on housing and public services during construction, and the loss of jobs after construction (Dominion 2007). Overall, the staff concludes that these impacts would be SMALL to MODERATE. Dominion would pay significant property taxes for the plant to local taxing districts. The staff concludes that the taxes would have a LARGE beneficial impact to the tax recipients.

The three coal-fired, powerblock units would be as much as 60 m (200 ft) tall and would be visible offsite during daylight hours. The three exhaust stacks would be as much as 183 m (600 ft) high. The stacks and associated emissions would likely be visible in daylight hours for distances greater than 16 km (10 mi). The powerblock units and associated stacks would also be visible at night because of outside lighting. The Federal Aviation Administration (FAA) generally requires that all structures exceeding an overall height of 60 m (200 ft) above ground level have markings and/or lighting so as not to impair aviation safety (FAA 2007). A mitigating factor is that the NAPS currently is an industrial site located in a semi-rural area. The visual impacts of a new coal-fired plant could be further mitigated by landscaping and color selection for buildings that is consistent with the environment. Visual impacts at night could be mitigated by reduced use of lighting, provided the lighting meets FAA requirements, and appropriate use of shielding. Overall, the staff concludes that the aesthetic impacts associated with new coal-fired power generation at the NAPS site would be MODERATE.

Coal-fired power generation would introduce mechanical sources of noise that would likely be audible offsite. Sources contributing to 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. Noise impacts associated with rail delivery of coal and lime/limestone would be most significant for residents living in the vicinity of the facility and along the rail route. Although noise from passing trains significantly increases noise levels near the rail corridor, the short duration of the noise reduces the impacts. Nevertheless, given the frequency of train transport and the fact that many people are likely to be within hearing distance of the rail line, the staff concludes that the impacts of noise on residents in the vicinity of the facility and of the rail line would be MODERATE. Noise and light from the plant would be detectable offsite.

Historic and cultural resource impacts for a new coal-fired plant located at the NAPS would be similar to the impacts for a new nuclear plant as discussed in Sections 4.1.3 and 5.1.3 of the ESP EIS (NRC 2006). A cultural resources inventory would likely be needed for any onsite property that has not been previously surveyed. Other lands, if any, acquired to support the plant would also likely need an inventory of field cultural resources, identification and recording of existing historic and cultural resources, and possible mitigation of the adverse effect from ground-disturbing actions. The studies would likely be needed for all areas of potential disturbance at the plant site; any offsite affected areas, such as mining and waste-disposal sites; and along associated corridors where new construction would occur, such as roads. The staff concludes that the historic and cultural resource impacts would likely be SMALL.

As discussed in Section 2.10 of the ESP EIS (NRC 2006), there are minority and low-income persons in the population near the NAPS site. Environmental impacts on minority and low-income populations associated with a new coal-fired plant located at the NAPS site and at the sites used for coal and limestone mining could be SMALL to MODERATE, depending on the distribution and intensity of adverse air quality impacts on the local population.

Other construction and operation impacts are likely to be SMALL. In most cases, the impacts would be detectable, but they would not destabilize any important attribute of the resource involved. Because of the minor nature of these impacts, mitigation beyond that discussed would not be warranted.

The construction and operation impacts of coal-fired power generation at the NAPS site are summarized in Table 9-1.

9.2.2.2 Natural Gas-Fired Generation

For the natural gas-fired alternative, the staff assumed construction and operation of a natural gas-fired plant located at the NAPS site. The staff assumed that the plant would use combined-cycle combustion turbines, which is consistent with Dominion's COL ER. The staff used the assumption in the COL ER of three units with a net capacity of 500 MW(e) per unit (Dominion 2007).

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

Impact Category	Impact	Comment
Land use	MODERATE	Uses approximately 121 ha (300 ac) for the powerblock and coal storage area. Offsite impacts for coal mining and waste disposal.
Air quality	MODERATE	SO_2 – 3777 MT (4163 tons)/yr NO_x – 1888 MT (2081 tons)/yr CO – 4248 MT (4683 tons)/yr PM_{10} – 853 to 1932 MT (940 to 2130 tons)/yr $PM_{2.5}$ – 490 to 1125 MT (540 to 1240 tons)/yr VOC – 165 MT (182 tons)/yr Hg – 0.34 to 0.85 MT (0.37 to 0.94 tons)/yr
Water use and quality	SMALL to MODERATE	Impacts would be comparable to the impacts for new nuclear generating units located at the NAPS.
Ecology	MODERATE	Impacts could include wildlife habitat loss and fragmentation, reduced productivity, and a local reduction in biological diversity. Impacts could occur at the NAPS site and at the sites used for coal and limestone mining. Disposal of fly ash could affect water quality and the aquatic environment. The impacts on threatened and endangered species would be similar to the impacts from new nuclear generating units at the NAPS site.
Waste management	MODERATE	Total waste volume would be approximately 100,000 to 428,000 MT (110,000 to 472,000 tons) per yr of ash and an additional 112,000 to 805,000 MT (123,000 to 887,000 tons) per yr of scrubber sludge.
Socioeconomics	LARGE Beneficial to MODERATE Adverse	Construction-related impacts would be noticeable. Local property tax base would benefit mainly during operations. Depending on where the workforce lives, the construction-related impacts would be noticeable or minor. Impacts during operation likely would be smaller than during construction. The plant would have aesthetic impacts. Some offsite noise impacts would occur.
Human health	SMALL	Regulatory controls and oversight are assumed to be protective of human health.
Historic and cultural resources	SMALL	Any potential impacts could likely be effectively managed. Most of the facility and infrastructure would be built on previously disturbed ground.
Environmental justice	SMALL to MODERATE	There are minority and low-income persons in the local population. Impacts to such persons would depend on the distribution and intensity of adverse air-quality impacts.

Air Quality

Natural gas is a relatively clean-burning fuel. When compared with a coal-fired plant, a natural gas-fired plant would release similar types of emissions but in lower quantities.

A new natural gas-fired power generation plant would likely need a prevention of significant deterioration permit and an operating permit from VDEQ. A new natural gas-fired combined-cycle plant would also be subject to the new source performance standards in 40 CFR 60, Subparts Da and GG. These regulations establish emission limits for particulates, opacity, SO_2, and NO_X.

The EPA has various regulatory requirements for visibility protection in 40 CFR 51, Subpart P, including a specific requirement for review of any new major stationary source in areas designated as in-attainment or unclassified under the Clean Air Act. The NAPS site is in an area designated as in-attainment or unclassified for criteria pollutants (40 CFR 81.347).

Section 169A of the Clean Air Act (42 USC 7401) 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 ensure no degradation in visibility for the least-impaired days over the same period (40 CFR 51.308(d)(1)). 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. The only mandatory Class I Federal area within 80 km (50 mi) of the NAPS is Shenandoah National Park which is within approximately 68 km (42 mi) of NAPS (NRC 2006).

Dominion estimates that a natural gas-fired plant equipped with pollution control technology to meet emission limits would have approximately the following emissions (Dominion 2007):

SO_x – 128 MT (141 tons)/yr
NO_x – 376 MT (414 tons)/yr
CO – 225 MT (248 tons)/yr
PM_{10} – 413 MT (455 tons)/yr
VOC – 79 MT (87 tons)/yr.

A natural gas-fired power plant would also have an estimated 6.1 million MT/yr (6.7 million tons/yr) of unregulated carbon dioxide emissions that could contribute to global warming (Dominion 2007).

The combustion turbine portion of the combined-cycle plant would be subject to EPA's National Emission Standards for Hazardous Air Pollutants for Stationary Combustion Turbines (40 CFR 63, Subpart YYYY) if the site is a major source of hazardous air pollutants. Major sources have the potential to emit 9 MT/yr (10 tons/yr) or more of any single hazardous air pollutant or 22.7 MT/yr (25 tons/yr) or more of any combination of hazardous air pollutants (40 CFR 63.6085(b)).

The fugitive dust emissions from construction activities would be mitigated using best management practices; such emissions would be temporary.

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 staff concludes that air quality impacts resulting from construction and operation of new natural gas-fired power generation at the NAPS site would be SMALL to MODERATE.

Waste Management

In the GEIS, the staff concluded that waste generation from natural gas-fired technology would be minimal (NRC 1996). The only significant waste generated at a natural gas-fired power plant would be spent SCR catalyst, which is used to control NO_x emissions. The spent catalyst would be regenerated or disposed of offsite. Other than spent SCR catalyst, waste generation at an operating natural gas-fired plant would be mostly limited to typical operations and maintenance waste. Construction-related debris would be generated during construction activities. Overall, the staff concludes that waste impacts from natural gas-fired power generation would be SMALL.

Human Health

In the GEIS, the staff identified cancer and emphysema as a potential health risk from natural gas-fired plants (NRC 1996). The risk may be attributable to NO_x emissions that contribute to ozone formation, which in turn contribute to health risk. Air emissions from a natural gas-fired power generation plant located at the NAPS site would be regulated by the VDEQ. The human health effect is expected to be either undetectable or sufficiently minor. Overall, the staff concludes that the impacts to human health from natural gas-fired power generation would be SMALL.

Other Impacts

A natural gas-fired generating plant would require approximately 45 ha (110 ac) for the power-block and support facilities (Dominion 2007). Construction of a natural gas pipeline from the NAPS to the closest natural gas distribution line would require additional acreage as would land required for natural gas wells and collection stations. The nearest natural gas supply line is approximately 21 km (13 mi) east of the NAPS site (Dominion 2008a). In the GEIS, the staff estimated that approximately 1460 ha (3600 ac) would be needed for wells, collection stations, and pipelines to support a 1000-MW(e) plant (NRC 1996). Overall, the staff concludes that the land use impacts from new natural gas-fired power generation at the NAPS would be SMALL to MODERATE.

The impacts on water use and quality from constructing and operating a natural gas-fired plant at the NAPS site would be comparable to the impacts associated with constructing and operating a new nuclear facility. The impacts on water quality from sedimentation during construction of a natural gas-fired plant were characterized in the GEIS as SMALL (NRC 1996).

The NRC also noted in the GEIS that the impacts on water quality from operations would be similar to, or less than, the impacts from other generating technologies (NRC 1996). Overall, the staff concludes that impacts on water use and quality would be SMALL to MODERATE.

Siting of the natural gas-fired plant would have ecological impacts that would be comparable to a new nuclear facility. Much of the impact would occur in areas that were previously disturbed during the construction of NAPS Units 1 and 2. Constructing a new underground gas pipeline to the site would cause temporary ecological impacts. Ecological impacts on the plant site and utility easements would not affect threatened and endangered species, although some wildlife habitat loss and fragmentation, reduced productivity, and a local reduction in biological diversity would be likely. Overall, the staff concludes that ecological impacts would be SMALL.

Socioeconomic impacts would result from the workers needed to construct the plant and the approximately 50 workers needed to operate it, demands on housing and public services during construction, and the loss of jobs after construction (Dominion 2007). Overall, the staff concludes that these impacts would be SMALL because of the mitigating influence of the site's proximity to the surrounding population area and the relatively small number of workers needed to construct and operate the plant in comparison to the nuclear and coal-fired generation alternatives. Dominion would pay property taxes for the plant to local taxing districts. Considering the population and economic condition of the county, the staff concludes that the taxes would have a MODERATE beneficial impact on the county.

The turbine buildings, three exhaust stacks (approximately 60 m [200 ft] tall) and associated emissions, and the gas pipeline compressors would be visible during daylight hours from offsite. Noise and light from the plant would be detectable offsite. A mitigating factor is that the NAPS site is currently an industrial site located in a rural, forested area. Overall, the staff concludes that the aesthetic impacts associated with new natural gas-fired power generation at the NAPS site would be SMALL to MODERATE.

Historic and cultural resource impacts for a new natural gas-fired plant located at the North Anna site would be similar to the impacts for a new nuclear plant, as discussed in Sections 4.1.3 and 5.1.3 of the ESP EIS (NRC 2006). A cultural resources inventory likely would be needed for any onsite property that has not been previously surveyed. Other land, if any, that is acquired to support the plant would also likely need an inventory of field cultural resources, identification, and recording of existing historic and cultural resources, and possible mitigation of the adverse effect from ground-disturbing actions. The studies would likely be needed for all areas of potential disturbance at the plant site, any offsite affected areas, such as mining and waste disposal sites, and along associated corridors where new construction would occur, such as roads. The staff concludes that the historic and cultural resource impacts would be SMALL.

As described in Section 2.10 of the ESP EIS (NRC 2006), there are minority and low-income persons in the population around the NAPS. The impacts of a natural gas-fired plant at the

NAPS site on minority or low-income populations would depend on the distribution and magnitude of adverse air quality impacts, but would likely be SMALL.

Other construction and operation impacts would be SMALL. In most cases, the impacts would be detectable, but they would not alter noticeably any important attribute of the resource involved. Because of the minor nature of these impacts, mitigation beyond that discussed would not be warranted. The construction and operational impacts of natural gas-fired power generation at the NAPS site are summarized in Table 9-2.

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

Impact Category	Impact	Comment
Land use	SMALL to MODERATE	Approximately 1500 ha (3700 ac) would be needed for the power-block and support systems, connection to a natural gas pipeline, natural gas wells, and collection stations.
Air quality	SMALL to MODERATE	SO_x – 128 MT (141 tons)/yr NO_x – 376 MT (414 tons)/yr CO – 225 MT (248 tons)/yr PM_{10} – 413 MT (455 tons)/yr VOC – 79 MT (87 tons)/yr
Water use and quality	SMALL to MODERATE	Impacts would be comparable to the impacts for new nuclear generating units located at the NAPS site.
Ecology	SMALL to MODERATE	Many of the impacts would occur in areas that were previously disturbed during the construction of NAPS Units 1 and 2. Thus, potential habitat loss and fragmentation and reduced productivity and biological diversity would be small.
Waste management	SMALL	The only significant waste would be from spent SCR catalyst used for control of NO_x emissions.
Socioeconomics	MODERATE Beneficial to MODERATE Adverse	Construction and operations workforces would be relatively small. Addition to property tax base, while smaller than for a nuclear or coal-fired plant, might still be quite noticeable. Construction-related impacts would be noticeable. Impacts during operation would be minor because of the small workforce involved. The plant would have aesthetic impacts.
Human health	SMALL	Regulatory controls and oversight are assumed to be protective of human health.
Historic and cultural resources	SMALL	Any potential impacts could likely be effectively managed. Most of the facility and infrastructure would be built on previously disturbed ground.
Environmental justice	SMALL	There are minority and low-income persons in the local population. Impacts to such persons would depend on the distribution and intensity of adverse air-quality impacts.

9.2.3 Other Alternatives

This section discusses energy alternatives that Dominion determined are not reasonable, the NRC staff's conclusions about the overall environmental impacts of each alternative, and the staff's basis for the conclusions. A new nuclear unit at the NAPS site would be a base-load generation plant, so any feasible alternative to the new unit would need to generate base-load power. In performing its initial evaluation in its COL ER, Dominion relied on the GEIS for license renewal (NRC 1996; Dominion 2007). The staff reviewed the information submitted by Dominion and also conducted an independent review, and found that Dominion's conclusion that these generation options would not be reasonable alternatives to a new nuclear unit was acceptable.

The staff 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 NAPS site. Any attempt to assign significance levels would require the staff to speculate about an unknown site.

9.2.3.1 Oil-Fired Generation

EIA's reference case in its *Annual Energy Outlook 2008* projects that oil-fired power plants will not account for any new electric power generation capacity in the United States through the year 2030 (DOE/EIA 2008). Oil-fired generation is more expensive than 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 the GEIS, the staff estimated that construction of a 1000-MW(e) oil-fired plant would require about 49 ha (120 ac) of land (NRC 1996). 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).

For the preceding economic reasons, the staff concludes that an oil-fired power plant at or in the vicinity of the NAPS site would not be a reasonable alternative to construction of a 1500-MW(e) nuclear power facility that would be operated as a base-load plant.

9.2.3.2 Wind Power

Virginia has significant land-based and offshore wind energy resources (VDMME 2007). Estimates of the wind resource are expressed in wind power classes ranging from Class 1 to Class 7, with each class representing a range of mean wind power density or equivalent mean speed at specified heights above the ground. Areas designated Class 4 or greater are suitable with advanced wind turbine technology under development today (DOE 2005). In Virginia, the potential installed capacity of land-based wind power in Class 4 and higher resource areas within 32 km (20 mi) of existing transmission lines is approximately 600 MW (VDMME 2007). In

April 2008, Dominion and BP Alternative Energy North America Inc. announced that they had entered into an agreement to jointly develop, own, and operate wind energy projects in Virginia (Dominion 2008b).

Newer wind turbines typically operate at approximately a 36 percent capacity factor (DOE 2008a). In comparison, the average capacity factor for a nuclear generation plant in 2006 in the United States was nearly 90 percent (NEI 2007). Wind turbines generally can serve as an intermittent base-load power supply (NPCC 2005). Wind power, in conjunction with energy storage mechanisms such as pumped-hydroelectric or compressed-air storage, or another readily dispatchable power source like hydropower, might serve as a means of providing base-load power. However, the staff concludes in Section 9.2.3.4 that the potential for new hydroelectric development in Virginia is limited. In addition, there is a limited near-term likelihood of an energy-storage facility for a 1500-MW(e) intermittent power plant. The EIA is not projecting any growth in pumped storage capacity (DOE/EIA 2008). The only compressed-air storage facility in the United States is a 110-MW(e) facility located in McIntosh, Alabama (ESP 2008).

Southern Company and the Georgia Institute of Technology (GIT) studied the viability of offshore wind turbines in the southeastern region of the United States (Southern and GIT 2007). Among the conclusions of the study authors were the following:

- The available wind data indicates that a wind farm located offshore of Georgia would likely have an adequate wind speed to support a project, although offshore project costs run approximately 50 to 100 percent higher than land-based systems.
- Based on today's prices for wind turbines, the 20-year levelized cost of electricity produced from an offshore wind farm would be above the current production costs from existing power generation facilities.
- The current commercially available offshore wind turbines are not built to withstand major hurricanes above a Category 3 or a 1-minute sustained wind speed of 200 km/h (124 mph).
- The U.S. Department of Interior Minerals Management Service (MMS) has jurisdiction, as authorized in the Energy Policy Act of 2005, over alternative energy-related projects on the outer continental shelf, including wind power developments.

MMS has been authorized to complete a rulemaking process outlining the permitting requirements for such projects. Until these regulations are finalized, only limited activities toward the development of an offshore wind farm in Federal waters can be conducted. The staff believes that the preceding conclusions would generally apply to a wind farm located offshore of Virginia.

For the preceding reasons, the NRC staff concludes that a wind energy facility at or in the vicinity of the NAPS site would not currently be a reasonable alternative to construction of a 1500-MW(e) nuclear power generation facility that would be operated as a base-load plant.

9.2.3.3 Solar Power

Solar technologies use energy and light from the sun to provide heating and cooling, light, hot water, and electricity for consumers. Solar energy can be converted to electricity using solar thermal technologies or photovoltaics. Solar thermal technologies employ concentrating devices to create temperatures suitable for power production. Concentrating thermal technologies are currently less costly than photovoltaics for bulk power production. They also can be provided with energy-storage capacity or auxiliary boilers to allow operation during periods when the sun is not shining (NPCC 2006).

The largest operational solar thermal plant is the 64-MW(e) Nevada Solar One plant located near Las Vegas, Nevada (DOE/EIA 2007).

Solar radiation has a low energy density relative to other common energy sources. Consequently, a large amount of land area is needed to gather an appreciable amount of energy. Typical solar-to-electric power plants require 2 to 4 ha (5 to 10 ac) for every MW of generating capacity (TSECO 2008). Thus, approximately 3000 to 6000 ha (7500 to 15,000 ac) would be needed for a hypothetical 1500-MW(e) solar power plant. For a large solar plant to be practical, a means to store large quantities of energy for distribution when the plant is producing less that 1500 MW(e) would be needed. However, the storage possibilities are limited as discussed in Section 9.2.3.2.

Solar energy in Virginia has the potential to support local electrical distribution systems during periods of peak demand, especially in summer months (VDMME 2007).

The staff concludes that solar energy facilities at or in the vicinity of the NAPS site currently would not be a reasonable alternative to construction of a 1500-MW(e) nuclear powered electricity generating facility that would be operated as a base-load plant.

9.2.3.4 Hydropower

A 1997 study prepared for DOE identified approximately 617 MW of undeveloped hydropower resource in Virginia (INEEL 1997). Significant legal and regulatory impediments, such as land acquisition and environmental protection, would be part of any major hydropower project. Additionally, reservoirs are typically built and managed primarily as municipal water supply and flood control systems and secondarily for power production.

EIA's reference case in its *Annual Energy Outlook 2008* projects that U.S. electricity production from hydropower plants will remain essentially stable through the year 2030 (DOE/EIA 2008).

In the GEIS, the staff estimated that land requirements for hydro power are approximately 0.4 million ha (1 million ac) per 1000 MW(e) (NRC 1996).

Because of the relatively low amount of undeveloped hydropower resource in Virginia and the large land-use and related environmental and ecological resource impacts associated with siting hydroelectric facilities large enough to produce 1500 MW(e), the staff concludes that local hydropower is not a feasible alternative to construction of a new nuclear power-generation facility operated as a base-load plant at the NAPS site.

9.2.3.5 Geothermal Energy

Hydrothermal resources, such as reservoirs of steam or hot water, are available primarily in the western states, Alaska, and Hawaii. However, geothermal energy can be tapped almost anywhere with geothermal heat pumps and direct-use applications. Other geothermal resources (e.g., hot dry rock and magma) are awaiting further technology development (DOE 2006).

Geothermal energy has an average capacity factor of 90 percent and can be used for base-load power where available. However, geothermal technology is not widely used as base-load power generation because of the limited geographical availability of the resource and immature status of the technology (NRC 1996). Geothermal systems have a relatively small footprint and minimal emissions (MIT 2006). A recent study led by the Massachusetts Institute of Technology concluded that a $300 to $400 million investment over 15 years would be needed to make early-generation enhanced geothermal system power plant installations competitive in the evolving U.S. electricity supply markets (MIT 2006).

Virginia has no high-temperature geothermal reservoirs, but it does have two low-temperature reservoirs that can be tapped for direct heat or for geothermal heat pumps (VDMME 2007).

For the reasons discussed in this section, the NRC staff concludes that a geothermal energy facility in Virginia currently would not be a reasonable alternative to construction of a 1500-MW(e) nuclear power-generation facility operated as a base-load plant at the NAPS site.

9.2.3.6 Wood Waste

In the GEIS, the staff determined that a wood-burning facility can provide base-load power and operate with an average annual capacity factor of around 70 to 80 percent and with 20 to 25 percent efficiency (NRC 1996). 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. The larger wood-waste power plants only produce 40 to 50 MW(e) of power. Estimates in the GEIS 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, although facilities using wood waste for fuel would be built at smaller scales (NRC 1996). Similar to coal-fired plants, wood-waste plants require large areas for fuel storage and processing, and involve the same type of combustion equipment.

Because of uncertainties associated with obtaining sufficient wood and wood waste to fuel a base-load power plant, the ecological impacts of large-scale timber cutting (e.g., soil erosion and loss of wildlife habitat), and high inefficiency, the staff concludes that wood waste would not be a reasonable alternative to a 1500-MW(e) nuclear power-generation facility operated as a base-load plant at the NAPS site.

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 can reduce the volume of waste by up to 90 percent and the weight of the waste by up to 75 percent (EPA 2008). Municipal waste combustors use three basic types of technologies: (1) mass burn, (2) modular, and (3) refuse-derived fuel (DOE/EIA 2001). 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. In the GEIS, the staff determined that the initial capital cost for municipal solid-waste plants is greater than for comparable steam-turbine technology at wood-waste facilities because of the need for specialized waste-separation and waste-handling equipment for municipal solid waste (NRC 1996).

Municipal solid-waste combustors generate an ash residue that is buried in landfills. 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 (DOE/EIA 2001).

Currently, approximately 89 waste-to-energy plants are operating in the United States. These plants generate approximately 2700 MW(e), or an average of approximately 30 MW(e) per plant (IWSA 2008). Given the small size of existing plants, the staff concludes that generating electricity from municipal solid waste would not be a reasonable alternative to a 1500-MW(e) nuclear power-generation facility operated as a base-load plant at the NAPS site.

9.2.3.8 Other Biomass-Derived Fuels

In addition to wood and municipal solid-waste fuel, several other biomass-derived fuels are available for fueling electric generators, including crop waste that can be burned, liquid fuels (such as ethanol) produced from crops, and gaseous fuels produced from crops or wastes (including wood waste). In the GEIS, the staff determined that none of these technologies has progressed to the point of being competitive on a large scale or of being reliable enough to replace a large base-load generating plant (NRC 1996).

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

The staff concludes that biomass-derived fuels do not offer a reasonable alternative to a 1500-MW(e) nuclear power-generation facility operated as a base-load plant at the NAPS site.

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 2007).

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

For the preceding reasons, the staff concludes that a fuel cell energy facility located at or in the vicinity of the North Anna site would not currently be a reasonable alternative to construction of a 1500-MW(e) nuclear power-generation facility operated as a base-load plant.

9.2.4 Combination of Alternatives

Individual alternatives to the construction of a new nuclear unit at the NAPS site might not be sufficient on their own to generate Dominion's target value of 1500 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.

Section 9.2.2.2 assumes the construction of three 500-MW(e) natural gas-fired, combined-cycle generating units at the NAPS site using the existing main cooling reservoir. For a combined alternatives option, the staff assessed the environmental impacts of an assumed combination of two 500-MW(e) natural gas-fired, combined-cycle generating units at the NAPS site, 150 MW of hydropower, 100 MW from biomass sources including municipal solid waste, 100 MW from conservation and DSM programs, and 150 MW from wind power. A summary of the environmental impacts associated with the construction and operation of this assumed combination of alternatives is shown in Table 9-3.

9.2.5 Summary Comparison of Alternatives

Table 9-4 contains a summary of the staff's environmental impact characterizations for constructing and operating new nuclear, coal-fired, and natural gas-fired, combined-cycle generating units at the NAPS site. The combination of alternatives shown in Table 9-4 assumes siting of natural gas-fired, combined-cycle units at the NAPS site and siting of other generating units in the general vicinity (within 160 km [100 mi]) of the site.

The staff reviewed the available information on the environmental impacts of power-generation alternatives compared to the construction of new nuclear units at the NAPS site. Based on this review, the staff concludes that from an environmental perspective, none of the viable energy alternatives are clearly preferable to construction of a new base-load nuclear power-generation plant at the NAPS site.

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 powerblock and connection to a natural gas pipeline. Wind, hydroelectric, and biomass facilities and associated transmission lines would have land-use impacts in addition to the land-use impact of the natural gas-fired plant.
Air quality	SMALL to MODERATE	Emissions from the natural gas-fired plant would be approximately: - SO_x – 85 MT (94 tons)/yr - NO_x – 251 MT (277 tons)/yr - CO – 151 MT (166 tons)/yr - PM_{10} – 277 MT (305 tons)/yr - VOC – 53 MT (58 tons)/yr - Municipal solid waste and biomass facilities would also have emissions.
Water use and quality	SMALL to MODERATE	Impacts would be less than the impacts for new nuclear generating units located at the NAPS site.
Ecology	SMALL to MODERATE	Many of the impacts for the natural gas-fired plant would occur in areas that were previously disturbed during the construction of NAPS Units 1 and 2. Thus, potential habitat loss and fragmentation and reduced productivity and biological diversity would likely be minimal. Wind energy facilities could result in some avian mortality. Hydropower facilities would impact terrestrial and aquatic habitat.
Waste management	SMALL to MODERATE	The only significant waste would be from spent SCR catalyst used for control of NO_x emissions and ash from biomass and municipal solid-waste sources.
Socioeconomics	MODERATE Beneficial to MODERATE Adverse	Construction and operations workforces would be relatively small. Addition to property tax base, while smaller than for a nuclear or coal-fired plant, might still be quite noticeable. Construction-related impacts would be noticeable. Impacts during operation would be minor because of the small workforce involved. The plants would have aesthetic impacts.
Human health	SMALL	Regulatory controls and oversight are assumed to be protective of human health.
Historic and cultural resources	SMALL	Any potential impacts could likely be effectively managed. Most of the facilities and infrastructure at the site would likely be built on previously disturbed ground.
Environmental justice	SMALL	Some impacts on housing availability and prices during construction may occur, as might beneficial impacts from property tax revenues.

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 at the NAPS Site

Impact Category	Nuclear	Coal	Natural Gas	Combination of Alternatives
Land use	SMALL	MODERATE	SMALL to MODERATE	MODERATE
Air quality	SMALL	MODERATE	SMALL to MODERATE	SMALL to MODERATE
Water use and quality	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE
Ecology	SMALL	MODERATE	SMALL to MODERATE	SMALL to MODERATE
Waste management	SMALL	MODERATE	SMALL	SMALL to MODERATE
Socioeconomics	LARGE Beneficial to MODERATE Adverse	LARGE Beneficial to MODERATE Adverse	MODERATE Beneficial to MODERATE Adverse	MODERATE Beneficial to MODERATE Adverse
Human health	SMALL	SMALL	SMALL	SMALL
Historic and cultural resources	SMALL	SMALL	SMALL	SMALL
Environmental justice	SMALL	SMALL	SMALL	SMALL

9.3 System Design Alternatives

Alternatives to the combination closed-cycle, wet and dry (hybrid) cooling system proposed for Unit 3 were evaluated in Section 8.2 of the ESP EIS (NRC 2006), in which once-through, wet, and dry cooling are discussed as alternatives to the proposed combination of wet and dry cooling for the proposed Unit 3. Dominion's COL ER provides further information that the proposed Unit 3 design characteristics for the combined-cycle, wet and dry cooling system are equal to or less than the ESP design parameters (Dominion 2007). The staff did not identify any information that was both new and significant regarding alternative heat dissipation systems. Therefore, the conclusion from the ESP EIS (NRC 2006) that the proposed combination of wet and dry cooling for the proposed Unit 3 is preferable to the other three cooling alternatives is still valid.

Alternatives to the water intake and discharge structure designs, water supply, and water-treatment systems for the proposed Unit 3 were not evaluated in the ESP EIS. Therefore, the remainder of this section provides a discussion of alternative intake and discharge structures, alternative water supplies, and alternative water-treatment systems that were evaluated for the COL.

9.3.1 Alternative Intake Structure Designs

The intake structure for the proposed Unit 3 is a partially submerged concrete inlet structure located on the shore of Lake Anna adjacent to the intake for the existing Units 1 and 2 (see

Figure 2-1 of this SEIS). This location is the same that was planned for two additional units that were proposed at the time that existing NAPS Units 1 and 2 were licensed. A cofferdam separating the main body of the lake from a settling lagoon is already in place; a set of box culverts through the cofferdam would allow water from the lake to enter the lagoon at a velocity of about 0.03 m/s (0.1 ft/s), meeting the ESP design parameter for the proposed Unit 3. Dominion's current description of the intake pump arrangement and debris exclusion system states that the flow rate into the trash racks and traveling screens will be less than 0.15 m/s (0.5 ft/s), which also meets the design parameter evaluated in the ESP EIS (NRC 2006).

At the time of the ESP application, Dominion stated that its proposed intake design had not matured enough to consider alternative pumping arrangements, defouling processes, or screen systems. However, Dominion did consider several alternative intake systems and locations: a submerged offshore structure positioned just above the lake bottom, a shoreline inlet structure at an alternative location several hundred feet from the existing units intake structure, and an intake structure located along the North Anna River downstream of the North Anna dam (Dominion Nuclear North Anna, LLC 2006). All of the alternative intake structure designs would disturb at least as much land and shoreline area during construction as the proposed intake structure, and could require additional permitting. Therefore, no further economic evaluation of the alternatives relative to the proposed structure was conducted. Because the potential environmental impacts associated with construction of any of these alternative structures are likely to be greater than those associated with the proposed structure, the NRC staff conclude that the proposed intake structure location and inlet design is preferable to either an inlet at another location or a submerged offshore intake design.

9.3.2 Alternative Discharge Structure Designs

Dominion proposes to discharge blowdown water from the proposed Unit 3 into the existing discharge canal through a partially submerged concrete outfall structure adjacent to the existing Units 1 and 2 outfall. The proposed Unit 3 discharge will mix with discharge from the existing Units in the discharge canal before entering the Waste Heat Treatment Facility. At the time of the ESP, Dominion considered several alternative discharge systems and locations: a completely submerged offshore structure positioned just above the bottom of the receiving water body, a discharge structure located directly on the shoreline of the Waste Heat Treatment Facility (bypassing the discharge canal), and a discharge location on the shoreline of Lake Anna (Dominion Nuclear North Anna, LLC 2006). All of the alternative discharge designs and locations would disturb more land and shoreline area during construction as the proposed discharge structure, and like the alternative intake structures, would require additional permitting. Therefore, no further economic evaluation of the alternatives relative to the proposed discharge structure was conducted. Because the potential environmental impacts associated with construction of any of these alternative structures are likely to be greater than those associated with the proposed structure, the NRC staff concludes that the proposed discharge structure location and design is preferable to either a submerged offshore discharge structure or a new shoreline discharge structure at a different location.

9.3.3 Alternative Water Supplies

Dominion proposes to use Lake Anna for its primary supply of water (Dominion Nuclear North Anna, LLC 2006). Dominion determined that because of the certainty of the water supply (Lake Anna) for the proposed Unit 3 closed-cycle cooling system, consideration of alternative cooling water sources was not warranted. The staff also did not evaluate any alternative water supplies in the ESP EIS and so the alternative water sources are not resolved in the ESP proceeding. The staff's evaluation of alternative water supplies follows.

The staff assumes, as did Dominion, that Lake Anna would be the sole source of water during normal years. However, because the staff determined that water-use impacts would be MODERATE in drought periods, the staff did consider alternative water supplies that might mitigate these impacts in such years. The staff considered inter-basin transfers, such as withdrawing water from the James River, and the use of wastewater. All of these alternatives would have significant construction impacts, because there is no existing canal or pipeline infrastructure available to transport the water to the NAPS site. Given the relatively sparse population, the local municipal wastewater capacity would not be adequate. Therefore, no further economic evaluation of the water supply alternatives relative to Lake Anna was conducted, and the staff concludes that no water supply was preferable to the sole reliance on Lake Anna.

9.3.4 Alternative Water-treatment Systems

Dominion proposes to use chemical water treatment. At the time of the ESP application, Dominion considered several water-treatment systems: mechanical treatment, chemical treatment, and non-chemical treatment (Dominion Nuclear North Anna, LLC 2006). However, the staff did not evaluate these alternatives in the ESP EIS and so the alternatives are not resolved in the ESP proceeding. The staff's evaluation of alternative waste treatment follows.

Mechanical treatment and non-chemical treatment result in no chemical discharges to the effluent. However, neither of these technologies is suitable for wet cooling portions of the proposed hybrid cooling tower. The staff determined that chemical treatment is the only technology suitable for the proposed cooling system design. Additionally, based on the requirements of 40 CFR Part 423, any impacts from these chemical additives would not justify mitigation.

9.4 Region of Interest and Site-Selection Process

Dominion's region of interest and site selection process is discussed in Section 8.3 of the ESP EIS (NRC 2006). No additional discussion of these topics is required in a supplement to an ESP EIS that is prepared for a COL application (10 CFR 51.92(e)(3)).

9.5 Alternative Sites

Alternatives sites are evaluated in Sections 8.3 and 8.8 of the ESP EIS (NRC 2006). No additional discussion of this topic is required in a supplement to an ESP EIS that is prepared for a COL application (10 CFR 51.92(e)(3)).

9.6 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 50. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 50, "National Primary and Secondary Ambient Air Quality Standards."

40 CFR Part 51. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 51, "Requirements for Preparation, Adoption, and Submittal of Implementation Plans."

40 CFR Part 60. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 60, "Standards of Performance for New Stationary Sources."

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."

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 423. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 423, "Steam Electric Power Generating Point Source Category."

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10.0 Conclusions and Recommendations

On November 27, 2007, the U.S. Nuclear Regulatory Commission (NRC) received an application from Dominion Virginia Power and Old Dominion Electric Cooperative, collectively known as Dominion, for a combined license (COL) for the North Anna Power Station (NAPS) site (Dominion 2007). The NAPS site is located approximately 64 km (40 mi) north-northwest of Richmond, Virginia. A COL, which encompasses both a construction permit and an operating license, is a Commission approval to build and operate one or more nuclear power facilities. In its application, Dominion specified the Economic Simplified Boiling-Water Reactor (ESBWR) as the proposed design for the new reactor, designated Unit 3, to be constructed and operated at the NAPS site.

Section 102 of the National Environmental Policy Act of 1969 (NEPA) (42 USC 4321 et seq.) directs 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 environmental impact of the proposed action
- any adverse environmental effects that cannot be avoided should the proposal be 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.

The NRC has implemented NEPA in Title 10 of the Code of Federal Regulations (CFR) Part 51. In 10 CFR 51.20, the NRC requires preparation of an EIS for issuance of licenses to construct and operate a nuclear power plant. Subpart A of 10 CFR Part 52 Subpart C contains the NRC regulations related to COLs.

The COL application (Dominion 2007) references an early site permit (ESP) for the North Anna ESP site, which is located on the NAPS. In November 2007, NRC approved issuance of the ESP for two additional nuclear units at the NAPS ESP site. This approval was supported by information documented in the ESP final environmental impact statement (ESP EIS) (NRC 2006). The ESP permit, ESP-003, was issued to Dominion by the NRC on November 27, 2007 (NRC 2007a). For a COL application that references an ESP, the NRC staff, pursuant to

10 CFR) 51.75(c), prepares a supplement to the ESP EIS in accordance with 10 CFR 51.92(e). Therefore the staff relies upon the analysis in that document as the basis in preparation of this supplemental EIS (SEIS).

Upon acceptance of the proposed Unit 3 COL application, the NRC began the environmental review process described in 10 CFR Part 51 by publishing in the *Federal Register* a Notice of Intent to prepare an EIS and Conduct Scoping (73 FR 13589). The initial Notice of Intent was later corrected and a supplement was published in the *Federal Register* (73 FR 41132). The staff held a public scoping meeting in Mineral, Virginia, on April 16, 2008, and a site audit at NAPS during the period of April 14-18, 2008. Both during and following the site audit and the scoping meeting and in accordance with NEPA and 10 CFR Part 51, the staff determined and evaluated the new and significant information related to the potential environmental impacts of constructing and operating a new nuclear unit at the NAPS site.

Included in this SEIS 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 nuclear unit at the NAPS site; (2) mitigation measures for reducing or avoiding adverse effects; (3) the environmental impacts of alternatives to the proposed action; and (4) the staff's recommendation regarding the proposed action based on its environmental review. The COL application references an ESP, so where appropriate, this SEIS adopts results of the environmental review conducted in support of the ESP application and incorporates those results by reference.

During the course of preparing this SEIS, the staff reviewed the Environmental Report (ER) submitted as part of the COL application (Dominion 2007); relied on the environmental review conducted for the ESP application (Dominion Nuclear North Anna, LLC 2006) and documented in the ESP EIS (NRC 2006); consulted with Federal, State, Tribal, and local agencies; and followed the guidance set forth in Regulatory Guide 4.2, Revision 2 (NRC 1976), and NUREG-1555, *Standard Review Plans for Environmental Reviews for Nuclear Power Plants* (NRC 2000). NUREG-0800, *Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants* (NRC 2007b) also was applicable. In addition, the NRC considered public comments related to the environmental review that were received during the scoping process. These comments are provided in Appendix D of this SEIS.

To guide its assessment of environmental impacts of a proposed action or alternative actions, the NRC has established a standard of significance for impacts based on guidance developed by the Council on Environmental Quality (40 CFR 1508.27). The three significance levels established by the NRC – SMALL, MODERATE, or LARGE – are defined as follows:

> SMALL – Environmental effects are not detectable or are so minor that they would 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 staff considered planned activities and actions that Dominion indicates it and others would likely take should Dominion receive a COL. In addition, Dominion provided estimates of the environmental impacts resulting from the construction and operation of a new nuclear unit on the NAPS site.

10.1 Impacts of the Proposed Action

Impacts associated with construction of the proposed Unit 3 are discussed in Chapter 4 of the ESP EIS and are summarized in Table 4-1 of that document (NRC 2006). Likewise, impacts associated with operation of the proposed reactor and its associated facilities are discussed in Chapter 5 of the ESP EIS and are summarized in Table 5-22 (NRC 2006). This information, as modified and supplemented by this SEIS, provide the basis for an informed decision concerning the environmental impacts of issuance of a COL by the NRC.

In Chapter 7 of this SEIS, the staff considered the potential cumulative impacts resulting from construction and operation of the proposed Unit 3 with past, present, and reasonably foreseeable future actions at and in the vicinity of the NAPS site. For each impact area, the staff's determination is that the potential cumulative impacts resulting from construction and operation would be SMALL and that mitigation is not warranted. Several issues have the potential for MODERATE impacts, most of which would occur under temporary circumstances or as the result of a larger-than-expected concentration of construction workers settling near the NAPS site.

10.2 Unavoidable Adverse Environmental Impacts

Section 102(2)(C)(ii) of NEPA requires that an EIS include information on any adverse environmental effects that cannot be avoided should the proposed project be implemented. Unavoidable adverse environmental impacts are those potential impacts of construction and operation of new units that cannot be avoided and for which no practical means of mitigation are available.

The unavoidable adverse environmental impacts associated with the granting of the COL for NAPS Unit 3 would include impacts of both construction and operation. Unavoidable adverse impacts will be mitigated using best available mitigation measures.

10.2.1 Unavoidable Adverse Impacts during Construction

Chapter 4 discusses in detail the potential impacts from construction of the proposed new Unit 3 at the NAPS site. The unavoidable adverse impacts related to construction are listed in Table 10-2 of the ESP EIS (NRC 2006). In Table 10-1 of its COL ER (Dominion 2007), Dominion listed newly identified construction-related, unavoidable adverse impacts that would occur beyond those evaluated during the ESP environmental review. The primary newly identified construction-related, unavoidable adverse environmental impacts are the result of construction of an additional 500-kV transmission line to support the operation of the proposed Unit 3. A majority of the newly identified construction-related activities for the proposed Unit 3, including ground-disturbing activities, would occur outside the existing NAPS site boundary. According to Dominion (2007), the onsite land area that would be affected on a long-term basis as a result of constructing and operating permanent facilities encompasses approximately 49 ha (120 ac), which is a slight decrease from the estimate of 52 ha (128 ac) that was estimated for the ESP EIS (NRC 2006). Additional onsite lands areas that would be disturbed on a short-term basis as a result of temporary construction activities and facilities included the laydown areas along with road and rail improvements to transport the reactor pressure vessel and other large components to the site (Dominion 2007).

Dewatering systems employed during excavation within the powerblock area would depress the water table in the general vicinity; however, the impacts would be localized and temporary. The alteration of the land surface at NAPS Unit 3 site would cause a localized change in the recharge rate to the Water Table aquifer.

Construction activities for the proposed new 500-kV transmission line along the existing transmission line right-of-way would create impacts both onsite and offsite. Specific information regarding this new transmission line is available in Section 3.7 of Dominion's COL ER (Dominion 2007). The 24-km (15-mi) transmission line would be constructed in the existing NAPS to Ladysmith right-of-way that is 84 m (275 ft) wide and would be approximately 3 m (10 ft) taller than the existing transmission line in the right-of-way.

Construction of the new transmission line would not impact any threatened and endangered species. Construction activities would be conducted in accordance with all applicable laws, regulations, and permit requirements, and would use good engineering and construction practices (Dominion 2007).

Socioeconomic impacts of construction include an increase in traffic involving construction workers, and possible demand pressure on the local housing market if workers concentrate in Louisa County. Air-quality impacts include fugitive dust from construction activities and pollutant emissions from construction equipment. Those impacts would be mitigated by the dust-control and vehicle-maintenance plans. Radiological doses to construction workers from the adjacent units are expected to be well below regulatory limits. No unusual resource dependencies on minority and low-income populations in the region were identified. In addition, no environmental pathways related to construction activities were found that would lead to adverse and disproportionate impacts on minority and low-income populations.

Newly identified unavoidable adverse impacts from construction of the proposed Unit 3 are summarized in Table 10-1.

Table 10-1. Newly Identified Unavoidable Adverse Environmental Impacts from Construction

Impact Category	Adverse Impacts Based on Dominion's Application	Actions to Mitigate Impacts	Newly Identified Unavoidable Adverse Impacts
Land use (onsite)	*Yes*	Comply with requirements of applicable Federal, State, Tribal, and local permits	49 ha (120 ac) disturbed on a long-term basis; additional land disturbed on a temporary basis
Transmission line rights-of-way and land use (offsite)	Yes	Restore disturbed areas, remove and dispose of debris left or caused by construction, restore damaged property to its original condition and to the satisfaction of the property owner, and take appropriate action following the discovery of potential historical or archeological resources.	Construction of an additional 500-kV transmission line, and associated equipment, in existing transmission rights-of-way
Hydrological and water use	Yes	Implement erosion and sedimentation control measures.	Construction of an additional 500-kV transmission line, and associated equipment, in an existing transmission line right-of-way and crossing water bodies
Ecological (terrestrial)	Yes	Control soil disturbances within 30 m (100 ft) of streams, creeks, and ditches with running water. Obtain all necessary permits, if applicable, prior to site-preparation activities. Dust-suppression techniques would be utilized and equipment maintenance employed to reduce airborne missions. After construction completed, restore disturbed areas with most practical methods.	Construction of a new 500-kV transmission line in and existing right-of-way would disturb existing terrestrial habitats
Aquatic	Yes	Control soil disturbances within 30 m (100 ft) of streams, creeks, and ditches with running water	Construction of new 500-kV transmission line in an existing right-of-way could impact existing aquatic habitats
Socioeconomic	Yes	Access to recreational areas impacted would be temporarily restricted	Construction of new 500-kV transmission line in an existing right-of-way could impact public access to areas for recreational activities

Table 10-1. (contd)

Impact Category	Adverse Impacts Based on Dominion's Application	Actions to Mitigate Impacts	Newly Identified Unavoidable Adverse Impacts
Water-use	Yes	Nonradioactive effluents, including sanitary waste and blowdown from the Unit 3 tower would be governed by limits of VPDES permit. Operate a dechlorination system to neutralize chlorine in circulating water system and cooling tower blowdown before discharge into WHTF.	New cooling tower and separate sanitary waste system would be added for the proposed Unit 3, creating the potential for additional chemical effluents
Nonradioactive waste system	Yes	Sanitary wastes will be managed onsite and disposed of at an offsite location in compliance with applicable laws, regulations, and conditions associated with required permits.	A separate sanitary waste system would be added for the proposed Unit 3, creating a requirement for disposal of additional sanitary waste

10.2.2 Unavoidable Adverse Impacts During Operation

Chapter 5 provides a detailed discussion of the potential impacts from operation of the proposed NAPS Unit 3. The unavoidable adverse impacts related to operation are listed in Table 10-3 of the ESP EIS (NRC 2006). In Table 10-2 of its COL ER (Dominion 2007), Dominion identified additional unavoidable adverse impacts during operation that would occur beyond those evaluated during the ESP environmental review. These impacts are summarized in Table 10-2.

Table 10-2. Newly Identified Unavoidable Adverse Environmental Impacts from Operation

Impact Category	Adverse Impacts Based on Dominion's Application	Actions to Mitigate Impacts	Additional Unavoidable Adverse Impacts
Hydrological and water use	Yes	Comply with limits established in VPDES permit. This will require operation of a dechlorination system.	Additional chemical effluents from new combined wet and dry cooling tower and separate sanitary waste system.
Hydrological and water use	Yes	Waste managed onsite and disposed of offsite in compliance with State and local regulations and permit conditions	New separate proposed Unit 3 sanitary waste system would be constructed and operated.

10.3 Alternatives to the Proposed Action

Alternatives to the proposed action discussed in this SEIS are the no-action alternative, energy alternatives, and system design alternatives that were not addressed in the ESP EIS (NRC 2006).

The no-action alternative is discussed in Section 9.1 of this SEIS. Under the no-action alternative, the NRC would not issue the COL to Dominion. There would be no environmental impacts associated with not issuing the COL at the NAPS site, except the impacts associated with activities not within the definition of *construction* at 10 CFR 50.10(a) and 51.4. At the same time, the benefits associated with the proposed action would not occur. If the COL application is denied, the power would still be needed as discussed in Chapter 8 of the SEIS. Dominion would have a variety of options for meeting power needs, including constructing a new nuclear power plant at another site, constructing a coal- or natural gas-fired plant at the NAPS site or at another site and pursuing one or more of the energy alternatives discussed in Sections 9.2.1 and 9.2.3 of this SEIS. There would be environmental impacts associated with each of these options that would occur at the site of implementation.

Energy alternatives are discussed in Section 9.2 of this SEIS. The staff concluded that none of the energy alternatives are both (1) practical for meeting Dominion's purpose of providing approximately 1500 MW(e) of base-load power, and (2) environmentally preferable to the proposed action.

System design alternatives are discussed in Section 9.3 of this SEIS. Cooling system design alternatives were evaluated and resolved as part of the ESP process. Alternatives to the water intake and discharge structure designs, water supply, and water treatment systems were evaluated in this SEIS. The staff concludes that none of the proposed alternatives in these areas were considered environmentally preferable to the proposed action.

10.4 Relationship Between Short-Term Uses and Long-Term Productivity of the Human Environment

Section 102(2)(C)(iv) of NEPA requires that an EIS include information on the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity. The evaluation of the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity for the construction and operation of proposed COL units can be performed by discussing the benefits of operating the units. The principal benefit is the production of electricity. The analysis of the benefit-cost balance is presented in Section 10.6 of this SEIS. If a new nuclear power plant is constructed on the NAPS site, power production would continue until the operating license or COL expires or the licensee chooses to cease operation. Once the plant is shut down, it 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.

10.5 Irreversible and Irretrievable Commitments of Resources

Section 102(2)(C)(v) of NEPA requires that an EIS include information on any irreversible and irretrievable commitments of resources that would occur if the proposed action is implemented. Irretrievable commitments of resources during construction of the proposed new units generally would be similar to that of any major construction project. A study by the U.S. Department of Energy (DOE) (DOE 2004) on new reactor construction estimated the following quantities of materials would be required for a new reactor: 9357 m^3 (12,239 yd^3) of concrete, 2819 MT (3107 tons) of rebar, 2,000,000 m (6,500,000 ft) of cable, and 83,820 m (275,000 ft) of piping would be needed for a single reactor building. Hazardous materials such as asbestos would not be used.

The staff expects that the use of construction materials in the quantities associated with those expected for NAPS Unit 3, 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 units 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, so that the irreversible and irretrievable commitment would be of small consequence.

10.6 Benefit-Cost Balance

The National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. 4321 et seq.), as amended, implemented by Executive Orders 11514 and 11991 and the Council on Environmental Quality's (CEQ) Guidelines (40 CFR Part 1500), 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. 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, 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 decisionmaking along with economic and technical considerations.

However, neither NEPA nor CEQ requires the benefits and costs of a proposed action be quantified in dollars or any other common metric.

NUREG 1555 (NRC 2000) Section 10.4.2 recommends the staff " … express all internal costs, either provided by the applicant or estimated by the staff, in monetary terms." 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 SEIS. It gathers the expected impacts from construction and operations of the proposed Unit 3 and aggregates them into two final categories: (1) the expected costs and (2) the expected benefits to be derived from approval of the proposed action.

This section identifies the benefits and costs of constructing and operating the proposed Unit 3 at the NAPS site. 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 Dominion's financial viability are outside NRC's mission and authority and, thus, are not considered in this SEIS. 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. 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.

Table 10-3. Monetary and Non-Monetary Benefits of the Proposed Unit 3 (Adapted from Dominion COL ER) (Dominion 2007)

Category of Benefit	Description of Benefit	Monetized Value of Benefit Over License Period
Net Electrical Generating Benefits		
Net generating capacity	~1500 MW(e)	
Electricity generated (operating at 90 percent cap.)	~12,000,000 MW(h) per year	
Taxes and Other Revenue During Plant Construction and Operation Period (transfer payments – not independent benefits)[(a)]		
Annual state taxes NAPS from construction	Proposed Unit 3 would pay $4.8 million per year over the 3-year construction period.	$14.4 million over the 3-year construction period
Annual property taxes from construction	Proposed Unit 3 would pay $3.1 million per year over the 3-year construction period.	$9.3 million over the 3-year construction period
Annual sales taxes from construction	Proposed Unit 3 would pay $0.4 million per year over the construction period.	$1.2 million over the 3-year construction period
Annual state taxes from NAPS from operations	Proposed Unit 3 would pay $14.8 million per year.	$592 million
Annual local property taxes from NAPS from operations	Proposed Unit 3 would pay $24.2 million per year.	$968 million
Annual local sales taxes NAPS from operations	Proposed Unit 3 would pay $3.5 million per year	$140 million
Local NAPS purchases	$29.3 million per year	$1172 million
Virginia NAPS purchases outside ROI	$40 million per year	$1600 million
U.S. NAPS purchases outside Virginia	$34 million per year	$1360 million
Effects on Regional Productivity		
Construction workers	Approximately 2500 to 3500 workers create an incremental increase of 1545 to 2163 indirect jobs within the region.	
Operational workers	500 workers create an incremental increase in 1035 indirect permanent jobs within the region for at least 40 operating years.	

Table 10-3. (contd)

Category of Benefit	Description of Benefit	Monetized Value of Benefit Over License Period
Socioeconomics	Increased tax revenue supports improvements to public infrastructure and social services. The increased revenue spurs future growth and development.	
Technical and other non-monetary benefits	Fuel diversity reduces exposure to supply and price risk associated with reliance on any single fuel source.	
Price volatility	Dampens potential for fuel price volatility.	
Electrical reliability	Enhances reliability of the electricity supply.	

(a) Local property and sales taxes include impacts on counties other than Louisa County. The VEDP estimated that about 92 percent of the local tax impact would occur in Louisa County during construction, but only 46 percent during operations. State and local tax impacts are based on the VEDP estimates of construction and operations expenditures and employment rather than Dominion current estimates of plant construction and operations requirements. See text in Section 10.6.1.2.

10.6.1 Benefits

The most apparent benefit from constructing and operating a power plant is that it would eventually generate power and provide thousands of residential, commercial, and industrial consumers with electricity. Section 8.1 of this SEIS outlines the social and economic importance of maintaining an adequate supply of electricity in any given region, establishing that power as the foundation for economic stability, growth, and as being fundamental to maintaining the standard of living we have come to expect. 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, and hydroelectric plants. Because the focus of this SEIS is on the proposed expansion of the generating capacity at the NAPS site, this section focuses primarily on the relative benefits of the proposed Unit 3 option rather than the broader, more generic benefits of electricity supply.

10.6.1.1 Societal Benefits

From a societal perspective, price stability and longevity and 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.

Price Stability and Longevity

Because of relatively low and nonvolatile fuel costs, approximately 0.5 cents per kWh, and projected availability rate of 85 to 93 percent (see Section 8.4.3.1), nuclear energy is a dependable provider of electricity that can be provided at relatively stable prices to the consumer over a long period of time.

Nuclear power plants are generally not subject to fuel price volatility like 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 7 percent; while doubling the price of gas would add about 70 percent to the price of electricity, and doubling the cost of coal would add about 36 percent to the price of electricity (WNA 2008).

Energy Security and Fuel Diversity

Currently, more than 70 percent of the electricity generated in the United States is from fossil-based technologies; thus, non-fossil-based generation, such as nuclear generation, are essential to maintaining diversity in the aggregate power generation fuel mix (DOE/EIA 2007). Nuclear power contributes to the diverse U.S. energy mix, thereby hedging the risk of shortages and price fluctuations for any one generating system.

Chapter 8 of the Dominion's COL ER (Dominion 2007) discussed the PJM load forecast for 2008 (PJM 2007), which revealed a need for approximately 1900 MW(e) of additional base-load generation within the Dominion Zone in the 2015/2016 time frame, even after accounting for conservation and load-management programs. The proposed Unit 3 would generate approximately 1500 MW(e) net, or about four-fifths of that anticipated surplus demand. Assuming a reasonably low capacity factor of 85 percent, the plant's average annual electrical energy generation would be more than 11,169,000 MWh. A reasonably high-capacity factor of 93 percent would result in slightly more than 11,826,000 MWh of electricity.

10.6.1.2 Regional Benefits

Tax Revenue Benefits

Dominion's 2007 tax payments to Louisa County for the NAPS site were about $9.7 million, which represented approximately 22 percent of the total county property tax revenues (Dominion 2008a). Additional state and local tax revenue would represent a transfer benefit, but one of considerable importance to local government bodies. In 2006, the Virginia Economic Development Partnership (VEDP) used IMPLAN, a commercially available input/output modeling program, to estimate the economic impact of the jobs created by the addition of a new nuclear generating unit at NAPS (Dominion 2008b). According to that report, Louisa County would realize substantial tax benefits (see Sections 4.5.3.2 and 5.5.3.2 of this SEIS). During the plant construction period, the VEDP estimated that the jobs created during construction of a new unit at the NAPS site should annually generate $4.8 million in state tax revenue and $3.5 million in tax revenue for the local counties (for the latter, $3.1 million in property taxes and $400,000 in sales and use taxes). The VEDP estimated the total tax benefit would be $24.9 million in total tax revenues over the projected 3-year construction period, $14.4 million in total state taxes to the Commonwealth of Virginia, $9.3 million in total property tax, and $1.2 million in total sales and use tax revenues allocated to the local counties. If the taxes paid during the construction period scale linearly with the construction project workforce size and duration, then based on Dominion's employment estimates, total construction period taxes would be roughly $51.9 to $72.6 million. These estimated taxes would be allocated as follows: $30 million to $42 million to the Commonwealth of Virginia, $19.3 million to $27.2 million in local property taxes, and from $2.5 million to $3.5 million in local sales and use taxes.

During the plant operation period, the VEDP estimated that the additional direct and indirect labor increases associated with the proposed Unit 3 should generate $14.8 million in state tax revenue and $27.7 million in tax revenue for the local counties each year. (Tax revenue for the local counties consisted of $24.2 million in property taxes and $3.5 million in sales and use taxes annually). In nominal terms, not taking into account inflation or discount rates, the additional direct and indirect jobs associated with operations at the proposed Unit 3 should result in $592 million in total state taxes to the Commonwealth of Virginia, $968 million in total property tax, and $140 million in total sales and use tax revenues to the local counties. All of the operations-related values would be 33 percent lower if they scaled with Dominion's estimate of the operations-period employment; however, for at least property taxes, the cost of the plant as constructed is not likely to scale downward with operation employment because the taxable value of the proposed Unit 3 will be determined by its cost to construct.

In 2006, Dominion spent about $58.6 million annually in operations and maintenance materials, supplies, and technical services from the three counties surrounding the plant, Louisa, Orange, and Spotsylvania Counties; and about $80 million more in Virginia outside this three-county area. Nationally, Dominion purchased products and services (including labor) outside Virginia totaling another $68 million in 2006 (NEI 2008). Assuming the proposed Unit 3 would induce a 50-percent increase in all operations and maintenance spending, over the 40-year life of the operating license, the three-county area could expect an increase in local commerce of about $1.2 billion, Virginia could experience an increase of $3.2 billion, and the rest of the nation could experience an increase in purchases of another $2.7 billion (in nominal dollars).

Regional Productivity and Community Impacts

Construction of NAPS Unit 3 would require a workforce of about 2500 to 3500 people and would generate additional income for the Commonwealth of Virginia and local economies for a period of up to 5 years (Section 4.5.3 of this SEIS). The subsequent operation of Unit 3 would require an operational workforce of about 500 people (Section 5.5.3 of this SEIS) and would generate additional income and value for the Commonwealth of Virginia and local economies for a period of at least 40 years.

Based on the VEDP estimates of a construction workforce of 2000 workers and a construction period of about 3 years (Dominion 2008b), the construction and operation of the proposed Unit 3 would increase economic output in the Commonwealth of Virginia's by $42.5 million annually. Given Dominion's somewhat higher estimate of the number of workers needed and construction time period, the positive impact of construction would be 25 to 75 percent higher, and would extend up to about 40 percent longer than estimated by the VEDP. If the direct value of the proposed Unit 3 output is included, State and County output attributable to the operation of Unit 3 would be significantly higher. The VEDP estimates that besides the 2000 direct construction jobs on Unit 3, 1236 additional indirect jobs would be created as a result of the construction activities at NAPS (Dominion 2008b). Temporary construction workers and their families would increase rental and property demand, spending on goods and services, and sales taxes collected.

In addition, the VEDP estimates that the operation of the proposed Unit 3 would create 750 direct jobs for Louisa County plus 1553 additional indirect jobs over a 40-year time period (Dominion 2008b). Dominion's estimate for the proposed Unit 3 direct employment is about 500 workers, so the indirect employment would be about 50 percent less than the employment estimated by the VEDP. The VEDP estimated that the indirect jobs would be concentrated in Louisa, Orange, and Spotsylvania Counties. Louisa County, where Unit 3 would be located, would experience the greatest impact. The general growth of the economic opportunities in the region would be a positive economic development.

A summary of benefits is shown in Table 10-3.

10.6.2 Costs

Internal costs to Dominion as well as external costs to the surrounding region and environment would be incurred during the construction and operation of the proposed Unit 3. Internal costs include the costs to physically construct the power plant (capital costs), as well as operating and maintenance costs, fuel costs, waste disposal costs, and decommissioning costs. External costs include all costs imposed on the environment and region surrounding the plant and may include such things as a loss of regional productivity, environmental degradation, or loss of wildlife habitat.

10.6.2.1 Internal Costs

The most substantial monetary cost associated with nuclear energy is the cost of capital. 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 the most important factor determining the economic competitiveness of nuclear energy. Construction delays can add significantly to the cost of a plant, but in Virginia, the cost for servicing debt is mitigated somewhat by the fact that by law any utility that constructs a nuclear plant can recover costs for the partially completed plant during construction (projected construction work in progress and associated allowance for funds used during construction) through a rate adjustment clause, thereby shifting the risk to consumers (Virginia Code § 56-585.1.A.6).

Construction Costs

In evaluating monetary costs related to constructing Unit 3, Dominion reviewed recently published literature, vendor information, internally generated financial information, and internally generated, site-specific information. A conservative ESBWR construction cost estimate is provided below. This estimate is based on a number of studies that have been conducted by government agencies, universities, and other entities, and includes a significant contingency to account for uncertainty. In its COL ER (Dominion 2007), Dominion expressed the construction cost estimate in terms of "overnight capital cost," which is a commonly used approach in the construction industry. The following costs are included in the overnight capital costs:

- the engineering, procurement, and construction costs for the ESBWR proposed for the NAPS site
- the owner's costs, including site work and preparation, cooling water intake structures and cooling towers, import duties on components, insurance, spare parts, transmission interconnection, development costs, project management costs, owner's engineering, state and local permitting, legal fees, and staffing-related training
- contingency costs
- Interest and cost escalation during the construction period is excluded from the overnight capital cost.

Dominion began with the Massachusetts Institute of Technology (MIT) 2003 study entitled *The Future of Nuclear Power* (MIT 2003), which gave $2000/kW(e) (in 2002 dollars) as a base-case estimate for the overnight capital cost of new nuclear units. Construction costs of $1800 to $2000 per kW(e) reported for two completed Advanced Boiling Water Reactors (ABWRs) at the Kashiwazaki-Kariwa Nuclear (KKN) Power Station in Japan were the basis for the MIT estimate. The DOE's Energy Information Agency (EIA) examined nuclear power plant costs published as part of *Annual Energy Outlook 2004* (DOE/EIA 2004). The EIA based its estimate on two Generation III light-water reactors in operation and another four reactors under construction in Asia. It started with the $2083 per kW(e) realized cost (inclusive of all contingencies) for the two completed reactors, and then projected that the realized cost, inclusive of contingencies, for the sixth unit, when completed, would be $1928 per kW(e). Dominion also examined an analysis jointly published by Organization for Economic Co-operation and Development (OECD) and the International Energy Agency (IEA), which provided an update on *Projected Costs of Generating Electricity, 2005 Update* (OECD/IEA 2005). The OECD/IEA reported that out of a reference set of 13 plants, the overnight construction costs for 11 of the plants generally ranged between $1000 to $2000 per kW(e). The overnight costs of the other two plants were slightly higher, with one plant at $2100 per kW(e) and another at $2500 per kW(e).

Finally, Dominion reviewed a report published by The Keystone Center entitled *Nuclear Power Joint Fact-Finding* (The Keystone Center 2007), which concluded overnight construction costs range between $3600 and $4200 per kW(e), based upon alternative discount rates and construction times. For comparison, Dominion quoted an early 2007 presentation by the Chief Financial Officer of FPL Group (Dewhurst 2007), who estimated a total overnight cost of $2400 to $3500 per kW(e) to which they added inflation and interest during the construction period for final construction costs (including financing cost) of between $4000 to $5500 per kW(e). Dominion also provided data in another 2007 presentation that suggested a capital cost in the $3200 to $4000 range per kW(e) (2007 dollars) in light of an escalating plant cost index (Dominion 2007).

Based on the results from the studies described above, Dominion chose an overnight construction cost of approximately $3000 per kW(e) (in 2007 dollars) for a new nuclear unit as a reasonable estimate for the purpose of demonstrating its financial qualifications, and added a conservative contingency factor of 30 percent, leading to an overnight cost of $3000 to $4000 per kW(e). This translates into a total capital expenditure value (including allowance for funds used during construction) of $5600 to $8600 per installed MW(e) (Dominion 2008c).

Operation Costs

Operation costs are frequently expressed as levelized cost of electricity, which is the price per kWh of producing electricity, including the cost needed to cover operating costs and annualized capital costs. Overnight capital costs account for a third of the levelized cost, and interest costs on the overnight costs account for another 25 percent (University of Chicago 2004). Levelized cost estimates range from $36 to $83 per MWh (3.6 to 8.3 cents per kWh). Dominion reviewed and adopted the conclusions of a DOE study in which the annual operating and maintenance costs of a 1340 MW(e) ESBWR plant were estimated to be $74,178,482 (i.e., $6.83 per MWh in their COL ER (DOE 2004). A number of factors can affect the range, such as the choice of discount rate, construction duration, plant life span, capacity factor, tax rates, and premium for uncertainty. Estimates include decommissioning, but 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.

Fuel Costs

Dominion calculated nuclear fuel cost and decommissioning cost separately using information from a study published jointly by the OECD and the IEA (OECD/IEA 2005). In the report, OECD/IEA estimated the average fuel cost for a nuclear generating plant to be $4.64 per MWh for a 5-percent discount rate.

Dominion's estimate of decommissioning cost is discussed below in the Decommissioning subsection.

Decommissioning

The NRC has requirements for licensees at 10 CFR 50.75 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 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, they account for 0.1 to 0.2 cents per kWh, which is no more than 5 percent of the cost of the electricity produced (WNA 2008). Dominion's decommissioning cost estimate is $518 million.

10.6.2.2 External Costs

External costs are social and/or environmental effects caused by the proposed construction of and operation of a new reactor at the NAPS site. This SEIS includes the NRC staff's analysis that considers and weighs the environmental impacts of constructing and operating a new nuclear unit at the NAPS 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

Although available information does not exist to assign monetary values to the impacts of construction and operation of NAPS Unit 3, 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. 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 nuclear units at the NAPS site. A summary of project internal and external costs is shown in Table 10-4.

10.6.3 Benefit-Cost Summary

As described in Section 8.4, there is increasing base-load demand and decreasing base-load supply in the region of interest. Without additional base-load generating capacity, Dominion's electricity network will fail to maintain an adequate power reserve margin and meet its public service obligations to provide adequate power, and will jeopardize Dominion's commitment to provide power to other electric service providers within the region. The proposed Unit 3 will help meet the increasing base-load demand in the region by supplying an average annual electrical-energy generation of about 12,000,000 MWh.

As described in this section, the proposed Unit 3 would have important strategic implications in terms of lessening the dependence of the United States on foreign energy supplies, and the potential interruption of these supplies, as well as vulnerability to volatile price changes or hostile political whims. While the additional direct and indirect creation of jobs would place some temporary burdens on local services and infrastructure, the additional annual taxes and revenue generated by the new workers would contribute to the local economy and stimulate future growth.

Table 10-4. Internal and External Costs of Proposed Unit 3 (Adapted from Dominion COL ER) (Dominion 2007)

Category of Cost	Description of Cost
Internal Costs[(a)]	
Construction (overnight cost)	$4.5 billion to $6.0 billion ($3000 to $4000 per installed kW(e))
Operation	$82 million per year ($6.83 per MWh for operations and maintenance, based on 12 million MWh), $55.7 million per year ($4.64 per MWh) for fuel
Decommissioning (NRC minimum)	$518 million (approximately $1-$2 per MWh)
External Costs	
Land and land use	SMALL. Unit 3 occupies approximately 128 acres (52 ha) of the approximately 1043 acres (422 ha) existing NAPS site.
Hydrological and water use	SMALL for most years; MODERATE during drought years. There are some costs associated with providing water for various needs during construction and operation. Cooling water is taken from Lake Anna. Relatively small levels of hazardous and/or radioactive effluents introduced into Lake Anna. Thermal plume resulting from cooling water blowdown discharged to Lake Anna. The effect of consumption of cooling water is relatively small.
Terrestrial and aquatic species	SMALL. Some cost to wildlife due to mortality during construction operations is anticipated. However, these costs do not affect long term wildlife populations. Wildlife mortality, including aquatic biota, during operations is expected to be minimal.
Radioactive effluents and emissions	SMALL. Radioactive waste is generated. The plant produces radioactive air emissions. Relatively small levels of radioactive effluents are introduced into Lake Anna.

Table 10-4. (contd)

Hazardous and radioactive waste	SMALL. Storage, treatment, and disposal of high-level radioactive spent nuclear fuel. Commitment of underground geological resources for disposal of radioactive spent fuel.
Air emissions	SMALL. Air emissions from diesel generators, auxiliary boilers and equipment, and vehicles that have a small impact on workers and local residents. Cooling tower drift that deposits some salt on the surrounding vicinity, but the level is unlikely to result in any measurable impact on plants and vegetation. Cooling tower atmospheric plume discharge abated with design.
Materials, energy, and uranium	SMALL. Irreversible and irretrievable commitments of materials and energy, including depletion of uranium.
Socioeconomics	SMALL. Construction of Unit 3 may pose additional costs to public and social services in the area. However, these costs are believed to be more than offset by increased tax revenues generated directly and indirectly by plant construction and operation. Impacts on recreation adverse and up to MODERATE in size during low-water periods.

(a) It is not clear whether these internal costs include all the state and local taxes paid by Dominion and its employees. It does not include taxes paid by businesses and individuals who are not part of the direct construction and operations activity. The additional cost for state and local taxes, whether external or internal to Dominion's cost estimate, is at most the total of tax benefits shown in Table 10-3.

On balance, the benefits of the proposed Unit 3 would significantly outweigh the economic, environmental, and social costs

10.7 Staff Conclusions and Recommendations

The staff's preliminary recommendation to the Commission related to the environmental aspects of the proposed action is that the COL be issued. The staff's evaluation of the safety and emergency preparedness aspects of the proposed action will be addressed in the staff's Safety Evaluation Report.

This preliminary recommendation is based on (1) Dominion's COL ER (Dominion 2007); (2) the staff's review conducted for the ESP application (Dominion Nuclear North Anna, LLC 2006), and documented in the ESP EIS (NRC 2006); 3) consultation with Federal, State, Tribal, and local agencies; (4) the staff's own independent review of potential new and significant information available since preparation and publication of the ESP EIS; (5) the staff's consideration of comments related to the environmental review that were received during the public scoping process; and (6) the assessments summarized in this SEIS, including the potential mitigation measures identified.

10.8 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 1500. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 1508, "CEQ – Regulations for Implementing NEPA."

73 FR 13589. "Dominion Nuclear Power, LLC; North Anna Power Station Combined License Application; Notice of Intent To Prepare an Environmental; Impact Statement and Conduct Scoping Process." Vol. 73, No. 50. March 13, 2008.

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Appendix A

Contributors to the Supplemental Environmental Impact Statement

Appendix A

Contributors to the Supplemental 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 Offices of New Reactors with assistance from other NRC organizations and Pacific Northwest National Laboratory.

Name	Affiliation	Function or Expertise
	Nuclear Regulatory Commission	
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Richard Raione	Office of New Reactors	Branch Chief
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Jay Lee	Office of New Reactors	Accidents
Richard Emch	Office of New Reactors	Health Physics, Cultural Resources
Norma Garcia-Santos	Office of Nuclear Material Safety and Safeguards	Transportation of Radioactive Materials
John Cook	Office of Nuclear Material Safety and Safeguards	Transportation of Radioactive Materials
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Mark McBride	Office of New Reactors	Water Use, Hydrology
Daniel Mussatti	Office of New Reactors	Socioeconomics, Environmental Justice, Cost Benefit
Michael Masnik	Office of New Reactors	Ecology
Stan Echols	Office of Nuclear Material Safety and Safeguards	Fuel Cycle
R. Brad Harvey	Office of New Reactors	Meteorology, Air Quality
Irene Yu	Office of New Reactors	Land Use, Alternative Energy Sources, Need For Power
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Donna Hostick		Socioeconomics, Environmental Justice, Cost Benefit
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Nancy Kohn		Aquatic Ecology
Paul Hendrickson		Land Use, Alternative Energy Sources
Greg Stoetzel		Health Physics, Fuel Cycle, Decommissioning, Non-Radiological Health
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(a) Pacific Northwest National Laboratory is operated for the U.S. Department of Energy by Battelle Memorial Institute.

Appendix B

Organizations Contacted

Appendix B

Organizations Contacted

During the course of the staff's independent review of potential environmental impacts from constructing and operating the proposed Unit 3 at the North Anna Power Station site, various Federal, State, regional, Tribal, and local agencies and organizations were contacted. Additional and more extensive contacts were made as part of the early site permit (ESP) application process. An entire listing of those contacts is available in Appendix B of the ESP environmental impact statement document. A listing of those agencies contacted as part of the proposed Unit 3 combined license application is provided below:

Lake Anna State Park, Spotsylvania, Virginia

Virginia Department of Conservation and Recreation, Richmond, Virginia

Virginia Department of Historic Resources, Richmond, Virginia

Chickahominy Indian Tribe, Providence Forge, Virginia

Chickahominy Indians – Eastern Division, Providence Forge, Virginia

Mattaponi Indian Tribe, West Point, Virginia

Monacan Indian Nation, Madison Heights, Virginia

Nansemond Indian Tribe, Suffolk, Virginia

Pamunkey Indian Tribe, King William, Virginia

Rappahannock Tribe, Indian Neck, Virginia

Upper Mattaponi Indian Tribe, Mechanicsville, Virginia

Eastern Shawnee Tribe of Oklahoma, Seneca, Missouri

Virginia Council on Indians, Richmond, Virginia

Advisory Council on Historic Preservation, Washington, D.C.

Tuscarora Nation, Lewiston, New York

Tuscarora Indian Tribe, Sanborn, New York

Shawnee Tribe, Miami, Oklahoma

Eastern Band of Cherokee Indians, Cherokee, North Carolina

Catawba Indian Nation, Rock Hill, South Carolina

Virginia Department of Health, Richmond, Virginia

Virginia Commonwealth University (Dr. Francine Marciano-Cabral), Richmond, Virginia

U.S. Fish and Wildlife Service Virginia Field Office, Gloucester, Virginia

United Keetoowah Band of Cherokee Indians in Oklahoma, Tahlequa, Oklahoma

U.S. Army Corps of Engineers, Potomac Virginia Field Office, Leonardtown, Maryland

Virginia Department of Environmental Quality, Richmond, Virginia

Virginia Department of Game and Inland Fisheries, Richmond, Virginia

Marine Resources Commission, Newport News, Virginia

U.S. Fish and Wildlife Service, Chesapeake Bay Field Office, Annapolis, Maryland

Lake Anna Boating and Recreation Association Louisa County, Virginia

Appendix C

Chronology of NRC Staff Environmental Review Correspondence Related to the Dominion Virginia Power and Old Dominion Electric Cooperative's Application for a Combined License for Unit 3 at the North Anna Power Station Site

Appendix C

Chronology of NRC Staff Environmental Review Correspondence Related to Dominion Virginia Power and Old Dominion Electric Cooperative's Application for a Combined License for Unit 3 at the North Anna Power Station Site

This appendix contains a chronological listing of correspondence between the U.S. Nuclear Regulatory Commission (NRC) and Dominion Virginia Power (Dominion) and other correspondence related to the NRC staff's environmental review, under 10 CFR Part 52, of Dominion's application for the construction and operation of one economic simplified boiling water reactor (ESBWR) at the North Anna Power Station (North Anna Unit 3). All documents, with the exception of those containing proprietary or sensitive information, have been placed in the Commission's Public Document Room, at One White Flint North, 11555 Rockville Pike (first floor), Rockville, Maryland. Such documents are also 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 publicly available records component of ADAMS. The ADAMS accession number for each document is included below:

October 11, 2007	Letter from Mr. Tony Banks, Dominion, to Dr. Ethel Eaton, Virginia Department of Historic Resources, regarding the Supplemental Archeological Survey for the Combined License Application at North Anna (Accession No. ML082910714)
November 7, 2007	Letter from Mr. Roger Kirchen, Virginia Department of Historic Resources, to Mr. Tony Banks, Dominion regarding the Supplemental Archaeological Survey (Accession No. ML082910712).
November 26, 2007	Letter from Mr. David A. Christian, Dominion Virginia Power, to NRC submitting the application for the construction and operation for an ESBWR at the North Anna Power Station (Accession No. ML073320913).
November 27, 2007	Letter from NRC to David A. Christian, Dominion Virginia Power regarding the issuance of the Early Site Permit for the North Anna ESP site (ESP-003) (Accession No. ML073180427).

November 27, 2007	North Anna Early Site Permit (ESP-003) (Accession No. ML073180440).
December 4, 2007	Notice of Issuance of Early Site Permit for Dominion Nuclear North Anna, LLC Located 40 Miles North-Northwest of the City of Richmond, Virginia (72 FR 68202).
December 6, 2007	Letter from NRC to Mr. Eugene S. Grecheck, Dominion Virginia Power, acknowledging the receipt and accessibility of the combined license application for North Anna Unit 3 (Accession No. ML073390655).
December 12, 2007	Federal Register Notice of the receipt and accessibility of the combined license application for North Anna Power Station, Unit 3 (72 FR 70619).
January 17, 2008	Letter from Mr. Eugene S. Grecheck, Dominion Virginia Power, to NRC supplementing the North Anna Unit 3 combined license application, with the early site permit COL Action Item 13.6-1 (Accession No. ML080230503).
January 28, 2008	Letter from NRC to Mr. Eugene S. Grecheck, Dominion Virginia Power, acknowledging the acceptance for docketing of the Dominion combined license application for North Anna Power Station, Unit 3 (Accession No. ML080240154).
February 4, 2008	Federal Register Notice of the acceptance for docketing the combined license application for North Anna Power Station, Unit 3 (73 FR 6528).
February 29, 2008	Federal Register Notice Regarding Opportunity to Petition to leave to Intervene for the North Anna, Unit 3, combine license application (Accession No. ML080390307).
March 7, 2008	Letter from NRC to Mr. Eugene S Grecheck, Dominion Virginia Power regarding the Notice of Intent to prepare an environmental impact statement and conduct scoping related to the combined license application for the North Anna Power Station (Accession No. ML080580288).
March 10, 2008	Federal Register Notice of hearing and opportunity to petition for leave to intervene on a combined license application for North Anna Power Station, Unit 3 (73 FR 12760).
March 13, 2008	Federal Register Notice of intent to prepare an environmental impact statement and conduct a scoping process for a combined license application for North Anna Power Station, Unit 3 (73 FR 13589).

April 2, 2008	Meeting Notice of Public Meeting to discuss the environmental scoping process for the North Anna Power Station, Unit 3 combined license application (Accession No. ML081290490).
April 4, 2008	Letter from NRC to Robert W. Duncan, Virginia Department of Game and Inland Fisheries, requesting information, comments, or concerns considered appropriate under the provisions of the Fish and Wildlife Coordination Act (FWCA) of 1934, as amended (Accession No. ML080780357).
April 4, 2008	Letter from NRC to Deanna Beacham, Virginia Council on Indians, regarding the North Anna Power Station Unit 3 combined license application review and request for comments under the scoping process (Accession No. ML080720297).
April 4, 2008	Letter from NRC to Chief Gene “PathFollower” Adkins, Eastern Chickahominy Tribe, regarding the North Anna Power Station Unit 3 combined license application review and request for comments under the scoping process (Accession No. ML080730087).
April 4, 2008	Letter from NRC to Mr. Don Klima, Advisory Council on Historic Preservation, regarding the North Anna Power Station Unit 3 combined license application review and request for comments under the scoping process (Accession No. ML080701146).
April 4, 2008	Letter from NRC to Mr. Roger Kirchen, Virginia Department of Historic Resources, regarding the North Anna Power Station Unit 3 combined license application review and request for comments under the scoping process (Accession No. ML080710129).
April 4, 2008	Letter from NRC to The Honorable Leo Henry, Chief, Tuscarora Nation, regarding the North Anna Power Station Unit 3 combined license application review and request for comments under the scoping process (Accession No. ML080920298).
April 4, 2008	Letter from NRC to Chief Kenneth Adams, Upper Mattaponi Tribe, regarding the North Anna Power Station Unit 3 combined license application review and request for comments under the scoping process (Accession No. ML080730099).
April 4, 2008	Letter from NRC to The Honorable Arnold Hewitt, Chief, Tuscarora Nation, regarding the North Anna Power Station Unit 3 combined license application review and request for comments under the scoping process (Accession No. ML080920275).

April 4, 2008	Letter from NRC to Dan Murphy, Deputy Field Supervisor (Acting), U.S. Fish and Wildlife Service regarding the North Anna Power Station Unit 3 combined license application review, list of protected species, and request for comments under scoping (Accession No. ML080710278).
April 8, 2008	Letter from NRC to Chief Barry W. Bass, Nansemond Tribe, regarding the North Anna Power Station Unit 3 combined license application review and request for comments under the scoping process (Accession No. ML080730151).
April 8, 2008	Letter from NRC to Chief William P. Miles, Pamunkey Tribal Government, regarding the North Anna Power Station Unit 3 combined license application review and request for comments under the scoping process (Accession No. ML080730135).
April 8, 2008	Letter from NRC to Chief Stephen R. Adkins, Chickahominy Tribe, regarding the North Anna Power Station Unit 3 combined license application review and request for comments under the scoping process (Accession No. ML080730095).
April 8, 2008	Letter from NRC to Chief Kenneth Branham, Monacan Indian Nation, Inc., regarding the North Anna Power Station Unit 3 combined license application review and request for comments under the scoping process (Accession No. ML080730159).
April 8, 2008	Letter from NRC to Chief G. Anne Richardson, Rappahannock Tribe, regarding the North Anna Power Station Unit 3 combined license application review and request for comments under the scoping process (Accession No. ML080730114).
April 8, 2008	Letter from NRC to Assistant Chief Carl “Lone Eagle” Custalow Mattaponi Tribe, regarding the North Anna Power Station Unit 3 combined license application review and request for comments under the scoping process (Accession No. ML080720568).
April 8, 2008	Letter from NRC to Mr. Neil Patterson, Jr., Tuscarora Nation, regarding the North Anna Power Station Unit 3 combined license application review and request for comments under the scoping process (Accession No. ML080920265).
April 9, 2008	Letter from NRC to Mr. Eugene S. Grecheck, Dominion Virginia Power, regarding the supplement to the Federal Register Notice of hearing and opportunity to petition for the North Anna Power Station, Unit 3 (Accession No. ML081000188).

April 12, 2008	Summary of public scoping meeting conducted related to the review of the North Anna Power Station, Unit 3 combined license application (Accession No. ML081220522).
April 18, 2008	Federal Register Supplement to Notice of Hearing and Opportunity to Petition for Leave to Intervene on a Combined License for North Anna Unit 3: Procedures for Access to Sensitive Unclassified Non-Safeguards Information and Safeguards Information for Contention Preparation (73 FR 21162).
May 1, 2008	Letter from Mr. Roger Kirchen, Virginia Department of Historic Resources, to NRC regarding scoping comments from Virginia Department of Historic Resources for the North Anna Unit 3 combined license application (Accession No. ML081290490).
May 9, 2008	Email from Amy Ewing, Virginia Department of Game and Inland Fisheries regarding scoping comments on the North Anna, Unit 3 combined license application (Accession No. ML081630141).
May 25, 2008	Correction to the Federal Register Notice of Hearing and Opportunity to Petition for Leave to Intervene on a Combined License for North Anna Unit 3 (Accession No. ML081440317).
June 2, 2008	Federal Register Notice to correct the Notice of Hearing and Opportunity to Petition for Leave to Intervene on a combined license application for North Anna Unit 3, which incorrectly identifies the applicants (73 FR 31516).
June 16, 2008	Memo regarding the summary of telecommunications with Dominion Virginia Power to discuss items associated with the environmental site audit for the combined License for the North Anna Power Station Unit 3 (Accession No. ML081630061).
June 18, 2008	Letter from NRC to Mr. Eugene S. Grecheck, Dominion Virginia Power, requesting additional information regarding the environmental review of the combined license application for North Anna Power Station, Unit 3 (Accession No. ML081630583).
July 14, 2008	Correction and supplement Federal Register Notice for Notice of Intent to prepare an environmental impact statement and conduct scoping process (Accession No. ML081920719).
July 17, 2008	Federal Register Notice of Correction and supplement to the Notice of Intent to prepare an environmental impact statement and conduct scoping process (73 FR 41132).

July 17, 2008	Letter from Mr. Eugene S. Grecheck, Dominion Virginia Power to NRC regarding Dominion responses to the environmental RAIs for the North Anna Power Station, Unit 3 combined license application (Accession No. ML082620236).
July 22, 2008	Emails from Tony Banks, Dominion Virginia Power to NRC, regarding the environmental report supplemental information needs responses (Accession No. ML081960674).
July 25, 2008	Letter from NRC to Ms. Glenna J. Wallace, Chief, Eastern Shawnee Tribe of Oklahoma, regarding the North Anna Power Station Unit 3 combined license application review and request for comments under the scoping process (Accession No. ML081890454).
July 25, 2008	Letter from NRC to Mr. Ron Sparkman, Chairman, Shawnee Tribe, regarding the North Anna Power Station Unit 3 combined license application review and request for comments under the scoping process (Accession No. ML081890449).
July 25, 2008	Letter from NRC to Mr. George Wickliffe, Chief, United Keetoowah Band of Cherokee Indians in Oklahoma, regarding the North Anna Power Station Unit 3 combined license application review and request for comments under the scoping process (Accession No. ML081890444).
July 25, 2008	Letter from NRC to Mr. James Bird, THPO, Eastern Band of Cherokee Indians, regarding the North Anna Power Station Unit 3 combined license application review and request for comments under the scoping process (Accession No. ML081890433).
July 25, 2008	Letter from NRC to Dr. Wenoah G. Haire, Jr., THPO, Catawba Indian Nation, regarding the North Anna Power Station Unit 3 combined license application review and request for comments under the scoping process (Accession No. ML081890451).
July 25, 2008	Letter from NRC to Ms. Karen Mayne, U.S. Fish and Wildlife Service, regarding the North Anna Power Station Unit 3 combined license application review and request for comments under the scoping process (Accession No. ML081900047).
August 14, 2008	Email from Ellie Irons, Virginia Department of Environmental Quality, to NRC regarding consultation and scoping comments for the North Anna Power Station Unit 3 combined license application review (Accession No. ML082321103).

September 4, 2008	Memorandum to Richard Raione, NRC, regarding the scoping summary report related to the environmental scoping process for the North Anna Power Station, Unit 3 combined license application (Accession No. ML082310340).
September 4, 2008	Scoping summary report related to the environmental scoping process for the North Anna Power Station, Unit 3 combined license application (Accession No. ML082480357).
September 19, 2008	Letter from Eugene S. Grecheck, Dominion Virginia Power to NRC, regarding the environmental report supplemental information (Accession No. ML082680222).
September 25, 2008	Email from Tony Banks Dominion Virginia Power to Alicia Williamson, NRC regarding VEDP Study with attached image (Accession No. ML082960804.
October 2, 2008	Email from Tony Banks Dominion Virginia Power to Alicia Williamson, NRC regarding the NAPS Unit 3 COL Application - NRC'S Environmental Review Supplemental Information Request on Louisa County Real Estate Taxes for NAPS (Accession No. ML082800274).
November 4, 2008	Letter from Mr. Eugene Grecheck, Dominion, to Ms. Kathleen Kilpatrick, Virginia Department of Historic Resources regarding the Dominion Combined License Project North Anna Power Station Project Update and Archeological Survey 2008 (Accession No. ML083220171.)
November 26, 2008	Memorandum from Ms. Alicia Williamson, NRC, to Mr. Gregory Hatchett, NRC, regarding the Summary of the Environmental Site Audit Related to the Review of the Combined License Application for North Anna Power Station, Unit 3 (Accession No. ML082970800.)

Appendix D

Scoping Meeting Comments and Responses

Appendix D

Scoping Meeting Comments and Responses

On March 13, 2008, in accordance with Title 10 of the Code of Federal Regulations (CFR) Part 51.26, the U.S. Nuclear Regulatory Commission (NRC) initiated the scoping process by publishing a Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process in the *Federal Register* (73 FR 9604). The Notice of Intent notified the public of the staff's intent to prepare a supplemental environmental impact statement (SEIS) and conduct scoping for the proposed North Anna Unit 3 combined license (COL) application. Through the notice, the NRC also invited the applicants; Federal, Tribal, State, and local government agencies; local organizations; and individuals to participate in the scoping process by providing oral comments at the public meeting and/or submitting written suggestions and comments no later than May 16, 2008. On July 17, 2008, a Correction and Supplement to the previously published Notice of Intent was published in the *Federal Register* (73 FR 41132). The scoping period was reopened for 30 days, allowing for comments to be received no later than August 15, 2008.

NRC regulations related to the environmental review of COL applications are contained in 10 CFR Part 51 and 10 CFR 52, Subpart C. Pursuant to NRC regulations in 10 CFR 51.50(c)(1), a COL applicant referencing an early site permit (ESP) need not submit information or analyses regarding environmental issues that were resolved in the ESP final environmental impact statement (EIS), except to the extent the COL applicant has identified new and significant information regarding such issues. In addition, pursuant to 10 CFR 52.39, matters resolved in the ESP proceedings are considered to be resolved in any subsequent proceedings, absent identification of new and significant information. The NRC staff is preparing this supplemental EIS (SEIS) to NUREG-1811, the ESP EIS, is in support of the COL application for the proposed Unit 3 at the North Anna Power Station.

A public scoping meeting was held at the Louisa County High School Auditorium in Mineral, Virginia, on April 16, 2008. In addition, the NRC held an informal open house one hour prior to the public meeting. Approximately 250 members of the public attended the meeting. This session began with NRC staff members providing a brief overview of the COL process and the environmental review process. Following the NRC's prepared statements, the meeting was opened for public comments. Forty four scoping meeting attendees representing 46 individuals (one speaker provided comments for herself and two other people) provided oral comments that were recorded and transcribed by a certified court reporter. Fourteen individuals also submitted written statements at the meeting. The transcripts of the meeting can be found as an attachment to the meeting summary, which was issued on May 12, 2008. The meeting summary and transcripts are available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records component of NRC's document system, the Agencywide Document Access and Management System (ADAMS) under accession numbers ML081220488 (meeting summary) and ML081220353 (meeting transcript). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room) (note that the URL is case-sensitive).

At the conclusion of the scoping period, the NRC staff and its contractor reviewed the transcript of the scoping meeting and the written material received to identify specific comments and issues. All comments and suggestions received orally or in writing during the scoping period were considered by the staff and reviewed in terms of new and significant information as required by 10 CFR 51.92(e). Preparation of the SEIS took into account the relevant issues raised during the scoping process.

Each comment applicable to this environmental review is summarized in this appendix. This information, which was extracted from the *North Anna Combined License Scoping Summary Report*, is provided for convenience of those interested in the scoping comments applicable to this environmental review. The comments that are outside of the scope of the environmental review for the proposed Unit 3 site are not included here. More detail regarding the disposition of general or inapplicable comments can be found in the Scoping Summary Report. The ADAMS accession number for the Scoping Summary Report is ML082486357. To maintain consistency with the Scoping Summary Report, the comment source ID and comment number along with the name of the commenter used in that report is retained in this appendix.

Comments were consolidated and categorized according to topic. Comments with similar specific objectives were combined to capture the common essential issues raised in the source comments. Once comments were grouped according to subject area, the staff determined the appropriate response for the comment.

Table D-1 identifies the individuals who provided comments in alphabetical order, their affiliation, if given, the source of their comments, and the ADAMS accession number that can be used to locate the correspondence that contained the comment. Parenthetical numbers after each comment refer to the comment source ID and comment numbers along with the name of the commenter. In Table D-2, comment categories are listed alphabetically with the associated commenters, their affiliations, and the comment numbers.

Table D-1. Individuals Providing Comments During the Scoping Period

Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #	Comment Sources ID and Comment Number
Amidon, Eleanor	Charlottesville Center for Peace and Justice	Meeting Transcript (ML081220353)	0034-97
AuClair-Valdez, Miguel	Peoples Alliance for Clean Energy	Letter (ML081130725)	0026-1 through 0026-15
		E-mail (ML081510225)	008-1
		Meeting Transcript (ML081220353)	0034-156 through 0034-160
Ball, Kenneth	Virginia Tech	E-mail (ML081510213) E-mail (ML081130725) (dup) E-mail (ML081510217) (dup)	0020-1 through 0020-6
		Meeting Transcript (ML081220353)	0034-110 through 0034-115
Beament, Peter	Dominion (retired)	Meeting Transcript (ML081220353)	0034-108 through 0034-109
Black, Betty	Piedmont Group of the Sierra Club	Letter (ML081130725)	0023-1 through 0023-9
		Meeting Transcript (ML081220353)	0034-147 through 155
Brown, Eugene F.	Virginia Tech	E-mail (ML081130725) E-mail (ML081510213) (dup) E-mail (ML081510217) (dup)	0019-1 through 0019-4
		Meeting Transcript (ML081220353)	0034-116 through 0034-119
Bryan, James	Self	Meeting Transcript (ML081220353)	0034-69 through 0034-71

Table D-1. (contd)

Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #	Comment Sources ID and Comment Number
Burns, Mecca	Self	E-mail (ML081510229)	0009-1 through 0009-2
Cherry, Pratt	Nuclear Advocacy Network	Meeting Transcript (ML081220353)	0034-213 through 0034-214
Crawford, Barbara	Self	E-mail (ML081510232)	0031-1 through 0031-14
		Meeting Transcript (ML081220353)	0034-197 through 0034-207
Day, Donal		Meeting Transcript (ML081220353)	0034-127 through 0034-135
Day, Elena	Peoples Alliance for Clean Energy (PACE)	E-mail (ML081510218) E-mail (ML081130725) (dup)	0017-1 through 0017-13
		Meeting Transcript (ML081220353)	0034-136 through 0034-146
DuBois, Paul and Linda	Self	E-mail (ML081510220)	0006-1 through 0006-2
Ellis, Larry	Dominion (Retired)	Meeting Transcript (ML081220353)	0034-65 through 0034-68
Ewing, Amy	VDGIF	E-mail (ML081630141)	0032-1 through 0032-2
Farmer, John	Virginia Power (retired)	Meeting Transcript (ML081220353)	0034-106 through 0034-107
Fawls, Rebecca	North American Young Generation in Nuclear	Meeting Transcript (ML081220353)	0034-78 through 0034-83
Fisher, Allison	Public Citizen	Meeting Transcript (ML081220353)	0034-91 through 0034-96

Table D-1. (contd)

Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #	Comment Sources ID and Comment Number
Gibson, Bob	Louisa County	Meeting Transcript (ML081220353)	0034-22 through 0034-25
Goldsmith, Aviv	Self	E-mail (ML082261539)	0035-1 through 0035-49
Grecheck, Eugene	Dominion	Letter (ML081130725)	0013-1 through 0013-7
Gunter, Paul	Nuclear Policy Research Institute	Meeting Transcript (ML081220353)	0034-43 through 0034-46
Harper, Willy	Louisa County Board of Supervisors	Meeting Transcript (ML081220353)	0034-9
Harte, Vicky	Women in Nuclear Global	Meeting Transcript (ML081220353)	0034-218 through 0034-220
Hayo, Dennis	Self	E-mail (ML081510235)	0010-1 through 0010-3
Heino, George and Gerry	Self	Letter (ML081130725) Letter (ML081510240) (dup)	0012-1 through 0012-6
		Meeting Transcript (ML081220353)	0034-190 through 0034-196
Irons, Ellie	Virginia Department of Environmental Quality	Letter (ML082270674)	0037-1 through 0037-3
Jones, Dale	Lake Anna Boating and Recreation Association	Meeting Transcript (ML081220353)	0034-173 through 0034-179
Kirchen, Roger	Virginia Department of Historic Resources	Letter (ML0812904901) Letter (ML081510228)(dup)	0001-1 through 0001-2
Lintecum, Lee	Louisa County	Letter (ML081130725)	0015-1 through 0015-8

Table D-1. (contd)

Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #	Comment Sources ID and Comment Number
		Meeting Transcript (ML081220353)	0034-10 through 0034-14
Manzari, Jack	Louisa County Chamber of Commerce	Meeting Transcript (ML081220353)	0034-26 through 0034-30
Marshall, Burton	Dominion (retired)	Meeting Transcript (ML081220353)	0034-100 through 0034-105
Montague, Joe	Self	Meeting Transcript (ML081220353)	0034-221
Moore, Kenneth	Virginia Power (Retired, VP Fossil and Hydro Services)	Meeting Transcript (ML081220353)	0034-59 through 0034-64
Murphey, Bill	Louisa County, Lake Anna Civic Association	Letter (ML081130725)	0014-1 through 0014-11
		Meeting Transcript (ML081220353)	0034-223
Nguyen, Vanthi	Peoples Alliance for Clean Energy	Meeting Transcript (ML081220353)	0034-98 through 0034-99
O'Hanlon, Jim	Dominion	Meeting Transcript (ML081220353)	0034-47 through 0034-53
Pierson, Mark	Virginia Tech	E-mail (ML081510213) E-mail (ML081510217) (dup) E-mail (ML081510223) (dup)	0021-1 through 0021-7
		Meeting Transcript (ML081220353)	0034-120 through 0034-126

Table D-1. (contd)

Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #	Comment Sources ID and Comment Number
Remmers, Ken	Waterside Property Owners Association, Lake Anna Civic Association	Letter (ML081130725)	0016-1 through 0016-6
		E-mail (ML081510210)	0018-1
		E-mail (ML082261540)	0036-1 through 0036-4
		Meeting Transcript (ML081220353)	0034-31 through 0034-38
Richmond, Michelle	Clean and Safe Energy Coalition	Meeting Transcript (ML081220353)	0034-215 through 0034-217
Rigali, Tony	Virginia State Building Construction Trades Council	Meeting Transcript (ML081220353)	0034-18 through 0034-21
Romano, John	Self	E-mail (ML081510224)	0011-1 through 0011-4
Rosenthal, Jerry	Concerned Citizens of Louisa County	Meeting Transcript (ML081220353)	0034-31 through 0034-42
Ruth, Harry	Friends of Lake Anna (FOLA)	Letter (ML081440463)	0033-1 through 0033-88
Ruth, Harry	Friends of Lake Anna (FOLA)	E-mail (ML081580556)	0028-1 through 0028-74
Schaible, Dennis	Self	Meeting Transcript (ML081220353)	0034-222
Smith, Doug	Lake Anna Civic Association	Letter (ML081130725)	0027-1 through 0027-7
		Meeting Transcript (ML081220353)	0034-180 through 0034-189

Table D-1. (contd)

Commenter	Affiliation (if stated)	Comment Source and ADAMS Accession #	Comment Sources ID and Comment Number
Stiles, Lisa	International Youth Nuclear Congress	Meeting Transcript (ML081220353)	0034-161 through 0034-172
Stuart, Michael		Letter (ML081130725)	0025-1 through 0025-3
		Meeting Transcript (ML081220353)	0034-84 through 0034-85
Taylor, Kelly	Self	Meeting Transcript (ML081220353)	0034-72 through 0034-77
Tolbert, J.R.	Environment America	Meeting Transcript (ML081220353)	0034-208 through 0034-212
Tribble, Charles	Virginia Power (retired)	Meeting Transcript (ML081220353)	0034-54 through 0034-58
Watkins, John	Virginia Legislature	Meeting Transcript (ML081220353)	0034-1 through 0034-8
Wright, Jack	Louisa Co. Board of Supervisors	Meeting Transcript (ML081220353)	0034-15 through 0034-17
Zeller, Lou	Blue Ridge Environmental Defense League	Letter (ML081500318)	0024-1 through 0024-13
		Meeting Transcript (ML081220353)	0034-86 through 0034-90

Table D-2. Comment Categories Alphabetically with Associated Commenters and Comments

Comment Category	Commenter (Comment ID)
Accidents-Design Basis	AuClair-Valdez, Miguel (0026-4) Goldsmith, Aviv (0035-31) (0035-32)
Accidents-Severe	AuClair-Valdez, Miguel (0026-9) Bryan, James (0034-69) (0034-70) (0034-71) Goldsmith, Aviv (0035-34) (0035-35) (0035-36) (0035-39) Stiles, Lisa (0034-172)
Alternatives-Energy	AuClair-Valdez, Miguel (0026-1) Day, Donal (0034-134) (0034-135) Day, Elena (0017-2) (0017-2) Day, Elena (0034-146) Fisher, Allison (0034-94) (0034-95) Goldsmith, Aviv (0035-40) Nguyen, Vanthi (0034-99) Pierson, Mark (0021-2) (0021-2) (0021-2) (0021-3) (0021-3) (0021-3) Pierson, Mark (0034-121) (0034-122) Stiles, Lisa (0034-167) (0034-168) Tolbert, J.R. (0034-211) Zeller, Lou (0024-7)
Alternatives-Sites	Zeller, Lou (0024-2) (0024-4) (0024-5)
Alternatives-System Design	Goldsmith, Aviv (0035-15) (0035-16) (0035-41) Hayo, Dennis (0010-3) Heino, George and Gerry (0012-6) (0012-6) Heino, George and Gerry (0034-196) Jones, Dale (0034-178) Remmers, Ken (0016-2) (0016-3) Remmers, Ken (0034-32) (0034-35) Ruth, Harry (0028-2) (0028-4) (0028-13) (0028-27) (0028-35) Ruth, Harry (0033-17) (0033-28) (0033-29) (0033-31) (0033-32) (0033-33) (0033-86) Zeller, Lou (0024-12)
Benefit-Cost Balance	AuClair-Valdez, Miguel (0026-2) Fawls, Rebecca (0034-79) (0034-82) Fisher, Allison (0034-92) (0034-96) Goldsmith, Aviv (0035-4) Gunter, Paul (0034-43) Pierson, Mark (0021-5) (0021-5) (0021-5)

Table D-2. (contd)

Comment Category	Commenter (Comment ID)
Benefit-Cost Balance (contd)	Pierson, Mark (0034-124) Rosenthal, Jerry (0034-40) Stiles, Lisa (0034-171) Taylor, Kelly (0034-72) Tolbert, J.R. (0034-209) (0034-212)
Cumulative Impacts	AuClair-Valdez, Miguel (0026-11) Remmers, Ken (0034-33)
Decommissioning	Goldsmith, Aviv (0035-38)
Ecology-Aquatic	Black, Betty (0023-6) Black, Betty (0034-152) Crawford, Barbara (0031-11) Ewing, Amy (0032-2) Goldsmith, Aviv (0035-27) (0035-28) Heino, George and Gerry (0034-194) Ruth, Harry (0028-8) (0028-16) (0028-21) (0028-22) (0028-40) (0028-50) (0028-61) Ruth, Harry (0033-6) (0033-24) (0033-25) (0033-26) (0033-48) (0033-59) (0033-70) Smith, Doug (0034-185)
Ecology-Terrestrial	Ewing, Amy (0032-1) Goldsmith, Aviv (0035-13) (0035-18)
Environmental Justice	Zeller, Lou (0024-9) (0024-10)
Geology	Zeller, Lou (0034-89)
Health-Non-Radiological	Black, Betty (0023-4) (0023-5) Black, Betty (0034-150) (0034-151) Ruth, Harry (0028-15) (0028-17) (0028-18) (0028-20) (0028-39) (0028-44) (0028-49) (0028-52) (0028-59) (0028-65) (0028-66) (0028-67) (0028-68) (0028-69) (0028-71) (0028-72) (0028-74) Ruth, Harry (0033-7) (0033-8) (0033-21) (0033-22) (0033-23) (0033-42) (0033-47) (0033-52) (0033-58) (0033-61) (0033-68) (0033-74) (0033-75) (0033-76) (0033-77) (0033-80) (0033-81) (0033-83)
Health-Radiological	AuClair-Valdez, Miguel (0026-8) Day, Elena (0017-8) Day, Elena (0034-141) Goldsmith, Aviv (0035-6) (0035-30) Ruth, Harry (0033-27) Zeller, Lou (0034-87)
Historic and Cultural Resources	Kirchen, Roger (0001-1) (0001-2) (0001-2)

Table D-2. (contd)

Comment Category	Commenter (Comment ID)
Hydrology-Groundwater	Zeller, Lou (0034-88)
Hydrology-Surface Water	AuClair-Valdez, Miguel (0008-1) AuClair-Valdez, Miguel (0026-14) (0026-15) (0034-157) AuClair-Valdez, Miguel (0034-158) (0034-159) Black, Betty (0023-3) (0023-7) Black, Betty (0034-149) (0034-153) Burns, Mecca (0009-1) Crawford, Barbara (0031-3) (0031-4) (0031-5) (0031-9) Crawford, Barbara (0034-201) (0034-203) Day, Elena (0017-9) Day, Elena (0034-142) Goldsmith, Aviv (0035-1) (0035-2) (0035-17) (0035-21) (0035-22) (0035-23) (0035-24) (0035-25) (0035-26) (0035-29) (0035-48) Heino, George and Gerry (0012-1) (0012-1) (0012-3) (0012-3) Heino, George and Gerry (0034-190) (0034-192) Jones, Dale (0034-174) (0034-176) (0034-177) Lintecum, Lee (0015-7) Marshall, Burton (0034-103) Murphey, Bill (0014-2) (0014-3) (0014-4) (0014-5) (0014-6) (0014-7) (0014-8) (0014-9) (0014-10) (0014-11) Murphey, Bill (0034-223) O'Hanlon, Jim (0034-51) Remmers, Ken (0016-1) (0016-4) (0016-5) (0016-6) Remmers, Ken (0018-1) Remmers, Ken (0034-31) (0034-34) (0034-36) (0034-37) (0034-38) Remmers, Ken (0036-1) (0036-2) (0036-3) (0036-4) (0028-5) (0028-6) (0028-9) Ruth, Harry (0028-11) (0028-14) (0028-23) (0028-24) (0028-26) (0028-42) (0028-45) (0028-54) (0028-55) (0028-60) (0028-62) (0028-63) (0028-64) (0028-70) (0028-73) Ruth, Harry (0033-2) (0033-3) (0033-9) (0033-11) (0033-12) (0033-13) (0033-14) (0033-15) (0033-16) (0033-19) (0033-20) (0033-34) (0033-43) (0033-50) (0033-54) (0033-63) (0033-64) (0033-69) (0033-71) (0033-72) (0033-73) (0033-78) (0033-79) (0033-82) (0033-84) (0033-85) Schaible, Dennis (0034-222) Smith, Doug (0027-2) (0027-3) (0027-4) (0027-5) (0027-6) (0027-7) Smith, Doug (0034-182) (0034-183) (0034-184) (0034-186) (0034-188) (0034-189) Stiles, Lisa (0034-166) Taylor, Kelly (0034-74) Watkins, John (0034-7)

Table D-2. (contd)

Comment Category	Commenter (Comment ID)
Hydrology-Surface Water (contd)	Zeller, Lou (0024-11)
Meteorology and Air Quality	Goldsmith, Aviv (0035-11) (0035-12) (0035-45) (0035-47) Ruth, Harry (0028-33) Ruth, Harry (0033-41)
Need for Power	Beament, Peter (0034-109) Brown, Eugene F. (0019-1) Brown, Eugene F. (0034-116) Ellis, Larry (0034-66) Farmer, John (0034-106) Fawls, Rebecca (0034-80) Grecheck, Eugene (0013-1) (0013-2) Manzari, Jack (0034-27) Marshall, Burton (0034-101) Moore, Kenneth (0034-60) Pierson, Mark (0021-4) Pierson, Mark (0034-123) Stiles, Lisa (0034-163) Stuart, Michael (0025-1) (0025-2) Stuart, Michael (0034-84) Tribble, Charles (0034-56) Watkins, John (0034-2) (0034-5) Wright, Jack (0034-15)
Opposition-Licensing Action	AuClair-Valdez, Miguel (0034-160) Black, Betty (0023-1) (0023-9) Black, Betty (0034-147) (0034-155) Day, Donal (0034-127) Day, Elena (0017-10)
Opposition-Licensing Process	Day, Elena (0017-1) (0017-13)
Opposition-Nuclear Power	AuClair-Valdez, Miguel (0034-156) Day, Donal (0034-132) (0034-133) Nguyen, Vanthi (0034-98)
Out of Scope-Emergency Preparedness	AuClair-Valdez, Miguel (0026-12) (0026-13) Crawford, Barbara (0031-13) Crawford, Barbara (0034-199) (0034-200) (0034-207) Goldsmith, Aviv (0035-14) Gunter, Paul (0034-45) Rosenthal, Jerry (0034-42) Ruth, Harry (0033-39)

Table D-2. (contd)

Comment Category	Commenter (Comment ID)
Out of Scope-Miscellaneous	Crawford, Barbara (0031-14) Day, Donal (0034-131) Goldsmith, Aviv (0035-43) Rosenthal, Jerry (0034-39) Ruth, Harry (0033-10) Tolbert, J.R. (0034-208)
Out of Scope-Miscellaneous (contd)	Rigali, Tony (0034-19) (0034-20) Ruth, Harry (0028-12) (0028-28) (0028-29) (0028-30) (0028-31) (0028-34) (0028-36) (0028-37) (0028-38) (0028-41) (0028-43) (0028-46) (0028-47) (0028-48) (0028-51) (0028-53) (0028-56) (0028-57) (0028-58) Ruth, Harry (0033-4) (0033-5) (0033-36) (0033-37) (0033-38) (0033-44) (0033-45) (0033-46) (0033-49) (0033-51) (0033-53) (0033-55) (0033-56) (0033-57) (0033-60) (0033-62) (0033-65) (0033-66) (0033-67) Smith, Doug (0034-181) Tribble, Charles (0034-55)
Out of Scope-NRC Oversight	Black, Betty (0023-8) (0034-154) Crawford, Barbara (0034-202) Day, Donal (0034-128) (0034-130) Rosenthal, Jerry (0034-41) Ruth, Harry (0033-87)
Out of Scope-Safety	Crawford, Barbara (0031-2) Watkins, John (0034-3) Wright, Jack (0034-16) Zeller, Lou (0034-86)
Out of Scope-Security and terrorism	AuClair-Valdez, Miguel (0026-10) Crawford, Barbara (0034-198) Day, Donal (0034-129) Day, Elena (0017-7) Day, Elena (0034-140) Goldsmith, Aviv (0035-7) (0035-33) Gunter, Paul (0034-46) Ruth, Harry (0033-30)
Process-ESP-COL	Ruth, Harry (0028-7) (0028-25) Ruth, Harry (0033-35) (0033-88) Zeller, Lou (0024-3) (0024-8)
Process-NEPA	Goldsmith, Aviv (0035-8) (0035-9) (0035-10) Irons, Ellie (0037-1) (0037-2) (0037-3) Ruth, Harry (0028-19) Ruth, Harry (0033-18) (0024-1) (0024-6) (0024-13) Zeller, Lou (0024-1) (0024-6) (0024-13) (0034-90)

Table D-2. (contd)

Comment Category	Commenter (Comment ID)
Site Layout and Design	Goldsmith, Aviv (0035-42) Tolbert, J.R. (0034-210)
Socioeconomics	Crawford, Barbara (0031-6) (0031-7) (0031-8) (0031-10) (0031-12) Crawford, Barbara (0034-204) (0034-205) (0034-206) Fawls, Rebecca (0034-78) (0034-81) Gibson, Bob (0034-22) (0034-23) (0034-24) Goldsmith, Aviv (0035-3) (0035-5) (0035-19) (0035-20) (0035-44) (0035-44) (0035-46) (0035-49) Hayo, Dennis (0010-2) Heino, George and Gerry (0012-2) (0012-4) (0012-4) (0012-5) (0012-5) Heino, George and Gerry (0034-191) (0034-193) (0034-195) Jones, Dale (0034-173) (0034-175) (0034-179) Lintecum, Lee (0015-2) (0015-3) (0015-4) (0015-5) (0015-6) Lintecum, Lee (0034-11) (0034-12) (0034-13) Manzari, Jack (0034-29)
Support-Licensing Action	Ball, Kenneth (0020-5) (0020-5) Ball, Kenneth (0034-114) Beament, Peter (0034-108) Brown, Eugene F. (0019-4) Brown, Eugene F. (0034-119) Cherry, Pratt (0034-214) Ellis, Larry (0034-65) (0034-68) Farmer, John (0034-107) Gibson, Bob (0034-25) Harper, Willy (0034-9) Harte, Vicky (0034-218) Hayo, Dennis (0010-1) Lintecum, Lee (0015-1) (0015-8) Lintecum, Lee (0034-10) (0034-14) Manzari, Jack (0034-26) (0034-30) Marshall, Burton (0034-100) (0034-105) Montague, Joe (0034-221) Moore, Kenneth (0034-59) (0034-62) (0034-64) Murphey, Bill (0014-1) O'Hanlon, Jim (0034-47) (0034-50) (0034-53) Pierson, Mark (0021-1) (0021-7) Pierson, Mark (0034-120) (0034-126) Rigali, Tony (0034-18) (0034-21) Ruth, Harry (0028-1) (0028-3) Ruth, Harry (0033-1) Smith, Doug (0027-1) Smith, Doug (0034-180) (0034-187)

Table D-2. (contd)

Comment Category	Commenter (Comment ID)
Support-Licensing Action (contd)	Stiles, Lisa (0034-161) Stuart, Michael (0025-3) Stuart, Michael (0034-85) Taylor, Kelly (0034-75) Tribble, Charles (0034-54) Watkins, John (0034-8) Wright, Jack (0034-17)
Support-Licensing Process	DuBois, Paul and Linda (0006-2) Grecheck, Eugene (0013-5) (0013-6) (0013-7) Moore, Kenneth (0034-61) O'Hanlon, Jim (0034-52) Richmond, Michelle (0034-217) Stiles, Lisa (0034-162) (0034-164)
Support-Nuclear Power	Ball, Kenneth (0020-1) (0020-2) (0020-3) (0020-4) (0020-6) Ball, Kenneth (0034-110) (0034-111) (0034-112) (0034-113) (0034-115) Brown, Eugene F. (0019-2) (0019-3) Brown, Eugene F. (0034-117) (0034-118) Cherry, Pratt (0034-213) DuBois, Paul and Linda (0006-1) Ellis, Larry (0034-67) Fawls, Rebecca (0034-83) Grecheck, Eugene (0013-3) (0013-4) Harte, Vicky (0034-219) (0034-220) Moore, Kenneth (0034-63) O'Hanlon, Jim (0034-48) Pierson, Mark (0021-6) Pierson, Mark (0034-125) Richmond, Michelle (0034-215) Romano, John (0011-4) Stiles, Lisa (0034-165) (0034-169) (0034-170) Taylor, Kelly (0034-73) (0034-76) Tribble, Charles (0034-57) (0034-58) Watkins, John (0034-1) (0034-4) (0034-6)
Support-Plant	Manzari, Jack (0034-28) Marshall, Burton (0034-102) (0034-104) O'Hanlon, Jim (0034-49) Richmond, Michelle (0034-216) Romano, John (0011-1) (0011-2) (0011-3) Taylor, Kelly (0034-77)

Table D-2. (contd)

Comment Category	Commenter (Comment ID)
Transportation	AuClair-Valdez, Miguel (0026-6) Day, Elena (0017-6) Day, Elena (0034-139)
Uranium Fuel Cycle	Amidon, Eleanor (0034-97) AuClair-Valdez, Miguel (0026-3) (0026-5) (0026-7) Black, Betty (0023-2) Black, Betty (0034-148) Burns, Mecca (0009-2) Crawford, Barbara (0031-1) Crawford, Barbara (0034-197) Day, Elena (0017-4) (0017-5) (0017-11) (0017-12) (0017-13) Day, Elena (0034-136) (0034-137) (0034-138) (0034-143) (0034-144) (0034-145) Fisher, Allison (0034-91) (0034-93) Goldsmith, Aviv (0035-37) Gunter, Paul (0034-44) Ruth, Harry (0028-32) Ruth, Harry (0033-40)

North Anna Combined License
Public Scoping
Comments and Responses

The comments and suggestions received as part of the scoping process are summarized and discussed below. Parenthetical numbers after each comment refer to the Comment Identification number (ID) number (document ID number-comment number) and the commenter name. Comments are grouped by category.

1. Comments Concerning the ESP-COL Process

Comment: Although the ESP was approved by the Commission in November, its order contained the seed of poor judgment. The Commission may have perfected the record but it failed to perfect the permit when it sidestepped the issues raised by Judge Karlin in his dissent. In fact, the Commission admitted to the self same errors of judgment in its Memorandum and Order approving the ESP. (**0024-3** (Zeller, Lou))

Response: *This issue is related to the Atomic Safety and Licensing Board and NRC Commission approval of the North Anna ESP application for up to two additional units to be constructed at the North Anna Power Station site. The NRC staff addressed the issues raised by Judge Karlin in supplemental information that was presented to the Commission. The NRC issued Dominion the North Anna ESP (ESP-003) in November 2007. This comment provides no new and significant information and will not be evaluated further.*

Comment: Both VDEQ and DGIF, in conjunction with Dominion Resources are currently conducting an In-stream Flow Incremental Methodology (IFIM) study on Lake Anna and the North Anna River and Pamunkey Rivers downstream to determine the effects of the reduced water flow on recreation, wildlife, aquatic life and fish as part of the conditional certification for the 3rd reactor Early Site Permit (ESP). This IFIM study must also address all of the comments made by the VA Dept of Conservation and Recreation (DCR). This IFIM study should be completed before any Draft Environmental Impact Statement for the COL is issued by the NRC so all the results of the IFIM study can be reviewed and commented on by the public. Otherwise the results from this important study will cause much re-work later by the NRC, Virginia and the public and waste much time. Currently there is no public participation in the study plan or results. (**0028-7** (Ruth, Harry))

Comment: We also request public participation in each step/review of the In-stream Flow Incremental Methodology (IFIM) study for Lake Anna and the North Anna River being conducted as part of Virginia and the U.S. North Anna Early Site Permit (ESP) approval process. (**0033-88** (Ruth, Harry))

Response: *Under conditions of the North Anna ESP permit (ESP-003), Dominion is required to conduct an In-stream Flow Incremental Methodology (IFIM) study that is designed and monitored in cooperation and consultation with the Virginia Department of Game and Inland Fisheries (VDGIF) and the Virginia Department of Environmental Quality (VDEQ) to address potential impacts of the proposed units on the fishes and other aquatic resources of Lake Anna and downstream waters. This study must be completed prior to issuance of a combined operating license for any new units at NAPS. Dominion agreed to consult both with VDGIF and VDEQ regarding surface water management, release, and in-stream flow conditions prescribed by VDGIF and VDEQ as implemented through appropriate state or Federal permits or licenses. Public involvement in the study plan and review of the results is the responsibility of the VDGIF and VDEQ, not the NRC. NRC staff, however, will monitor the progress related to completion of the study and results obtained. Any information that is available regarding the IFIM study at the time the SEIS is prepared will be included in the SEIS as part of Chapter 2.7.*

Comment: As part of the earlier ESP process, Dominion continued to make revisions to issues as they were identified and analyzed. Hence our review of the DEIS became a moving target, without the NRC extending the time for the public to respond. It is requested that each time that Dominion makes a change to a previously submitted document that impacts the DEIS, that the NRC automatically extends the public comment period and the COL schedule as well to give the public sufficient time to review the changes and make comments. Hardcopies of the original documents and changes should also be supplied to the persons who sign up to request them, as trying to keep up with thousands of pages and changes on a home computer and ink-jet printer is next to impossible. The home printing cost for thousands of pages is prohibitive for most of the public and prevents them from participating in the public process. Also without having a hard copy to find all the references that are made throughout the documents and requests for information (ROI's) it also a very impossible task to participate in the public process. (**0028-25, 0033-35** (Ruth, Harry))

Response: *These comments express general opposition to the NRC licensing process and provide no specific information related to the environmental review. Up-to-date information regarding the North Anna Power Station, Unit 3 COL application can be found at www.nrc.gov. These comments also fall outside the scope of 10 CFR 51 and 52, which describe the NRC's environmental review process for a COL. Therefore, the comments will not be evaluated further.*

2. Comments Concerning Process - NEPA

Comment: I guess more important and also relevant in this matter is the Fifth Amendment to the Constitution of the United States, which says that no person shall be deprived of life, liberty, or property without due process of law. I would submit to you that an accident caused by a foreseeable event cannot be construed as due process. (**0034-90** (Zeller, Lou))

Response: *The evaluation of postulated accidents and their impact on the environment and the public will be evaluated with in Chapter 5.10 of the SEIS.*

Comment: Public meetings should be held at other locations and times around the region so that interested parties are given the opportunity to be educated and voice their input in a public forum. This would facilitate public participation (which is one of the goals of the NEPA process). (**0035-9** (Goldsmith, Aviv))

Response: *Although NEPA does require federal agencies to initiate a scoping process, the decision of how to implement scoping is left to the agencies' discretion. It is the policy of the NRC to involve the public in the Commission's decision-making process and therefore it elect's to conduct open public scoping meetings in association with its environmental review process. Meetings are generally held in a location to reach the largest population that will experience the most direct environmental impact as a result of the proposed action. In the case of NAPS Unit 3, this population is located in the area of Louisa County, Virginia. The scoping period is open for 60 days and, during this time, the public and other agencies are welcome to also submit written comments. The NRC will hold additional public meetings after the draft SEIS is published. Separate meetings will be held by the NRC in association with the safety review process.*

Comment: It seems that the ESL [ESP] EIS, was not performed by an unbiased interdisciplinary team as is required by NEPA. For example, Page 1-6 states that "Dominion did not or was unable to provide information and analysis for certain issues sufficient to allow the NRC staff to complete its independent analysis." Thus the issues "are not resolved." The NRC should commission independent sources to develop the required data at this time. (**0035-10** (Goldsmith, Aviv))

Response: *All identified issues not resolved during the ESP process will be evaluated as part of the evaluation of the COL application. Those specific issues that were not resolved are listed in Appendix J of the ESP final environmental impact statement (NUREG-1811, Vol. 1) that was issued by the NRC in December 2006.*

Comment: The following discussion pertains to the NRC's decision to prepare a supplemental EIS in support of the COL instead of an EIS. Inasmuch as a COL is a major federal action, a supplemental EIS would not provide the rigorous environmental analysis necessary to guide decision makers on a COL application. The NRC has repeatedly stated that "to construct and operate a nuclear power plant, an ESP holder must obtain a CP and OL, or a COL, which are separate major federal actions which require their own environmental review in accordance with 10 CFR Part 51" (references: ESP Final EIS, page 1-2, ESP Supplemental EIS, Executive Summary, page xviii, and ESP, DEIS, Executive Summary page xxi). The recent decision (published on July 17, 2008) to prepare a supplement to the Final ESP EIS to support the COL instead of another EIS for the COL is also inconsistent with the NRC's earlier position as reflected in Mr. William D. Beckner's July 6, 2005 letter responding to Mr. Adrian Heymer at the Nuclear Energy Institute. In that letter, Mr. Beckner stated "We believe that a portion of the underlying basis for industry's view is not consistent with the NRC's regulations and the applicable case law interpreting the National Environmental Policy Act of 1969, as amended (NEPA). In particular, inasmuch as an ESP and a COL are major federal actions, an environmental assessment is not a sufficient environmental inquiry on which to base an action on an ESP or COL application. Accordingly, pursuant to 10 CFR 51.20, both actions require the preparation of an EIS."

While we understand that the NRC's current rules implementing NEPA (10 CFR 51.92) allow the NRC to prepare a supplement to the ESP EIS to support the COL, over the past five years (since 2003 until March 13, 2008) the NRC has consistently maintained that an EIS would be prepared to support the COL. It was with this understanding that the Commonwealth reviewed and commented on the Draft EIS (March 3, 2005) and Supplemental EIS (September 8, 2006) for the ESP. During the ESP review process several environmental impact considerations were deferred to the COL stage of the licensing process. Following the 2006 amendments to the NRC rules, the Final ESP EIS which was published in December 2007 continued to assert that the ESP and COL are separate major federal actions requiring their own environmental review. Therefore, the Commonwealth had no reason to anticipate the NRC's recent change in its position on the type of NEPA document which would be prepared for the COL process. (**0037-1** (Irons, Ellie))

Response: *As outlined in a Federal Register Notice of August 28, 2007 (72FRN 49429), the NRC agrees an early site permit and a combined license are major Federal actions significantly affecting the quality of the human environment and both actions would require the preparation of an EIS. However, 10 CFR part 52 does provide finality for previously resolved issues. Thus, the environmental review conducted by the NRC at the combined license stage is informed by the EIS prepared at the ESP stage and information can be incorporated by reference in a combined license supplemental EIS. This supplemental EIS will focus on any identified new and significant information, resolution of significant environmental issues not addressed in the early site permit proceedings, and that all environmental terms and conditions included in the early site permit will be satisfied by the date of issuance of the combined license.*

Comment: <u>Environmental Review</u>
The following state and local Virginia agencies are likely to be included in the coordinated review of submitted environmental documents (note: starred (*) agencies administer one or more of the Enforceable Policies of the Virginia Coastal Resources Management Program.
Department of Environmental Quality:
Office of Environmental Impact Review
Tidewater Regional Office*
Water Division
Air Division*
Waste Division
Department of Game and Inland Fisheries*
Department of Conservation and Recreation:
Division of Chesapeake Bay Local Assistance*
Division of Soil and Water Conservation*
Division of Planning and Recreation Resources
Department of Health*
Marine Resources Commission*
Department of Historic Resources

Virginia Institute of Marine Science
Department of Mines, Minerals, and Energy
Department of Agriculture and Consumer Services
U.S. Nuclear Regulatory Commission
Department of Forestry
Department of Transportation
Hampton Roads Planning District Commission
Affected Locality(ies)

In order to ensure an effective coordinated review of the EIS and the consistency certification, we will require about 24 copies of each document (6 hard copies and 18 CDs) when it is published. The document should include one or more U.S. Geological Survey topographic maps as part of its information. We recommend, as well, that project details be adequately described and analyzed. While this Office does not participate in scoping efforts beyond the advice given herein, other agencies may independently provide scoping comments to you concerning the preparation of the NEPA document for the proposed project. (**0037-3** (Irons, Ellie))

Response: *An ample number of draft supplemental EIS documents will be made available for review by the state agencies that have been identified. Any comments from these agencies will be considered if they are submitted during the open scoping period.*

Comment: Pursuant to the CZMA, federal licensing or permit activities affecting Virginia's coastal resources or coastal uses must be consistent with the enforceable policies of the Virginia Coastal Resources Management Program (VCP) (also called the Virginia Coastal Zone Management Program) (see Federal Consistency Regulations, 15 CFR Part 930, sub-part D, Consistency for Activities Requiring a License or Permit). DEQ must be provided with a federal consistency certification which involves an analysis of the activities in light of the enforceable policies of the VCP (first enclosure), and a commitment to comply with the enforceable policies. In addition, we invite your attention to the advisory policies of the VCP (second enclosure).

Sections 930.57 and 930.58 of the Federal Consistency Regulations and Virginia's Federal Consistency Information Package available on DEQ's web site at http://www.deq.virginia.gov/eir/federal.html, give content requirements for a consistency certification. We recommend that the submission of the federal consistency certification follows the completion of the NEPA review process to facilitate the resolution of issues before embarking on the consistency review. We believe that this approach will prevent unnecessary delays in the consistency review process which could result from changes made during the NEPA review. (**0037-2** (Irons, Ellie))

Response: *This issue will be addressed in Chapter 2.2.1 of the COL SEIS. Dominion is required to provide a Coastal Zone Management Act certification to the Commonwealth of Virginia for proposed Unit 3 at the North Anna Power Station. Dominion has documented the need for preparing the consistency determination in Chapter 1 of the Environmental Report that was submitted with the application. The environmental report for the proposed Unit 3 is a publicly available record from the NRC Agencywide Documents Access and Management*

System (ADAMS). ADAMS is accessible at http://www.nrc.gov/reading-rm/adams.html. The ADAMS accession number for the North Anna Unit 3 ER is ML073321238.

3. Comments Concerning Site Layout and Design

Comment: I know that someone has stood up here and said that there don't have to be any changes to the transmission line, but listening to our introduction this evening, I heard that Dominion has said that we will have to change the transmission line. So that's something that needs to be considered. (**0034-210** (Tolbert, J.R.))

Response: *The environmental impacts associated with transmission lines from the proposed Unit 3 are considered new and significant and will be addressed in Chapter 3 of the SEIS.*

4. Comments Concerning Meteorology and Air Quality

Comment: Impact of additional fog and icing from wet cooling towers on local roadways and surrounding residential homes and communities. (**0028-33** (Ruth, Harry))

Comment: Impact of additional fog and icing from wet cooling towers on local roadways and surrounding residential homes and communities. (**0033-41** (Ruth, Harry))

Response: *Fog and icing from cooling towers was previously discussed in NUREG-1811, ESP EIS for the early site permit. The analysis for the North Anna Unit 3 SEIS will address only new and significant information to determine if the impact level has changed.*

Comment: The impacts to traffic from increased fog occurrence should be addressed. (**0035-12** (Goldsmith, Aviv))

Response: *Fog and icing from cooling towers was previously discussed in NUREG-1811, ESP EIS for the early site permit. The analysis for the North Anna Unit 3 SEIS will address only new and significant information to determine if the impact level has changed.*

Comment: The same limited three-year climatological data set that was used in the DEIS was used for the SDEIS (page 2-7 line 3). Is this the same data referred to in Page 5-14 line 22? This may be insufficient to accurately predict ground fog impacts from the project. Furthermore, this data sent is inconsistent with other reporting periods (see DEIS Section 5-58 line 38 e.g.) used elsewhere in the document. (**0035-11** (Goldsmith, Aviv))

Response: *This comment refers to information in the North Anna draft ESP EIS that was superseded by the North Anna final ESP EIS (NUREG-1811) published by NRC in December 2006. NUREG-1811 was revised to incorporate numerous public comments (see NUREG-1811, Appendix E). Dominion was issued an ESP permit (ESP-003) in November 2007 for two units at the North Anna Power Station site under the specifications contained in that permit. All environmental issues related to the ESP application from Dominion were identified, evaluated, and resolved or proposed mitigation actions were identified. The* *impacts related to ground fog impacts were discussed and resolved in Chapter 5 of NUREG-1811, ESP EIS.*

Comment: The cooling tower will shift much of the thermal load from Lake Anna to the atmosphere. Shouldn't mitigation be required to minimize heat island and climate change impacts? Such mitigation could include tree planting and similar regional measures. (**0035-47** (Goldsmith, Aviv))

Response: *This comment refers to information in the North Anna draft ESP EIS that was superseded by the North Anna final ESP EIS (NUREG-1811) published by NRC in December 2006. NUREG-1811 was revised to incorporate numerous public comments (see NUREG-1811, Appendix E). Dominion was issued an ESP permit (ESP-003) in November 2007 for two units at the North Anna Power Station site under the specifications contained in that permit. All environmental issues related to the ESP application from Dominion were identified, evaluated, and resolved or proposed mitigation actions were identified. The information related to atmospheric moisture and cooling towers was discussed and resolved in Chapter 2 of NUREG-1811, ESP EIS. Staff will evaluate new and significant information relating to cooling towers in Chapter 5 of the SEIS to determine whether the impact level has changed.*

Comment: Overall, the mitigations listed in Section 10 are insufficient. Items such as "consider" plume abatement measures are just one example. Plume abatement should be implemented. (**0035-45** (Goldsmith, Aviv))

Response: *This comment refers to information in the North Anna draft ESP EIS that was superseded by the North Anna final ESP EIS (NUREG-1811) published by NRC in December 2006. NUREG-1811 was revised to incorporate numerous public comments (see NUREG-1811, Appendix E). Dominion was issued an ESP permit (ESP-003) in November 2007 for two units at the North Anna Power Station site under the specifications contained in that permit. All environmental issues related to the ESP application from Dominion were identified, evaluated, and resolved or proposed mitigation actions were identified. The impacts related to plume abatement were discussed and resolved in Chapter 10.2 of NUREG-1811, ESP EIS.*

5. <u>Comments Concerning Geology</u>

Comment: Regarding seismicity, vibratory ground motion, the variance requested says, Unit 3 does not fall within the ESP and the site safety analysis report. The data show the top of competent rock under Unit 3, seismic category 1 structures is higher than assumed for the ESP. The Nuclear Regulatory Commission has responsibility in this matter under 10 CFR 51.105, also under appendix A to part 100, which describes the type of inquiry necessary for the Nuclear Regulatory Commission to determine site suitability with regard to geologic stability and seismicity. (**0034-89** (Zeller, Lou))

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, such a reactor or reactors can be constructed and operated without undue risk to the health and safety of the public. This comment provides no new and significant information and will not be evaluated further.*

6. Comments Concerning Hydrology - Surface Water

Comment: I am opposed to this partly because of concern for global warming and associated drought issues in the region. It has been shown that this site is not capable of sustaining any more reactors. (**0009-1** (Burns, Mecca))

Comment: A major problem for improvement of the conservation and use of lake water is that there are so many independent entities that have power over any change. LACA is appealing to all these entities to modify their positions so all of us can benefit from improved conservation and water use. (**0014-3** (Murphey, Bill))

Comment: We ask that Dominion Resources, Louisa County, Fluvanna County, and the James River Authority all cooperate to enlarge the James River-Zions Cross Road water pipe (to about 60 MGD) and extend the pipe through the town of Louisa to the North Anna Power Plant to permit the use of James River waster for make-up water for the third unit. (**0014-5** (Murphey, Bill))

Comment: We ask the NRC to actively work with the other entities to achieve improved water conservation and use. (**0014-8** (Murphey, Bill))

Comment: We ask specifically for NRC support to obtain third unit make-up water from the James River. (**0014-9** (Murphey, Bill))

Comment: The Lake Anna region has been designated a growth area in the County's Comprehensive Plan. In view of the annual low water level in Lake Anna and potential needs for water sources in the immediate future, Louisa County has recently begun a study to identify potential water supplies for our citizens. Lake Anna and its tributaries have been identified as potential water resources for this ever-growing population center of our County. **(0015-7** (Lintecum, Lee))

Comment: Lake Anna is the smallest body of water in the eastern United States that provides water for cooling a nuclear power plant. The two operating reactors are putting a tremendous strain on the water resources of central Virginia, particularly during times of draught. Additional reactors will threaten the water that Virginians use for drinking, agriculture, and recreation. They will put increasing pressure on the ecosystem of the York River Watershed. (**0023-7, 0034-153** (Black, Betty))

Comment: The addition of North Anna Unit 3 at North Anna will have a large negative impact on water supply during that timeframe and would, as such, be a major factor in the water control plan. In response to drought conditions in Virginia and in accordance with 9 VAC25-780, the Town of Louisa has entered into a long-term regional water planning process with a completion due date of November 2, 2011.

Unit 3 is to utilize a closed-cycle dry and wet tower cooling system which is expected to have an evaporation rate of 8707 gallons per minute and a minimum make-up flow rate 6 of 15,376 gpm in Maximum Water Conservation mode. Therefore, Unit 3 alone would have an annual consumptive use of over 8 billion gallons in water conservation mode. Thermoelectric power plants require huge amounts of water and the Surry and North Anna nuclear stations are the two top water users in Virginia. Together, they accounted for 44% of statewide surface water withdrawals; in 2001 the North Anna Power Station alone used 56% more surface water than all of Virginia's agricultural, commercial, manufacturing, mining and public water supply users combined. (**0024-11** (Zeller, Lou))

Comment: The NRC needs to stop passing the buck to the state of Virginia and ignoring the water crisis. The previous EIS gave this issue short shrift, stating that it's Virginia's problem and that our DEQ (Dept of Environmental Quality) can simply order Dominion to shut down one or more reactors in the event of low water! Does it make sense to build yet another reactor? What are the chances that all 3 reactors will even be able to operate at the same time? (**0031-4** (Crawford, Barbara))

Comment: The previous EIS stated that there were no new or anticipated residential, business, or commercial demands on the watershed near the plant. This is incorrect. It was known, or should have been known based on documentation submitted to you, that there are 3 significant residential developments in the works, including Cutalong which is building a golf course that will require significant water withdrawals from Contrary Creek, one of the feeder streams for the power plant. Note that the DEQ has recommended this permit be granted. In addition, there are at least 3 businesses, that I know of, near the plant that require significant water use: Argonaut, Martin Marietta, and a shopping center with supermarket at Cutalong, all of which require water in order to operate. Again, the new EIS needs to look closely at these competing demands for water in an area that has very little of it. The new EIS needs to reevaluate the availability of water for a 3rd reactor. (**0031-9** (Crawford, Barbara))

Comment: Electric power generation accounts for only about three percent of freshwater consumption in the U.S. The largest portion, 80 percent, is used for irrigation. And the next largest consumption is for residential use, at seven percent. There is nothing unique to nuclear power plants about the possibility of reducing electricity production because of decreased water levels in a drought or a severe heat wave. Whether this happens depends on what is constrained in local, state, and federal permits and the assumption of flow rates, temperatures, and water levels used in the safety analyses. (**0034-166** (Stiles, Lisa))

Comment: Central Virginia and especially Louisa County is notoriously drought-prone and water-poor. And Lake Anna is already struggling to sustain reactors 1 and 2 and protect those who live, work, and recreate on and around the lake. Dominion based its location of the power plant on the assumption that there will be drought every 20 years or so. In fact, we have had three major droughts in the past nine years. We are currently experiencing a drought that began last May that is now 11 months old and shows no sign of abating. There are predictions from the weather experts that this drought will continue throughout the spring and summer. Lake Anna's lake level has dropped in excess of two feet in five of the past years. This fact alone suggests that the environmental impact statement needs to be revisited. (**0031-3, 0034-201** (Crawford, Barbara))

Comment: One of the problems has been the idea of the low level of the lake and the small input into the lake. One of the solutions lies in what Louisa County is already doing. That is getting water from the James River and bringing it over to Zion Crossroads. What we would like to do is recommend that NRC work with the many other entities that are involved in the water and have the makeup water for the third unit piped over from the James River. Pipes are going to go all the way to Zion Crossroads. Already have heard about one of the county commissioners bringing water up into the center of the county. What we are saying is for Dominion and Louisa County, Fluvanna County, and the James River Authority, along with NRC, work to have the water makeup brought in from the James River. (**0034-223** (Murphey, Bill))

Response: *The comments will be considered in the Staff's review of new and significant information related to water use and water availability of the Lake Anna Reservoir. Water resource management incorporates the uncertainty of projections of the future supply and demand for water that results from natural climate variability (e.g., droughts) and man-made demands. The Commonwealth of Virginia (VDEQ), the U.S. Environmental Protection Agency (EPA), and the U.S. Army Corps of Engineers (ACE) have jurisdiction for regulating water use and water quality through Federal and State laws.*

Comment: Virginia has been in drought conditions. This has been true at Lake Anna where water levels have been down from 2 to 5 feet in 5 of the past 8 years (3.5 ft this year). (**0012-1, 0034-190** (Heino, George and Gerry))

Comment: Dominion is now proposing Unit 3 which per their documentation will double the drought cycle and increase its length from 21 to 40 days (of course this occurs when the lake is most used in the summer months), (up to 24 million gallons a day will be extracted from the Lake). (**0012-3, 0034-192** (Heino, George and Gerry))

Comment: We ask that the NRC review the estimates of water inflow to the Lake in relation to the uses proposed for the third unit. This review is in light of what appears to be a climate change in the amount of rainfall. The change in rainfall is shown by the occurrence two 20 year droughts in the past 5 years and by the fact that the Lake release has had to be reduced to the 20 cfs rate 5 times in the past 8 years. (**0014-7** (Murphey, Bill))

Comment: The current proposed cooling is a combination dry and wet cooling tower which introduces significant evaporation of water in the Lake Anna reservoir (up to 16.6 MGD water in the Maximum Water Conservation Mode). (**0016-1** (Remmers, Ken))

Comment: Report on the North Anna Early Site Permit Water Budget Model (Lake WBT) for Lake Anna by Cook et al. January 2005 is insufficient and significant new information can come from an updated water budget model. This study was performed before the change in cooling technique to wet-dry hybrid system and only looked at once pass through and totally wet cooling. This study should be redone and include a hybrid and totally dry cooling systems. Once again travel time for the water to circulate from the discharge back to the input of the plant was not available for this study. It should be collected at least in the WHTF so that accurate predictions can be made. (**0016-4** (Remmers, Ken))

Comment: The study does not address temperature. In response to a question by the NRC, Dominion stated On a long term basis the average temperature of the cooling lake due to the reduced lake level from Unit 3 has been estimated to be less than 0.1 degrees F. The so called long term effect is not where the problem exists. The hot summer months needs to be evaluated for temperature change. No calculations were provided by Dominion. It was only estimated. The calculations for the summer time periods should be performed by Dominion and independent calculations done by NRC. Units 1 and 2 will heat the water faster and return time for recycling will be increased during the problematic hot summer months. This temperature needs to be investigated more carefully. (**0016-5** (Remmers, Ken))

Comment: I am working on getting a knot meter to measure the currents on the hot side. I would expect that we would measure the flow pattern i.e. The two canals, dikes 1, 2, 3 and exit to the power plant. Question on the temperature increase due to the third reactor. What volume of water do you assume the 100F blowdown is influencing? Where would the temperature be 0.1F higher? Or is there a gradient from plant output (hot side) to plant intake (cold side)? If you use the entire volume of the lake in this calculation, this would be inaccurate. My LACA measurements indicate the temperature of the reservoir at dike three even at 3 meters depth is cooler than that measured temperature at the dam up to 3 meters. Can you provide the calculations that back up this 0.1F increase? Can you assure me that this will be considered as significant new information in the North Anna COLA DEIS. (**0018-1** (Remmers, Ken))

Comment: Drought conditions this past summer decreased lake levels as well as downstream flows. Another reactor would increase the amount of water needed to cool the reactors. More hot water released into the Lake would increase evaporation, and further decrease lake levels as well as downstream flows into the North Anna and Pamunkey Rivers. Our water resources need to be protected, not wasted on inefficient and consumptive new and old nuclear units. (**0026-15** (AuClair-Valdez, Miguel))

Comment: Low water levels on Lake Anna expose safety hazards to the thousands of recreational users of the Lake, create increased erosion along the entire shoreline, and damage wetlands and other aquatic life. Every effort to mitigate these impacts should be carefully considered. We would like the NRC to focus its attention in the COL Environmental Impact Statement on the impact of low water levels on the Lake, its users, and its ecosystems. (**0027-4, 0034-183** (Smith, Doug))

Comment: The third unit will consume 16 million gallons per day even while running in water conservation mode, resulting in the loss of up to 1.4 inches of lake level per month. If the third unit were operating this past year the lake would now be 15 inches lower. Its low point last fall would have been an additional 9 inches—about 4 feet below normal. The existing environmental impact statement assumes one drought every 20 years. We have had two official droughts and reached drought conditions of 248 feet on the lake in 5 of the last 8 years. The ESP EIS estimates that wetlands impact is small because as much wetland is created as is destroyed, but is silent about the impact of what appears to be an almost annual reduction to the 248' level. We ask the NRC to review the water level modeling done in the ESP EIS to incorporate actual data and do further analysis of deviations from averages. Annual averages do not give accurate indications of summer lake level impacts and 20 year averages have not been consistent with actual experience. Additionally, inflow assumptions have not been field verified and should be reviewed: In dry weather Conditions, the already small Lake Anna watershed is significantly reduced by the impoundments caused by Lake Louisa, Lake Orange, and the hundreds of farm ponds and small lakes that impede the transmittal of water to the Lake. Dominion has developed new data including actual surveys of a portion of the wetlands on the Lake. We ask the NRC to carefully review and use this new data to determine if it alters its earlier impact assessments. (**0027-5** (Smith, Doug))

Comment: We are concerned about the impact of low water levels. We believe new information is available to better estimate low water level impacts and that there are steps that can be taken to mitigate those impacts. We urge the NRC to focus its new efforts particularly on the modeling and assumptions made in the estimates on water levels, further analysis of impacts on the lake, and potential mitigation efforts. (**0027-7, 0034-189** (Smith, Doug))

Comment: The Lake Anna Lake Level Task Force consisting of members from the Friends of Lake Anna, Lake Anna Civic Association and the Lake Anna Boating and Recreation Association have identified the following impacts that will be caused as a result of declining lake water levels. Each of these issues should be reviewed during the DEIS of the COL for the 3rd reactor:

- The creation of many boating hazards with previously submerged items (rocks, stumps, sandbars, etc.) are exposed creating major safety hazards for recreational users when their boats hit these submerged items;
- The water will get hotter faster in the summer months to unsafe water temperatures causing negative health impacts to humans, fish, wildlife, aquatic life, clams and mussels;
- There will be major fire safety hazards for lake homes/communities by making the dry fire hydrants unusable due to the lack of water at the lake intake caused by the decreasing lake water level.

- There will be shoreline stabilization problems and
- There will be negative impacts on many lake businesses as people go elsewhere to recreate and live. (**0028-11** (Ruth, Harry))

Comment: The previous NRC Lake Model in the ESP EIS also provided no details on how the assessment was made when it concluded that the lake water temperature would not rise any more than 0.1F with decreased water levels, and the addition of the proposed reactor 3 wet/dry cooling method. It appears that the EIS lake model did not take into consideration that Lake Anna is unique for providing cooling water for nuclear power plants. Most nuclear power plants receive cooling water from robust fast flowing rivers or oceans with the heated water flowing downstream and is quickly cooled. Lake Anna is unique in that 99% of the water is recirculated between the power plant and the dam, while only 1% of the water flows over the dam and downstream. As a result, 99% of the recirculated water gets hotter and hotter over the summer months. The NRC lake model for the COL DEIS should be updated to reflect the continuous re-circulation of Lake Anna water and the cumulative effects of Units 1, 2, & 3 operating at the same time, with results being published in the COL DEIS. The projected cumulative impacts of global warming should also be included in these lake water temperature calculations. (**0028-14** (Ruth, Harry))

Comment: The DEIS should examine what is the actual water flow into Lake Anna from all feeder streams during times of drought. Apparently all lake level predictions are based on computer models only and no one has ever taken actual water measurements on water flow from <u>all</u> the feeder streams to Lake Anna during drought conditions. Since Lake Anna is in a very small watershed and outflow over the dam is based on the Lake water level (and the outflow fluctuates during a drought), it is extremely important to know how much water is coming in the lake. The lake has experienced drought conditions during 5 of the past 8 years, so the accurate measure should easily be achieved. It is widely acknowledged that the water sources for Lake Anna are not nearly as substantial or robust as was originally planned. (**0028-23, 0033-19** (Ruth, Harry))

Comment: Recreational boaters will find more hazards throughout the lake, with stumps, rocks, sandbars, etc. causing lower units to hit them which in turn could necessitate major repairs or replacement of propellers, other engine components and boat hulls. In addition, the safety of all aboard the boats is severely jeopardized when the boats run into these newly emergent and changing boating hazards when the lake level is below 250 MSL and continues to decrease during drought cycles. Note: Per Dominion and the NRC, these drought cycles will be doubled with the proposed type of 3rd reactor wet/dry cooling method. These increased droughts will result in many human safety risks increasing dramatically. (**0028-42, 0033-50** (Ruth, Harry))

Comment: Any substantial change to the lake water level will cause further erosion, as current bulkheads and rip rap and are installed for protecting the shoreline at the 250 MSL lake level. These installed shoreline stabilization techniques coupled with the natural shoreline weeds and tree roots have created the current shoreline stabilization throughout the 13,000 acre lake. If the lake level decreases, then the wave action will cause erosion to occur at a different water level. This increased erosion may create muddy water and the current shoreline stabilization techniques may need to be changed. (**0028-45, 0033-54** (Ruth, Harry))

Comment: Dominion has acknowledged that the wet/dry cooling method for the 3rd reactor will use up to an additional 24 million gallons of Lake Anna water each day in the Energy

Conservation Mode and up to 16.6 million gallons per day in the Maximum Water Conservation Mode. (**0028-5** (Ruth, Harry))

Comment: When boating, the lake users will find more hazards throughout the lake, with stumps, rocks, sandbars, etc. causing lower units to hit them which in turn could necessitate major repairs or replacement of propellers, other engine components and boat hulls. In addition, the safety of all aboard the boats is severely jeopardized when the boats run into these newly emergent and changing boating hazards when the lake level is below 250 MSL and continues to decrease during drought cycles. Note: Dominion and the NRC state these drought cycles will be doubled with the proposed type of 3rd reactor wet/dry cooling method. The doubling of the drought cycle will increase the human safety risks dramatically. (**0028-54, 0033-63** (Ruth, Harry))

Comment: Any substantial change to the lake water level will cause further erosion, as current bulkheads and rip rap and are installed for protecting the shoreline at the 250 MSL lake level. These installed shoreline stabilization techniques coupled with the natural shoreline weeds and tree roots have created the current shoreline stabilization throughout the 13,000 acre lake. If the lake level decreases, then the wave action will cause erosion to occur at a different water level. This increased erosion may create muddy water and the current shoreline stabilization techniques may need to be changed, which will increase the cost to the homeowner to modify their existing stabilization technique. (**0028-55, 0033-64** (Ruth, Harry))

Comment: The Virginia Dept of Environmental Quality (VDEQ) Dept of Water Resources and the Dept of Game & Inland Fisheries (DGIF) have previously indicated that the North Anna watershed is too small to allow large water withdrawals. These could adversely affect the beneficial users of the North Anna and Pamunkey River which eventually flows into the Chesapeake Bay and the Atlantic Ocean. The DGIF &VDEQ analyses and Dominion acknowledges that the 3rd reactor would increase the drought cycle and cause decreased water flows during March, April; May; June, July, August, and September (7 months) of each year. Dominion has stated that the drought cycle will double with the addition of the 3rd reactor wet/dry cooling method. The proposed cooling method will cause the average drought period to increase from 21 to over 40 days per year (most likely during the summer months). Note that lake levels have decreased below 248 MSL in five out of the last eight years. Dominion has stated that with the addition of reactor 3 that a drought would only occur each 10 years. Our current drought started in May 2007 when the lake level fell below 250 MSL. The DEIS should explore facts versus Dominion predictions with lake levels decreasing below 250 MSL and related impacts to the public, fish, clams/mussels, and wildlife. (**0028-6** (Ruth, Harry))

Comment: We (Friends of Lake Anna) are very concerned that that the declining water levels caused by natural drought cycles, global warming and water release rates to downstream users will be exasperated by the addition of a 3rd nuclear reactor with wet/dry cooling towers that will cause an additional evaporation rate of up to 28 million gallons per day and doubling of the drought cycle that will cause the water to decline further and the water to get hotter faster. (**0028-60, 0033-69** (Ruth, Harry))

Comment: Water level decrease—According to the Nuclear Regulatory Commission Environmental Report (See Page 5.12) says: Because the Unit 3 Cooling tower would consume water (up to 28 Million Gallons per day (see section 3.2), the volume of water in Lake Anna would be reduced (compared to operation of only Units 1 and 2 alone) when the lake level elevation is below 250 ft MSL. Assuming the heat rejection rate from operations of Units 1 and 2 remains constant, the reduced volume of water in the lake caused by Unit 3 operation would result in a faster increase of lake water temperature (See Page 5.12). (**0028-63** (Ruth, Harry))

Comment: The VA Dept of Water Resources estimated that with the 3rd unit operating, the lake would decline at an additional rate of approximately 1.1 inches per month and the current drought started in May 2007. When the lake was recently down about 30 inches, with the 3rd reactor wet/dry cooling method operating it would have been down about another 12 inches for a total of about a 42 inch drop in water level. Dominion states that when the lake is down to 242 ft, the reactors must be shut down. If the 3rd reactor as proposed with wet/dry cooling towers is operational, one wonders whether Lake Anna can sustain three reactors running simultaneously, with the possibility of an 8 foot drop in water levels. (**0028-64, 0033-73** (Ruth, Harry))

Comment: The previous NRC Lake Model in the ESP EIS has compared the once through cooling method (used by Units 1 & 2) with total wet cooling only and also used 20 year averages to compute modeling results. This lake model should be updated to the current proposed unit 3 wet/dry cooling method and use median results for the past 20 years, so all the highs & lows are defined, including the most recent and current drought levels. VDEQ's Dept of Water Resources has estimated that the lake levels will decline approximately 1.1 inches per month during a drought. During the current that started in May 2007, this would translate into decreased water level of over 1 foot today. (**0028-9** (Ruth, Harry))

Comment: The proposed 3rd reactor will contribute to further low levels at the lake, contrary to Dominion's statements that the hybrid cooling system will not use additional water. According to Dominion's own numbers, the proposed cooling system will cause up to 24 million gallons of water to evaporate every day. Again, given that Lake Anna is struggling to sustain 2 reactors and that the ongoing low water levels are causing a myriad of problems for the people who live and work at the lake as well as the many people of the county and beyond who use Lake Anna for boating, fishing, swimming, etc., does it really make sense to build another reactor there? (**0031-5, 0034-203** (Crawford, Barbara))

Comment: The previous NRC Lake Model in the ESP EIS also provided no details on how the assessment was made when it concluded that the lake water temperature would not rise any more than 0.1F with decreased water levels, and the addition of the proposed reactor 3 wet/dry cooling method. It appears that the EIS lake model used averaging that may have masked temperature maximums in the summer months and did not take into consideration that Lake Anna is unique for providing cooling water for nuclear power plants. Most nuclear power plants receive cooling water from robust fast flowing rivers or oceans with the heated water flowing downstream and is quickly cooled. Lake Anna is unique in that 99% of the water is recirculated between the power plant and the dam, while only 1% of the water flows over the dam and downstream. As a result, 99% of the re-circulated water gets hotter and hotter over the summer months. Note that with only Units I & 2 operating, water temperatures have previously been recorded at over 104F in the cooling lagoons and over 93F on the main reservoir. The hot water is where humans recreate and where fish, wildlife, clams/mussels, and aquatic life share the water in what appears to be unsafe conditions. We request an upper water temperature limit in Fahrenheit degrees on the discharge of the water. (**0033-11** (Ruth, Harry))

Comment: The NRC's lake model should also be updated to the current proposed Unit 3 wet/dry cooling method and use accurate results for the past 20 years, so all the high's & low's are defined (not 20 year averages), including the most recent and current drought levels. It also does not include all relevant data for the current proposed wet/dry cooling method. The previous NRC Lake Model in the ESP EIS has compared the once through cooling method (used by Units 1 & 2) with total wet cooling only and also used 20 year averages to compute modeling results. The model apparently does not take into consideration the various times of the year, particularly the high water temperatures (over 104F) during the hot summer months when the environmental impact is the greatest for the public, fish and wildlife. The lake model should be updated to the current proposed Unit 3 wet/dry cooling method and use actual high temperatures in the summer and low temperatures in the winter for the past 20 years, so all the high's & low's are defined, including the most recent and current drought levels. VDEQ's Dept. of Water Resources has estimated that the lake levels will decline approximately 1.1 inches per month during a drought, while others have estimated 1.4 inches. During the current drought that started in May 2007, this would translate into an additional decreased water level of between 13 to 17 inches by April 08. (**0033-12** (Ruth, Harry))

Comment: The NRC's Report on the North Anna Early Site Permit Water Budget Model (Lake WBT) for Lake Anna by Cook et al. January 2005 is insufficient and significant new information will come from an updated water budget model. This study was performed before the change in cooling technique for Unit 3 to a combination wet-dry hybrid system and only looked at once pass through and totally wet cooling. This study should be redone and include a hybrid and totally dry cooling systems. The old study indicated that travel time for the water to circulate from the discharge back to the input of the plant was not available. This is critical information and it should be collected at least in the WHTF (cooling lagoons) so that accurate predictions can be made. The study does not address water temperature. In response to a question by the NRC, Dominion stated On a long term basis the average temperature of the cooling lake due to the reduced lake level from Unit 3 has been estimated to be less than 0.1 degrees F. The so call long term effect is not where the problem exists. The hot summer months needs to be evaluated separately for temperature change. No calculations were provided by Dominion. It was only estimated. The calculations for the summer time periods should be performed by Dominion and the NRC should also perform its own independent calculations to verify the data. Units 1and 2 will heat the less water caused by Unit 3 evaporation much faster and the return time for recycling will be shortened during the problematic hot summer months. This heated water temperature needs to be investigated more carefully, as it is the root cause for many of the public, fish and wildlife concerns. Annual averages do not give accurate indications of summer lake level impacts and 20 year averages have not been consistent with actual experience. (**0033-13** (Ruth, Harry))

Comment: Impacts of Declining Water Levels in Lake Anna. Dominion has acknowledged that the wet/dry cooling method for the 3rP reactor will use up to an additional 24 million gallons of Lake Anna water each day in the Energy Conservation Mode and up to 16.6 million gallons per day in the Maximum Water Conservation Mode. Both of these methods will cause Lake Anna to have declining water levels, particularly during the summer months. The accumulative environmental issues as defined in subparagraphs (a) through (o) below caused by the projected annual low water levels in Lake Anna as a result of the 3rd reactor cooling method is LARGE and therefore mitigation efforts for alternative cooling methods are required. (**0033-2** (Ruth, Harry))

Comment: The NRC should look at the impact to the public, fish, clams/mussels and wildlife as a result of increased droughts caused by the proposed wet/dry cooling method proposed. The Virginia Dept of Environmental Quality (VDEQ) Dept. of Water Resources and the Dept. of Game & Inland Fisheries (DGIF) have previously indicated that the North Anna watershed is too small to allow large water withdrawals. These could adversely affect the beneficial users of the North Anna and Pamunkey River which eventually flows into the Chesapeake Bay and the Atlantic Ocean. The DGIF &VDEQ analyses and Dominion acknowledges that the 3rd reactor would increase the drought cycle and cause decreased water flows during March, April, May, June, July, August, and September (7 months) of each year. Dominion has stated that the drought cycle will double with the addition of the 3rd reactor wet/dry cooling method. The proposed cooling method will cause the average drought period to increase from 21 to over 40 days per year (most likely during the summer months). Note that lake levels have decreased below 248 MSL in five out of the last eight years. Dominion has stated that with the addition of reactor 3 that a drought would only occur each 10 years. Our current drought started in May 2007 when the lake level fell below 250 MSL and did not increase to 250 MSL for 1 year in April 2008. The DEIS should explore facts versus Dominion predictions with lake levels decreasing below 250 MSL and related impacts to the public, fish, clams/mussels, and wildlife. (**0033-20** (Ruth, Harry))

Comment: The Lake Anna Lake Level Task Force consisting of members from the Friends of Lake Anna, Lake Anna Civic Association and the Lake Anna Boating and Recreation Association have identified the following impacts that will be caused as a result of declining lake water levels.

- The creation of many safe boating hazards when previously submerged items (rocks, stumps, sandbars, etc.) are exposed creating major safety hazards for recreational users when their boats hit these submerged items;

- The water will get hotter faster in the summer months to unsafe water temperatures causing negative health impact to humans, fish, wildlife, aquatic life, clams, and mussels; (**0033-3** (Ruth, Harry))

Comment: The accumulative environmental impacts caused by the projected annual low water levels in Lake Anna as a result of the 3 reactor cooling method are LARGE and therefore mitigation efforts for alternative cooling methods are required. (**0033-43** (Ruth, Harry))

Comment: We the undersigned persons who recreate on the 13,000 acre Lake Anna, Virginia and/or own property adjacent to the main reservoir and/or cooling lagoons of the lake or nearby areas and/or own-or manage businesses that are affected by Lake Anna are very concerned about the declining water levels, increased water temperatures during the summer months and associated impacts to all forms of recreation in/on Lake Anna. We are also concerned that these declining water levels will:

(a) create many boating hazards with previously submerged items (rocks, sandbars, etc.), and create major safety hazards for recreational users when their boats hit these submerged Items;
(b) cause the water to get hotter faster in the summer months to unsafe-water temperatures causing negative impacts to humans, fish, wildlife, aquatic life, clams and mussels;
(c) create a major fire safety hazard for lake homes/communities by making the dry fire hydrants unusable;
(d) increase shoreline stabilization problems and
(e) negatively impact many lake businesses with loss of customers. (**0033-84** (Ruth, Harry))

Comment: Dominion states the addition of the 3rd nuclear reactor, will cause up to an additional 24 million gallons per day to be evaporated from the lake causing a doubling of the drought cycle and further lake level declines. (**0033-85** (Ruth, Harry))

Comment: The NRC lake model for the COL DEIS should be updated to reflect the continuous re-circulation of Lake Anna water and the cumulative effects of Units 1, 2, & 3 operating at the same time, with results being published in the COL DEIS. (**0033-9** (Ruth, Harry))

Comment: And the drought conditions in the past summer decreased the level, the lake levels, as well as downstream flow. Another reactor would simply increase the need for cooling water. More hot water will be released in the lake, which will increase evaporation and further decrease lake levels as well as downstream flow into the North Anna and Pamunkey Rivers. (**0034-159** (AuClair-Valdez, Miguel))

Comment: Lake Anna has hundreds of stumps and boulders that were not removed prior to the hurricane filling the lake. When the lake level starts to decline below the 250-foot level, many hazardous conditions are created. The reduced water level has already caused numerous boating accidents on the lake and from these submerged objects. (**0034-174** (Jones, Dale))

Comment: According to Dominion Resources, a proposed wet/dry cooling system will remove up to million additional gallons of water from the lake per day except when they are in the water conservation mode. In the conservation mode, they will evaporate 16 million gallons of water a day. This would cause the lake water level to drop more than 12 inches of water annually. During the past ten years, we experienced several periods of drought that reduce the lake levels from the requisite 250 to below 245 feet level. During the drought in 2007, the lake level dropped and a half feet. Further adding to the problem is a requirement of dumping a minimum of 26 million gallons of water per day from the lake to supply the businesses located below in Hanover County. (**0034-176** (Jones, Dale))

Comment: Presently there are over 40 million gallons of water being removed daily from the lake over the dam. And the lake is still below 250 feet. A comprehensive study should be completed to evaluate the amount of water that is flowing into the lake when drought conditions prevail. Obviously for the last years, there has been insufficient water flow to maintain the 250-foot level during the critical summer months. (**0034-177** (Jones, Dale))

Comment: The third unit will consume 16 million gallons a day in the water conservation mode, resulting in the loss of 1.4 inches of lake level per month. If the third unit were operating this last year, the lake would currently be 15 inches lower. Its low point last fall would have been an additional nine inches, making this more than four feet below normal. The existing environmental impact statement assumes one drought every 20 years. We have had 2 official droughts and reached the drought condition of 248-foot level on the lake in 5 of the last 8 years. Clearly the water level modeling is suspect. (**0034-184** (Smith, Doug))

Comment: The ESP EIS claims that wetlands impact is small because as much wetland is created as is destroyed, but is silent about the impact of what appears to be an almost annual reduction to the 248-foot level. The NRC should review modeling done in the environmental impact statement to incorporate new actual data and do further analysis of deviations from the 20-year averages. Additionally, inflow assumptions have not been field-verified and should be reviewed. Dominion has developed new data, including actual surveys of a portion of the wetlands on the lake. We ask that NRC carefully review and use this new data to determine if it alters its earlier impact assessment. Additional steps can and should be taken to mitigate low water level impact on safety, erosion, and ecosystems on the lake. (**0034-186** (Smith, Doug))

Comment: NRC's report on the North Anna early site permit water budget model, lake WHTS, for Lake Anna in January of 2005 is insufficient, and significant new information can come from an update water budget model. This study was performed before the change in the cooling technique to wet/dry cooling hybrid systems, and only looked at once passthrough and totally wet cooling. The study should be redone to include hybrid and totally dry cooling systems. Once again, this study indicated that the travel time for the water to circulate from the discharge, all the way back to the intake of the plant, was not available for this study. This critical information should be collected at least in the waste heat treatment facility, so that accurate predictions can be made on that study. (**0034-36** (Remmers, Ken))

Comment: The study does not address temperature. In response to a question by NRC, Dominion stated on a long-term basis the average temperature of the cooling lake, due to the reduced lake level from Unit 3, has been estimated to be less than one-tenth of a degree Fahrenheit. The so-called long-term effect is not where the problem exists. The hot summer months need to be evaluated for temperature change. No calculations were provided by Dominion. It was only estimated. The calculation for the summertime period should be performed by Dominion, and independent calculations done by NRC. Units 1 and 2 will heat the water, less amounts—less amounts of water faster, and return time for recycling will be shortened during the problematic hot summer months. This temperature needs to be investigated more carefully. (**0034-37** (Remmers, Ken))

Comment: Water level changes will be heightened during the period July-September. Since this coincides with increased summer recreational use of the lake, even minor changes could have MODERATE or HIGH impacts. (**0035-21** (Goldsmith, Aviv))

Response: *NRC staff will evaluate new information relating to inputs to the water budget model and any resulting changes to impacts of plant operation on Lake Anna reservoir lake level and discharge to the North Anna River. Inputs to the water budget model include plant water use, plant discharges, meteorology (precipitation), and streamflow information. Lake level and thermal impacts were previously addressed in NUREG-1811, ESP EIS; therefore, the SEIS analysis will focus on new and significant information that might change the original impact level. Water-related impacts of plant operation will be addressed in Chapter 5.3 of the SEIS. The results of the lake level elevation and discharge evaluation will also be used to evaluate ecological, socioeconomic, and human health impacts of plant operation, which will be addressed in Chapter 5.4, 5.5, and 5.8, respectively, of the SEIS.*

Comment: A problem with Lake water quality is caused by the discharge of sewage plant effluent into the Lake. We understand that as part of the third unit, Dominion is planning to build an additional sewage treatment plant. They plan to discharge more sewage effluent into the Lake. This is environmentally bad. There is so little inflow to the Lake and thus so little flow-through. The small flow-through means that the sewage effluent accumulated over time to unacceptable levels. (**0014-10** (Murphey, Bill))

Comment: We request that there be no discharge of sewage effluent into the Lake. We request that Dominion follow the example of the Cutalong Project and use the sewage effluent as irrigation water or holding pond water on their own site. We request that the NRC support this reduction in environmental impact of the third unit. (**0014-11** (Murphey, Bill))

Comment: Dominion has proposed a new Waste Treatment Facility for Unit 3. This is new and significant information. The effluent would be discharged into the WHTF of Lake Anna. Their current waste treatment facility for Units 1 and 2 already discharges in the lake and we would oppose a new discharge. Why can't the current treatment plant support the new Unit 3? Is it up to capacity? Is the size of the proposed plant larger than needed or would it replace the Unit 1 and 2 treatment plant? (**0016-6** (Remmers, Ken))

Comment: In order to support the operation of a new unit and the 750 workers hired to operate and maintain it, Dominion plans to build a second waste treatment plant to locally process human and other waste. The treated effluent of that plant, like the effluent from the existing waste treatment facility, would be dumped into Lake Anna at the discharge canal. Lake Anna is not a free flowing stream. The added nutrients from the effluent will remain in the lake and accumulate over years. The buildup of nitrates can produce algae blooms that produce fish kills and encourage plant growth such as hydrilla that can choke entire bays. (**0027-2** (Smith, Doug))

Comment: An alternative [sanitary waste treatment] system that would store the effluent and use it to water grass or wooded areas is available. It is currently in place in the town of Louisa and is planned for the golf community called Cutalong on Lake Anna. The ESP EIS listed impact on water quality as unresolved, due to the lack of information about the impact of these other waste streams flowing into the WHTF (Sec. 5.3). We ask the NRC to review the cumulative impact of dumping sewage effluent into Lake Anna. We would like for Dominion to consider an alternative method and include the existing sewage treatment facility effluent so that no effluent is dumped into the lake at all. (**0027-3** (Smith, Doug))

Comment: We [Lake Anna Civic Association] are concerned about the dumping of sewage effluent into the lake and the impact of low water conditions on safety, erosion, and aquatic life. We encourage the consideration of a new alternative to preclude the dumping of effluent. (**0027-6** (Smith, Doug))

Comment: The DEIS should examine the effects of adding additional treated sewage effluent from the requested expansion of the Dominion sewage treatment plant as needed for the influx of new workers who will be hired to construct the new reactor at Lake Anna. This sewage effluent will then be dumped into Lake Anna water and re-circulated throughout the lake with the current re-circulation flow. Note that 99% of the lake water is currently re-circulated between the power plant and the dam and only 1% runs over the dam. This water is heated by the power plant, which increases the risk to humans who swim and recreate in the water to increased biological risks from the sewage effluent. See attachment 2 for potential health risks from hotter water in Lake Anna. (**0028-24** (Ruth, Harry))

Comment: The NRC in its DEIS should examine the effects of the new and significant information of Dominion requesting to put additional treated sewage effluent from the requested expansion of the Dominion sewage treatment plant as needed for the influx of new workers who will be hired to construct and/or operate the new reactor at Lake Anna. The NRC must look at the accumulative affect of dumping sewage effluent into the lake. This treated sewage effluent will then be discharged into the cooling lagoons (WHTF) of Lake Anna water and heated up to 104 degrees during the summer months. While effluent may meet standards set for sewage discharge, nitrates in the water can accumulate and cause runaway plant growth that clogs streams and impedes navigation. In addition, the sewage effluent being heated to high temperature (over 100 degrees F) offers the opportunity for an increased proliferation of bacteria in the water where people swim and recreate on a routine basis. This water is then re-circulated throughout the main reservoir backup to the power plant with the current re-circulation flow where many other people recreate. Note that 99% of the lake water is currently re-circulated between the power plant and the dam and only 1% runs over the dam. See Attachment B for Potential Human Health Impacts. (**0033-14** (Ruth, Harry))

Comment: We are opposed to any additional sewage effluent being discharged into Lake Anna. Why can't the current treatment plant support the new Unit 3? Is the current plant up to capacity? Why can't innovative techniques be used to preclude putting the effluent into the lake and not create potential serious health hazards and runaway aquatic plant growth? (**0033-15** (Ruth, Harry))

Comment: Dominion plans to build a second waste treatment plant to locally process human and other wastes. The treated effluent of that plant, like the effluent from the existing waste treatment facility, would be dumped into Lake Anna at the discharge canal. Lake Anna is not a free-flowing stream. The added nutrients from the effluent will remain in the lake and accumulate over the years. The build-up of nitrates can produce algae blooms that produce fish kills and encourage plant growth, such as Hydrilla, that can choke entire bays. An alternative system that would store the effluent and use it to water grass or wooded areas is available. It is currently in place in the Town of Louisa and is planned for the golf community called Cutalong on Lake Anna. We ask the NRC to review the cumulative impact of dumping sewage effluent into Lake Anna. This is legitimate because it is an unresolved issue in supplement number 1. And, as far as I can tell, we have never looked at the accumulated effect of the dumping of the sewage effluent. We would like Dominion to consider an alternative method and include the existing sewage treatment facility effluent so that no effluent is dumped into the lake at all. (**0034-182** (Smith, Doug))

Comment: We are concerned about the dumping of sewage effluent into the lake and the impact of low water conditions on safety, erosion, and aquatic life. We ask the NRC to review long-term impact, and we ask Dominion to consider a new alternative to include the dumping of effluent. (**0034-188** (Smith, Doug))

Comment: Dominion has proposed a new waste heat treatment facility for Unit 3. This is new and significant information. The effluent would be discharged into the waste heat treatment facility of Lake Anna. The current waste treatment facility for Units 1 and 2 already discharge into the lake, and we would oppose a new discharge. Why can't the current treatment plant support the new Unit 3? Is it up to capacity already? Is the size of the proposed new waste treatment plant larger than needed? Or would it replace the Units 1 and 2 treatment plant? Why can't new techniques be used where the effluent is not dumped into the lake? (**0034-38** (Remmers, Ken))

Comment: When you talk about opposing a new discharge effluent path into the lake, that you don't want to put the water back in the lake, it seems to me contradictory if you're going to say that and then talk about water balanced studies, and so on and so forth. If you're not going to put the water back in the lake, what are you going to do for it? What are you going to do with it? You're going to increase how much water you're taking out of the lake. And if the water is clean enough and meets the government's standards and the EPA standards and the state standards, in all the studies that are done, why wouldn't you put the water back in the lake so that we can use it for the water table, so we can use it for the downstream effluence? Why would you just randomly say, no, don't put this water back in the lake, and somebody else figure out what to do with it. (**0034-74** (Taylor, Kelly))

Response: *The North Anna Unit 3 COL application contains new information regarding a proposed sanitary treatment plant that will discharge effluent at the same location as other plant effluent discharges. This information will be evaluated by NRC staff to determine impacts to water quality, which will be addressed in Chapter 5.3 of the SEIS. The NRC does not have the authority to set water quality limits; plant effluent discharges will continue to be regulated by VDEQ. Related ecological and human health impacts will be addressed in Chapter 5.4 and 5.8, respectively, of the SEIS.*

Comment: We ask that the seasonally adjusted level of the Lake to be increased to 250 feet 3 inches above MSL (mean seal level). This will conserve water for use during low water times. (**0014-4** (Murphey, Bill))

Comment: We ask that the dam release requirement be reduced to 20 cfs at a Lake level of 250 feet 3 inches.
—The below dam inflow study will show that the contribution of the Lake is not essential to the downstream user needs.
—This change will conserve water for dry time use. (**0014-6** (Murphey, Bill))

Comment: For example, the lake levels should not be raised which could cause property damage to lake owners in order unduly to quarantine more water so that it can be released later to satisfy the downstream users at different times of the year. Likewise the consumptive use of water and increased needs for water caused by population growth by downstream users should not cause the lake levels to be dropped so more water flow could be released to downstream users and then create mud flats throughout the lake. (**0028-26** (Ruth, Harry))

Comment: For example, the lake levels should not be raised greater than 3 inches, which could cause property damage to lake owners in order unduly to quarantine more water so that it can be released later to satisfy the downstream users at different times of the year. Likewise the consumptive use of water and increased needs for water caused by population growth by downstream users should not cause the lake levels to be dropped so more water flow could be released to downstream users and then create mud flats throughout the lake during droughts. (**0033-34** (Ruth, Harry))

Comment: North Anna is supplied by one of the smallest bodies of water supporting a nuclear power plant. And if we add an additional more than 50 percent, unless Dominion has figured a way to suspend the laws of physics and chemistry, we are going to have hotter water, we are going to have less water, and we are going to have lower levels in the lake. Now, a lot of this can be mitigated by keeping the water levels higher, allowing less water to go out over the dam, et cetera, and I would recommend that the NRC require Dominion to come up with proven solutions to the low water conditions before the permits are issued. (**0034-222** (Schaible, Dennis))

Comment: It is our understanding that when the MWC mode is in effect, it will stay there until the water level of the reservoir goes above 250 ft msl. Why on page 2-134 of the FSAR does Dominion say While in the MWC mode, the dry tower fans may be turned off to provide additional electrical output during hours of peak demand? This is totally against the idea of conserving water and the MWC mode. (**0036-2** [Remmers, Ken])

Response: *NRC staff will evaluate new and significant information relating to impacts of plant operation on Lake Anna reservoir lake level and discharge to the North Anna River below the dam. Water-related impacts of plant operation will be addressed in Chapter 5.3 of the SEIS. However, adjustments to reservoir operations are under the authority of the Commonwealth of Virginia, not the NRC.*

Comment: In light of the NRC concern with the environmental impact of the third unit, these requests are to reduce the environmental impact of the construction and operation of the third unit. We want to improve the conservation of the quantity and quality of water in Lake Anna. (**0014-2** (Murphey, Bill))

Comment: I want to emphasize again my outrage that Dominion continues to discharge water without an upper temperature limit into Lake Anna's cooling lagoons. Dominion's activities are not in compliance with the federal Clean Water Act which protects surface waters of the U.S. The ill effects of high water temperatures in Lake Anna have been well documented. (**0017-9** (Day, Elena))

Comment: Water temperatures have reached as high as 106 degrees F in the Lake Anna cooling lagoons and 93 degrees in the main lake. There are no limits on these water temperatures. (**0023-3** (Black, Betty))

Comment: Last Oct. the VA Dept. of Environmental Quality reissued the 316A variance to Dominion which permits the utility to continue to dump water used to cool the nuclear generating units into Lake Anna without an upper temperature limit. (Last summer temperatures in the so called cooling lagoons reached 106 F). This is illegal according to the Clean Water Act since the waters of Lake Anna and the streams that feed into the lake are recognized as surface waters of the U.S. Currently People's Alliance for Clean Energy and Blue Ridge Environmental Defense League as well as three Louisa County residents are appealing this decision of VADEQ. (**0026-14** (AuClair-Valdez, Miguel))

Comment: The U.S. Clean Water Act appears to have more safeguards for fish, wildlife, aquatic life, clams and mussels then for the protection of humans and recreation. VDEQ assumes that if the fish are o.k. then everything else must be o.k. There are currently no water temperature limits in Fahrenheit imposed in the current Water Discharge permit and its 316A

Variance for the North Anna plant for the current 2 reactors that can be measured by the public. Dominion can currently heat the entire lake to any temperature it desires with no penalties. (**0028-62** (Ruth, Harry))

Comment: Lake Anna has currently experienced water temperatures exceeding 104 degrees F in some areas in the cooling lagoons and over 93F on the main reservoir with just two nuclear reactors operating. The NRC says (1) With the addition of the proposed 3rd reactor cooling method (a combination air and water cooling system), that the lake water will evaporate at a rate of up to 24 million gallons per day and (2) the water temperature will get hotter faster as the water level declines. The VDEQ Water Resources Dept says the water level will decline at an additional rate of about 1.1 inches per month when the 3rd unit is operating and the water level is below 250 MSL. (**0028-70, 0033-79** (Ruth, Harry))

Comment: Question?—Can we take the chance that one of our loved ones will get sick or die because the water temperatures in Lake Anna which are currently at high levels in the summer months and will be increased further because of the up to 24 million gallons a day additional evaporation from the 3rd reactor cooling method than what they currently are from the existing two reactors?? Why? Because the water level will decline and there will be less water to cool the heat from the two current reactors causing the water to get hotter starting earlier in the summer and increasing temperatures throughout the summer and extending further into the fall. A simple analogy for the heating of water faster can be made with the fact that heating a cup of coffee will occur much faster than for heating a whole cup of coffee. If Dominion changed its proposed 3rd reactor cooling method to dry cooling (which they proposed for Unit 4 and is currently used in many places throughout the world), then the 3rd reactor cooling method would not further impact the hot water temperatures during the summer months in Lake Anna. (**0028-73, 0033-82** (Ruth, Harry))

Comment: The NRC in its DEIS should evaluate the new significant information from other U.S. states and governing bodies regarding national trends to reduce the water temperatures and the use of water from power plants to protect humans, fish, and wildlife. West Virginia in 2008 issued a draft permit for Mt. Storm in the future (which is similar to Lake Anna) that imposed different water temperature restrictions measured in Fahrenheit degrees depending on the time of year. (In winter 1 Dec -30 Apr—a maximum discharge water temperature of 73 degrees F (with a 5 degree differential between input and output, while in the summer (1 May - 30 Nov) a maximum discharge water temperature of 87 degrees F, with no more than a 5 degree temperature differential between input and output. Likewise New York is permitting only dry cooling on any new power plants on the Hudson River to insure that no additional heat is introduced to the Hudson River. Arizona and California are also imposing very strict restrictions on the use of water and adding heat to the water. Since the 3rd unit at North Anna will be in existence for probably the next 40 to 50 years, now is the time for Dominion to make the necessary changes in its cooling methods to reduce water consumption to be in front of or in line with the national curve and negate any additional heat being placed in Lake Anna to protect the Lake Anna environment for future generations. (**0033-16** (Ruth, Harry))

Comment: The U.S. Clean Water Act appears to have more safeguards for fish, wildlife, aquatic life, clams and mussels then for the protection of humans and recreation. VDEQ assumes that if the fish are o.k.—then everything else must be o.k. There are currently no water temperature limits in Fahrenheit imposed in the current Water Discharge permit and its 316A Variance for the North Anna plant for the current 2 reactors that can be measured by the public. Dominion can currently heat the entire lake to any temperature it desires with no penalties. (**0033-71** (Ruth, Harry))

Comment: Water level decrease—According to the Nuclear Regulatory Commission Environmental Report (See Page 5.12) says: Because the Unit 3 Cooling tower would consume water (up to 28 Million Gallons per day -see Section 3.2), the volume of water in Lake Anna would be reduced (compared to operation of only Units I and 2 alone) when the lake level elevation is below 250 ft MSL. Assuming the heat rejection rate from operations of Units 1 and 2 remains constant, the reduced volume of water in the lake caused by Unit 3 operations would result in a faster increase of lake water temperature (See Page 5.12). (**0033-72** (Ruth, Harry))

Comment: In October 2007, the Virginia Department of Environmental Quality (VDEQ) has granted a water discharge permit to Dominion that has imposed no water temperature limits in Fahrenheit that can be measured by the public at the North Anna plant for the current two operating nuclear units. In addition, VDEQ has granted Dominion a 316A Variance from the U.S. Clean Water Act which allows them legally to heat the entire lake to any temperature that they desire without any penalties.

8. Microcystis Algae Bloom Facts—Note that Algae Blooms occur in Lake Anna every summer when the lake water gets hot. (**0033-78** (Ruth, Harry))

Comment: While I was Manager of Water Quality at Dominion, the 316(A) temperature study of Lake Anna was completed and approved by the regulatory agencies. The company has agreed to change their water cooling design to a closed loop, hybrid system, instead of an open system, to minimize thermal impacts on Lake Anna. (**0034-103** (Marshall, Burton))

Comment: I am outraged that Dominion continues to discharge water without an upper temperature limit into Lake Anna's cooling lagoons. Dominion's activities are not in compliance with the federal Clean Water Act, which protects surface waters of the United States. And, indeed, the waters of Lake Anna are surface waters of the United States. The ill effects of high water temperatures in Lake Anna have been well-documented. It's irresponsible again for Dominion and the NRC to continue with an application to site new nukes on an already environmentally and hydrologically stressed watershed. And soon you're going to find us humans competing with the nuclear reactors for water, for our sustenance. (**0034-142** (Day, Elena))

Comment: The North Anna Power Station already threatens the water resources of this region. One, water temperatures have reached as high as 106 degrees Fahrenheit in the Lake Anna cooling lagoons and 93 degrees in the main lake. There are no limits on these water temperatures. (**0034-149** (Black, Betty))

Comment: Last October the Virginia Department of Environmental Quality reissued the 316(a) variance to Dominion, which permitted the utility to continue to dump water used to cool the nuclear generating units at Lake Anna, which have been discussed. There has been reference to the cooling lagoon, reaching temperatures of 106 degrees Fahrenheit. Now, as a retired administrative law judge, it would seem to me that if we go with the same standards that the applicants used when they first came in, we are missing the point. I can't imagine that Dominion came in and say, You know, we've got this great cooling system. We're going to have 106-degree Fahrenheit water in our cooling lagoons. I can't imagine they said that. So they have proven, in fact, that there are some real suspect operations in terms of what they are doing. So if the NRC again uses this neutral kind of standard with somebody who already has one strike against them, they're missing the boat. They've go to say, Look, the applicant has not performed satisfactorily in the past. The stakes are so high we are actually going to have a presumption against them. And until they can come up with convincing evidence to the contrary, they're not going to get a pass from us. (**0034-157** (AuClair-Valdez, Miguel))

Comment: The other thing is that this temperature is in violation of the Clean Water Act since Lake Anna, as has been pointed out, is surface water of the U.S. (**0034-158** (AuClair-Valdez, Miguel))

Comment: Now that the economically simplified boiling water reactor has been selected by Dominion, the issue of cooling the third reactor can now carefully be reviewed. The once passthrough cooling was rejected in the EIS ESP because of the water temperature. It heated the lake up too much. The current proposed cooling is a combination of wet/dry cooling tower, which introduces significant evaporation of the water in Lake Anna reservoir, up to 16.6 million gallons a day of water in the maximum water conservation mode. Several state agencies—DGIF, VDEQ, Division of Water Resources, DCR, and many other public sources such as the Lake Level Task Force Committee, which is a group of organizations and associations around the lake—LACA, FOLA, LABERA, and many other businesses around the lake—have objected to this high evaporation rate. It takes away the water in the lake very significantly. (**0034-31** (Remmers, Ken))

Comment: Plan 3 was considered in a stand-alone condition. No consideration was made for the alternative of installing additional water conservation measures to the existing power reactors of Units 1 and 2, to compensate or mitigate against the significant, adverse, incremental impacts caused by Unit 3. **(0034-34** (Remmers, Ken))

Comment: The new reactor at North Anna will not increase the temperature of Lake Anna. After concerns were raised by—of the potential thermal impact of a new reactor, Dominion committed to change the design to include cooling towers. (**0034-51** (O'Hanlon, Jim))

Comment: The adverse impact of the new unit on Lake Anna will be minimal. Dominion has already committed to install a $200 million cooling system to that new unit, so that the power station will not increase the temperature of the water it feeds into the lake. (**0034-7** (Watkins, John))

Comment: Chapter 3 mentions blowdown and other discharges. Will the applicant stipulate to a 100 degree thermal discharge limit as an operating permit condition as requested by the

Waterside Property Owners Association? Will the applicant stipulate to a 104 degree limit at the end of the discharge canal as requested by Friends of Lake Anna? **0035-17** (Goldsmith, Aviv))

Comment: Wouldn't the installation of new unit(s) be an opportunity to mitigate some of the existing problems with water temperature and lake level? **0035-25** (Goldsmith, Aviv))

Response: *NRC staff will evaluate the Unit 3 plant water use, cooling system operation, and effluent discharge descriptions in the COL application relative to the plant parameter envelope committed to by Dominion and approved by NRC as part of the ESP. New and significant information will be reviewed to determine whether there are any changes to the impacts of plant operation on water use and water quality, including temperature. The environmental impacts of construction on water use and water quality will be addressed in Chapter 4.3 of the SEIS; impacts of plant operation will be addressed in Chapter 5.3 of the SEIS. Related ecological, socioeconomic, and human health impacts of plant operation will be addressed in Chapters 5.4, 5.5, and 5.8, respectively, of the SEIS. The NRC does not have the authority to set water quality limits; plant effluent discharges will continue to be regulated by the Commonwealth of Virginia-VDEQ.*

Comment: Wrt [with respect to] Section 316(b), DGIF recommended a 2 mm screen intake with intake velocity of 0.25 fps. What is the design of this intake screen currently by Dominion? Will they comply with the bmp recommended by DGIF? (**0036-4** (Remmers, Ken))

Response: *NRC staff will consider these comments in its review of new and significant information related to proposed plant cooling system design and water use, which will be addressed in Chapter 3 of the SEIS.*

Comment: It appears that there are major discrepancies in the water sections. In numerous places the SDEIS asserted that data was lacking or simplified methodologies were used. (See for example Page 1-6 which states inter alia insufficient information was available "to allow the NRC staff to complete its independent analysis" and "these issues are not resolved for the North Anna ESP site"). (**0035-1** (Goldsmith, Aviv))

Comment: As evidenced from the recent public hearing, water use and impacts on lake level and downstream flow are major areas of concern. The SDEIS (see Table 10-3 e.g.) that the impacts of water use and quality are "unresolved" is not sufficient to make a determination of the project's acceptability. Perhaps a solution is to commission a truly unbiased third party water study to provide better methodology and data for impact assessments. This study could be incorporated into a new DEIS. (**0035-2** (Goldsmith, Aviv))

Comment: The SDEIS continues to be very troubling regarding water analysis. It states that the assessments "are based on a simplified representation of the conservation of mass for the lake." This excludes water temperature stratifications and the flow contributions from a many of the tributaries. How then, can the impact forecasts of SMALL be reliable? How can "no mitigation" be a reasonable solution? (**0035-22** (Goldsmith, Aviv))

Comment: SDEIS page 5-7 line 26 concluded that "relatively small errors in the pool elevation measurements using this model can result in significant errors in the precipitation, groundwater, and tributary inflow estimate." How then, can the impact forecasts of SMALL be reliable? How can "no mitigation" be a reasonable solution? Perhaps an independent comprehensive water study would provide more robust impact assessments. (**0035-23** (Goldsmith, Aviv))

Comment: The determination in Table 10-3 and elsewhere that the impacts on water use and quality is "likely to be SMALL" is unsubstantiated. As was clear from the last public hearing, the public's perception is that the impacts are LARGE. (**0035-48** [Goldsmith, Aviv])

Response: *This comment refers to the North Anna draft ESP EIS that was superseded by the North Anna final ESP EIS (NUREG-1811) published by NRC in December 2006. NUREG-1811 was revised to incorporate numerous public comments (see NUREG-1811, Appendix E) and an independent water budget analysis (NUREG-1811, Appendix K). Dominion was issued an ESP permit (ESP-003) in November 2007 for two units at the North Anna Power Station site under the specifications contained in that permit. All environmental issues related to the ESP application from Dominion were identified, evaluated, and resolved or proposed mitigation actions were identified. In Chapter 5.3 of the SEIS, NRC staff will evaluate any new and significant information pertaining to the water-related impacts of plant operation to determine whether the impact level has changed from NUREG-1811, ESP EIS.*

Comment: In the FEIS for the ESP, it is stated that The MWC mode would be used when Lake Anna is below 250 ft msl for seven consecutive days. DGIF requested a change in this schedule to less than seven days and even when the level is above 250 ft msl during certain critical periods. In the submitted Rev 0 of the COLA Final Safety Analysis, page 2-133, Dominion states if the reservoir water level falls below Elevation 76.2 m (250 ft) msl and is not restored within a reasonable period of time, the MWC mode is used. Why is the seven continuous days eliminated from discussion and why is the DGIF request ignored? (**0036-1** (Remmers, Ken))

Comment: Why are the Cooling Tower discussions in the FSAR and not in the EIS? Cooling tower discussions were unresolved in the FEIS of the ESP. The IFIM results could impact the amount of water released over the dam as well as any studies of the reservoir levels in the lake itself wrt recreation and safety. NRC should require Dominion put all cooling tower issues in the EIS. This is new and significant information and the NRC should open and address this issue of cooling methods used by Dominion for Unit #3. There may be insufficient water in the reservoir depending on the final IFIM recommendations. Virginia Coastal may not find the project in compliance and may not issue a certification. (**0036-3** (Remmers, Ken))

Response: *NRC staff will evaluate the Unit 3 plant water use, cooling system operation, and effluent discharge descriptions in the COL application relative to the plant parameter envelope committed to by Dominion and approved by NRC as part of the ESP. Staff will evaluate new and significant information relating to impacts of plant operation on Lake Anna reservoir lake level and discharge to the North Anna River below the dam, including any information available from the IFIM study. Water-related impacts of plant operation will be addressed in Chapter 5.3* *of the SEIS. However, adjustments to reservoir operations are under the authority of the Commonwealth of Virginia VDEQ, not the NRC.*

Comment: Shouldn't the operator's role in decisions to change the normal lake level (Page 5-11, line 28 et. seq.) be one of conditions of the COL? Just because "modifications to the water release regime from the Lake Anna Dam to mitigate impacts would be under the jurisdiction of VDEQ" Page 5-33 line 14), does not absolve the operator or the NRC from adopting reasonable mitigation measures which could be subject to VDEQ approval. (**0035-24** (Goldsmith, Aviv))

Response: *This comment refers to information in the North Anna draft ESP EIS that was superseded by the North Anna final ESP EIS (NUREG-1811) published by NRC in December 2006. NUREG-1811 was revised to incorporate numerous public comments (see NUREG-1811, Appendix E). Dominion was issued an ESP permit (ESP-003) in November 2007 for two units at the North Anna Power Station site under the specifications contained in that permit. In Chapter 5.3 of the SEIS, NRC staff will evaluate any new and significant information relating to impacts of plant operation on Lake Anna reservoir lake level to determine whether the impact level has changed from NUREG-1811, ESP EIS. Adjustments to reservoir operations affecting lake water level are under the authority of the Commonwealth of Virginia VDEQ, not the NRC.*

Comment: "Consumptive water losses may noticeably impact lake levels and downstream flows." This is a major area of local concern and should be more thoroughly analyzed and documented. It is hard to understand how an impact assessment of SMALL is derived from the discussion. It seems like the impacts are at least MODERATE and potentially LARGE. (**0035-29** (Goldsmith, Aviv))

Response: *This comment refers to information in the North Anna draft ESP EIS that was superseded by the North Anna final ESP EIS (NUREG-1811) published by NRC in December 2006. NUREG-1811 was revised to incorporate numerous public comments (see NUREG-1811, Appendix E). Dominion was issued an ESP permit (ESP-003) in November 2007 for two units at the North Anna Power Station site under the specifications contained in that permit. Under conditions of the ESP permit, Dominion is required to conduct an Instream Flow Incremental Methodology (IFIM) study that is designed and monitored in cooperation and consultation with the Virginia Department of Game and Inland Fisheries (VDGIF) and the Virginia Department of Environmental Quality (VDEQ) to address potential impacts of the proposed units on the aquatic resources of Lake Anna and downstream waters. This study must be completed prior to issuance of a combined license for any new units at NAPS. In Chapter 5 of the SEIS, NRC staff will evaluate any new and significant information pertaining to the water-related and aquatic resource impacts of plant operation to determine whether the impact level has changed from NUREG-1811, ESP EIS.*

Comment: Shouldn't the WHTF be subject to Clean Water Act and DEQ standards? It is fed by eight public streams and should be treated as public waters. (**0035-26** (Goldsmith, Aviv))

Response: *In the Commonwealth of Virginia, the U.S. Environmental Protection Agency has granted VDEQ authority for regulating water quality under the Clean Water Act. The Commonwealth has determined that the WHTF for the plant's thermal discharge is subject to the "waste treatment system" exclusion in the 9 VAC 25-31-10 definition of "surface waters." VDEQ does not have authority to regulate the treatment facility itself, but VDEQ does regulate discharges from the WHTF into Lake Anna. For Chapter 5 of the SEIS, staff will review new and significant information related to the water quality impacts of Unit 3 plant operation to determine whether there is any change to the impact levels determined in NUREG-1811, ESP EIS.*

7. Comments Concerning Hydrology – Groundwater

None of the comments in this area were considered in scope.

8. Comments Concerning Ecology - Terrestrial

Comment: We [VDGIF] have reviewed the proposed corridor for the additional 500kV line required to carry the output of the existing Lake Anna units and the proposed third unit. We do not currently document any listed wildlife or resources under our jurisdiction from the project area. Therefore, impacts upon such species and resources are not likely to result from the construction of this line. In addition, as this new line will be co-located within an existing power line corridor, it does not appear that significant wildlife habitat alterations will occur. (**0032-1** (Ewing, Amy))

Response: *The comment concerns terrestrial ecology issues and state listed species, and provides information relevant to the description of existing resources that will be provided in Chapter 2 of the SEIS. Impacts of construction of the plant and transmission line will be considered in Chapter 4, and the impacts of operation of the plant and transmission line will be considered in Chapter 5 of the SEIS.*

Comment: Does the feeding range of bald eagles or loggerhead strikes extend to the North Anna vicinity (Page 213 line 32)? (**0035-13** (Goldsmith, Aviv))

Comment: Section 4.4.3 line 35 acknowledged that bald eagles nest as close as 2.5 miles to the site. What effect will the project have on fish that the eagles may use as a food source? (**0035-18** (Goldsmith, Aviv))

Response: *Both the bald eagle and the loggerhead shrike would be expected to feed in the vicinity of NAPS Unit 3. NUREG-1811, ESP EIS determined that construction and operation of the proposed ESP facilities would have a SMALL impact on species of concern, including the eagle and shrike. The staff will evaluate whether there is any new and significant information concerning impacts to these species and will describe any changes to NUREG-1811, ESP EIS conclusions in Chapters 4.4 and 5.4 of the SEIS. Potential effects of plant operations on fish populations were considered in Chapter 5.4.2 of NUREG-1811, ESP EIS and new and significant information relevant to these impacts will be evaluated for Chapter 5.4 of the SEIS.*

9. Comments Concerning Ecology - Aquatic

Comment: We recommend that all land disturbing activities adhere to erosion and sediment controls. We recommend conducting any in-stream activities during low or no-flow conditions, using non-erodible cofferdams to isolate the construction area, blocking no more than 50% of the streamflow at any given time, stockpiling excavated material in a manner that prevents reentry into the stream, restoring original streambed and streambank contours, revegetating barren areas with native vegetation, and implementing strict erosion and sediment control measures. Due to future maintenance costs associated with culverts, and the loss of riparian and aquatic habitat, we prefer stream crossings to be constructed via clear-span bridges. (**0032-2** (Ewing, Amy))

Response: *These recommendations will be considered; construction impacts will be addressed in Chapter 4 of the SEIS.*

Comment: Sterile Grass Carp were introduced to assist in controlling the hydrilla. The grass carp life span was projected to be 15 years and that is just a few years away. (**0028-21, 0033-24** (Ruth, Harry))

Response: *The staff will review new information regarding the current and planned activities associated with stocking the reservoir and incorporate this information into the SEIS.*

Comment: The DEIS should examine the impact of declining Lake Anna Water levels on the wetlands and feeder streams throughout both the main reservoir and cooling lagoons of the lake. What will happen to the fish and wildlife that currently depend on the wetlands for survival? The DEIS should look at how long it takes to reestablish life forms at new water levels and the impact of increasing the range of variation of levels on the wetland areas. The ESP EIS identified that a cursory check had been accomplished and concluded that changes in the lake level result in creation of as much wildlife as is inundated or destroyed, hence low impact. A more comprehensive survey must now be accomplished. (**0028-22** (Ruth, Harry))

Comment: Fish, aquatic life, clams, mussels and wildlife may be adversely impacted with less lake water which is also hotter in the summer months. (**0028-40, 0033-48** (Ruth, Harry))

Comment: Fish, aquatic life, clams, mussels, and wildlife may be adversely impacted with less water and therefore hotter water because Units 1 & 2 cooling will still generate the same heat as today, but will have less water to cool it and the result will be hotter water. (**0028-50, 0033-59** (Ruth, Harry))

Comment: We are also concerned that these declining water levels will cause the water to get hotter faster in the summer months to unsafe water temperatures causing negative impacts to humans, recreation, fish, wildlife, aquatic life, clams and mussels. (**0028-61, 0033-70** (Ruth, Harry))

Comment: The NRC in its DEIS should examine the impact of declining Lake Anna Water levels on the wetlands and feeder streams throughout both the main reservoir and cooling lagoons of the lake and the additional human health impact of mosquito's breeding in the stagnant water in the wetlands. What will happen to the fish and wildlife that currently depend on the wetlands for survival? The DEIS should look at how long it takes to reestablish life forms at new water levels and the impact of increasing the range of variation of levels on the wetland areas. The ESP EIS previously identified that a cursory check had been accomplished and concluded that changes in the lake level result in creation of as much wildlife as is inundated or destroyed, hence low impact. It also appears that no one previously investigated the human health impact of mosquito's breeding in the stagnant water caused by declining water levels. (**0033-26** (Ruth, Harry))

Comment: The ESP EIS claims that wetlands impact is small because as much wetland is created as is destroyed, but is silent about the impact of what appears to be an almost annual reduction to the 248-foot level. The NRC should review modeling done in the environmental impact statement to incorporate new actual data and do further analysis of deviations from the 20-year averages. Additionally, inflow assumptions have not been field-verified and should be reviewed. Dominion has developed new data, including actual surveys of a portion of the wetlands on the lake. We ask that NRC carefully review and use this new data to determine if it alters its earlier impact assessment. Additional steps can and should be taken to mitigate low water level impact on safety, erosion, and ecosystems on the lake. (**0034-185** (Smith, Doug))

Comment: Other impacts are unsafe water conditions, which occur at low water levels; boating hazards; shoreline stabilization issues; impact to wetlands; and impacts to business and home values. (**0034-194** (Heino, George and Gerry))

Response: *The impacts of temperature and low water levels on Lake Anna wetlands and aquatic resources were previously resolved in NUREG-1811, ESP EIS. The staff will evaluate new information, including any revision to the water budget, to determine whether the impact levels previously stated should be changed. The impacts of plant operation on aquatic resources will be discussed in Chapter 5.4 of the North Anna Unit 3 SEIS. Related impacts on recreation and human health will be discussed in Chapter 5.5 and 5.8, respectively, of the SEIS.*

Comment: A major clam die-off occurred last year, but no study has been conducted by a certified malacologist to determine the health of the mussels and clams in Lake Anna. (**0023-6, 0034-152** (Black, Betty))

Comment: The SDEIS should also include the results of a professionally conducted total Clam/Mussel Survey of the entire Lake Anna as was previously requested by Brian Watson, the DGIF Wildlife Diversity Biologist/Malacologist. Apparently this study has never been completed. According to Brian Watson (Phone 434-525-7522) a clam/mussel survey should be conducted by a Virginia State certified malacologist and should be current within the last 2 year time period. Mr. Watson has identified that the Asian clam (*Corbicula fluminea*), Eastern elliptio (*Elliptio complanata*), Paper pondshell (*Uterbackia imbecillis*) and Easter Floater (*Pyganodon cataracta*) are resident in Lake Anna. In addition, he is concerned about the potential impacts of elevated water temperatures upon native freshwater mussels and that other freshwater rare species mussels (*Yellow lampmussel lampsilis cariosa*), (*eastern lampmussel lampsilis radiata*, *Eastern pondmussel liguimia nasuta*) and the (*Tidewater mucket-leptodea ochraces*) which are rare species may also be present. This study needs to be done and now is the time to do it before irreparable harm is done. (**0028-16, 0033-25** (Ruth, Harry))

Response: *The staff will evaluate new investigation and monitoring information relating to aquatic resources, to determine whether the impact levels previously analyzed in NUREG-1811, ESP EIS should be changed. The impacts of plant construction and operation on aquatic resources will be discussed in Chapter 4.4 and 5.4 of the SEIS.*

Comment: Both VDEQ and DGIF, in conjunction with Dominion Resources are currently conducting an Instream Flow Incremental Methodology (IFIM) study on Lake Anna and the North Anna River and Pamunkey Rivers downstream to determine the effects of the reduced water flow on recreation, wildlife, aquatic life and fish as part of the conditional certification for the 3rd reactor Early Site Permit (ESP). This IFIM study must also address all of the comments made by the VA Dept of Conservation and Recreation (DCR). This IFIM study should be completed before any Draft Environmental Impact Statement for the COL is issued by the NRC so all the results of the IFIM study can be reviewed and commented on by the public. Otherwise the results from this important study will cause much re-work later by the NRC, Virginia and the public and waste much time. Currently there is no public participation in the study plan or results. (**0028-8** (Ruth, Harry))

Comment: The IFIM Study will be completed in June and should be studied and analyzed as a part of the new EIS. Dominion has been directed to conduct a scientific study called the Instream Flow Incremental Methodology study. DEQ, DGIF, and DCR are providing input and supervision. This study looks at both Lake Anna and the downstream rivers (North Anna and Pamunkey) and will provide much guidance and valuable information which needs to be evaluated before a COLA can be granted. (**0031-11** (Crawford, Barbara))

Comment: The referenced IFIM study should be completed in draft only before any Draft Environmental Impact Statement for the COL is issued by the NRC so all the results of the IFIM study can be reviewed and commented on by the public. Otherwise the results from this important study will cause much re-work later by the NRC, Virginia and the public which will waste much time. Currently there is no public participation in the study plan or results. DCR, VDEQ, and DGIF, in conjunction with Dominion Resources are currently conducting an In-stream Flow Incremental Methodology (IFIM) study on Lake Anna and the North Anna River and Pamunkey Rivers downstream to determine the effects of the reduced water flow on recreation, wildlife, aquatic life and fish as part of the conditional certification for the 3rd reactor Early Site Permit (ESP). This IFIM study must also address all of the comments made by the VA Dept. of Conservation and Recreation (DCR) as to the total lake and recreation on the lake, as well as public review of the study. (**0033-6** (Ruth, Harry))

Response: *Under conditions of the ESP permit (ESP-003), Dominion is required to conduct an Instream Flow Incremental Methodology (IFIM) study that is designed and monitored in cooperation and consultation with the Virginia Department of Game and Inland Fisheries (VDGIF) and the Virginia Department of Environmental Quality (VDEQ) to address potential impacts of the proposed units on the fishes and other aquatic resources of Lake Anna and downstream waters. This study must be completed prior to issuance of a combined license for* *any new units at NAPS. Dominion agreed to consult both with VDGIF and VDEQ regarding surface water management, release, and instream flow conditions prescribed by VDGIF and VDEQ as implemented through appropriate state or Federal permits or licenses. Public involvement in the study plan and review of the results is the responsibility of the VDGIF and VDEQ, not the NRC. NRC staff, however, will monitor the progress related to completion of the study and results obtained. Any information that is available regarding the IFIM study at the time the SEIS is prepared will be included as part of Chapter 2.7.*

Comment: Page 5-24 states that "larval abundance is not known" and that a 1978 model was used for the estimation. How good is the estimation? Couldn't representative sampling give an estimate of larval abundance? (**0035-27** (Goldsmith, Aviv))

Comment: Page 5-27 discusses cold shock and says that it will be less of a problem with a multiple unit plant. This is only true if the entire station does not shut down. If the remaining unit or units shut down, the cold shock will be much more severe due to the loss of a huge thermal load. (**0035-28** (Goldsmith, Aviv))

Response: *These comments refer to information in the North Anna draft ESP EIS that was superseded by the North Anna final ESP EIS (NUREG-1811) published by NRC in December 2006. NUREG-1811 was revised to incorporate numerous public comments (see NUREG-1811, Appendix E). Dominion was issued an ESP permit (ESP-003) in November 2007 for two units at the North Anna Power Station site under the specifications contained in that permit. All environmental issues related to the ESP application from Dominion were identified, evaluated, and resolved or proposed mitigation actions were identified. The impacts to aquatic resources were discussed and resolved in Chapters 4.4, 5.4, and 7.5 of the ESP EIS (NUREG-1811). Staff will evaluate new investigation and monitoring information relating to aquatic resources, to determine whether the impact levels previously stated should be changed. The impacts of plant construction and operation on aquatic resources will be discussed in Chapter 4.4 and 5.4 of the North Anna Unit 3 COL SEIS.*

10. Comments Concerning Socioeconomics

Comment: The first item is the number of workers and residents using Route 652, Kentucky Springs Road. It is our understanding that North Anna Power Station employs approximately 800 permanent workers and every 18 months brings in an additional 1,000 workers during its outages. If Unit 3 is approved, there would be a need for approximately 2,000 employees during the construction phase. When Unit 3 is complete and operational, North Anna Power Station would employ approximately 1500 full time employees and still require additional workers every 18 months. There are dozens of multi-lot subdivisions along Route 652. The Waters Subdivision is a 400 lot development within a few miles of the plant. Cutalong is a mixed use development, that at full build out, will have over 1000 dwellings, a golf course and commercial retail space at the intersection of Route 652 and Route 208. There will be severe traffic congestion with that many people traveling a two-lane country road. While there will be long economic benefits to the County, those effects will not be felt until construction of Unit 3 begins and well thereafter. Louisa County needs to know what Dominion Power is doing for the increase of vehicles on Route 652? (**0015-2** (Lintecum, Lee))

Comment: Dominion has stated that it would be willing to work cooperatively with state and county governments to facilitate planning decision to minimize transportation impacts to avoid congestion and they would develop a construction management traffic plan prior to the start of construction. If widening Route 652 to handle the massive increase in traffic is required, planning needs to begin now. (**0015-3** (Lintecum, Lee))

Comment: Secondly, there would be a major influx of new people into Louisa County resulting in the need for new schools. Louisa County is currently building a new elementary school that will house 700 students. Even with the addition of this school, our elementary system will still be at maximum capacity. Louisa County Public Schools is currently working on a school construction plan, but needs more information about the impact of Unit 3 for that plan. (**0015-4** (Lintecum, Lee))

Comment: The County understands that because of the nature of the construction industry, with a variety of employee skill sets required, many employees will be transient but Louisa County has a tremendous wealth of attractants that many employees may make Louisa their permanent home. Since energy is a national priority, with a focus on nuclear energy, then possibly school construction grants can be provided by the Federal government to assist with new school construction. Again, if we are not prepared for the impact on our community's infrastructure, the County will have to play catch up, which will cost more in the long run. (**0015-5** (Lintecum, Lee))

Comment: Why there is a discrepancy of the ESP defining of 5000-7000 new workers (construction, periodic maintenance, professional) employees for 5 years on local roads and schools and now Dominion is saying there will only be 2000 workers involved with the 3rd reactor. In any case, the COL DEIS should evaluate these new worker impacts on the need for new expanded and improved roads before the project begins because of the heavy equipment, large number of workers and the three newly approved Louisa County subdivisions for about 1800 new homes in close proximity to the plant. (**0028-29** (Ruth, Harry))

Comment: New schools and other county infrastructure (police, fire, rescue squads, etc.) will need to be planned and built prior to any new tax dollars coming from Dominion. Louisa is now the 73rd fastest growing county in the U.S. Louisa and Spotsylvania are centrally located between three major fast growing metropolitan areas (Washington D.C., Richmond, and Charlottesville, VA). Who is going to pay for all these new requirements? Is the Federal Government (NRC & other departments) going to give grants to Louisa and Spotsylvania Counties, similar to the 8 to 10 million dollar grant they gave to Dominion for processing the Early Site Permit? (**0028-30, 0033-38** (Ruth, Harry))

Comment: Emergency evacuation on small 2 lane roads. Need for expanded road system to accommodate new workers, heavy construction equipment and subdivisions. (**0028-31** (Ruth, Harry))

Comment: The previous EIS calls the impacts of building a new reactor on Louisa County's infrastructure small. This is absurd and must be revisited as part of the new EIS. This is not a wealthy county. Our schools will be overwhelmed and unable to serve the children of the estimated 5000 workers who would be employed for a period of five years to build the 3rd reactor, in addition to the 850 people who work there now and the special crews that come to North Anna for the intermittent outages. Our roads are narrow, winding, 2-lane and unable to handle the new traffic. The construction equipment and materials would be heavy and damaging. Dominion has been directed to conduct a Traffic Impact Analysis. Have they done this? The results should be made available to the public. The new EIS should evaluate the results and set forth exactly what improvements Dominion will be expected to make. (**0031-12** (Crawford, Barbara))

Comment: One is the State Route 652 Kentucky Springs Road, which is a two-lane road. And with the construction that is going to happen, and with the—and then afterwards with the additional workers that we're going to be able to enjoy, the question is, you know, is that road adequate enough to handle the traffic that's coming? And we have more development coming in that area, as it is—Lake Anna is one of the growth areas in Louisa County, and we're going to have to face these problems. Obviously, the state currently is not in a position to help us with roads, so we're having to try to figure it out ourselves. (**0034-11** (Lintecum, Lee))

Comment: The second issue has to do with our school population. We're getting ready to build our fourth elementary school, and when it's built it will already be full. So we're wondering about this influx of new people, about how to play catch up in our school construction, and what may be available to help us on that. (**0034-12** (Lintecum, Lee))

Response: *Impacts of North Anna Unit 3 plant construction and operation on the utilization of existing local infrastructure or need for new infrastructure are within the scope of the socioeconomic impacts to be addressed in the SEIS. Impacts related to socioeconomics previously resolved in NUREG-1811, ESP EIS will be evaluated in terms of new and significant information to determine if impact levels should be changed.*

Comment: The Lake Anna region has been designated a growth area in the County's Comprehensive Plan. In view of the annual low water level in Lake Anna and potential needs for water sources in the immediate future, Louisa County has recently begun a study to identify potential water supplies for our citizens. Lake Anna and its tributaries have been identified as potential water resources for this ever-growing population center of our County. (**0015-6** (Lintecum, Lee))

Comment: The previous EIS stated that there were no new or anticipated residential, business or commercial demands on the watershed near the plant. This is incorrect. It was known, or should have been known based on documentation submitted to you, that there are 3 significant residential developments in the works, including Cutalong which is building a golf course that will require significant water withdrawals from Contrary Creek, one of the feeder streams for the power plant. Note that the DEQ has recommended this permit be granted. In addition, there are at least 3 businesses that I know of, near the plant that require significant water use: Argonaut, Martin Marietta, and a shopping center with supermarket at Cutalong, all of which require water in order to operate. Again, the new EIS needs to look closely at these competing demands for water in an area that has very little of it. The new EIS needs to reevaluate the availability of water for a 3rd reactor. (**0031-10** (Crawford, Barbara))

Comment: The previous EIS looked at the 3 counties bordering the lake, plus Henrico County and the City of Richmond. Considering that the water that flows over the dam goes into Hanover County and that Hanover County is dependent on that water for sewage treatment plants, private businesses such as Big Bear Paper Co. and Kings' Dominion, and the health and recreation uses of the North Anna and Pamunkey Rivers, I would argue that the new EIS should take a close and hard look at the impacts on that county. The LLCP or Lake Level Contingency Plan is a fragile and contentious balance between Louisa County and Hanover County and reflects the competing needs for water. (**0031-6** (Crawford, Barbara))

Comment: The third concern we have is that, since it is a growth area, we're going to have to someday figure out how to get the public water supply in that area, and what the availability of or the tributaries that make up Lake Anna or Lake Anna as a possible water source, we would like to discuss those with Dominion. (**0034-13** (Lintecum, Lee))

Comment: Considering that the water that flows over the dam goes into Hanover County and that Hanover County is dependent on that water for sewage treatment plans, private businesses, such as Big Bear Paper Company and King's Dominion, and the health and recreational uses of North Anna and Pamunkey Rivers, I would argue that the new EIS should take a close and hard look at the impacts on that county. (**0034-204** (Crawford, Barbara))

Comment: It's important to bear in mind that when Lake Anna was created, neither Dominion nor any governmental body, whether federal, state, or local, in any way discouraged the public from purchasing land and building homes around the lake. I would argue that there, therefore, exists a responsibility to those homeowners to protect them from the adverse impacts of the power station. Okay. There is misinformation in here. It is in my written statements. We have three housing developments going up there plus three businesses that are going to use a lot of water. You have the information in your hands, and you put down that there was nothing planned. I don't understand how that can happen. (**0034-206** (Crawford, Barbara))

Response: *The effects of population and industry on water demand, in conjunction with North Anna Unit 3 plant construction and operations, are within the scope of the SEIS. Impacts related to socioeconomics previously resolved in NUREG-1811, ESP EIS will be evaluated in terms of new and significant information to determine if impact levels should be changed.*

Comment: Why there is a discrepancy of the ESP defining of 5000-7000 new workers (construction, periodic maintenance, and professional) employees for 5 years on local roads and schools and now Dominion is saying there will only be 2000 workers involved with the 3rd reactor. In any case, the COL DEIS should evaluate these new worker impacts on the need for new expanded and improved roads before the project begins because of the heavy equipment, large number of workers and impact on earlier analysis of the three newly approved Louisa County subdivisions for about 1800 new homes in close proximity to the plant. (**0033-37** (Ruth, Harry))

Comment: The new unit will bring 750 new jobs to the local area, additional tax revenues, and reduce the dependence on foreign oil, providing enough electricity to provide 375,000 homes. (**0034-181** (Smith, Doug))

Comment: And what I'm here tonight to speak on is this is going to support—once this project starts, it's going to support young kids that want to get in a trade, to learn a trade, which it can support them the rest of their life for their families. (**0034-19** (Rigali, Tony))

Comment: North Anna 3 could—is an economic engine for Louisa County and the Commonwealth as a whole. And Dominion—if Dominion were to build this new nuclear unit at North Anna, the company would expect a workforce for more than 3000 construction workers, and that's pretty much what it took when I was over there, and would require permanent workers of 750 high-paying permanent workers that were created for the station's operation. The power station currently provides employment for more than 900 people. Roughly one third of these employees live in Louisa County, while the rest live in Richmond, Fredericksburg, and Spotsylvania County. (**0034-20** (Rigali, Tony))

Comment: In direct revenue, North Anna pays Louisa County each year approximately $11 million. And since its inception, it has paid Louisa County over $230 million of direct revenue. The third nuclear reactor will add millions more dollars to that, and if you really want to see the impact just look at our new schools and our fire trucks and police cars and the services that this revenue provides our county. (**0034-22** (Gibson, Bob))

Comment: The second point I'd like to make is, like our previous speaker said, 300—approximately 300 of the 900 workers live in Louisa County. The average salary of these workers is $60,500. That equates to an annual payroll of Louisa County citizens of over $18 million. The new reactor is going to employ 750 people. If the same ratio applies, that means 250 of these jobs will go to Louisa County citizens, and with the same average payroll that's an additional $15 million annually of payroll in Louisa County for Louisa County citizens. Taken together, that is over $33 million of payroll within Louisa County, and keep in mind this money changes hands several times before it leaves Louisa County, so which will mean several million dollars more of additional indirect revenue for the county. (**0034-23** (Gibson, Bob))

Comment: I would like to again bring out the point that a previous speaker made of the 3000 construction workers coming into Louisa County. You know, the word surge is kind of popular these days in the United States, but this is going to be an economic development surge for the county, because these workers are going to get paid and probably a pretty good salary, and they're going to rent homes, they're going to buy homes, they're going to buy groceries, they're going to buy automobiles and trucks and every other type of retail purchase in our county. So this is going to mean additional revenue for our county. (**0034-24** (Gibson, Bob))

Comment: The North Anna power station has also been—had a positive impact on the county. I don't think I could add anything to what Bob just said. However, the county has benefitted economically from the—through the increased tax base and increased numbers of employees. (**0034-29** (Manzari, Jack))

Comment: As Dominion's lowest cost source of baseload electricity, nuclear is important to the economic well being of Virginians and to the economy of the Commonwealth. North Anna power station, as has been stated, has paid over $230 million in taxes to Louisa County, and I am informed that the taxes would more than double after this third unit goes into operation. (**0034-55** (Tribble, Charles))

Comment: I'd like to start off talking about a Nuclear Energy Institute study that looked at the economic impact of North Anna power station on the State of Virginia. North Anna generates more than $710 million in economic benefit to the state. This includes approximately $11 million in property tax for the surrounding counties, which enables the counties to provide excellent educational facilities and staff, and other public works for everyone in the county, not just Dominion employees' families. (**0034-78** (Fawls, Rebecca))

Comment: Building a new nuclear power plant will bring approximately 2000 jobs during construction and provide approximately 600 permanent high-paying jobs. The new nuclear power plant would also increase tax revenues to the surrounding counties and Virginia as a whole. An added benefit would be the ripple effect on the economy, such as housing, restaurants, and manufacturing for the state. (**0034-81** (Fawls, Rebecca))

Response: *The impacts of North Anna Unit 3 plant construction and operating workforce are within the scope of the socioeconomic impacts to be addressed in the SEIS. Impacts related to socioeconomics previously resolved in NUREG-1811, ESP EIS will be evaluated in terms of new and significant information to determine if impact levels should be changed.*

Comment: I AM OPPOSED TO A PLANT THAT WILL LOWER THE LAKE WATER LEVEL. Lowering the Lake level will negatively impact property values and negatively impact recreation. (**0010-2** (Hayo, Dennis))

Comment: When water levels are down 2 ft the lake becomes unusable for the majority of homeowners. (**0012-2** (Heino, George and Gerry))

Comment: Dominion (Vepco) was allowed to build their reactors as long as the lakes provide recreation, their proposed design will limit that significantly. (**0012-4** (Heino, George and Gerry))

Comment: Other impacts are unsafe water conditions which occur at low water levels, boating hazards, shoreline stabilization issues, impact to wetlands and impacts to business and home values. (**0012-5** (Heino, George and Gerry))

Comment: Recreational boaters will find more hazards throughout the lake, with stumps, rocks, sandbars, etc. causing lower units to hit them which in turn could necessitate major repairs or replacement of propellers, other engine components and boat hulls. When the lake level is below 250 MSL and continues to decrease during drought cycles, these hazards will only increase. (**0028-12** (Ruth, Harry))

Comment: It is important to remember that the lake was not just built for Dominion to use to cool its power plant. The enabling legislation set forth very clearly that Lake Anna was also created as a recreational lake for the public to enjoy. One use is no more important than the other. And one use, e.g., cooling the reactors, cannot be allowed to destroy the lake's recreational use. (**0031-7** (Crawford, Barbara))

Comment: It is important to bear in mind that when Lake Anna was created, neither Dominion nor any governmental body, whether federal, state or local, in any way discouraged the public from purchasing land and building homes around the lake. I would argue that there therefore exists a responsibility to those homeowners to protect them from adverse impacts of the power station. (**0031-8** (Crawford, Barbara))

Comment:

Business Real Estates Sales/Rentals (B3R)
i. Advantage: None
ii. Disadvantages

1. Lower lake level discourages any potential buyers or renters -minimal sales
2. Current depressed real estate market will further decline
3. Real Values and Assessments will decrease
4. Sales /rental commissions will decrease
5. Taxes to local communities will decrease
6. Insurance rates may increase due to lack of water at dry fire hydrants
7. Shoreline instability problems may create many related impacts.
8. Fewer sales will mean less need for loans from banks/mortgage lenders
9. Fewer sales will means less need for future land development
10. Fewer sales will mean less need for title agencies. (**0033-44** (Ruth, Harry))

Comment:

Business Construction (BC)

i. Advantages: None
ii. Disadvantages

1. With fewer real estate sales/rentals there will be less need for future construction
2. This will directly reduce need for building designers, building contractors, building materials, cabinetry & countertops, clearing services, concrete, construction of decks, decorative concrete, docks and boathouses, drywall contractors, excavating, hauling, heating & air conditioning, home improvement, home staging, interior design, kitchen & bath, landscape design, landscape lighting, lumber, remodeling, soil consultants, surveyor, underground sprinkler systems and water treatments. (**0033-45** (Ruth, Harry))

Comment:

Business Lake Recreation (BL)

i. Advantages: Boating major repairs will increase for the few boaters that use lake
ii. Disadvantages

1. With less water in the lake, fewer people will want to use the lake or visit the lake

(**0033-46** (Ruth, Harry))

Comment: This will directly reduce the business for boat rentals, boat repairs for many boaters who would have previously used the lake, boat RV/PWC/storage, boat sales, campgrounds and marinas. (**0033-49** (Ruth, Harry))

Comment: An example of one safety impact is: Recreational boaters will find more hazards throughout the lake, with stumps rocks, sandbars, etc. causing lower units of boats to hit them which can cause severe injury to passengers and necessitate major repairs or replacement of propellers, other engine components and boat hulls. When the lake level is below 250 MSL and continues to decrease during drought cycles, these hazards will only increase. The drought cycles will double if the wet/dry cooling method for Unit 3 is selected. Businesses will suffer and users of the lake will find other places to recreate which will decrease property values and reduce tax income to the local counties. Also note that when the lake level drops below 248 MSL that over 50% of the homeowners cannot use their boats piers due to low water levels. (**0033-5** (Ruth, Harry))

Comment: Boat slip rental business and lake waterfront owners will encounter major difficulties in getting boats off boat lifts, possibly having mud-flats in front of their property making the lake unusable for swimming or using their boats. (**0033-51** (Ruth, Harry))

Comment: Marinas, Campgrounds and lake front owners may have to extend their boat ramps & docks so they can launch and retrieve their boats. (**0033-53** (Ruth, Harry))

Comment: If fewer people come to the lake because of declining lake levels, then the need for other lake services will also decline. (**0033-55** (Ruth, Harry))

Comment: Fewer real estate sales & rentals and less construction will mean fewer people will live on or visit the lake, thereby decreasing the business for accounting, advertising, automotive, attorneys, awards, bed and bath, blinds & shades, business services, catering services, cleaning services, computer services, county stores, physicians, dentists, dining, event location, fitness centers, investment securities, lawn care, newspapers, retailers, self storage, shipping services, skin care, beauty shops, television services, travel & leisure, wineries, etc. (**0033-56** (Ruth, Harry))

Comment:

1. Advantage: Potential for lower taxes due to decreasing value of property.
2. Disadvantages:

    a. Lower lake level discourages any potential buyers or rentals
    b. Real estate values and assessments could decrease. (**0033-57** (Ruth, Harry))

Comment: Waterfront owners will encounter major difficulties in getting boats off boat lifts, possibly having mud-flats in front of their property making the lake unusable for swimming & boating. (**0033-60** (Ruth, Harry))

Comment: Some owners and/or Property Owner Associations may have to extend their boat ramps so they can launch and retrieve their boats. (**0033-62** (Ruth, Harry))

Comment: Day User (DU) Does not own Lake Anna property and uses Lake Anna for recreation (e.g., campground, marina, state park, etc.) for day and then goes to home, motel or cabin.

1. Advantage: None.
2. Disadvantages:

   a. Less water will cause the existing water to get hotter faster and increase the human health risks for immersion in heated water, together with the potential for health risks of increased bacteria (microorganisms) or algae blooms. Hotter water makes the lake less desirable in summer time and day users may try to find other cooler waters to recreate in.
   b. Fish, aquatic life, clams, mussels and wildlife may be adversely impacted with less water and the water temperatures rising could cause lethal effects to various water related wildlife.
   c. Lower and hotter water levels could encourage the hydrilla and other aquatic life to proliferate, thereby making it less desirable, as well as unhealthy to swim and recreate on the lake. Previous high levels of hydrilla caused major difficulties in launching boats, caused the weeds to become entangled in boat propellers and choke the engine. In addition, young children when swimming previously became entangled in the hydrilla creating a very serious safety issue.
   d When boating, the lake users will find more hazards throughout the lake, with stumps, rocks, sandbars, etc. causing lower units to hit them which in turn could necessitate major repairs or replacement of propellers, other engine components and boat hulls. In addition, the safety of allay board the boats is severely jeopardized when the boats run into these newly emergent and changing boating hazards when the lake level is below 250 MSL and continues to decrease during drought cycles. Note: Dominion and the NRC state these drought cycles will be doubled with the proposed type of 3rd reactor wet/dry cooling method. The doubling of the drought cycle will increase the human safety risks dramatically.
   e. If fewer people come to the lake because of declining lake levels, then it is quite possible that many of the current lake services (restaurants, retail, etc.) will be unable to grow or stay in business due to lack of customers and will be unavailable to the day user when they visit. (**0033-66** (Ruth, Harry))

Comment: Lake Anna Boating and Recreation Association has concerns that the proposed cooling towers for the third nuclear reactor at Lake Anna will create an additional adverse impact when lowering the lake levels, lower lake levels when compared to the safety and welfare of the estimated 500,000 boating and recreation enthusiasts that live at and visit the lake. (**0034-173** (Jones, Dale))

Comment: Unsafe low water conditions cause many of the people that previously boated here to look elsewhere for the boating recreation. This causes a negative impact on our local business community. Many Lake Anna businesses rely on the sales that are made in the spring, summer, and fall months. The low water condition affects real estate, construction, marinas, dock builders, restaurants, banks, fishing guides, boat sales, repair shops, et cetera. The business owners that we had personally spoken to—and we haven't spoken to all of them—have all concurred that the low lake levels will adversely impact their businesses. (**0034-175** (Jones, Dale))

Comment: Fewer people will visit the Lake Anna State Park because of the increased risks at the lake. (**0028-58, 0033-67** (Ruth, Harry))

Comment: The Lake Anna Boating and Recreation Association recognizes and appreciates the many benefits that are derived from the Dominion Resources, including construction of the lake. Many of our members, friends, and neighbors enjoy employment, which we have seen here tonight, a lot of them. They have enjoyed home ownership and business due to their presence. In the past, we have considered them to be a good neighbor and would expect that in the process of planning for future business expansion, Dominion Resources would be considerate of the needs of the public and continue to help maintain a healthy lake condition, as promised, rather than purposely destroy them. The maintenance of the 250-foot water level will only help ensure the continued success as well as others in the community. (**0034-179** (Jones, Dale))

Comment: The majority of docks at Lake Anna only have three feet of water. When water levels are down two feet, the lake becomes unusable for the majority of homeowners. (**0034-191** (Heino, George and Gerry))

Comment: Dominion, VEPCO, was allowed to build their reactors as long as the lake provides recreation. Their proposed design will limit that significantly. (**0034-193** (Heino, George and Gerry))

Comment: Other impacts are unsafe water conditions, which occur at low water levels; boating hazards; shoreline stabilization issues; impact to wetlands; and impacts to business and home values. (**0034-195** (Heino, George and Gerry))

Comment: The LLCP, or lake level contingency plan, is a fragile and contentious balance between Louisa County and Hanover County and reflects the competing needs for water. It is important to remember that the lake was not just built for Dominion to use to cool its power plant. The enabling legislation set forth very clearly that Lake Anna was also created as a recreational lake for the public to enjoy. One use is no more important than the other. And one use; for example, cooling the reactors, cannot be allowed to destroy the lake's other use: its recreational use. (**0034-205** (Crawford, Barbara))

Response: *Impacts of low water levels on Lake Anna recreation, businesses, and property values were previously resolved in NUREG-1811, ESP EIS. Impacts related to socioeconomics previously resolved in the ESP EIS will be evaluated in terms of new and significant information to determine if impact levels should be changed.*

Comment:

Business Real Estates Sales/Rentals (BR)
i. Advantages—None
ii. Disadvantages—

1. Lower lake level discourages any potential buyers or renters—minimal sales
2. Current depressed real estate market will further decline
3. Real Values and Assessments will decrease
4. Sales/rental commissions will decrease
5. Taxes to local communities will decrease
6. Insurance rates may increase due to lack of water at dry fire hydrants
7. Shoreline instability problems may create many related impacts.
8. Fewer sales will mean less need for loans from banks/mortgage lenders
9. Fewer sales will means less need for future land development
10. Fewer sales will mean less need for title agencies (**0028-36** (Ruth, Harry))

Comment:

Business Construction (BC)
i. Advantages: None
ii. Disadvantages

1. With fewer real estate sales/rentals there will be less need for future construction
2. This will directly reduce need for building designers, building contractors, building materials, cabinetry & countertops, clearing services, concrete, construction of decks, decorative concrete, docks and boathouses, drywall contractors, excavating, hauling, heating & air conditioning, home improvement, home staging, interior design, kitchen & bath, landscape design, landscape lighting, lumber, remodeling, soil consultants, surveyor, underground sprinkler systems and water treatments (**0028-37** (Ruth, Harry))

Comment:

Business Lake Recreation (BL)
i. Advantages: Boating major repairs will increase for the few boaters that use lake
ii. Disadvantages

1. With less water in the lake, fewer people will want to use the lake or visit the lake (**0028-38** (Ruth, Harry))

Comment: This [fewer people using the lake because of declining lake levels] will directly reduce the business for boat rentals, boat repairs for many boaters who would have previously used the lake, boat RV/PWC/storage, boat sales, campgrounds and marinas. (**0028-41** (Ruth, Harry))

Comment: Boat slip rental business and lake waterfront owners will encounter major difficulties in getting boats off boat lifts, possibly having mud-flats in front of their property making the lake unusable for swimming or using their boats. (**0028-43** (Ruth, Harry))

Comment: If fewer people come to the lake because of declining lake levels, then the need for other lake services will also decline. (**0028-46** (Ruth, Harry))

Comment: Fewer real estate sales & rentals and less construction will mean fewer people will live on or visit the lake, thereby decreasing the business for accounting, advertising, automotive, attorneys, awards, bed and bath, blinds & shades, business services, catering services, cleaning services, computer services, county stores, physicians, dentists, dining, event location, fitness centers, investment securities, lawn care, newspapers, retailers, self storage, shipping services, skin care, beauty shops, television services, travel & leisure, wineries, etc. (**0028-47** (Ruth, Harry))

Comment: Homeowners (H)

1. Advantage: Potential for lower taxes due to decreasing value of property.
2. Disadvantages:

    a. Lower lake level discourages any potential buyers or rentals
    b. Real estate values and assessments could decrease (**0028-48** (Ruth, Harry))

Comment: Waterfront owners will encounter major difficulties in getting boats off boat lifts, possibly having mud-flats in front of their property making the lake unusable for swimming & boating. (**0028-51** (Ruth, Harry))

Comment: Some owners and/or Property Owner Associations may have to extend their boat ramps so they can launch and retrieve their boats. (**0028-53** (Ruth, Harry))

Comment: Homeowner Insurance rates may increase due to lack of water at dry fire hydrants k. If fewer people come to the lake because of declining lake levels, then it is quite possible that many of the current lake services (restaurants, retail, etc.) will be unable to grow or stay in business due to lack of customers. (**0028-56** (Ruth, Harry))

Comment:

Day User (DU) Does not own Lake Anna property and uses Lake Anna for recreation (e.g., campground, marina, state park, etc.) for day and then goes to home, motel or cabin.

1. Advantage: None.
2. Disadvantages:

    a. Less water will cause the existing water to get hotter faster and increase the human health risks for immersion in heated water, together with the potential for health risks of increased bacteria (microorganisms) or algae blooms. Hotter water makes the lake less desirable in summer time and day users may try to find other cooler waters to recreate in.

b. Fish, aquatic life, clams, mussels and wildlife may be adversely impacted with less water and the water temperatures rising could cause lethal effects to various water related wildlife.
c. Lower and hotter water levels could encourage the hydrilla and other aquatic life to proliferate, thereby making it less desirable, as well as unhealthy to swim and recreate on the lake. Previous high levels of hydrilla caused major difficulties in launching boats, caused the weeds to become entangled in boat propellers and choke the engine. In addition, young children when swimming previously became entangled in the hydrilla creating a very serious safety issue.
d. When boating, the lake users will find more hazards throughout the lake, with stumps, rocks, sandbars, etc. causing lower units to hit them which in turn could necessitate major repairs or replacement of propellers, other engine components and boat hulls. In addition, the safety of all aboard the boats is severely jeopardized when the boats run into these newly emergent and changing boating hazards when the lake level is below 250 MSL and continues to decrease during drought cycles. Note: Dominion and the NRC state these drought cycles will be doubled with the proposed type of 3rd reactor wet/dry cooling method. The doubling of the drought cycle will increase the human safety risks dramatically.
e. If fewer people come to the lake because of declining lake levels, then it is quite possible that many of the current lake services (restaurants, retail, etc.) will be unable to grow or stay in business due to lack of customers and will be unavailable to the day user when they visit. (**0028-57** (Ruth, Harry))

Comment: There will be major fire safety hazards for lake homes/communities by making the dry fire hydrants unusable due to the lack of water at the lake intake caused by the decreasing lake water level.

- There will be shoreline stabilization problems (the seawalls & rip rap are designed for a water level of 250 MSL) and
- There will be negative impacts on many lake businesses as people go elsewhere to recreate and live. (**0033-4** (Ruth, Harry))

Comment: Homeowner Insurance rates may increase due to lack of water at dry fire hydrants. If fewer people come to the lake because of declining lake levels, then it is quite possible that many of the current lake services (restaurants, retail, etc.) will be unable to grow or stay in business due to lack of customers. (**0033-65** (Ruth, Harry))

Response: *Impacts of low water levels on Lake Anna recreation, businesses, and property values were previously resolved in NUREG-1811, ESP EIS. Impacts related to socioeconomics previously resolved in the ESP EIS will be evaluated in terms of new and significant information to determine if impact levels should be changed. The impacts on fire safety will be considered as part of the SEIS and addressed in Chapter 5.*

Comment: The height of dry and wet cooling towers and facility buildings should not exceed the tree line to protect the rural aesthetic landscape of the community as Dominion indicated in its Jan 2006 stakeholder meeting. (**0028-28** (Ruth, Harry))

Comment: Noise concerns/decibel levels emitted from 180/230 foot buildings that will travel long distances without having tree barriers to break the sound from giant fans. (**0028-34** (Ruth, Harry))

Comment: To ensure that the proposed construction of a 3 reactor will minimize the adverse effects on the quality of life for those who live and work on and around or use Lake Anna, we also ask that you further evaluate the following concerns prior to your making a final decision on the ESP (conditional certification requirements) and are included for evaluation in the COL DEIS.

a. The height of dry and wet cooling towers and facility buildings should not exceed the tree line to protect the rural aesthetic landscape of the community as Dominion indicated in its January 2006 stakeholder meeting. (**0033-36** (Ruth, Harry))

Response: *Local noise impacts and visual aesthetics of the proposed Unit 3 are within the scope of the SEIS. Impacts related to noise and visual aesthetics previously resolved in NUREG-1811, ESP EIS will be evaluated in terms of new and significant information to determine if impact levels should be changed.*

Comment: The section on socioeconomics is lacking. For example, there is no data on the impact that the project will have on local house values. The impacts on the human environment must be fleshed out in an EIS and this should be addressed as part of Section 5.5.3.1 or 5.5.3.5. The potential impacts to the DC area are not addressed at all in the document and should be included. (**0035-3** (Goldsmith, Aviv))

Response: *Impacts of the construction and operation of the proposed power plant on housing availability and housing values were previously discussed and resolved in NUREG-1811, ESP EIS. The Unit 3 SEIS will primarily discuss new and significant information available since NUREG-1811 to determine whether any previously stated conclusions would change as a result of the new information. With respect to the impacts to the DC metropolitan area, the number of activities that affect that metropolitan housing market are many and diffuse, and it is extremely unlikely that the impact of the construction and operation of North Anna Unit 3 could be separately identified in that market.*

Comment: The transportation section is totally deficient. There is currently insufficient infrastructure to support the construction workforce or handle an evacuation. Assuming that the roads will be there when required (Page 5-37, line 16) is not science, it is superstition. The SDEIS stated "No new transportation routes...are currently planned in the vicinity of NAPS." (Page 2-4 line 37). There is little to no funding for road expansions in Virginia. The DEIS acknowledged that the I-95/606 interchange is congested at "LOS D or worse" and that SR208 from Blockhouse Road to Lake Anna (about 12.5 miles) is a minor two-lane road. Increased construction usage will have major impacts on these roads. If an evacuation is required during the construction interval when additional personnel are on site, the impact would be staggering. (**0035-5** (Goldsmith, Aviv))

Response: *The transportation section will address new and significant information available since NUREG-1811, ESP EIS, to determine if any impacts estimated in the ESP EIS should be changed.*

Comment: Given that Louisa County had a population of about 25,000 in 2000 (Page 2-1 line 42), the SDEIS conclusion that a construction work force of 5000 would have a SMALL impact (Section 4.5) is unsubstantiated and suspect. (**0035-19** [Goldsmith, Aviv])

Response: *In NUREG-1811, ESP EIS for the North Anna site, the impact of the construction-related population was based in part on where the construction workforce chose to live. The basic assumption was that the construction workforce would largely come from outside of Louisa County and would commute to the North Anna site. The basis for that assumption was given in the NUREG-1811, ESP EIS. It also stated that if more workers than expected located in Louisa County, the impact was estimated to rise to MODERATE. The North Anna Unit 3 construction workforce is significantly smaller than that assumed in the ESP EIS, but more is now known about the housing and public services that the workforce would actually face. The North Anna Unit 3 COL SEIS will consider whether new and significant information available since NUREG-1811, ESP EIS would change any impact levels previously discussed.*

Comment: At the ESL public hearing that I was able to attend, Lake Anna residents expressed concern about the aesthetics of the cooling towers. A visual simulation should be included as part of Section 4.5.1.4 to address this concern. (**0035-20** (Goldsmith, Aviv))

Response: *A visual simulation has been provided in the applicant's ER and will be discussed in the North Anna Unit 3 COL SEIS.*

Comment: Table 10-1 acknowledges that increased traffic congestion is unavoidable. This is not congruous with the SMALL impact determination. Table 10-2 should include an assessment of traffic similar to Table 10-1. Presently, this would also conclude that increased traffic congestion is unavoidable. (**0035-44** (Goldsmith, Aviv))

Response: *The analysis of mitigation and unavoidable impacts will consider any new and significant information on traffic congestion and the impact of traffic management plans.*

Comment: [Overall, the mitigations (listed in Section 10) are insufficient]. Major contributions to construction of a reliable road network are required. Financial contributions to neighboring counties to alleviate the housing, school, and health care burdens of the project should be implemented. (**0035-46** (Goldsmith, Aviv))

Response: *Chapter 10 of NUREG-1811, ESP EIS, considered potential mitigation actions in the area of traffic congestion. Potential mitigative actions will again be considered for impacts identified in the Unit 3 SEIS.*

Comment: Shouldn't Appendix F or L or the socioeconomic section of the text include mention of the resolution passed by Spotsylvania County against the project and the ESP? (**0035-49** (Goldsmith, Aviv))

Response: *The resolution will be considered in the North Anna Unit 3 SEIS to the extent that it provides new and significant information that affects the impact levels previously discussed in NUREG-1811, ESP FEIS, or impacts that were not previously discussed.*

11. <u>Comments Concerning Historic and Cultural Resources</u>

Comment: Many issues regarding potential impacts to historic properties, specifically archaeological resources, were resolved during the Early Site Permit (ESP) process. Given the limitations of the ESP process and changes to the scope of the project, additional studies are warranted to determine this undertaking's effect to historic properties. We understand, that an additional 90+ acres have been added to the project. We recommend that this and any additional areas included in the project be subjected to Phase I archaeological survey by a qualified professional in accordance with our *Survey Guidelines* (rev. 2003). Furthermore, as new tower height is established, we recommend finalizing the viewshed analysis to determine potential impacts to the setting of nearby historic properties. Finally, we are concerned about the avoidance and continued management of the three known cemeteries (44LS0221, 0222, and 0227) and the historic site (44LS0226), which have been found to be potentially eligible for listing in the National Register of Historic Places. We request that the NRC provide for their protection. (**0001-1** (Kirchen, Roger))

Response: *Cultural resource management and measures associated with impacts to cultural resources will be discussed in Chapters 4 and 5 of the SEIS.*

Comment: Since consultation regarding the ESP, several Federally-recognized Indian tribes have informed our office of their possible interest in undertakings in Virginia. Find attached contact information for these tribes. We do not know of any specific tribe with interest in this project nor do we make any statement regarding the completeness of this list. This information is provided as a courtesy and is intended as technical assistance to NRC in meeting its tribal consultation requirements. (**0001-2** (Kirchen, Roger))

Response: *The NRC intends to make use of the list of tribes provided by the Virginia SHPO to meet its tribal consultation requirements.*

12. <u>Comments Concerning Environmental Justice</u>

Comment: NRC Commissioner Jaczko took issue with his fellow commissioners in the November decision to approve the North Anna ESP. In dissent, he wrote: "I concur with my colleagues on most of this decision, but dissent, in part, on the environmental justice portion of the Memorandum and Order. Environmental justice is a critical component of the agency's NEPA review. It seeks to ensure that environmental, social, economic and health issues are all appropriately considered in the context of minority and low-income populations where the impacts of actions may be remarkably different from the impacts on the majority. Although the staff obtained underlying data on minority and low-income populations and provided its conclusions on the potential environmental impacts on those populations in the Environmental Impact Statement (EIS), I do not believe that the Staff sufficiently explained how it reached its conclusions regarding environmental justice. Without such an explanation, I believe it is difficult for the Commission, or the public, to determine whether the Staff has examined environmental justice issues in greater detail—as we, in our Environmental Justice Policy Statement, directed the Staff to do. I fully support my colleagues' efforts in this Memorandum and Order to ensure that future environmental justice reviews are supported by a level of detail that would transparently describe the basis for the Staff's conclusions. I diverge from my colleagues on this issue in one respect: I would have also directed the Staff to prepare a Supplemental EIS that provides a supporting analysis for its conclusions prior to the issuance of this Early Site Permit. I recognize that requiring additional work in the environmental justice area would then impact the finality of this Early Site Permit. I also recognize that this could cause the applicant to adjust its future plans, even though it is the agency's, not the applicant's, responsibility to consider environmental justice issues. But as I have previously stated, this agency exists to serve the public. I have consistently demanded that applicants present thorough and high quality applications to this agency and it would be inconsistent for me not to demand the same in the Staff's review of those applications. Both are necessary for the NRC to be able to transparently demonstrate how we meet our mission. In this instance, I believe we could have provided a supplemental environmental justice analysis at the cost of a bit more time, but with the benefit of being certain that the agency had a thorough analysis supporting issuance of this Early Site Permit."

It is now incumbent on the NRC to rectify this error. The supplemental analysis outlined above would be a reasonable, practicable remedy. We hereby request that the NRC implement this process at the earliest possible date. (**0024-10** (Zeller, Lou))

Comment: The Nuclear Regulatory Commission has not fulfilled the environmental justice requirements embodied in Executive Order 12898 which requires the agency to review its programs, policies and activities to address disproportionately high impacts on minority and low-income populations. (**0024-9** (Zeller, Lou))

Response: *Environmental Justice is within the scope of the SEIS. Because this subject was analyzed for the EIS developed for the North Anna ESP (NUREG-1811), the analysis for the Unit 3 COL SEIS will consider new information to assess whether the impact level determine in the NUREG-1811, ESP EIS should be changed.*

13. <u>Comments Concerning Health - Non Radiological</u>

Comment: The human brain eating Naegleria fowleri amoeba was found in both the main reservoir and the cooling lagoons. This same amoeba caused deaths in Florida, Texas, and Arizona last summer. It proliferates in water around 86 degrees and thrives especially well at 95 degrees and above. (**0023-4, 0034-150** (Black, Betty))

Comment: <u>Previous water temps</u>—LACA/VDEQ water teams in 2006 and 2007 have confirmed in various tests that the Water Temperatures have risen to 104.6F on the warm side of the lake and 93F on the cool side of the lake. Dominion's data reported to VDEQ and NRC is very close to this.

1. <u>How water temps affect prolonged human immersion and changes in concentrations of micro-organisms.</u> The Virginia State Health Commissioner in a Sept. 15, 2005 letter to the Virginia Department of Environmental Quality state when evaluating the potential health effects of any such new nuclear reactors from (1) Direct effects of heat from immersion in ambient waters by recreational bathers, and (2) the potential adverse effects of any changes in the concentrations of microorganisms in those waters said in part:

    a. Naegleria Fowleri (amoebas1 which have been found at various locations in Lake Anna) species organism begins to proliferate at temperatures around 86F and thrives especially well (compared to its competitors) at temperatures of 95 to 113F. Primary Amoebic Meningoencephalatis (PAM) is a rare but nearly always fatal infection caused by Naegleria fowleri.
    b. Persons with heart disease, children, parents and guardians of young children, the elderly, pregnant women and persons with spinal cord or peripheral nerve disorders should be cautious of prolonged immersion in waters that are warmer than body temperature. Bodies of water that have a temperature exceeding 104F should be considered unsafe for recreational activity for all persons due to the effects of heat alone.
    c. Common sense suggests that to reduce the risk of PAM, swimmers might wish to avoid swimming in freshwater venues when water temperatures are high, (e.g. when surface water temperatures are greater than or equal to 95F. (**0028-65, 0033-74** (Ruth, Harry))

Comment: Various newspapers articles during the summer of 2007 identified that 6 deaths occurred in 3 different states in the U.S. during the summer of 2007 due to PAM. This is a major increase from previous statistics where the Centers for Disease Control said there were only 24 deaths between 1989 and 2000.

1. The Virginia Commonwealth University conducted tests for Lake Anna Civic Association (LACA) the summer of 2007 to identify the presence or absence of Naegleria Fowleri (NF) in Lake Anna. See report dated Dec 2007 that identified 16 locations were tested and that 9 of the 16 locations tested positive for NF. 5 on the warm side of the lake and 4 on the cold side of the lake. Some of the locations on the cold side are in the upper part of the lake above the 208 bridge. (See the full report at <u>www.LakeAnnaVirginia.org</u>)

    a. <u>On Page 4 of the VCU Related research about NF Amebae states.</u>" In studies of fresh water lakes associated with power plants, N. fowleri was routinely isolated. The heated water is a breeding ground for pathogenic NF amebae. Thermal enrichment of water can cause proliferation of amebae especially at temperatures of 86F to 111F.
    b. <u>On Page 5 Recommendations to reduce the risk of infection</u>. The report says "Since it has been shown that N. fowleri is present in Lake Anna, the public

should be warned to wear nose plugs while diving, swimming or engaging in water activities in which the head is submerged when temperatures of Lake Anna reach 84F or higher." (**0028-67, 0033-76** (Ruth, Harry))

Comment: Both amoeba and ameba are acceptable spellings as well as the plurals -bas and -bae and all are used throughout this document by various authorities.

a. On Page 13—In Conclusion the report says Quote Lake Anna Civic Association studies indicate that Lake Anna is unique in that 99% of the water between the power plant and the dam is re-circulated by the North Anna Power Station cooling pumps. During the summer months water temperatures are in excess of 100 degrees F at some locations. Thus, recirculation of the water could account for sites being positive on one sampling date and negative at another sampling date. This study indicates that increased temperatures at sites on the lake are associated with the presence of Naegleria fowleri. These sites should be monitored during the summer months when there are increased water activities to determine the abundance of amebae, in order to prevent primary amebic meningoencephalitis. There is a large body of literatures that demonstrates that as water temperatures rise, the amebae proliferate. This increased proliferation is consistent with a possible increased risk of human infection. Unquote.
b. On Page 13—In summary the report says that Identifying the risk of contracting Primary Amebic Meningoencephalitis infection when N. fowleri amebae are present in the water is a very complex issue and there are no U.S. Standards. When concentrations of amebae are high there is a greater chance of becoming infected, but we do not know what all of the risk factors are and what the actual risk of infection is. (**0028-68, 0033-77** (Ruth, Harry))

Comment: The VA State Health Commissioner says that as water temperatures rise there is an increased risk to the public for immersion in the hot water and also that amoebae proliferates faster in water temperatures above 85F. LACA/VDEQ teams have recorded water temperatures of 104.6F on the warm side and 93F on the cold side. The VA State Health commissioner says that persons with heart disease, children, parents and guardians of young children, the elderly, pregnant women and persons with spinal cord or peripheral nerve disorders should be cautious of prolonged immersion in waters that are warmer than body temperature (98.6F). The U.S. Safety Commission says that it could be fatal if you go into a hot tub with temperatures greater than 104F. Various newspapers confirmed the deaths of 6 young people in 3 states due to PAM during the summer of 2007. (**0028-71, 0033-80** (Ruth, Harry))

Comment: Virginia Commonwealth University (VCU) studies during the summer of 2007 confirmed the presence of Naegleria Fowleri (NF) on both sides of Lake Anna. The VCU studies further states that as water temperatures increase above 86F and the NF proliferate the risk of getting PAM in Lake Anna increases. The study also says there is a large body of literatures that demonstrates that as water temperatures rise, the amebae proliferate. This increased proliferation is consistent with a possible increased human infection. VDEQ has granted water discharges permits for the current 2 units to Dominion to heat up the entirety of Lake Anna to any water temperature it desires without any penalties. We have previously had water temperatures over 104F in some parts of the lake and in the high 90s in many parts of the lake. We also know that 99% of the water re-circulates between the power plant and the dam and what amoebas are at one location today could be at another tomorrow. There is much scientific evidence that there is increased risk of an algae bloom (with heated water and an abundance of nutrients in the water) which in turn creates various health concerns with the type of water exposure (contact or ingestion). The health risks to human from algae blooms have found to contribute to eye, ear, and skin irritation. More serious health effects (e.g., muscle cramps twitching) can also occur. (**0028-72, 0033-81** (Ruth, Harry))

Comment: The FOLA organization is concerned about the Virginia Commonwealth University (VCU) conducted tests in 2007 for the presence or absence of Naegleria Fowleri (NF) a human brain eating amebae in Lake Anna. They tested 16 locations and found that 9 of the 16 locations tested positive for NF. VCU also indicated that heated water is a breeding ground for pathogenic NF amebae. Thermal enrichment of water can cause proliferation of amebae especially at temperatures of 86F to 111 F. Note that Lake Anna had previous confirmed water temperatures exceeding 104F degrees F. We believe that the NRC should require Dominion to have continued tests bi-annually throughout the cooling lagoons and main reservoir to monitor the NF amebae and the results should be reported to the public bi-annually. These new and significant actions by the Health Department and State Park which effect the local economy with less people visiting the lake, loss of real estate values, etc. should be fully evaluated by the NRC during the DEIS. (**0033-8** (Ruth, Harry))

Response: *The staff will evaluate any new and significant information relating to the presence of the microorganism Naegleria fowleri in the Lake Anna reservoir to determine if impact levels should be changed. The staff will also evaluate new and significant information that may change the impacts related to the original thermal impact level and thus the nonradiological health impact level previously resolved in NUREG-1811, ESP EIS.*

Comment: Note that with only Units 1 and 2 operating, water temperatures have previously been recorded at over 104F in the cooling lagoons and over 93F on the main reservoir. The hot water is where humans recreate and where fish, wildlife, clams/mussels, and aquatic life share the water in what appears to be unsafe conditions. (**0028-15** (Ruth, Harry))

Comment: The NRC in its DEIS should also examine the effects of increased undesirable aquatic growth from the declining water levels which allows sunlight to permeate to lower levels of the lake, that previously were darkened. Will this declining water level caused by unit 3 create a reoccurrence of increased undesirable aquatic life throughout the lake and the associated human safety concerns defined below? The sun light penetration enhances the growth of aquatic weeds (hydrilla) and (skunk weed) and possibly others. The skunk weed has increased dramatically during the recent drought due to lower water levels causing unsafe swimming conditions for young children. Approximately 11 years ago, hydrilla growth created many safety risks for the public and created many boating hazards in Lake Anna. Humans could not swim in many parts of the lake due to 10’ long hydrilla patches throughout. Children would become entangled in the hydrilla creating serious safety concerns. Boats would come to an abrupt stop when there motors were choked out by hydrilla causing people to become thrown about in their boats. (**0028-20, 0033-23** (Ruth, Harry))

Comment: Less water will cause the existing water to get hotter faster in the summer and increase the possibility of adverse impacts to humans through the increased health risks of human immersion in heated water, together with the potential for dangerous growth of bacteria (microorganisms) or algae blooms. (**0028-39, 0033-47** (Ruth, Harry))

Comment: Less water will cause the existing water to get hotter faster and increase the human health risks for immersion in heated water, together with the potential for adverse effects of increased bacteria (microorganisms) or algae blooms. (**0028-49, 0033-58** (Ruth, Harry))

Comment: Lower and hotter water levels could encourage the hydrilla and other aquatic life to proliferate, thereby making it less desirable to swim and recreate on the lake. Previous high levels of hydrilla caused major difficulties in launching boats, caused the weeds to become entangled in boat propellers and choked off the engine. In addition, young children when swimming previously became entangled in the hydrilla creating a very serious safety issue. (**0028-44, 0028-52, 0033-52, 0033-61** (Ruth, Harry))

Comment: What do we know that is identified in official government, university, or government sanctioned studies/documents about the potential health risks to humans from hot water in Lake Anna from the current 2 nuclear reactors? Will the Lake water temperatures get hotter from the proposed 3rd Unit cooling method and decreased water levels? What are the health risks to humans from hot water??? (**0028-59, 0033-68** (Ruth, Harry))

Comment: <u>How elevated water temps affects prolonged human immersion.</u> The U.S. Consumer Safety Commission indicates that no one should go into a Hot Tub if the water temperature exceeds 104F because of possible fatal consequences. (**0028-66, 0033-75** (Ruth, Harry))

Comment: In October 2007, the Virginia Department of Environmental Quality (VDEQ) has granted a water discharge permit to Dominion that has imposed no water temperature limits in Fahrenheit that can be measured by the public at the North Anna plant for the current two operating nuclear units. In addition, VDEQ has granted Dominion a 316A Variance from the U.S. Clean Water Act which allows them legally to heat the entire lake to any temperature that they desire without any penalties.

1. Microcystis Algae Bloom Facts—Note that Algae Blooms occur in Lake Anna every summer when the lake water gets hot. Frequently Asked Questions Concerning Health Impacts of Algae Blooms (**0028-69** (Ruth, Harry))

Comment: Question? —Can we take the chance that one of our loved ones will get sick or die because the water temperatures in Lake Anna which are currently at high levels in the summer months and will be increased further because of the up to 24 million gallons a day additional evaporation from the 3rd reactor cooling method than what they currently are from the existing two reactors?? Why? Because the water level will decline and there will be less water to cool the heat from the two current reactors causing the water to get hotter starting earlier in the summer and increasing temperatures throughout the summer and extending further into the fall. A simple analogy for the heating of water faster can be made with the fact that heating a cup of coffee will occur much faster than for heating a whole cup of coffee. If Dominion changed its proposed 3rd reactor cooling method to dry cooling (which they proposed for Unit 4 and is currently used in many places throughout the world), then the 3rd reactor cooling method would not further impact the hot water temperatures during the summer months in Lake Anna. (**0028-74**, **0033-83** (Ruth, Harry))

Comment: The NRC in keeping with its charter to protect public health and safety should evaluate in the DEIS for the Unit 3 COL all the related public health impacts that could result from hotter water in Lake Anna as a result of further lake level declines caused by the evaporation of up to 24 million gallons per day.

We understand that the Virginia Dept of Health is considering issuing a statement that if the Lake Anna water is over 104 degrees F that it is unsafe for humans because of the water temperature. The health dept is also considering issuing a statement indicating to avoid swimming, jumping or diving into bodies of water when water temperatures are high (above 95 degrees F), especially when the water levels are low. We further understand that the Virginia State Park is planning to monitor Lake Anna water temperatures and recommend that no one swims at the state park if the Lake Anna water temperatures exceed 95 degrees F. (**0033-7** (Ruth, Harry))

Response: *The impacts of lake temperature and low water levels were resolved in the NUREG-1811, ESP EIS. The staff will evaluate new and significant information to determine whether the previously resolved impact levels related to health risks or recreational hazards from warmer water or low lake level should be changed.*

Comment: Noise concerns/decibel levels emitted from 180/230 foot buildings that will travel long distances without having tree barriers to break the sound from giant fans. (**0033-42** (Ruth, Harry))

Response: *Local noise impacts and visual aesthetics of the proposed Unit 3 are within the scope of the SEIS. Impacts related to noise and visual aesthetics previously resolved in NUREG-1811, ESP EIS will be evaluated in terms of new and significant information to determine if impact levels should be changed.*

Comment: PCBs have been found in Lake Anna resulting in a fish consumption advisory by the State Health Commissioner. (**0023-5, 0034-151** (Black, Betty))

Comment: The DEIS should examine the source of Lake Anna PCB contamination that has now caused the Virginia Dept. of Health to issue a fish consumption advisory on August 31, 2007. The VDH advisory cautions: Do not eat any Lake Anna gizzard shad and do not eat more than two meals a month of carp, largemouth bass, striped bass, white perch, white catfish, channel catfish or blue gill sunfish. The health advisory applies to the total lake, both the main reservoir and cooling lagoons. (**0028-17** (Ruth, Harry))

Comment: The NRC in its DEIS should examine the source of Lake Anna PCB contamination that has now caused the Virginia Dept of Health to issue a fish consumption advisory on

August 31, 2007. The VDH advisory cautions: Do not eat any Lake Anna gizzard shad and do not eat more than two meals a month of carp, largemouth bass, striped bass, white perch, white catfish, channel catfish or blue gill sunfish. The health advisory applies to the total lake, both the main reservoir and cooling lagoons. (**0033-21** (Ruth, Harry))

Response: *The staff will evaluate any new and significant information relating to the presence of PCBs in fish and sediments from the Lake Anna reservoir and the WHTF as they relate to assessing the human health impacts of Unit 3 construction and operation. This information will be evaluated in terms of new and significant to determine if impact levels should be changed.*

Comment: The DEIS should further investigate the fire at the North Anna Power station in 1981 and the significant spill of transformer oil associated with this event as it likely contained polychlorinated biphenyls (PCB's). It was reported at the time that some unknown quantity of oil did reach the waters of Lake Anna. The complete remediation effort, including what happened to the contaminated material from the ground site and precisely how the PCB's were extracted from Lake Anna should be identified in the DEIS. This survey should include what possible impact the ground excavation for the 3rd reactor (which is on the same site as the PCB spill) and its facility buildings will have on Lake Anna. (**0028-18** (Ruth, Harry))

Comment: The DEIS should further investigate the spill and fire at the North Anna Power station of poly-chlorinated biphenyls (PCB) transformer oil in 1981. It was reported at the time that some unknown quantity of oil did reach the waters of Lake Anna. It has also been noted that Dominion has not released the results of PCB samples that it recently took in the WHTF/Cooling Lagoons 1 & 3. The complete Dominion disclosure of the remediation effort, including what happened to the contaminated material from the ground site and precisely how the PCB's were extracted from Lake Anna should be identified in the DEIS. This disclosure should include what possible impact the ground excavation for the 3rd reactor (which is on the same site as the PCB spill) and its facility buildings will have on Lake Anna. Core samples of the existing ground should be taken to insure it is PCB free. (**0033-22** (Ruth, Harry))

Response: *The staff will evaluate any new and significant information relating to the presence of PCBs on or near the proposed construction site, including Lake Anna in the vicinity of the intake structure, to determine whether previously stated impact levels should be changed. Construction impacts will be discussed in Chapter 4 and operational impacts will be discussed in Chapter 5 of the SEIS.*

14. Comments Concerning Health - Radiological

Comment: I hold in my hand here North Anna 3 combined license application part 7 departures report. Departures report is variances of plant-specific deviation from one or more of the site characteristics design parameters terms and conditions of the early site permit or from the site safety analysis report. I picked out a few of these. There's a long list of them, including annual thyroid dose and liquid effluent releases and gaseous pathways. But regarding the radiological exposure, the variances requested by Dominion say, distances to the closest receptors had changed. People are living closer to the plant. (**0034-87** (Zeller, Lou))

Response: *The staff will evaluate the impacts of the revised liquid and gaseous effluent release source term from the proposed Unit 3 at North Anna in Chapter 5.9 of the SEIS. The impact of the revised receptor locations will also be evaluated.*

Comment: We are learning more and more about the hazards of tritium exposure and we also know that it is routinely released into the Lake and into the atmosphere. How will Dominion and the NRC act to limit tritium releases? Both Dominion and the NRC must continue to study and make public the effects of tritium exposure on humans and flora and fauna who live on and in the Lake and downstream. (**0017-8** (Day, Elena))

Comment: The EIS should fully address the impact on flora and fauna in Lake Anna and surrounding tributaries caused by North Anna-3's planned release of radioactive waste into the Lake. (**0026-8** (AuClair-Valdez, Miguel))

Comment: The NRC in its DEIS should evaluate the effect of tritium being released into Lake Anna together with its heated water from Units 1 and 2 and if the possibility exists that Unit 3 proposed cooling method could also introduce additional tritium which has a radioactive half-life of 12.3 years. Our understanding is that the current two units routinely discharge not only tremendous amount of heat, because the reactors are only 33 percent thermally efficient. 67 percent of the fission generated heat is dumped into the lake together with some radioactivity. According to NRC records, since 2000, the current reactors have released more than 5700 curies of radioactive tritium water into the lake. It is increasingly uncertain what constitutes a permissible radiation exposure. The NRC's protective standard for radioactive tritium in drinking water is 1 million picocuries per liter. While the Environmental Protection Agency standard is 20,000 picocuries per liter, Colorado and California have set theirs at 400 per liter. What will the impact of the 3rd unit have on additional radioactivity being released into the lake with the reduced water levels? (**0033-27** (Ruth, Harry))

Comment: I'm also concerned about the hazards of tritium exposure. And we also note that this tritium is routinely released into the lake and into the atmosphere. How would Dominion and the NRC act to limit tritium releases? Both Dominion and the NRC must continue to study and make public the effects of tritium exposure on humans and flora and fauna who live in and around the lake and downstream. (**0034-141** (Day, Elena))

Response: *The staff will review the impact of tritium releases to Lake Anna and the atmosphere in Chapter 5.9 of the SEIS. Tritium releases from the proposed ESBWR reactor design for Unit 3 are significantly lower than those evaluated in NUREG-1811, ESP EIS.*

Comment: A summary is required that clearly sets out expected radiation impacts in the study area. (**0035-6** (Goldsmith, Aviv))

Comment: The section on emergencies and radiation impacts is not understandable by lay persons. A summary is required that clearly sets out (a) expected radiation impacts in the study area, and (b) the possible radiation impacts from an emergency. (**0035-30** (Goldsmith, Aviv))

Response: *The final ESP EIS (NUREG-1811) published by the NRC in December 2006 discussed radiological impacts of normal operations in Chapters 5.9 and 7.8. The environmental impacts of postulated accidents (emergencies) were discussed in Chapter 5.10 of NUREG-1811, ESP EIS. Chapter 5.9 and Chapter 5.10 both contain summary information at the end of each section. All environmental issues associated with radiological impacts of normal operations and environmental impacts of postulated accidents were resolved in NUREG-1811, ESP EIS. The analysis for the North Anna Unit 3 SEIS will address only new and significant information to determine whether the impact level has changed. Any new and significant information identified since the ESP will be evaluated in Chapter 5 (Chapters 5.9 and 5.10) of the COL SEIS.*

15. <u>Comments Concerning Accidents - Design Basis</u>

Comment: The EIS should address potential consequences (on the Lake, on people, on flora and fauna in the region) of a serious accident in the irradiated fuel pool at North Anna-3, and in other potential high-level radioactive waste storage facilities. (**0026-4** (AuClair-Valdez, Miguel))

Response: *Design-basis and severe accidents of the proposed Unit 3 are within the scope of the SEIS. Impacts related to design-basis and severe accidents previously resolved in the NUREG-1811, ESP EIS will be evaluated in terms of new and significant information to determine if impact levels should be changed.*

Comment: Section 5.10 [Impacts of Postulated Accidents] is hard to understand the possible radiation impacts from an emergency. Given that "radiation experts conservatively assume that any amount of radiation exposure may pose some risk of causing cancer or a severe hereditary effect," a common language summary is required that clearly sets out expected radiation impacts in the study area. (**0035-31** (Goldsmith, Aviv))

Comment: Please clarify the statements in page SDEIS 5-57 line 35 et. seq. Does the SDEIS say that the project would create "730 fatal cancers, nonfatal cancers, and severe hereditary effects per 10,000 persons?" (**0035-32** (Goldsmith, Aviv))

Response: *These comments refer to generic information in the North Anna ESP draft EIS and draft supplemental EIS that were superseded by the North Anna final ESP EIS (NUREG-1811) published by NRC in December 2006. NUREG-1811 was revised to incorporate numerous* *public comments (see NUREG-1811, Appendix E). Dominion was issued an ESP permit (ESP-003) in November 2007 for two units at the North Anna Power Station site under the specifications contained in that permit. The information presented in NUREG-1811 is resolved. The statement quoted above related to the number of fatal cancers, nonfatal cancers, and severe hereditary effects is incomplete. The full statement gives a correlation between population dose and health effects published by the International Commission on Radiation Protection. That correlation says that a population dose of 1 million person-rem can be expected to produce 730 fatal cancers, nonfatal cancers, and severe hereditary effects. This correlation applies to population doses due to the project. It is used to convert population doses to health effects; it is not a statement that the project would cause 730 fatal cancers, nonfatal cancers, and severe health effects.*

16. Comments Concerning Accidents - Severe

Comment: When I read about the risk assessment of severe accidents in the environment impact statement prepared here, and specifically in Table 518, which I think was renumbered, but it's—it was reviewed somewhat in response to public comments on that section in Volume 2, Section 3.14.3, Severe Accidents. And here I quote, A severe accident without loss of containment for an advanced boiling water reactor is estimated to have a core damage frequency of 1.34 times 10-7. That is 1.34 of the severe accidents in 10 million years. Now, how in the world are you predicting 10 million years from here? It just—it's—my algebra teacher, when I was in ninth grade—and this was quite a few years ago --said, You can't extrapolate way beyond your data. And I found this true when I did my master's degree. I found this true when I did my doctorate. You can't extrapolate like this. What are you doing thinking about 10 million years from now, and there is a likelihood of 1.34 accidents, severe accidents, in the proposed plant. I object also to the using two decimal points. It gives an illusion of—that you know what you're doing. And I have to say these two decimal points do not give any additional information. You don't have any idea, even to—even to an order of magnitude, and to put in 1.34, this is—this is a problem we've got in this country. (**0034-69** (Bryan, James))

Response: *The commenter refers to NUREG-1811 ESP EIS, specifically Table 5-18, where results are reported per reactor year (Ryr^{-1}). The term reactor year refers to an operating year for a given reactor. For these analyses, the probability of a given event occurring are an indication of the probability of occurrence per operational year, considering the anticipated operational lifetime of the reactor (i.e., 40 years). Although the analyses indicate a very low probability occurrence for some events and consequences, this is not equivalent to the probability of a given event or consequence if the reactor were operated for millions of years. The staff agrees the use of 3 significant figures in the previously-reported results overstates their relative degree of accuracy. This comment provides no new and significant information; therefore, it will not be evaluated further.*

Comment: Now, looking a little further at the same data, there is another problem. And that's that when they do their analysis they leave out Three Mile Island. And if you read the explanation for it. Three Mile Island Reactor Number 2 is left out of the data set, and this accident -- this absence, I thought it was an accident. But they answer—Three Mile Island, Unit 2 is not among the current generation reactors included in preparation of Table 522, because it is no longer in operation. Well, do you want to make your basis of thinking the elimination of your most significant accident? (**0034-70** (Bryan, James))

Response: *The commenter refers to NUREG-1811 ESP EIS, specifically Table 5-22, where results for core damage frequency and population dose risk are compared to 28 operating current-generation reactors. Because only operating reactors are included in the comparison, the commenter incorrectly infers that lessons learned from the 1978 Three Mile Island Unit 2 accident are not considered. To the contrary, the analyses are made using well-developed methods that have been updated based on investigation of the accident at Three Mile Island and considerable research following the accident. These methods explicitly consider both pre-accident and post-accident human errors. The comparison of analysis results to operating current-generation reactors is appropriate because many of the specific errors that led to the accident at Three Mile Island have been eliminated or reduced through updated design and procedure. This comment provides no new and significant information; therefore, it will not be evaluated further.*

Comment: The EIS should describe and address the potential consequences of a beyond design basis accident at North Anna-3 and should address potential additional risks of a First-of-a-Kind reactor design. (**0026-9** (AuClair-Valdez, Miguel))

Comment: He [Dr. James Bryan] mentioned that Three Mile Island is considered as a reference case in either the ESP or the COL, wherever he had his comment. And I wanted to tell him that Three Mile Island was a PWR, pressurized water reactor. The reactor we are proposing or that Dominion is proposing here is ESBWR, a boiling water reactor. What happened at Three Mile Island can't happen at a boiling water reactor. (**0034-172** (Stiles, Lisa))

Comment: My third concern about the safety issue is the human error problem. And within the reports, the NRC says that they are taking into consideration human error. Human error has been the problem at Chernobyl, it has been the problem at Three Mile Island, it has been the problem in Japanese reactors. And one of the main human reactors—one of the main human errors has been when they have neglected to do the safety checks, the analyses that they needed to do. Now, you may say, Oh, this is Russia. This is Japan. This is not the United States. Well, right this month we have got airlines not being inspected when they needed to be inspected. We all know about that. There may be some people in this room that have been grounded for it. Fortunately, no one has been damaged by it, as far as I know. But leaving out the safety inspections that are mandated has been a worldwide problem, and it has not been absent here in the States either. You've got to pay more attention to human error. It's a human characteristic. It's just as part of us as breathing, is that we make mistakes. We try to take shortcuts. We try to do things the easy way. When there are safeguards, we figure out ways to make it—to overlook them. And this has to be part of a solid safety analysis is human error. (**0034-71** (Bryan, James))

Response: *Design-basis and severe accidents of the proposed Unit 3 are within the scope of the SEIS. Impacts related to design-basis and severe accidents previously resolved in the NUREG-1811, ESP EIS will be evaluated in terms of new and significant information to* *determine if impact levels should be changed. In addition, the staff will evaluate the potential consequences of design-basis accidents and the probability and consequences of severe accidents for the ESBWR as part of its review of the application for certification of the reactor design. While a detailed description of the design certification review is beyond the scope of the SEIS, it is important to note that while the reactor design may be new, severe accidents are associated with multiple failures of components, such as valves, and that the likelihood of failure of components may be reasonably well understood, even if the reactor type is new. The analysis methods also explicitly consider both pre-accident and post-accident human errors, along with any applicable lessons learned following operational events or accidents at world-wide locations, including the 1978 accident at Three Mile Island Unit 2. These comments provide no new and significant information; therefore, it will not be evaluated further.*

Comment: Section 5.10 [Impacts of Postulated Accidents] should include a worst case analysis for low-probability events. (**0035-34** (Goldsmith, Aviv))

Comment: A common-language summary of section 5.10.2 [Severe Accidents] is required. (**0035-35** (Goldsmith, Aviv))

Comment: The statement on page 5-69 line 40 that "alternatives to mitigate severe accidents are not resolved" is incongruous with the SMALL impact determination. Since the ESP is designed to address site-specific issues, these must be resolved now, not at the COL stage as is suggested by page 5-70 line 2. (**0035-36** (Goldsmith, Aviv))

Comment: There should be a Section 7.8.B that discusses the cumulative radiologic impacts of emergency situations (accidents and terrorism). Casual discussion in 7.8 of normal operations is insufficient treatment for this potentially devastating situation. (**0035-39** (Goldsmith, Aviv))

Response: *These comments refer to information on severe accidents in the North Anna ESP EIS (NUREG-1811) published by NRC in December 2006. NUREG-1811 includes revisions based on numerous public comments (see NUREG-1811, Appendix E). Dominion was issued an ESP permit (ESP-003) in November 2007 for two units at the North Anna Power Station site under the specifications contained in that permit. Environmental issues related to severe accidents in the ESP application were identified, evaluated, and resolved in Chapter 5.10.2 of the ESP EIS (NUREG-1811). Staff will evaluate new information relating to severe accidents in Chapter 5 of the COL SEIS to determine whether the impact level has changed. The Commission has considered the type of analyses that are appropriate for evaluating consequences of severe accidents and has determined that the evaluation should be on the basis of mean estimates of risk (51 FR 30028). NUREG-1811 concludes that the risk of severe accidents is comparable to the risk of normal operation and that risks of early fatality from normal operation or a severe accident are small compared to risks of an early fatality from other human activities. NUREG-1811 considered the risks of severe accidents and concluded that based on the risk the environmental impacts of severe accidents were SMALL. This does not mean that staff determined that the risk of severe accident could not be reduced further. The applicant did not address, and was not required to address, severe accident mitigation design alternatives and other severe accident mitigation alternatives in the ESP application.*

Therefore, the staff did not address them in NUREG-1811. Severe accident mitigation design alternatives and other severe accident mitigation alternatives must be addressed by the applicant in the COL application and by the staff in its review of that application. The staff does not believe that it is appropriate to assess cumulative impacts of severe accidents, regardless of the cause. Should there be a severe accident with large release of radioactive material, the impacts of that release will dominate the impacts of releases of radioactive material from normal operations. And, the likelihood of simultaneous severe accidents is too small to be considered reasonably foreseeable.

17. Comments Concerning the Uranium Fuel Cycle

Comment: It will be used up by the waste that is produced by 2010. So Dominion continues to bet that this high-level waste is going to go somewhere else. So I feel that this is irresponsible for Dominion as well as the NRC to entertain construction of new nukes when the high-level radioactive waste—and now since Barnwell is also going to close in June 2008, the low-level radioactive waste issue remains unresolved. (**0034-137** (Day, Elena))

Comment: The EIS particularly needs to include the fact that—and assume that there will be no available repository for the full operating lifetime of this reactor, this proposed reactor, and to consider the consequences of onsite storage in perpetuity there on Lake Anna. This would also apply to—again, to what Jerry pointed out, was that as of June 2008, South Carolina will be closing the Barnwell low-level radioactive waste facility to Virginia, and so the EIS consequently, since there are no other sites, I believe it's the responsibility of the EIS to fully account for the consequences of onsite storage of low level—so-called low-level radioactive waste. (**0034-44** (Gunter, Paul))

Comment: The reactors will create approximately 20 MT/year of nuclear waste. Detailed plans for safe waste management, transport, and disposal should be presented and analyzed in the COL SDEIS. (**0035-37** (Goldsmith, Aviv))

Response: *The staff will evaluate new and significant information concerning the impact of low-level waste storage and disposal in Chapter 6.1 of the SEIS. The safety and environmental effects of long-term storage of spent fuel on site has 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 or 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." These comments provide no new and significant information; therefore, they will not be evaluated further.*

Comment: Finally, we are again facing the very real possibility of uranium mining and milling in VA. There are uranium deposits in Orange, Madison, Fauquier, and Pittsylvania Counties. The drive by Dominion and other utilities to build new reactors has made uranium mining attractive once again after a twenty-five year ban. Mining and milling of uranium has never been attempted in a wet climate like ours. (**0017-11, 0034-143** (Day, Elena))

Comment: Furthermore, the history of mining and milling of uranium in our western states is one of high cancer rates. The radioactive tailings love to continue to disburse their radioactivity as the wind blows. So the uranium fuel cycle from start to finish leaves a huge carbon imprint, a footprint, or whatever. (**0017-12, 0034-144** (Day, Elena))

Comment: And in Virginia, this is interesting the way it is playing out is the claim for energy independence currently is being lauded by those seeking to extract uranium from the enormous deposit that has been identified in Virginia, in Pittsylvania County. The basis of this claim is that we do currently import about 70 percent of the uranium we use for fuel, for fuel in our reactors from abroad, from countries like Canada and Australia and some of the former Soviet Union states. So, then, to mine it here in Virginia, I suppose it would help us reduce our dependency on foreign sources of energy. I would say that it probably does not reduce our addiction to oil, as it has been brought up here tonight. As far as I know, we are not using uranium in our tanks at this point. But certainly it would bring up uranium. It would bring it back into our economy in the form of both mining and milling. What is interesting is that Virginia is going to be the only state in the country that is witnessing firsthand the cause and effect of nuclear expansion. Here in Virginia we have both a proposal for a new reactor and a corporation challenging the state's moratorium on uranium mining. (**0034-91** (Fisher, Allison))

Comment: And these [effects of nuclear expansion as relates to speculation on uranium mining] should be present in the environmental impact statement. The NRC should fully review the impacts of mining and milling within the scope of the EIS. (**0034-93** (Fisher, Allison))

Response: *Chapter 6.1 of SEIS will address new and significant information related to the environmental impacts of the uranium fuel cycle and solid-waste management to include uranium mining and milling. 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." Per the guidance in 10 CFR 51.51, the staff will rely on Table S-3 as a basis for the impact of uranium fuel-cycle impacts to include uranium mining and milling.*

Comment: So Dominion continues to bet that this high level waste is going to go somewhere else. It is irresponsible for Dominion as well as for the NRC to entertain construction of new nukes when the high level radioactive waste issue (and now since Barnwell is to close in June 2008)—the low level radioactive waste issue as well) remains unresolved. How much low level waste does Dominion plan to store on Lake Anna's shores? How many dry casks does Dominion plan to site on the shores of Lake Anna. And will it be expanding water storage capacity? Will construction of more pools physically disturb Lake shores? Will more waste increase possibility of accident in the irradiated fuel pools? (**0017-5** (Day, Elena))

Comment: The EIS should address the possible effects of North Anna-3 on the existing dry cask irradiated fuel storage units at the North Anna site, including their potential degradation over time as well as the potential impacts of a large expansion of the dry cask units to store high-level radioactive waste from North Anna-3. (**0026-5** (AuClair-Valdez, Miguel))

Comment: How much low-level waste does Dominion plan to store on Lake Anna shores? These are my concerns. This should be addressed in the EIS. How many dry casks does Dominion plan to site on the shores of Lake Anna? How will it be expanding water storage capacity for spent fuel? Will construction of more pools physically disturb lake water? Will more waste increase the possibility of accident in the irradiated fuel pools? (**0034-138** (Day, Elena))

Comment: The EIS should address how and where all of the low-level radioactive waste at North Anna-3 can be expected to generate during its lifetime will be stored. Virginia's access to the Barnwell, South Carolina low-level radioactive waste facility will end in June 2008. There are no current plans to build a new facility to handle radioactive waste generated in Virginia. This the EIS should assume that all low-level radioactive waste generated by North Anna-3 will be stored on-site for its licensed lifetime. (**0026-7** (AuClair-Valdez, Miguel))

Comment: We believe that the on-site storage of radioactive waste poses unreasonable environmental and security risks for the people of Virginia. Building new reactors will increase these risks and leave our children and grandchildren with a horrible burden. (**0034-148** (Black, Betty))

Response: *The staff will evaluate new and significant information related to the impacts of low-level waste storage and disposal and the potential of fuel handling accidents in the reactor's spent fuel pool in Chapter 6.1 and 5.10.1 of the SEIS, respectively.*

Comment: The uranium fuel cycle from start to finish leaves a huge carbon footprint--in fact it takes two coal plants just to run the facility that processes the uranium into fuel rods in Kentucky—regardless of industry claims that there building nukes to save us from greenhouse gas emissions and global warming. Dominion's plans for new nukes will associate it with the despoliation of our pristine rural VA counties if mining is allowed in the Commonwealth. (**0017-13** (Day, Elena))

Comment: In fact, it takes two coal plants at Paducah, Kentucky to run the facility that processes the uranium into fuel rods. So, regardless of the claims of the industry that building nukes to save us from greenhouse gas emissions and global warming, you know, it's not true that uranium cycle from start to finish leaves a huge carbon footprint. (**0034-145** (Day, Elena))

Response: *Chapter 6.1 of the SEIS will address new and significant information related to the environmental impacts of the uranium fuel cycle and solid-waste management to include uranium enrichment activities. 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." Per the guidance in 10 CFR 51.51, the staff will rely on Table S-3 as a basis for the impact of uranium fuel-cycle impacts to include uranium enrichment.*

18. Comments Concerning Transportation

Comment: If and when a repository for high level waste is licensed, how will the waste be transported safely, along what routes and is an evacuation plan included to safeguard residents in Louisa and along transportation routes in VA. (**0017-6, 0034-139** (Day, Elena))

Comment: The EIS should address possible effects of transportation of radioactive waste generated at North Anna, in the unlikely event a waste repository ever will be built. This should include road, rail and barge transportation. If barges are not used, then trucks or trains would be. The Baltimore train tunnel fire of 2001 could have killed thousands if high-level radioactive waste had been on board, and that route has been targeted by the Dept. of Energy in the past. (**0026-6** (AuClair-Valdez, Miguel))

Response: *A detailed analysis of the health and safety impacts of transporting fuel and waste by truck to and from the proposed North Anna Power Station site will be conducted and included in Chapter 6 of the SEIS. Emergency preparedness planning and preparations to respond to transportation accidents is described in detail in the "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-0250F) and will not be addressed in the SEIS.*

19. Comments Concerning Decommissioning

Comment: Section 6.3 of the SDIES mentioned that decommissioning would eventually be required and "reduction of residual radioactivity to a level that permits termination of the NRC license." Has this been successfully done anywhere in the US? What financial security does the operator post to assure successful decommissioning? (**0035-38** (Goldsmith, Aviv))

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 license to certify that sufficient funds will be available to assure radiological decommissioning at the end of power operations. Chapter 6.3 of the SEIS will evaluate the applicant's plan for assuring these funds are available.*

20. Comments Concerning Cumulative Impacts

Comment: The EIS should address the cumulative effects of routine radiation releases on nearby populations and on aquatic life in and around the lake. (**0026-11** (AuClair-Valdez, Miguel))

Response: *The cumulative impacts associated with the construction and operation of the proposed Unit 3 will be evaluated and the results of this analysis will be presented in Chapter 7 of the SEIS.*

Comment: Plant 3 was considered in a stand-alone condition. No consideration was made for the alternative of installing additional water conservation measures to the existing power reactors of Units 1 and 2, to compensate or mitigate against the significant, adverse, incremental impacts caused by Unit 3. (**0034-33** (Remmers, Ken))

Response: *Portions of the alternative cooling systems (i.e., cooling towers) previously resolved in the NUREG-1811, ESP EIS will be evaluated in terms of new and significant information to determine if impact levels should be changed. Information not analyzed in NUREG-1811, ESP EIS regarding alternative cooling systems intake and discharges structures will be evaluated in Chapter 9 of the SEIS.*

21. Comments Concerning the Need for Power

Comment: Our goal in applying for the COL is to continue to maintain the option to build a third nuclear unit to meet the skyrocketing demand for electricity projected for Virginia. Right now, Virginia is the second largest importer of electricity in the nation, behind California. The state imports 30 percent of its electricity from electrical generators located in other states. Virginia also is one of the fastest-growing states in the United States. (**0013-1** (Grecheck, Eugene))

Comment: The PJM Interconnect, the regional transmission operator for the Mid-Atlantic region, projects that by 2017 there will be a large gap between the amount of electricity that will be required for our customers and the electrical generation facilities available in Virginia to meet this demand. We are talking about a gap of 4000 megawatts of generating capacity, of which 2000 megawatts must be from the type that is available 24 hours a day, seven days a week. (**0013-2** (Grecheck, Eugene))

Comment: As you can see, according to U.S. DOE projections, we will need to increase our production of electricity by nearly 50% in the coming years. This increase is necessary due to population expansion, a greater reliance on electronics, and soon a major shift towards plug-in hybrid electric vehicles. As you can see, even if North Anna Unit 3 is built, and by some miracle we are able to miraculously expand our renewable contribution to 15%, we still have a huge gap of needed electricity. What's even more sobering is that means we have to keep every coal, oil, gas, and nuclear station that we currently operate today. (**0025-2** (Stuart, Michael))

Comment: Virginia is facing a significant shortfall of electricity of about 4000 megawatts in 2017. With today's volatile energy markets, we can no longer afford to rely on imported power for Virginia's needs. If built, Unit 3 would make us less dependent on electricity produced outside the state. And it will also provide nearly a third of that shortfall in 2017. (**0034-101** (Marshall, Burton))

Comment: Nuclear energy is a key ingredient in the Virginia energy plan, which calls for a 20 percent increase in the in-state production of electrical energy by 2017 and the simultaneous 30 percent decrease in the level of greenhouse gas emissions by 2025. According to remarks made by Steven Walsh, Chair of Governor Kaine's Energy Policy Advisory Council, conservation and renewable energy targets will only get us halfway to this target. Research in the use of clean-burning coal-fired power plants and nuclear energy is clearly needed to make up the difference. (**0019-1, 0034-116** (Brown, Eugene F.))

Comment: One of the issues that—concerns I have, and I think everybody does, we have—there will be a shortage of energy (**0034-15** (Wright, Jack))

Comment: Clearly the need for 4000 megawatts of new generating capacity, with 2000 of that being base load, is well-documented and validated by the PJM Interconnection Corporation. Also, the evaluation of the alternatives available to meet future energy needs show that to best meet Virginia needs, nuclear must play a large part. (**0034-163** (Stiles, Lisa))

Comment: There is a need for a substantial amount of new generation capacity here in this state. Recent estimates call for an additional 4000 megawatts within a decade in order to serve the needs of Virginia. The southeastern region is a well-balanced mix of energy resources that help maintain reliable service and act as a hedge against price volatility and supply interruptions. It is important that we expand generation capacity and that we maintain the diversity of these sources. (**0034-2** (Watkins, John))

Comment: The United States, and Virginia in particular, has an ever increasing need for electric power. In order to maintain our economic prosperity, we must continue to develop new sources of energy—electricity—as well as conserve as much as possible. This new unit will help in meeting that increased need. (**0034-27** (Manzari, Jack))

Comment: The Virginia Energy Plan, of which I was a part in drafting and getting passage of in the Virginia Legislature back in 2006, calls for the needs of nuclear energy here in Virginia as an important capacity. (**0034-5** (Watkins, John))

Comment: Virginia is in a deficit as far as generating capacity is concerned. The generation gap is projected to be about 4000 megawatts by 2017, and that goes well beyond already significant ability to import power from other states. In order to keep Virginia's growing energy needs and keep rates stable, we surely need to have a strong investment in baseload energy sources within the Commonwealth. (**0034-60** (Moore, Kenneth))

Comment: It is projected that Dominion's Virginia service territory will require an additional 4000 megawatts in the next decade. The state currently is the second largest importer of electricity, second only to California. Because 30 percent of the electricity currently used in Virginia is imported, Virginians are more vulnerable to price volatility in the electricity market. In order to keep rates stable, there is a significant need for investment in a diverse mix of generation within the state. (**0034-66** (Ellis, Larry))

Comment: Over the next 10 years, Virginia will need to add an additional 4000 megawatts of capacity in order to keep up with demand. This electricity can either be generated here in Virginia, bringing our state closer to energy independence, or it can be imported. Either way it will be needed. North Anna Unit 3 would generate an additional 1520 megawatts. (**0034-80** (Fawls, Rebecca))

Comment: I am here today to speak about the need for power. Let me start by making it clear that Virginia is the second largest importer of electricity in the United States. The only state that imports more electricity in the United States is California. (**0034-84** (Stuart, Michael))

Response: *Affected states or regions prepare a Need for Power evaluation and assessment of the regional power system for planning or regulatory purposes. A Need for Power analysis may also be prepared by a regulated utility and submitted to a regulatory authority, such as a State Public Utility Commission. However, the data may be supplemented by information from other sources. The determination for the need for power is not under NRC's regulatory purview. When another agency has the regulatory authority over an issue, NRC defers to that agency's decision. The NRC staff reviews the Need for Power and determines if it is (1) systematic, (2) comprehensive, (3) subject to confirmation, and (4) responsive to forecasting uncertainty. If the Need for Power evaluation is found to be acceptable, no additional independent review by the NRC is needed. The Need for Power review will be discussed in Chapter 9 of the SEIS.*

Comment: While I laud renewable energy sources such as solar and wind and believe that we must continue to build more of these kinds of plants, the point I am making is that they just cannot keep up with the current growth in electrical demand compared to other electrical generation sources such as nuclear. (**0021-4** (Pierson, Mark))

Comment: I am here today to speak to the issue of the Need for Power. Let me start by making it clear that Virginia is the second largest importer of electricity in the United States. The only state that imports more power than Virginia is California. (**0025-1** (Stuart, Michael))

Comment: North Anna right now contributes 17 percent of the power generated and used by Dominion customers. Of course, the new unit will increase this. And this station is strategically located between two very high growth areas in the company. This is a source for base-loaded power, which can operate at a very low cost and will enable us to keep electric rates within a reasonable amount of charge at which probably inflation increases. (**0034-106** (Farmer, John))

Comment: Base load means a lot of generation when it's needed. And the alternatives are offered of conservation, solar, wind energy, and tidal energy. Now, the problem is that when the wind doesn't blow and the sun doesn't shine, then base load is needed for reliability of the system as a whole to provide our customers. And conservation has a limited application in favor of an increase in population and customer demand. (**0034-109** (Beament, Peter))

Comment: Why I applaud renewable sources, such as solar and wind, and believe that we must continue to build more of these kinds of plants, the point I am making is that they just cannot keep up with the current growth in electrical demand compared to other electrical generation sources, such as nuclear. (**0034-123** (Pierson, Mark))

Comment: Last fall, last summer, we reached almost 20,000 megawatt hours as a peak load, so we doubled from '84 to '07. The projections indicate that we will double again by 2030. That's 40,000 megawatts. Now, we all talk about conservation and, you know, I've got some of those little light bulbs that burn less energy, and I tend to cut off lights when I leave rooms, like I was taught. But at the same time, we can't get there with conservation. We can help, but we can't get there. We've got to have additional energy. (**0034-56** (Tribble, Charles))

Response: *The NRC staff will review the Need for Power and determine if it is (1) systematic, (2) comprehensive, (3) subject to confirmation, and (4) responsive to forecasting uncertainty. If the Need for Power evaluation is found to be acceptable, no additional independent review by the NRC is needed. The Need for Power review will be discussed in Chapter 9 of the SEIS. Regional forecasts, conservation, imports, and generation alternatives will be addressed in the discussion.*

22. <u>Comments Concerning Alternatives - Energy</u>

Comment: Numerous comments have been received questioning an agency's obligation, under the National Environmental Policy Act, to evaluate alternatives to a proposed action developed by an applicant for a federal permit or license. (**0024-7** (Zeller, Lou))

Comment: The alternative section of the needs to assess other alternatives beyond siting such as renewables, demand side management, repowering of Units #1 and #2, etc. (**0035-40** (Goldsmith, Aviv))

Response: *Alternatives to the proposed action including energy alternatives and the no-action alternative will be considered in the SEIS.*

Comment: If and how conservation and energy efficiency might offset the need to embark on construction of new nukes is not even mentioned (has Dominion even explored these options?). (**0017-2** (Day, Elena))

Comment: The North Anna Power Station Unit Three reactor plant would provide about 1500 MW of electricity. For comparison, this is equivalent to about 750 to 1000 wind turbines—more than twice the size of the world's largest wind farm. Additionally, wind turbines have an average output of about 30% of their maximum power capacity, only providing electricity when wind speeds are able to support it. Thus, to consistently provide the same electrical power generation as North Anna Unit Three, it would require about three times as many wind turbines or 2000 to 3000 turbines. I contend the environmental impact of one modern state-of-the-art nuclear reactor is much less than the impact of 3000 wind turbines covering 100 acres per turbine or over 300,000 acres total. Additionally, on a hot, steamy, windless day when power loads from air conditioning are at a peak, wind power is not available. However, North Anna Unit Three would be on line providing 1500 MW of electricity all day. (**0021-2, 0034-121** (Pierson, Mark))

Comment: If we compare a nuclear reactor to solar generation, it would take at least 12,000 acres of solar arrays to produce a maximum electrical power output equivalent. But once again, solar is not always available, especially at night, and the average output is only 20 percent of the maximum capacity. Thus, over 60,000 acres, or just under 100 square miles, of solar arrays would be needed to consistently produce the same output as one nuclear reactor. Of course, the largest solar farm currently planned to be built would only yield about

80 MW of electricity at an estimated cost of about half a billion dollars. Note also that most solar facilities are being built in the western United States in the desert where there is no snow and ice. Thus, on an overcast snowy and icy day on the east coast during a peak heating load, solar power is not available. However, North Anna Unit Three would be on line providing 1500 MW of electricity day and night. (**0021-3, 0034-122** (Pierson, Mark))

Comment: The EIS should fully consider alternatives to North Anna-3, including but not limited to:
* use of renewable energy to meet electricity demand
* use of energy efficiency to reduce electricity demand, including various and aggressive energy efficiency program scenarios
* use of a combination of renewable energy and energy efficiency to meet electricity demand
* the no action alternative (**0026-1** (AuClair-Valdez, Miguel))

Comment: More [solar] energy falls on the surface of the Earth in one hour than the entire humanity uses in a year. It's time for us to get creative, and it's time to think outside the box. (**0034-134** (Day, Donal))

Comment: Let me also point out to all of these people who talk about the windmills only producing when the wind blows and solar only producing when the sun shines. Dominion operates one of the largest pump storage facilities in the world because not all of the time they run their nuclear power plant, people are using the energy. They pump water uphill and store it very effectively and run it downhill. There is no reason that that same technique can't be used for wind or for solar. (**0034-135** (Day, Donal))

Comment: And there are many things that recent claims and stories didn't mention, such as though the last August heat wave is often mentioned, most stories fail to point out that during the hottest weeks, the nation's nuclear power plants were running at 98 percent capacity factor. During California's heat wave in 2006, in which 60 people died, San Onofree and Diablo Canyon nuclear power plants were running at full output. On the other hand, the capacity factor for the state's wind farms was an abysmal four percent. This performance for wind turbines during a heat wave is not unusual. According to the Energy Information Administration, capacity factors for wind farms are always the lowest during the hottest months of the year. (**0034-167** (Stiles, Lisa))

Comment: Hydroelectric and thermal solar use more water per megawatt hour produced than nuclear. The already low efficiency of solar photovoltaics drops even further at high temperatures. And we certainly don't want to depend on being able to grow corn, sugar, or switch grass, or anything else during a prolonged drought. The single largest nuclear facility in North America is in the middle of the desert in Arizona. And it does not suffer from any drought-related setbacks simply because water conservation was built into the design. (**0034-168** (Stiles, Lisa))

Comment: There are alternatives out there, though, that are not anywhere near as expensive as the nuclear energy is and have lower CO_2 emissions than nuclear energy. If you look at wind power, which everybody has bashed wind power a lot tonight, there is a very interesting study from March 2007 from the Oxford Research Group that just compares the carbon emissions of nuclear power to the carbon emissions of wind power. And, at its best, nuclear power has 4 grams per kilowatt hour more of carbon emissions than wind power and 44 more grams of carbon emissions per kilowatt hour at its worst. So that's one thing to consider. What do we need to consider? We need to be considering ways to look at energy efficiency. Energy efficiency is a realistic reliable way to do it. And we can decrease our energy consumption by 20 percent and be able to have no net cost to the economy as well as we need to shift to renewable energy. (**0034-211** (Tolbert, J.R.))

Comment: The scope of the EIS also considers alternatives to the project. This includes a no-action option. And this goes back to the first statement I made. I mean, obviously the alternative question is paramount here in Virginia. It asks the following. If not this reactor, how will Virginia meet its energy needs or we can pose it another way. Do we even need to assume the risk associated with the new reactor and mining in order to keep the lights on? I appreciate the graph that was just up here a few minutes ago. And I saw what was trying to be projected. I think what that was speaking to was not potential for renewable energy here in Virginia. It was talking about the political will and the utility's will to implement those kind of technologies. So, to address these questions, the EIS should consider that Virginia's choices are not limited to new nuclear or coal. In fact, it is technically and economically feasible for a diverse mix of existing renewable energy and efficiency technologies to completely need Virginia's electricity needs over the coming decades. (**0034-94** (Fisher, Allison))

Comment: These renewable resources could be harnessed effectively and reliably and without producing carbon dioxide or carbon emissions, radioactive waste, or relying on mining a finite resource. According to the National Renewable Energy Laboratory data in a Virginia Center for Coal and Energy Research study, Virginia's electricity needs can be fully met in the coming decades by wind, solar, advanced hydroelectric power, and geothermal heat pumps. Then the EIS should include a full examination of the following data from the NREL study. First, Virginia's wind potential comes over 104 million megawatt hours. That is over 92 percent of Virginia's total annual electricity consumption. Virginia's PV solar potential is 25,000 megawatts by 2025, which would generate over 46 million megawatt hours annually. Right now that's... And then, finally, geothermal heat pumps could also be used in Virginia to reduce the energy used for heating and cooling billings by 30 to 60 percent. So it's not just turning off your lights, and it's not just putting in those newfangled light bulbs. There's some other stuff out there that could be implemented. (**0034-95** (Fisher, Allison))

Comment: And you can turn your considerable talents and your healthy ambitions to life-enhancing projects, utilizing solar, wind, and wave energy to creating real and not bogus safety and security and to safeguarding the intensity of our relationship with future generations and with the whole of the natural world. (**0034-99** (Nguyen, Vanthi))

Comment: It is time for Dominion to stop its quest for new nukes and, instead, commit to programs of conservation, efficiency in conjunction with renewables as they come on line. (**0034-146** (Day, Elena))

Response: *Alternative energy sources, including energy conservation and renewable energy sources, will be addressed in Chapter 9 of the SEIS.*

23. Comments Concerning Alternatives - System Design

Comment: I am hoping that you could use some kind of cooling tower to do the job [avoid lowering lake level]. (**0010-3** (Hayo, Dennis))

Comment: The solution is simple although it may cost more it will insure Lake Anna continues to be a major state attraction. Dominion has proposed dry cooling for a potential Unit 4. If this was used for Unit 3 also then these major issues go away. This type of cooling is used in other countries why not here. (**0012-6** (Heino, George and Gerry))

Comment: A new-fresh look at cooling technologies needs to be performed. Specifically the hybrid-cooling proposed will only remove up to 1/3 of the heat of the entire system during the hot humid days. The other 2/3 will be done by the wet cooling with large evaporation (16.6 MGD). In contrast dry cooling technology would consume only about 5-10% of that amount. Despite this enormous water savings, most of the cooling for new power plants primarily uses wet cooling. This is because on hot days, dry cooling can lead to increased turbine back pressure that prevents a plant from generating at its full rated capacity. The problem is compounded because hot days are precisely when the electricity demand is the highest. This hot-day performance problem with dry-cooled units can be alleviated by using small water supplemental cooling as needed. One such method recommended PIER Energy-Related Environmental Research http://www.energy.ca.gzov/reports/2004-03-09 50003-109.PDF is to introduce a small amount of water spay into the cooling tower inlet air stream, where it evaporates and cools the air. Studies have shown that reducing inlet air temperature by even a few degrees can maintain much of the plant's output during hot hours. This is one of many dry cooling examples which are currently being used in the USA and worldwide. This dry cooling needs to be studied more carefully. (**0016-2** (Remmers, Ken))

Comment: Plant #3 was considered in a standalone condition and no consideration was made for the alternative of installing additional water conservation measures on the existing nuclear power reactors Units 1 and 2, to compensate or mitigate against the significant and adverse incremental impacts that will be caused by Unit 3. Judge Karlin (ALSBP) stated that some of the once-through cooling water from Units 1 and 2 could be diverted to the cooling tower used for Unit 3. While this diversion would be small, it would offset some of the impacts of Unit 3. He rejected the NRC staff's position that such an offset is per se unreasonable under NEPA. He stated There is no dispute that the NEPA alternative analysis {is the heart of the environmental impact statement}. When a company operates an existing facility that emits pollution and/or has adverse environmental impacts, it is common for a regulator to at least consider, and sometimes impose, additional environmental controls on the existing units as trade-off for obtaining approval to construct additional units. Judge Karlin stated It seems to me that creative nuclear engineers and environmental scientist, if properly motivated, might very well propose realistic offsets or mitigation measures that could be applied to the pre-existing reactors on the same site. This is significant new information that needs to be addressed. (**0016-3** (Remmers, Ken))

Comment: The NRC should now determine how to implement the modest recommendations of ASLB Judge Karlin who parted ways with the majority on water supply: "My [Judge Alex Karlin] dissent is also based on the fact that Section 8.2 of the FEIS, entitled "System Design Alternatives" and the NRC Staff, excluded, per se, even considering the alternative of asking or requiring Dominion's affiliates to install additional water conservation measures on the existing nuclear power reactor Units 1 and 2, to compensate or mitigate against the significant and adverse incremental impacts that will be caused by proposed Units 3 and 4." (**0024-12** (Zeller, Lou))

Comment: The drought cycles will double if the wet/dry cooling method for Unit 3 is selected. (**0028-13** (Ruth, Harry))

Comment: We have several concerns, primarily with the cooling method proposed for the 3rd reactor which will use up to 24 million gallons a day of Lake Anna water. If the cooling method were changed to dry cooling which Dominion has proposed for the 4th reactor and which is used in other parts of the world, most of our concerns would go away. (**0028-2, 0028-4** (Ruth, Harry))

Comment: One alternative discussed, but not proposed by Dominion for the 3rd reactor's cooling method is to exclusively use Dry Air Cooling for the 3rd unit, which would then negate any further water withdrawals from our small watershed and would also hopefully reduce major safety problems in the event that the dam would break or be blown-up by a terrorist attack, causing sudden loss of water for cooling any of the reactors. The North Anna Nuclear Power Plant (which supplies over 20% of Virginia's power) could be offline for 3 years while we wait for the lake to refill. Our power would be purchased from other sources and our bills would increase significantly. The dry-air cooling appears to be a feasible option, since this is the same technology that Dominion has proposed for Unit 4 and is used by many overseas countries that do not have a local water source. In addition, many of the recommendations by VDEQ analysis to the NRC, requests that the air cooling mode be used with Unit 3 for 7 months of the year to reduce lake water drawdown and reduce the risk of a complete Unit 3 shutdown. In its response to the ESP DEIS, VDEQ's Division of Water Resources (DWR) expressed its preference that the once-through cooling process proposed for Unit 3 be changed to a dry cooling tower because the dry cooling tower would results in less consumptive use of water than the either the once-through cooling or the combination wet/dry cooling tower. Also in its comments on the DEIS, DWR stated that it would have no concerns about this project if both the third and fourth reactors at North Anna were air cooled. The COL DEIS should fully analyze this alternative dry cooling method. (**0028-27** (Ruth, Harry))

Comment: Dry Air cooling of the 3rd reactor will preserve this beautiful lake resource for future generations and will not create all the decreasing water levels and negative effects as defined above that will be caused by the proposed wet/dry cooling towers. (**0028-35** (Ruth, Harry))

Comment: The NRC should evaluate including the system design alternative of imposing some form of water saving measures and temperature reductions on the two nuclear reactors that already exist on the site, as a form of offset to the impacts of the proposed new reactors. Since there are significant surface water impacts that will be caused by the proposed Unit 3 (cooling method using up to 24 million gallons per day), the system design alternatives should include the alternative of imposing some form of water saving measures and temperature reductions on the two nuclear reactors that already exist on the site, as a form of offset to the impacts of the proposed new reactor. These Unit 1 & 2 offsets are necessary under the National Environmental Policy Act (NEPA) where the applicant and its affiliates seek to add a nuclear reactor at the same location of existing nuclear operations. The Units I & 2 water conservation measures should mitigate against the significant -and adverse incremental impacts that will be caused by the proposed Unit 3 cooling method. (**0033-17** (Ruth, Harry))

Comment: The COL DEIS should fully analyze alternative cooling methods for the 3rd reactor which do not create all the environmental impacts defined above. An alternative cooling method that does not cause declining water levels would mitigate the LARGE declining water level impacts from the proposed 3rd reactor wet/dry cooling method currently proposed. (**0033-28** (Ruth, Harry))

Comment: One alternative discussed, but not proposed by Dominion for the 3rd reactor's cooling method is to exclusively use Dry Air Cooling for the 3rd unit, which would then negate any further water withdrawals from our small watershed. (**0033-29** (Ruth, Harry))

Comment: Dry-air cooling appears to be a feasible option, since this is the same technology that Dominion has proposed for Unit 4 and is used by many overseas countries that do not have a local water source. In addition, many of the recommendations made by VDEQ analysis from almost all Virginia regulation authorities to the NRC, requests that the air cooling mode be used with Unit 3 for 7 months of the year to reduce lake water drawdown and reduce the risk of a complete Unit 3 shutdown. In its response to the ESP DEIS, VDEQ's Division of Water Resources (DWR) expressed its preference that the once-through cooling process proposed for Unit 3 be changed to a dry cooling tower because the dry cooling tower would results in less consumptive use of water than the either the once-through cooling or the combination wet/dry cooling tower. Also in its comments on the DEIS, DWR stated that it would have no concerns about this project if both the third and fourth reactors at North Anna were air cooled. (**0033-31** (Ruth, Harry))

Comment: Another alternative cooling method to be considered is the small water supplemental cooling method recommended by PIER Energy-Related Environmental Research. With the current proposed wet/dry cooling this will only remove up to 1/3 of the heat of the entire system during the hot humid days. The other 2/3 will be done be by the wet cooling with large evaporation (16.6 MGD). In contrast dry cooling technology would consume only about 10% of that amount. Despite this enormous water savings, most of the cooling for the proposed power plant would still use primarily wet cooling. This is because on hot days, dry cooling can lead to increased turbine back pressure that prevents a plant from generating at its full rated capacity. The problem is compounded because hot days are precisely when the electricity demand is the highest. This hot-day performance problem with dry-cooled units can be alleviated by using small water supplemental cooling. This supplemental cooling would introduce a small amount of water spray into the cooling tower inlet air stream, where it evaporates and cools the air. Studies have shown that reducing inlet air temperature by even a few degrees can maintain much of the plant's output during hot hours. This is one of many dry cooling examples which are currently used in the USA and worldwide. No such studies of dry cooling were performed in the EIS-ESP because the PPE did not define a specific reactor design. This supplemental dry cooling needs to be studied more carefully before a cooling method is selected. (**0033-32** (Ruth, Harry))

Comment: Another alternative cooling method would be for Dominion to run water pipes from the James River to the North Anna site to provide cooling for the Pr reactor without impacting the Lake Anna water level and the related negative effects. This alternative would also provide additional water for the power plant in the event that a dam leak occurred causing the shutdown of Units 1 and 2. All eggs would not be in the same basket of using exclusively Lake Anna water and also gives the additional opportunity of cooling Unit 4 in the future. Louisa County is currently planning to pipe in water from the James River to the Zion Crossroads in the county; possibly Dominion could participate in a joint venture with the county to extend the water pipe to the power plant at Lake Anna. (**0033-33** (Ruth, Harry))

Comment: Other alternative cooling methods (i.e., dry cooling that Dominion proposed for the 4th reactor) would not impact the lake level. (**0033-86** (Ruth, Harry))

Comment: The consumption of an additional million gallons of water a day only aggravates an already serious condition. If the proposed cooling towers are to be used, then consideration must be given to other options to conserve and/or send water back into the lake for environmental concerns and public safety as the lake was originally designed. This is required to help facilitate the needs of the nuclear power plant, control water for usage in Hanover County, provide safe boating conditions on the lake for recreation, and ultimately help restore and promote business for all of the communities. (**0034-178** (Jones, Dale))

Comment: The solution is simple. Although it may cost more, it will ensure Lake Anna continues to be a major state attraction. Dominion has proposed dry cooling for potential Unit 4. If this were used for Unit 3 also, then these major issues would go away. This type of cooling is used in other countries. So we can use it here. (**0034-196** (Heino, George and Gerry))

Comment: A new fresh look at cooling technologies needs to be performed, specifically the hybrid cooling process, will only remove up to one-third of the heat of the entire system during the hot humid days. The other two-thirds will be done by wet cooling with large evaporation—the 16.6 million gallons a day. In contrast, dry cooling technology would consume only about 5 to 10 percent of that amount. Despite this enormous water savings, most of the cooling for new power plants primarily use wet cooling. This is because on hot days dry cooling can lead to increased turbine back pressure that prevents a plant from generating at its full rated capacity. This problem is compounded because the hot days are precisely when the electric demand is the highest. The hot day performance problem with a dry cooled unit can be alleviated by using a technique such as small water supplemental cooling as needed. One such method is recommended by PIER Energy-Related Environmental Research—to introduce a small amount of water spray in the cooling tower inlet stream where it evaporates and cools the air, and such studies have shown that reducing the inlet air temperature, even by a few degrees, can maintain much of the plant's output during hot hours. This is just one of many dry cooling examples which are currently being used in the USA and worldwide. No such studies of dry cooling were performed in the ESP EIS, because the PPE did not define this specific reactor design. (**0034-32** (Remmers, Ken))

Comment: Judge Karlin of the Atomic Licensing Safety Board Panel stated that some of the once through cooling water from Unit 1 and 2 could be diverted to the cooling tower used for Unit 3. While this diversion would be small, it would offset some of the impacts of Unit 3. He rejected NRC staff position that such an offset per se is unreasonable under NEPA. He stated there is no dispute that the NEPA alternative analysis is the heart of the environmental impact statement. When a company operates in an existing facility and emits pollution and/or has environmental impacts, it is common for regulators to at least consider, and sometimes impose, additional environmental controls on existing units as a tradeoff. Judge Karlin stated, It seems to me that creative nuclear engineers and environmental scientists, if properly motivated, might very well propose a realistic offset or mitigation measures that could be applied to the preexisting reactors at the same site. (**0034-35** (Remmers, Ken))

Response: *The issue of alternative cooling system designs at North Anna was partially resolved in NUREG-1811, ESP EIS and will be evaluated in terms of new and significant information to determine if impact levels should be changed. Information not analyzed in NUREG-1811, ESP EIS regarding alternative cooling systems intake and discharge structures will be evaluated in Chapter 9 of the SEIS.*

Comment: Section 3 introduced the hybrid cooling tower. Is there an operating nuclear plant in the U.S. that has demonstrated this hybrid cooling tower technology is appropriate and safe for such a large thermal load? If not, the technology risks should be assessed and discussed herein. (**0035-15** (Goldsmith, Aviv))

Comment: Since water is a critical concern, among the major alternatives that should be considered in detail in Chapter 8 are the retrofitting of a cooling tower to Units #1 and/or #2, and the application of a dry cooler to Unit 3. Factors in the analysis such as capital and operating costs and operating efficiencies should be detailed. The conclusion on page 8-5 line 23 is not supported. (**0035-41** (Goldsmith, Aviv))

Response: *These comments refer to information in the North Anna draft ESP EIS that was superseded by the North Anna final ESP EIS (NUREG-1811) published by NRC in December 2006. Dominion was issued an ESP permit (ESP-003) in November 2007 for two units at the North Anna Power Station site under the specifications contained in that permit. The issue of alternative cooling system designs for North Anna Units 3 and 4 was partially resolved in NUREG-1811, ESP EIS and will be evaluated in terms of new and significant information to determine if impact levels should be changed. Information not analyzed in NUREG-1811, ESP EIS regarding alternative cooling systems intake and discharges structures will be evaluated in Chapter 9 of the SEIS.*

Comment: Section 3.2.1.2 mentions water treatment effluent. Shouldn't Chapter 8 include an assessment of a zero discharge option as is used in many other power plants? (**0035-16** (Goldsmith, Aviv))

Response: *This comment refers to plant water treatment systems for Unit 3, which were not specified at the time of NUREG-1811, ESP EIS, because a specific system design had not been selected. For the COL SEIS, NRC staff will evaluate the water treatment and effluent discharge systems proposed in the COL application. Impacts related to effluent water quality will be addressed in Chapter 5 of the SEIS. Effluent discharges would be regulated by VDEQ through the Virginia Pollutant Discharge Elimination System.*

24. Comments Concerning Alternatives - Sites

None of the comments in this area were considered in scope.

25. Comments Concerning Benefit - Cost Balance

Comment: Let us look at electrical generation costs. Since the year 2000, nuclear power has surpassed coal as the cheapest method of electricity production. In 2006, the average cost to produce electricity from nuclear generation was 1.72 cents per kilowatt-hour. This is compared to 2.37 cents per kilowatt-hour for coal generation and 6.75 cents for natural gas generation. We do admit these costs are based on the current fleet of nuclear power plants which have long since paid off most of their capital investment costs. It is anticipated that the cost to produce electricity from a new nuclear power plant will be approximately 4 cents per kilowatt-hour. However, since global warming has become an issue, there will come a time soon in this country where we will have some sort of carbon emission cap and trade program in place. Under this scenario, the cost of generating electricity from new nuclear power plants will be much lower than the cost from other sources such as coal or natural gas which will have to buy carbon credits from utilities that own nuclear power plants or hydroelectric facilities. This is because nuclear power plants have zero emission of carbon dioxide during production of electricity. In fact, nuclear power provides the largest source of emission-free electricity making up over 73% of the total emission-free electrical generation in the United States. The other primary source of emission-free electricity at 24% is hydroelectric. However, hydroelectric capacity in this country is about tapped out. We will not be building very many new major dams any time soon given the present regulations protecting our streams and rivers. To put all of this in perspective, it is estimated that the new North Anna Power Station Unit Three would reduce greenhouse gas emissions by the equivalent of taking 1.5 million cars off the road compared to conventional power production sources. (**0021-5** (Pierson, Mark))

Comment: Let us look at electrical generation costs. Since the year 2000, nuclear power has surpassed coal as the cheapest method of electricity production. We do admit these costs are based on the current fleet of nuclear power plants, which have long since paid off most of their capital costs. However, since global warming has become an issue. There will come a time soon in this country where we will have some sort of a carbon emission cap and trade program in place. Under this scenario, the cost of generating electricity from new nuclear plants will be much slower than the cost from other sources, such as coal or natural gas. This is because nuclear power plants have zero emission of carbon dioxide during production of electricity. In fact, nuclear power provides the largest source of emission-free electricity, making up over 73 percent of the total emission-free electrical general in the United States. The other primary source of emission-free electricity, at 24 percent, is hydroelectric. However, hydroelectric capacity in this country is about tapped out. To put all of this in perspective, it is estimated that the new North Anna Power Station unit 3 would reduce greenhouse gas emissions by the equivalent of taking 1.5 million cars off the road compared to conventional power production sources. (**0034-124** (Pierson, Mark))

Comment: The EIS should examine the Cost/Benefits of North Anna-3 using a process that would account for differing construction cost estimates for the facility. Moody's Investor Services predicts construction costs for new reactors to be $5,000-$6,000/kw. In filings with the Florida Public Service Commission, Florida Power & Light projects costs as high as $12 billion per reactor. Because of these uncertainties, the EIS should examine the cost/benefits at the various cost ranges. (**0026-2** (AuClair-Valdez, Miguel))

Comment: I would say don't just look at the cost of building the plant. Look at the true cost associated with it. Taxpayers are what fund nuclear energy. You fund it when the money comes out of your check every week from the federal government taxes. You fund it when you have to buy the power from the utility company. You are what's funding nuclear power. And look at the true cost to people. So when you are doing this cost-benefit analysis, peel back more than just the look at what the cost is and the economic benefit for the local community and compare what would it be if we didn't have the massive subsidies that are paying for the nuclear energy right now. (**0034-212** (Tolbert, J.R.))

Comment: Let's look at the economic review. When we talk about the cost of nuclear power, it is not just Dominion's cost. Taxpayers—every time somebody in the nuclear industry opens their mouth, they want to put their hand in your pocket and take it out with your money. It's taxpayer money. So let's add it all up. Let's find out where all these costs are. We've got the utility cost, we've got the fed cost, we've got waste, we've got high-level waste, we've got low-level waste. We've got insurance, we've got subsidies. Let's add it up, so that we can have a true site. (**0034-40** (Rosenthal, Jerry))

Comment: I think one of the primary purposes of the EIS is to provide a clear, reasoned, and transparent cost-benefit analysis. And so we believe that this EIS should include a full range of cost estimates for the projected construction of the ESBWR, rather than hold those costs as propriety information. So I think that it's vital, and particularly in terms of providing public credibility to this whole process, that the EIS—first of all, take a look at the fact that since the early site permit process was completed, that the cost projections for nuclear power have gone up by about 300 to 400 percent. Right now, the latest estimate that we've seen was provided in discovery documents as a result of Florida Power and Light disclosures to the Florida Public Service Commission where now we're looking at projected costs of anywhere from $5500 per kilowatt to more than $8000 per kilowatt hour for new nuclear construction. So if you convert that to about a 1500 megawatt reactor, that is anywhere from between $6 billion to $12 billion for a new reactor. Clearly, this should be taken into consideration in terms of the cost-benefit analysis. (**0034-43** (Gunter, Paul))

Comment: I'd like to point out to—as the NRC knows, and to members of the audience, that when you talk about rising fuel costs, the rising cost of concrete, the rising cost of metal, and you talk about the skyrocketing expenses that are involved in building a potential North Anna Unit 3, those same skyrocketing costs would apply to any baseload energy that you want to put in. (**0034-72** (Taylor, Kelly))

Comment: The study also shows that this nuclear facility's electricity production cost was 1.38 cents per kilowatt hour in 2006. This is considerably lower than the coal, natural gas, and renewables whose --when the renewables cost was $4.37 per kilowatt hour. (**0034-79** (Fawls, Rebecca))

Response: *The cost and benefits of construction and operation of Unit 3 will be evaluated in Chapter 10, Benefit Cost, of the SEIS.*

Comment: I am just suggesting that nuclear power is not the best way to decrease emissions. It's important to recognize those emissions from cradle to grave. From the point where we begin to take action on mining the uranium, we are making an environmental imprint. Okay? So we have to take that into account when we're considering nuclear energy. Furthermore, not just a process of the mining of the uranium, but you have to enrich the uranium, the construction of the reactor, the disposing of the waste, which has been pointed out over and over,—we don't really have a way to dispose of that waste right now—as well as any changes to the transmission line that would occur. (**0034-209** (Tolbert, J.R.))

Response: *Life-cycle carbon impacts will be considered to the extent that they were not previously considered in NUREG-1811, ESP EIS. The carbon impacts will be considered in Chapters 4 and 5 (construction and operation) and Chapter 9 (alternatives). If new and significant information concerning carbon cycle is found, it will be considered in the benefit-cost analysis in Chapter 10.*

Comment: We need to evaluate all energy technologies with the same set of objective criteria, whether they relate to lifetime emissions, economic issues,—I started making notes as the speakers were going on—waste streams, or environmental footprints. When we consider all of those criteria objectively, then we need to thoughtfully deploy all our energy technologies so we meet the needs of all members of society, especially those that are disadvantaged and minimize the impact to our environment. If we do that thoughtfully and carefully, we will find that we need all energy technologies, including nuclear. As one speaker put it, nuclear is not the cheapest or the cleanest. In this country, that would be hydro. But, in addition to the limit imposed by the number of adequate sites for hydroelectric power, consider that per-kilowatt hour produced, as I said before, hydro consumes much more water than nuclear. And as far as safety, far more people have been hurt or killed by dam breaks in this country than by nuclear power plants. What I am saying is that there is no one energy technology that is safest, cleanest, and cheapest. We have to thoughtfully maximize the benefits and minimize the risks of each one to solve our energy and environmental problems. (**0034-171** (Stiles, Lisa))

Comment: The GE-designed ESBWR has multiple backup safety systems with automatic safety features. It is a low carbon energy source with a small ecological footprint. To make the same amount of electricity from a wind farm as a nuclear power plant, it would take up to 200 square miles. And a solar plant would take 75 square miles, where a nuclear power plant would take approximately one square mile. (**0034-82** (Fawls, Rebecca))

Comment: And also due to this unique circumstance [proposed nuclear reactor vs. state moratorium on uranium mining], the environmental impact statement, whose main purpose is to establish a cost-benefit analysis of the project to determine if the environmental costs outweigh the stated benefits, should consider the effects of nuclear expansion and how it relates to the booming speculation on uranium. (**0034-92** (Fisher, Allison))

Comment: So regarding these technologies and for the purposes of the EIS, an analysis should consider cost comparison, ratepayer savings, and certainly job creation, which is another issue that has been broached here by several of the presenters. And there are plenty of studies that are showing that these technologies are bringing just as many jobs and just as many opportunities into communities and without the risks associated with nuclear power or coal. Alleviating us from these technologies is not going to shut down the economy, I assure you. So, just again, you know, or the choices our utilities are making for us are critical. And we really cannot afford economically as well as environmentally to continue on this business as usual path. And I think that, when all things are considered, what we will see is nuclear power is not the cheapest. It's not the safest. And it's certainly not the cleanest. (**0034-96** (Fisher, Allison))

Response: *The cost and benefits of construction and operation of Unit 3 will be evaluated in Chapter 10, Benefit Cost, of the SEIS.*

26. General Comments in Support of the Licensing Action

None of the comments in this area were considered in scope.

27. General Comments in Support of the Licensing Process

None of the comments in this area were considered in scope.

28. General Comments of Support of Nuclear Power

None of the comments in this area were considered in scope.

29. General Comments in Support of the Existing Plant

None of the comments in this area were considered in scope.

30. General Comments in Opposition to the Licensing Action

None of the comments in this area were considered in scope.

31. General Comments in Opposition to the Hearing Process

None of the comments in this area were considered in scope.

32. General Comments in Opposition to Nuclear Power

None of the comments in this area were considered in scope.

33. Comments Concerning Issues Out of Scope – Emergency Preparedness

None of the comments in this area were considered in scope.

34. Comments Concerning Issues Out of Scope – Miscellaneous

None of the comments in this area were considered in scope.

35. Comments Concerning Out of Scope – NRC Oversight

None of the comments in this area were considered in scope.

36. <u>Comments Concerning Issues Out of Scope – Safety</u>

None of the comments in this area were considered in scope.

37. <u>Comments Concerning Issues Out of Scope – Security and Terrorism</u>

None of the comments in this area were considered in scope.

Appendix E

Comments and Responses on the Draft Supplemental Environmental Impact Statement

Appendix E

Comments and Responses on the Draft Supplemental Environmental Impact Statement

This appendix was intentionally left blank in the Draft Supplemental Environmental Impact Statement (SEIS). In the Final SEIS, Appendix E will include written comments and responses received on the Draft SEIS.

Appendix F

Key Consultation Correspondence

Appendix F

Key Consultation Correspondence

Correspondence received during the evaluation process of the combined license (COL) application for Virginia Electric Power and Power Company and Old Dominion Electric Cooperative (collectively known as Dominion) for the proposed Unit 3 at the North Anna Power Station is identified in Table F-1. A full list of all correspondence during the preparation of this Supplemental Environmental Impact Statement is located in Appendix C.

Table F-1. Caption

Source	Recipient	Date of Letter/E-mail
Virginia Department of Historic Resources (Mr. Roger Kirchen)	U.S. Nuclear Regulatory Commission (Pao-Tsin Kuo)	November 07, 2007
Virginia Department of Historic Resources (Mr. Roger Kirchen)	U.S. Nuclear Regulatory Commission (Alicia Williamson)	May 01, 2008
Virginia Department of Game and Inland Fisheries (Ms. Amy Ewing)	U.S. Nuclear Regulatory Commission (Alicia Williamson)	May 09, 2008
Virginia Department of Environmental Quality (Ms. Ellie Irons)	U.S. Nuclear Regulatory Commission (Alicia Williamson)	August 14, 2008
Virginia Department of Historic Resources (Ms. Kathleen Kilpatrick)	U.S. Nuclear Regulatory Commission (Alicia Williamson)	November 4, 2008

JAN 03 2008 15:19 P.04

COMMONWEALTH of VIRGINIA

L. Preston Bryant, Jr.
Secretary of Natural Resources

Department of Historic Resources
2801 Kensington Avenue, Richmond, Virginia 23221

Kathleen S. Kilpatrick
Director

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www.dhr.virginia.gov

November 7, 2007

Mr. Tony Banks
Dominion Resource Services, Inc.
Innsbrook Technical Center
5000 Dominion Blvd.
Glen Allen, VA 23060

RE: Supplemental *Archaeological Survey, Dominion Combined License Project, North Anna Power Station, Louisa County, Virginia*
DHR File No. 2000-1210

Dear Mr. Banks:

We have received for consideration the above-referenced document prepared by The Louis Berger Group, Inc. for Dominion Resource Services, Inc. We are pleased to inform you that the report meets the Secretary of the Interior's *Standards and Guidelines for the Documentation of Archaeological Sites* (48 FR 44734-44742) and our Department's *Survey Guidelines* (revised 2003).

The survey investigated six proposed work areas for the expansion of Dominion's North Anna facility. The survey documented one previously unrecorded archaeological site (44LS0226), one known cemetery (44LS0227 and 054-5035), and one isolated find. The isolated find is, by definition, not eligible for listing in the National Register of Historic Places and no further work at this resource is warranted.

Site **44LS0226** is the remains of a late 19th to early 20th century domestic site. Based on the integrity of the site and its potential to add to our understanding of the African-American experience during the Reconstruction and Growth era, the consultant recommends site 44LS0226 as eligible for listing in the National Register. Until a formal Phase II evaluation of the site has been completed, we recommend this site be treated as *potentially eligible* for listing in the National Register and recommend avoidance or additional Phase II investigations.

The identified cemetery, recorded as both archaeological site **44LS0227** and architectural resource **#054-5035**, dates to the 19th century, although the absence of inscribed markers makes dating the burials difficult. The cemetery is currently fenced and no evidence is presented that suggests it extends beyond this established boundary. This site was not evaluated for National Register-eligibility during this study; however, we recommend *avoidance* of this resource. If avoidance is not feasible, additional evaluation

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Tidewater Region Office
14415 Old Courthouse Way, 2nd Floor
Newport News, VA 23608
Tel: (757) 886-2807
Fax: (757) 886-2808

Roanoke Region Office
1030 Penmar Ave., SE
Roanoke, VA 24013
Tel: (540) 857-7585
Fax: (540) 857-7588

Northern Region Office
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PO Box 519
Stephens City, VA 22655
Tel: (540) 868-7031
Fax: (540) 868-7033

P.05

Page 2
November 7, 2007
Mr. Tony Banks

will be necessary to determine National Register-eligibility and a permit must be obtained from our office for its removal.

Considering our earlier comments to the Nuclear Regulatory Commission dated October 20, 2006, the results of this study, and Dominion's letter to our office dated October 11, 2007, we concur with your conclusion that this project will not negatively impact historic properties provided that the following resources are avoided and adequately protected during construction and operation of the facility: 44LS0221, 44LS0222, 44LS0226, and 44LS0227/054-5035. If at any point, avoidance of these sites is deemed impractical, please reinitiate consultation with our office concerning the effect of this undertaking on historic properties.

We look forward to receiving the Commission's formal determination of effect for this undertaking and working with all parties throughout this project. If you have any questions, please do not hesitate to contact me at (804) 367-2323, ext. 153 or e-mail roger.kirchen@dhr.virginia.gov.

Sincerely,

Roger W. Kirchen, Archaeologist
Office of Review and Compliance

Cc: Mr. Eric Voigt, The Louis Berger Group, Inc.

✓USNRC
VDEQ } per TB 12/28/07

TOTAL P.05

RULES AND DIRECTIVES BRANCH USNRC

2008 MAY -6 AM 9: 32

COMMONWEALTH of VIRGINIA

L. Preston Bryant, Jr.
Secretary of Natural Resources

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3/13/08
73 FR 13589
1

May 1, 2008

Chief, Rules and Directives Branch
Division of Administrative Services
Mail Stop T-6D59
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

RE: North Anna Power Station – Unit 3 Combined License (COL) Application Review
DHR File No. 2000-1210; NRC Docket No. 52-017

We have received from the Nuclear Regulatory Commission (NRC) notice of the action referenced above conducted on the behalf of Dominion Virginia Power. Thank you for initiating consultation on this undertaking pursuant to Section 106 of the National Historic Preservation Act and its implementing regulations codified at 36 CFR Part 800. On April 17, 2008, DHR staff met with representatives from the NRC and Pacific Northwest National Laboratory to discuss this action and consultation to date on the North Anna project.

Many issues regarding potential impacts to historic properties, specifically archaeological resources, were resolved during the Early Site Permit (ESP) process. Given the limitations of the ESP process and changes to the scope of the project, additional studies are warranted to determine this undertaking's effect to historic properties. We understand that an additional 90+ acres have been added to the project. We recommend that this and any additional areas included in the project be subjected to Phase I archaeological survey by a qualified professional in accordance with our *Survey Guidelines* (rev. 2003). Furthermore, as new tower height is established, we recommend finalizing the viewshed analysis to determine potential impacts to the setting of nearby historic properties. Finally, we are concerned about the avoidance and continued management of the three known cemeteries (44LS0221, 0222, and 0227) and the historic site (44LS0226) which have been found to be potentially eligible for listing in the National Register of Historic Places. We request that the NRC provide for their protection.

Since consultation regarding the ESP, several Federally-recognized Indian tribes have informed our office of their possible interest in undertakings in Virginia. Find attached contact information for these tribes. We do not know of any specific tribe with interest in this project nor do we make any statement regarding the completeness of this list. This information is provided as a courtesy and is intended as technical assistance to NRC in meeting its tribal consultation requirements.

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Fax: (540) 868-7033

SUNSI Review Complete
Template = ADM-013
E-RIDS = ADM-03
Call = A. Williamson (ARW1)

Page 2
North Anna Power Station COL
DHR File No. 2000-1210; NRC Docket No. 52-017

We look forward to working with the NRC and its consultants and applicant throughout this process. If you have any questions, please do not hesitate to contact me at (804) 367-2323, ext. 153 or e-mail roger.kirchen@dhr.virginia.gov.

Sincerely,

Roger W. Kirchen, Archaeologist
Office of Review and Compliance

Cc (via email): Ms. Alicia R. Williamson, NRC

Page 3
North Anna Power Station COL
DHR File No. 2000-1210; NRC Docket No. 52-017

ATTACHMENT: TRIBAL CONTACTS

George Wickliffe, Chief
Lisa C. Stopp, Acting THPO
United Keetoowah Band of Cherokee Indians in Oklahoma
PO Box 746
Tahlequa, OK 74465
Phone: (918) 431-1818
Fax: (918) 431-1873
lstopp@unitedkeetoowahband.org

Dr. Wenonah G. Haire Jr.
Tribal Historic Preservation Officer
Catawba Indian Nation
Catawba Cultural Preservation Project
611 East Main Street
Rock Hill, SC 29730
(803) 328-2427
wenonahh@ccppcrafts.com (also cc to jackier@ccppcrafts.com)

Mr. James Bird
Tribal Historic Preservation Officer
Eastern Band of Cherokee Indians
Cultural Resources Department Qualla Boundary
P.O. Box 455
Cherokee, NC 28719
(828) 497-1594
jamgbird@nc-cherokee.com

Glenna J. Wallace, Chief
Ms. Jo Ann Beckham, Administrative Assistant
Eastern Shawnee Tribe of Oklahoma
PO Box 350
Seneca, MO 64865
Phone: (918) 666-2435
Fax:(918) 666-2186
estochief@hotmail.com

Ron Sparkman, Chairman
Ms. Rebecca Hawkins
Shawnee Tribe
Historic Preservation Department
P.O. Box 189
Miami, OK 74355
Phone: (918) 542-2441
Fax: (918) 542-2922
shawneethpo@neok.com

Chief Leo Henry
Tuscarora Nation
2006 Mt. Hope Road
Lewiston, New York 14092
Phone: (716) 622-7061
Fax: (716) 297-735

NAPSEISComment Resource

From: Amy.Ewing@dgif.virginia.gov
Sent: Friday, May 09, 2008 11:10 AM
To: Alicia Williamson
Cc: Brian.Watson@dgif.virginia.gov; John.Kauffman@dgif.virginia.gov
Subject: RE: North Anna Power Station Combined License Application Review

Ms. Williamson,

We have reviewed the proposed corridor for the additional 500kV line required to carry the output of the existing Lake Anna units and the proposed third unit. We do not currently document any listed wildlife or resources under our jurisdiction from the project area. Therefore, impacts upon such species and resources are not likely to result from the construction of this line. In addition, as this new line will be co-located within an existing power line corridor, it does not appear that significant wildlife habitat alterations will occur.

We recommend that all land disturbing activities adhere to erosion and sediment controls. We recommend conducting any in-stream activities during low or no-flow conditions, using non-erodible cofferdams to isolate the construction area, blocking no more than 50% of the streamflow at any given time, stockpiling excavated material in a manner that prevents reentry into the stream, restoring original streambed and streambank contours, revegetating barren areas with native vegetation, and implementing strict erosion and sediment control measures. Due to future maintenance costs associated with culverts, and the loss of riparian and aquatic habitat, we prefer stream crossings to be constructed via clear-span bridges.

We have been very involved over many years and have provided a lot of input to Dominion, the permitting agencies and the NRC during the review process for the addition of Unit 3 to the North Anna Nuclear Power Plant. We are currently awaiting the results of the Instream Flow Incremental Methodology (IFIM) study. Upon review of those results, we will make further recommendations regarding the protection of aquatic species under our jurisdiction as it relates to the addition of Unit 3 to the plant. If you are in need of any specific information or recommendations from us regarding this aspect of the COL at this time, please contact me.

Thank you.

Amy M. Ewing
Environmental Services Biologist
Virginia Dept. of Game and Inland Fisheries
4010 West Broad Street
Richmond, VA 23230
804-367-2211
amy.ewing@dgif.virginia.gov

From: Alicia Williamson [mailto:Alicia.Williamson@nrc.gov]
Sent: Wednesday, April 30, 2008 11:44 AM
To: Ewing, Amy
Cc: Fernald, Ray; Watson, Brian; Kauffman, John
Subject: RE: North Anna Power Station Combined License Application Review

Amy-
Sorry about any confusion our letter may have brought about, I hope our chat yesterday helped to clarify the information requests from NRC regarding the North Anna combined license environmental review. Attached is a map showing where the proposed new transmission lines will be placed. Dominion is planning to add the new lines to a pre-existing corridor, Line 575 (North Anna Station to Lady Smith Substation corridor) which is

1

highlighted. In addition, below is a link to the North Anna combined license home page should you need more detailed information.

We look forward to receiving VDGIF's comments on the scope of the North Anna combined license environmental review.
If you have any additional questions, please feel to contact me.

Thanx
Alicia

http://www.nrc.gov/reactors/new-licensing/col/north-anna.html
Scroll down to Applicant Documents, Click part 3 - Environmental Report

---

From: Amy.Ewing@dgif.virginia.gov [mailto:Amy.Ewing@dgif.virginia.gov]
Sent: Tuesday, April 29, 2008 3:31 PM
To: Alicia Williamson
Cc: Ray.Fernald@dgif.virginia.gov; Brian.Watson@dgif.virginia.gov; John.Kauffman@dgif.virginia.gov
Subject: North Anna Power Station Combined License Application Review

Ms. Williamson,

We received a letter from your office dated April 1, 2008 that requests information, comments or concerns from us that we consider appropriate under the provisions of the FWCA. It appears you are asking for this information in preparation for writing the EIS on the combined license. As you know, our agency has been very involved in all aspects of this project, including the IFIM being performed in waters downstream of Lake Anna. We have not, as of yet, received any maps of the proposed transmission line and cannot provide comments related to impacts the construction of this line may have on wildlife without understanding what the proposed corridor is.

I am writing to ask for clarification about what information you are looking for. I assume the NRC has received or been made aware of our comments and concerns to this point as they relate to the addition of unit 3 at Lake Anna. Are you just inquiring, then, about our comments related to the new transmission line? If so, please provide a map of the proposed line route and we would be happy to provide comments and recommendations about the protection of wildlife resources related to the construction of that line. If you are in need of broader comments regarding the project as a whole, please clarify that for me so that I may put together our comprehensive comments about this project.

We appreciate any clarification you can provide. We want to make sure that we do not miss any available opportunities to provide comments on this project. Thank you. Amy

Amy M. Ewing
Environmental Services Biologist
Virginia Dept. of Game and Inland Fisheries
4010 West Broad Street
Richmond, VA 23230
804-367-2211
amy.ewing@dgif.virginia.gov

2

7/17/08
73 FR 41132

(1)

COMMONWEALTH of VIRGINIA

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TDD (804) 698-4021
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L. Preston Bryant, Jr.
Secretary of Natural Resources

David K. Paylor
Director

(804) 698-4000
1-800-592-5482

August 14, 2008

RECEIVED
2008 AUG 18 PM 3:49
RULES AND DIRECTIVES BRANCH
USNRC

Chief, Rulemaking
Directives and Editing Branch
Division of Administrative Services
Office of Administration
Mailstop T-6D59
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

RE: Request for Comments on the Nuclear Regulatory Commission's Virginia Electric and Power Company, D/B/A Dominion Virginia Power, and Old Dominion Electric Cooperative North Anna Nuclear Station Unit 3 Combined License Application; Correction and Supplement to Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process, *Federal Register* Vol. 73, No. 138, pages 41132-41133

Dear Sirs:

This is in response to the Nuclear Regulatory Commission (NRC) July 17, 2008 *Federal Register* notice, Virginia Electric and Power Company, D/B/A Dominion Virginia Power, and Old Dominion Electric Cooperative North Anna Nuclear Station Unit 3 Combined License Application; Correction and Supplement to Notice of Intent to Prepare an Environmental Impact Statement and Conduct Scoping Process (73 FR 138, 41132-33).

Description of the NRC Notice

According to the NRC notice, the notice corrects and supplements a previous Notice of Intent to Prepare an Environmental Impact Statement (EIS) and Conduct Scoping Process (regarding an application for a combined license) published in the Federal Register on March 13, 2008 (73 FR 13589). The action is necessary:

SUNSI Review Complete
Template = ADM-013

E-RIDS = ADM-03
Add = A. Williamson
(ARW1)

Chief, Rulemaking
U.S. Nuclear Regulatory Commission

1. to correctly identify the document the NRC staff intends to prepare, the applicants for the combined license (COL) and the matters that the scoping process is intended to accomplish;
2. to inform the public and other scoping participants that alternative sites will not be considered in the review of the staff of the U.S. Nuclear Regulatory Commission (NRC or Commission) or in the environmental impact statement (EIS) prepared in connection with the COL application; and
3. to reopen the scoping comment period so as to provide the public with an opportunity to participate in the environmental scoping process, as described in 10 CFR 51.29, in regard to the correctly identified matters that the scoping process is intended to accomplish.

On November 27, 2007, the NRC issued ESP-003 to Dominion Nuclear North Anna, LLC, for the North Anna Early Site Permit Site (ESP) (the site of proposed Unit 3). Furthermore, an application dated November 27, 2007, for a COL for North Anna Unit 3 submitted by Virginia Electric and Power Company d/b/a Dominion Virginia Power and Old Dominion Electric Cooperative (Applicants) references the ESP for the North Anna ESP site, ESP–003. According to the NRC notice, for a COL application that references an ESP, the NRC staff, pursuant to 10 CFR 51.75(c), prepares a supplement to the ESP EIS (NUREG-1811) in accordance with 10 CFR 51.92(e). Accordingly, the purpose of the notice is to inform the public that the NRC staff will be preparing a supplement to NUREG-1811, the ESP Final EIS, in support of the review of the COL.

Pursuant to NRC regulations in 10 CFR 51.92(e), the scoping process for the supplemental EIS to the ESP Final EIS will be used to accomplish the following:

(a) Identification of the economic, technical, and other benefits and costs of the proposed action, to the extent that the EIS for the ESP did not include an assessment of these benefits and costs;
(b) Identification of other energy alternatives, to the extent that the EIS for the ESP did not include an assessment of energy alternatives;
(c) Identification of the issues related to the impacts of construction and operation of the facility that were not resolved in the ESP proceeding; and
(d) Identification of the issues related to the impacts of construction and operation that were resolved in the ESP proceeding but where new and significant information exists, including but not limited to, new and significant information demonstrating that the design of the facility falls outside the site characteristics and design parameters specified in the ESP.

In light of the above information, the NRC staff has decided to reopen the scoping comment period for thirty (30) days to enhance the ability of members of the public to participate in the scoping process.

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Chief, Rulemaking
U.S. Nuclear Regulatory Commission

SCOPING COMMENTS

The following discussion pertains to the NRC's decision to prepare a supplemental EIS in support of the COL instead of an EIS. Inasmuch as a COL is a major federal action, a supplemental EIS would not provide the rigorous environmental analysis necessary to guide decision makers on a COL application. The NRC has repeatedly stated that "*to construct and operate a nuclear power plant, an ESP holder must obtain a CP and OL, or a COL, **which are separate major federal actions which require their own environmental review** in accordance with 10 CFR Part 51*" (references: ESP Final EIS, page 1-2, ESP Supplemental EIS, Executive Summary, page xviii, and ESP, DEIS, Executive Summary page xxi). The recent decision (published on July 17, 2008) to prepare a supplement to the Final ESP EIS to support the COL instead of another EIS for the COL is also inconsistent with the NRC's earlier position as reflected in Mr. William D. Beckner's July 6, 2005 letter responding to Mr. Adrian Heymer at the Nuclear Energy Institute. In that letter, Mr. Beckner stated "*We believe that a portion of the underlying basis for industry's view is not consistent with the NRC's regulations and the applicable case law interpreting the National Environmental Policy Act of 1969, as amended (NEPA). In particular, inasmuch as an ESP and a COL are major federal actions, an environmental assessment is not a sufficient environmental inquiry on which to base an action on an ESP or COL application. Accordingly, pursuant to 10 CFR 51.20, both actions require the preparation of an EIS.*"

While we understand that the NRC's current rules implementing NEPA (10 CFR 51.92) allow the NRC to prepare a supplement to the ESP EIS to support the COL, over the past five years (since 2003 until March 13, 2008) the NRC has consistently maintained that an EIS would be prepared to support the COL. It was with this understanding that the Commonwealth reviewed and commented on the Draft EIS (March 3, 2005) and Supplemental EIS (September 8, 2006) for the ESP. During the ESP review process several environmental impact considerations were deferred to the COL stage of the licensing process. Following the 2006 amendments to the NRC rules, the Final ESP EIS which was published in December 2007 continued to assert that the ESP and COL are separate major federal actions requiring their own environmental review. Therefore, the Commonwealth had no reason to anticipate the NRC's recent change in its position on the type of NEPA document which would be prepared for the COL process.

NEPA AND FEDERAL CONSISTENCY REVIEW AUTHORITIES

DEQ's roles with respect to the review of any environmental documents that may be prepared for the proposed action are described below. DEQ's Office of Environmental Impact Review (OEIR) will coordinate Virginia's review of environmental documents prepared pursuant to the National Environmental Policy Act and comment to the NRC on behalf of the Commonwealth. A similar review process pertains to federal consistency certifications (FCC) submitted pursuant to the Coastal Zone Management Act (CZMA) of 1972, as amended.

3

Chief, Rulemaking
U.S. Nuclear Regulatory Commission

Pursuant to the CZMA, federal licensing or permit activities affecting Virginia's coastal resources or coastal uses must be consistent with the enforceable policies of the Virginia Coastal Resources Management Program (VCP) (also called the Virginia Coastal Zone Management Program) (see *Federal Consistency Regulations*, 15 CFR Part 930, sub-part D, Consistency for Activities Requiring a License or Permit). DEQ must be provided with a federal consistency certification which involves an analysis of the activities in light of the enforceable policies of the VCP (first enclosure), and a commitment to comply with the enforceable policies. In addition, we invite your attention to the advisory policies of the VCP (second enclosure).

Sections 930.57 and 930.58 of the *Federal Consistency Regulations* and Virginia's *Federal Consistency Information Package* available on DEQ's web site at http://www.deq.virginia.gov/eir/federal.html, give content requirements for a consistency certification.

We recommend that the submission of the federal consistency certification follows the completion of the NEPA review process to facilitate the resolution of issues before embarking on the consistency review. We believe that this approach will prevent unnecessary delays in the consistency review process which could result from changes made during the NEPA review.

Environmental Review

The following state and local Virginia agencies are likely to be included in the coordinated review of submitted environmental documents (note: starred (*) agencies administer one or more of the Enforceable Policies of the Virginia Coastal Resources Management Program.

- Department of Environmental Quality:
    - Office of Environmental Impact Review
    - Tidewater Regional Office*
    - Water Division
    - Air Division*
    - Waste Division
- Department of Game and Inland Fisheries*
- Department of Conservation and Recreation:
    - Division of Chesapeake Bay Local Assistance*
    - Division of Soil and Water Conservation*
    - Division of Planning and Recreation Resources
- Department of Health*
- Marine Resources Commission*
- Department of Historic Resources
- Virginia Institute of Marine Science
- Department of Mines, Minerals, and Energy
- Department of Agriculture and Consumer Services
- Department of Forestry

4

Chief, Rulemaking
U.S. Nuclear Regulatory Commission

Department of Forestry
Department of Transportation
Hampton Roads Planning District Commission
Affected Locality (ies)

In order to ensure an effective coordinated review of the EIS and the consistency certification, we will require about 24 copies of each document (6 hard copies and 18 CDs) when it is published. The document should include one or more U.S. Geological Survey topographic maps as part of its information. We recommend, as well, that project details be adequately described and analyzed. While this Office does not participate in scoping efforts beyond the advice given herein, other agencies may independently provide scoping comments to you concerning the preparation of the NEPA document for the proposed project.

If you have questions about the NEPA review process or the federal consistency review process, feel free to call me at (804) 698-4325 or John Fisher of this Office at (804) 698-4339.

Sincerely,

Ellie IS

Ellie L. Irons, Manager
Office of Environmental Impact Review

Enclosures
cc. Richard Weeks, DEQ
Michael Murphy, DEQ
Thomas Faha, DEQ-NVRO
Kotur S. Narasimhan, DEQ-Air
Paul Kohler, DEQ-Waste
Joseph Hassell, DEQ-Water
John Kauffman, DGIF
Amy Ewing, DGIF
Bob Munson, DCR
Robbie Rhur, DCR
Rene Hypes, DCR
Les Foldesi, VDH
Susan Douglas, VDH
Tony Watkinson, MRC
Ethel R. Eaton, DHR
Chris Adkins, VDOT
Keith Tignor, VDACS
Matt Heller, DMME
Todd Groh, VDF

COMMONWEALTH of VIRGINIA

L. Preston Bryant, Jr.
Secretary of Natural Resources

DEPARTMENT OF ENVIRONMENTAL QUALITY
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David K. Paylor
Director

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Attachment 1

Enforceable Regulatory Programs comprising Virginia's Coastal Resources Management Program (VCP)

a. Fisheries Management - The program stresses the conservation and enhancement of finfish and shellfish resources and the promotion of commercial and recreational fisheries to maximize food production and recreational opportunities. This program is administered by the Marine Resources Commission (VMRC); Virginia Code 28.2-200 to 28.2-713 and the Department of Game and Inland Fisheries (DGIF); Virginia Code 29.1-100 to 29.1-570.

The State Tributyltin (TBT) Regulatory Program has been added to the Fisheries Management program. The General Assembly amended the Virginia Pesticide Use and Application Act as it related to the possession, sale, or use of marine antifoulant paints containing TBT. The use of TBT in boat paint constitutes a serious threat to important marine animal species. The TBT program monitors boating activities and boat painting activities to ensure compliance with TBT regulations promulgated pursuant to the amendment. The VMRC, DGIF, and Virginia Department of Agriculture Consumer Services (VDACS) share enforcement responsibilities; Virginia Code 3.1-249.59 to 3.1-249.62.

b. Subaqueous Lands Management - The management program for subaqueous lands establishes conditions for granting or denying permits to use state-owned bottomlands based on considerations of potential effects on marine and fisheries resources, tidal wetlands, adjacent or nearby properties, anticipated public and private benefits, and water quality standards established by the Department of Environmental Quality (DEQ). The program is administered by the Marine Resources Commission; Virginia Code 28.2-1200 to 28.2-1213.

c. Wetlands Management - The purpose of the wetlands management program is to preserve wetlands, prevent their despoliation, and accommodate economic development in a manner consistent with wetlands preservation.

(1) The tidal wetlands program is administered by the Marine Resources Commission; Virginia Code 28.2-1301 through 28.2-1320.

(2) The Virginia Water Protection Permit program administered by DEQ includes protection of wetlands --both tidal and non-tidal; Virginia Code §62.1-44.15:5 and Water Quality Certification pursuant to Section 401 of the Clean Water Act.

Attachment 1 continued

Page 2

d. Dunes Management - Dune protection is carried out pursuant to The Coastal Primary Sand Dune Protection Act and is intended to prevent destruction or alteration of primary dunes. This program is administered by the Marine Resources Commission; Virginia Code 28.2-1400 through 28.2-1420.

e. Non-point Source Pollution Control – (1) Virginia's Erosion and Sediment Control Law requires soil-disturbing projects to be designed to reduce soil erosion and to decrease inputs of chemical nutrients and sediments to the Chesapeake Bay, its tributaries, and other rivers and waters of the Commonwealth. This program is administered by the Department of Conservation and Recreation; Virginia Code 10.1-560 et.seq.).

(2) Coastal Lands Management is a state-local cooperative program administered by the DCR's Division of Chesapeake Bay Local Assistance and 84 localities in Tidewater (see i) Virginia; Virginia Code §10.1-2100 –10.1-2114 and 9 VAC10-20 et seq.

f. Point Source Pollution Control - The point source program is administered by the State Water Control Board (DEQ) pursuant to Virginia Code 62.1-44.15. Point source pollution control is accomplished through the implementation of:

(1) the National Pollutant Discharge Elimination System (NPDES) permit program established pursuant to Section 402 of the federal Clean Water Act and administered in Virginia as the Virginia Pollutant Discharge Elimination System (VPDES) permit program.

(2) The Virginia Water Protection Permit (VWPP) program administered by DEQ; Virginia Code §62.1-44.15:5 and Water Quality Certification pursuant to Section 401 of the Clean Water Act.

g. Shoreline Sanitation - The purpose of this program is to regulate the installation of septic tanks, set standards concerning soil types suitable for septic tanks, and specify minimum distances that tanks must be placed away from streams, rivers, and other waters of the Commonwealth. This program is administered by the Department of Health (Virginia Code 32.1-164 through 32.1-165).

h. Air Pollution Control - The program implements the federal Clean Air Act to provide a legally enforceable State Implementation Plan for the attainment and maintenance of the National Ambient Air Quality Standards. This program is administered by the State Air Pollution Control Board (Virginia Code 10-1.1300 through §10.1-1320).

(i) Coastal Lands Management is a state-local cooperative program administered by the DCR's Division of Chesapeake Bay Local Assistance and 84 localities in Tidewater, Virginia established pursuant to the Chesapeake Bay Preservation Act; Virginia Code §10.1-2100 –10.1-2114 and Chesapeake Bay Preservation Area Designation and Management Regulations; Virginia Administrative Code 9 VAC10-20 et seq.

Attachment 2

Advisory Policies for Geographic Areas of Particular Concern

a. Coastal Natural Resource Areas - These areas are vital to estuarine and marine ecosystems and/or are of great importance to areas immediately inland of the shoreline. Such areas receive special attention from the Commonwealth because of their conservation, recreational, ecological, and aesthetic values. These areas are worthy of special consideration in any planning or resources management process and include the following resources:

a) Wetlands
b) Aquatic Spawning, Nursery, and Feeding Grounds
c) Coastal Primary Sand Dunes
d) Barrier Islands
e) Significant Wildlife Habitat Areas
f) Public Recreation Areas
g) Sand and Gravel Resources
h) Underwater Historic Sites.

b. Coastal Natural Hazard Areas - This policy covers areas vulnerable to continuing and severe erosion and areas susceptible to potential damage from wind, tidal, and storm related events including flooding. New buildings and other structures should be designed and sited to minimize the potential for property damage due to storms or shoreline erosion. The areas of concern are as follows:

i) Highly Erodible Areas
ii) Coastal High Hazard Areas, including flood plains.

c. Waterfront Development Areas - These areas are vital to the Commonwealth because of the limited number of areas suitable for waterfront activities. The areas of concern are as follows:

i) Commercial Ports
ii) Commercial Fishing Piers
iii) Community Waterfronts

Although the management of such areas is the responsibility of local government and some regional authorities, designation of these areas as Waterfront Development Areas of Particular Concern (APC) under the VCRMP is encouraged. Designation will allow the use of federal CZMA funds to be used to assist planning for such areas and the implementation of such plans. The VCRMP recognizes two broad classes of priority uses for waterfront development APC:

i) water access dependent activities;
ii) activities significantly enhanced by the waterfront location and complementary to other existing and/or planned activities in a given waterfront area.

Advisory Policies for Shorefront Access Planning and Protection

a. Virginia Public Beaches - Approximately 25 miles of public beaches are located in the cities, counties, and towns of Virginia exclusive of public beaches on state and federal land. These public shoreline areas will be maintained to allow public access to recreational resources.

b. Virginia Outdoors Plan - Planning for coastal access is provided by the Department of Conservation and Recreation in cooperation with other state and local government agencies. The Virginia Outdoors Plan (VOP), which is published by the Department, identifies recreational facilities in the Commonwealth that provide recreational access. The VOP also serves to identify future needs of the Commonwealth in relation to the provision of recreational opportunities and shoreline access. Prior to initiating any project, consideration should be given to the proximity of the project site to recreational resources identified in the VOP.

c. Parks, Natural Areas, and Wildlife Management Areas - Parks, Wildlife Management Areas, and Natural Areas are provided for the recreational pleasure of the citizens of the Commonwealth and the nation by local, state, and federal agencies. The recreational values of these areas should be protected and maintained.

d. Waterfront Recreational Land Acquisition - It is the policy of the Commonwealth to protect areas, properties, lands, or any estate or interest therein, of scenic beauty, recreational utility, historical interest, or unusual features which may be acquired, preserved, and maintained for the citizens of the Commonwealth.

e. Waterfront Recreational Facilities - This policy applies to the provision of boat ramps, public landings, and bridges which provide water access to the citizens of the Commonwealth. These facilities shall be designed, constructed, and maintained to provide points of water access when and where practicable.

f. Waterfront Historic Properties - The Commonwealth has a long history of settlement and development, and much of that history has involved both shorelines and near-shore areas. The protection and preservation of historic shorefront properties is primarily the responsibility of the Department of Historic Resources. Buildings, structures, and sites of historical, architectural, and/or archaeological interest are significant resources for the citizens of the Commonwealth. It is the policy of the Commonwealth and the VCRMP to enhance the protection of buildings, structures, and sites of historical, architectural, and archaeological significance from damage or destruction when practicable.

Eugene S. Grecheck
Vice President
Nuclear Development

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Dominion®

November 4, 2008

Ms. Kathleen Kilpatrick, Director
Virginia Department of Historic Resources
2801 Kensington Avenue
Richmond, Virginia 23221

COL-0370

Re: DOMINION COMBINED LICENSE PROJECT
NORTH ANNA POWER STATION
PROJECT UPDATE and ARCHAEOLOGICAL SURVEY (2008)
VDHR File No. : 2000-1210

Dear Ms. Kilpatrick:

This letter follows up on Dominion's continued progress with the above-referenced project. As you are likely aware, Dominion received an Early Site Permit (ESP) for the North Anna site from the U.S. Nuclear Regulatory Commission (NRC) on November 27, 2007. Upon NRC's issuance of the ESP and finding of site suitability for potential new nuclear generation at North Anna, Dominion applied to NRC for a license to construct and operate (COL) a third nuclear unit at the North Anna site. This COL application (COLA) was submitted to the NRC on November 27, 2007, and has been under review by NRC since that time.

The NRC has been in consultation with VDHR during their review of Dominion's North Anna COLA. Dominion expects NRC's review of the COLA to be completed in mid-2011. Site development and construction is planned during the next several years. As stated in an October 11, 2007 letter from Mr. Tony Banks of my staff to Dr. Ethel Eaton of VDHR, Dominion will continue to communicate and work closely with all appropriate agencies regarding cultural resources associated with this project.

One 2008 project development relevant to both VDHR and NRC review is the identification of another archaeological site in an area proposed for construction support purposes. Earlier this year, our consultant, The Louis Berger Group, Inc. (Berger), conducted an additional archaeological survey, identified one archaeological site, and recommended avoidance and preservation in place, if feasible. (A final report of this archaeological survey will be provided to VDHR when it is available.) Dominion commits to preserving this archaeological site, through avoidance, should it or any others be determined eligible for inclusion in the National Register of Historic Places. Different means of avoidance could include noting locations designated for protection on drawings, following directions through appropriate procedures and work instructions, and/or physical controls such as fencing or postings.

Ms. Kathleen Kilpatrick
COL-0370
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Furthermore, as planning continues and activities begin that may have ground-disturbing impacts, Dominion will coordinate with VDHR to ensure the protection of previously evaluated and any newly-discovered cultural resources. If, at any point, avoidance of a cultural resources site is deemed impractical, consultation with VDHR will be re-initiated to determine other appropriate treatment measures.

Please be advised that Dominion's cultural resources assessments and consultations with VDHR are shared with NRC. It is Dominion's intent to not only meet our regulatory obligations, but to be good stewards of the resources located in the communities in which we serve. Dominion will continue to work with VDHR and NRC as we move forward on this important project.

Please contact Tony Banks at (804) 273-2170 (tony.banks@dom.com) if you have questions.

Very truly yours,

Eugene S. Grecheck

cc: R. Kirchen, VDHR
A. Williamson, USNRC
R. Bronson, USACE

Appendix G

Environmental Impacts of Transportation

Appendix G

Environmental Impacts of Transportation

Appendix G of the North Anna early site permit environmental impact statement (ESP EIS) provides information on unirradiated fuel shipment; spent fuel shipment, and radioactive waste shipment from the North Anna Power Station. For each shipment areas, the environmental impacts are estimated along with information regarding transportation accidents. Any new information discovered since the preparation of the ESP EIS is provided in Section 6.2 of this supplemental EIS. Sections 4.8.3 and 5.8.6 provide information regarding the impact of transporting both construction and operational workers to the site, respectively.

Appendix H

Supporting Documentation on Radiological Dose Assessment

Appendix H

Supporting Documentation on Radiological Dose Assessment

Appendix H of the North Anna early site permit environmental impact statement (ESP EIS) provides information regarding the methodology and input data for dose estimates to the public from liquid effluents; from gaseous effluents, from airborne tritium releases from the proposed Unit 3 wet cooling towers; cumulative dose estimates; and dose estimates to biota from liquid and gaseous effluents. Revised dose estimates based on source terms for the proposed Unit 3 reactor design are provided in Sections 4.9, 5.9, and 7.8 of this supplemental EIS.

Appendix I

Early Site Permit Site Characteristics and Plant Parameter Envelope

Appendix I

Early Site Permit Site Characteristics and Plant Parameter Envelope

Appendix I of the North Anna early site permit environmental impact statement (ESP EIS) provides the site specific plant parameter envelope values for the North Anna ESP site. For the ESP, the impacts of constructing two units, Units 3 and 4, were evaluated. The information listed in Appendix I is for a single unit value, which in most cases is identical for the proposed second unit. Under the ESP issued by the U.S. Nuclear Regulatory Commission, the value of the plant parameters listed in Appendix I of the ESP EIS are limiting values for receiving a combined license for up to two additional units at the North Anna ESP site. Based on the chosen reactor design, actual values or statement that the plant parameter envelope will not be exceeded for the various items are provided in appropriate sections of this supplemental EIS.

Appendix J

Early Site Permit Site Permit Conditions, Commitments, Assumptions, and Unresolved Issues

Appendix J

Early Site Permit Site Permit Conditions, Commitments, Assumptions, and Unresolved Issues

Appendix J of the North Anna early site permit environmental impact statement (ESP EIS) provides information on the ESP permit conditions, identifies assumptions, and lists the unresolved issues. Assumptions were listed according to various technical disciplines as well as by site conditions, mitigation of impacts, plant parameter envelope values, and identification of information that could affect the technical basis or conclusions for the determination of the impact levels identified in the ESP EIS. Permit conditions were incorporated in the ESP (ESP-003) that was issued by the U.S. Nuclear Regulatory Commission to Dominion Virginia Power and Old Dominion Electric Cooperative in November 2007.

All unresolved issues have been addressed in the appropriate sections of this supplemental EIS. These unresolved issues fell into two categories: (1) those dependent on a specific reactor design that was identified in the combined license (COL) application, or (2) those that could be deferred until the submittal of the COL (e.g., need for power, energy alternatives, and alternatives to mitigate severe accidents).

Appendix K

Staff's Independent Review of Water Budget Impacts

Appendix K

Staff's Independent Review of Water Budget Impacts

Appendix K of the early site permit environmental impact statement (ESP EIS) provides (1) information regarding the methods used by the U.S. Nuclear Regulatory Commission staff in their independent assessment of the impacts of the proposed Unit 3's closed-cycle, combination dry and wet cooling system and (2) the staff's findings. The proposed reactor design and cooling system in the combined license application is similar to that evaluated in the staff's independent review for North Anna Power Station ESP site, and the staff's findings do not change from those documented in the ESP EIS. More specific information regarding the cooling system for the proposed Unit 3 is provided in Section 3.3.2 of this supplemental EIS.

Appendix L

Authorizations and Consultations

Appendix L

Authorizations and Consultations

Table L-1 contains a list of the environmental-related authorizations, permits, certifications, and consultations, potentially required by Federal, State, regional, local, and affected Native American tribal agencies for activities related to site preparation, construction, and operation of a potential new nuclear unit at the North Anna Power Station Unit 3 site.

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

Agency	Authority	Requirement	Activity Covered
Federal Aviation Administration	49 USC 1501; 14 CFR 77.13; Code of Virginia, Section 5.1-25.1	Construction Notice	Notice of erection of structures (>200 feet) potentially impacting air navigation. A permit from the Virginia Aviation Board would be needed if FAA identifies the structure as an air navigation obstruction.
NRC	10 CFR Part 52, Subpart C	Combined License	NRC requirements and procedures applicable to issuance of combined licenses for nuclear power facilities
NRC	10 CFR Part 30	Byproduct Materials License	NRC license to possess special nuclear materials
NRC	10 CFR Part 70	Special Nuclear Materials License	NRC license to possess nuclear fuel
USACE	CWA 33 USC 1344	Section 404 Permit	Disturbing or crossing wetland areas or navigable waters
USACE	Rivers and Harbors Act, Section 10; 33 USC 403	Section 10 Permit	Impacts to navigable waters of the United States
USFWS	Migratory Bird Treaty Act	Federal or State Permit	Adverse impact on protected species under the Migratory Bird Act
USFWS and NOAA Fisheries	Endangered Species Act, 16 USC 1536	Consultation regarding potential to adversely impact protected species	Consultation concerning potential impacts to threatened and endangered species and their habitat

Agency	Authority	Requirement	Activity Covered
Virginia State Corporation Commission	Code of Virginia, Section 56-265.2 and 56-46.1	Certificate of Public Convenience and Necessity	Approval for construction of new generating facility
VDEQ	9 VAC 5-20-160	Registration	Annual re-certification of air emission sources from NAPS site
VDEQ	Clean Air Act, Title V; 9 VAC 5-80-50	Operating Permit	Operation of air emission sources
VDEQ	9 VAC 5-80-120	Minor Source - General Permit	Construction and operation of minor air emission sources
VDEQ	CWA, Section 402; 9 VAC 25-10	Virginia Pollutant Discharge Elimination System Permit (VPDES)	Regulate limits of pollutants in liquid discharge to surface water
VDEQ	9 VAC 25-210	Virginia Water Protection Permit (Individual or General)	Permit to dredge, fill, discharge pollutants into or adjacent to surface water. Joint application with USACE Section 404 permit.
VDEQ	CWA, Section 401; 33 USC 1341	Section 401 Certification	Compliance with water quality standards
VDEQ	9 VAC 25-220	Surface Water Withdrawal Permit	Permit to withdraw water from Lake Anna (unless otherwise regulated by State Water Control Board)
VDEQ	Coastal Zone Management Act, 16 USC 1456 Virginia Coastal Resources Management Program	Consistency determination	Compliance with Virginia Coastal Program
VDCR	4 VAC 50-60-10	General Permit Registration Statement for storm water discharges from construction activities (VAR10)	General permit to discharge storm water from site during construction

Agency	Authority	Requirement	Activity Covered
VDCR	9 VAC 25-180	General Permit Notice of Termination (NOT) for storm water discharges from construction activities (VDCR 199-147)	Termination of coverage under the general permit for storm water discharge from construction site activities
Virginia Department of Historic Resources (VDHR)	National Historic Preservation Act, Section 106; 36 CFR Part 800	Cultural Resources Survey/Consultation	Determine location of historic/cultural resources at the North Anna Unit 3 site and any associated work areas. If resources are present, avoidance is recommended per the VDHR.
Virginia Marine Resources Commission	9 VAC 25-210	Permit	Permit to fill submerged land. Joint application with USACE Section 404 permit.

Appendix M

Severe Accident Mitigation Alternatives

Appendix M

Severe Accident Mitigation Alternatives

M.1 Introduction

Dominion Virginia Power and Old Dominion Electric Cooperative, collectively known as Dominion, have submitted an application to construct an Economic Simplified Boiling-Water Reactor (ESBWR) at the North Anna Power Station (NAPS). Current policy developed after the Limerick decision (Limerick 1989) requires that the U.S. Nuclear Regulatory Commission (NRC) staff 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.

In 10 CFR 52.79(a)(38), the NRC requires that applicants for combined licenses (COLs) include "… a description and analysis of design features for the prevention and mitigation of severe accidents." The Environmental Report and the Final Safety Analysis Report in the Dominion COL application (Dominion 2007) address these requirements. In 10 CFR 52.47(a)(23), the NRC requires that applications for a reactor design certification include "… a description and analysis of design features for the prevention and mitigation of severe accidents…." In addition, 10 CFR 52.47(a)(27) requires a description of a "…plant-specific probabilistic risk assessment (PRA) and its results." That information and related supplemental information in response to requests for additional information have been submitted by the applicant for design certification. In addition, the applicant for design certification has provided technical documents covering the ESBWR PRA (GE 2006; GEH 2008a) and ESBWR SAMDAs (GEH 2007).

While the NRC has not completed its generic SAMDA review of the ESBWR for design certification, it has conducted a SAMDA review specific to operation of an ESBWR at the NAPS site. The analysis is based on:

1. the most recent PRA and SAMDA submissions for the ESBWR design certification review
2. results of the analysis of probability-weighted risks of an earlier ESBWR design at the NAPS early site permit (ESP) site included in the ESP environmental impact statement (EIS) (NRC 2006)
3. comparison of reactor core inventories, of severe accident release rates, and of core damage frequencies (CDFs) for the current design with those of the earlier design.

An analysis for an ESBWR at a generic site is presented first, and then the analysis is extended to include consideration of NAPS site-specific information.

M.2 ESBWR SAMDA Review – Generic Site

Section 10 of the Design Control Document (DCD), Tier 2 (GEH 2008b) of the design certification application for the ESBWR design provides an estimate of the offsite risk to the population within 80 km (50 mi) of a location with conservative siting characteristics. The baseline results of the PRA for internal events during full-power operation are presented and compared to the Commission’s individual and societal safety goals in Table M-1. These results indicate that the risk from severe accidents would be at least four orders of magnitude lower than the Commission’s Safety Goals (51 FR 30028).

Table M-1. Comparison of ESBWR PRA Results for a Generic Site with the Commissions’ Safety Goals

Goal	Risk Goal	ESBWR 24 Hours After Onset of Core Damage (ground release)	ESBWR 72 Hours After Onset of Core Damage (ground release)	Safety Goal Achieved 72 Hours After the Onset of Core Damage
Individual Risk (0 – 1 Mile)	$<3.9 \times 10^{-7}$ (0.1%)	7×10^{-11}	8×10^{-11}	Yes
Societal Risk (0 – 10 Mile)	$<1.7 \times 10^{-6}$ (0.1%)	9×10^{-12}	1×10^{-11}	Yes
Radiation Dose Probability at 0.25 Sv (0 – 0.5 Mile)	$<10^{-6}$	2×10^{-9}	2×10^{-9}	Yes

Adapted from NEDO-33201 Revision 3 Table 10.4-2 (GEH 2008a).

For external events and shutdown modes, the PRA includes surrogate values for all but seismic events. Section 19.1.4.5 of the DCD lists the external event and shutdown CDF results. The values listed are of the same magnitude as those for the at-power internal events case. Because the individual CDF values are developed with differing levels of conservatism, the applicant indicated that it is not meaningful to add the CDF values to create total values. Nevertheless, it is apparent that for the two safety goal measures, the total risk from all accidents (internal and external events) would not increase by more than two orders of magnitude.

General Electric-Hitachi Nuclear Energy (GEH) affirmed that the individual risk and societal risk goals are maintained with a sufficient margin of safety. The risk results, together with supporting sensitivity studies, lead to the risk insight that public health and safety is well achieved in the ESBWR design, as shown by the PRA analysis.

M.2.1 Potential Design Improvements

The design certification applicant identified 177 candidate alternatives based on a review of alternatives for other plant designs, including those considered in license renewal environmental reports and the General Electric Advanced Boiling-Water Reactor (ABWR) SAMDA study (GE 1995). Certain design improvements were eliminated from further consideration because they were already incorporated into the ESBWR design. The following are examples of design enhancement features currently included in the ESBWR design:

- improved isolation condenser system design
- depressurization valves
- A.C.-independent fire water pumps for makeup and injection
- passive containment cooling system
- basemat internal melt arrest and coolability device and gravity driven cooling system deluge function
- D.C. power reliability
- actuation logic reliability
- motor-driven, feed-water pumps
- water pool elevation above drywell head elevation
- containment ultimate strength and maximum design pressure
- incorporation of flood mitigation into design
- reactor water cleanup system heat exchanger sized for decay heat removal
- 72-hour coping period for station blackout

- upgraded low-pressure piping for the reactor coolant pressure boundary
- digital instrumentation and control systems.

In the screening process, 42 candidate alternatives were eliminated as being inapplicable for the ESBWR design, 65 candidate alternatives were considered to be similar to those already included in the ESBWR design, 29 candidate alternatives were procedural or administrative rather than design alternatives (whose benefits were considered to be unlikely to exceed those alternatives evaluated relative to their potentially high costs), and 26 candidate alternatives were eliminated on the basis of their high cost relative to potential benefits. The remaining 15 candidate alternatives were considered to have very low benefit because they would not significantly reduce risk.

M.2.2 Risk Reduction Potential of Design Improvements

The design certification applicant assumed that each design alternative would work perfectly to completely eliminate all severe accident risk from the internal events that were evaluated. This assumption is conservative as it maximizes the benefit of each design alternative. The applicant 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 an 80-km (50-mi) radius of the generic ESBWR site.

The design certification applicant used the cost-benefit methodology found in NUREG/BR-0184, *Regulatory Analysis Technical Evaluation Handbook* (NRC 1997) to calculate the maximum attainable benefit associated with completely eliminating all risk for the ESBWR. This methodology considers averted onsite and replacement power costs. The applicant estimated the present worth of eliminating all severe accident risk at about $4630. If the offsite population doses and property damage costs were a factor of 10 higher, the present worth would be about $41,380.

The design certification applicant's risk reduction estimates are based on point-estimate (mean) 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.

M.2.3 Cost Impacts of Candidate Design Improvements

NEDO-33306, Revision 1, Licensing Topical Report, *ESBWR Severe Accident Mitigation Design Alternatives* (GEH 2007) did not assess the capital cost associated with the various design alternatives evaluated by the design certification applicant. The applicant maintained that the economic impacts of severe accidents, when combined with their associated frequencies, would result in an overall risk that is significantly lower than current operating reactors; therefore, any additional design modifications would be costly compared to any potential benefits. The applicant further indicated that any design modifications, including even a change of a manufacturer to reduce CDF, would incur approximately $2 million associated with the implementation of the supplier quality assurance program.

M.2.4 Cost-Benefit Comparison

The methodology used by GEH was based primarily on the NRC's guidance for performing cost-benefit analysis outlined in NUREG/BR-0184 (NRC 2004). The guidance involves determining the net value for each SAMDA according to the following formula:

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

where
- APE = present value of averted public exposure ($)
- AOC = present value of averted offsite property damage costs ($)
- AOE = present value of averted occupational exposure costs ($)
- AOSC = present value of averted onsite costs ($); 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. Table M-2 summarizes the applicant's and NRC staff's estimates of each of the associated cost elements. The provided results are based on the approach, parameters, and data listed in NUREG/BR-0184. The estimates in Table M-2 are based on the PRA Revision 1 CDF of 7.54×10^{-8}/yr (GEH 2006). The total CDF in the updated PRA is 6.6×10^{-8}/yr (GEH 2008a). This value would reduce the benefits listed in the table.

The design certification applicant provided estimates using a 7-percent discount rate. The NRC recently issued Revision 4 of NUREG/BR-0058, "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission," (NRC 2004), which reflects the agency's policy on discount rates. NUREG/BR-0058, Revision 4, states that two sets of estimates should be developed: one at 3 percent and one at 7 percent. Use of a 3-percent discount rate would result in an almost doubling of the estimated benefits.

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 estimate reflects 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 Averted Costs for a Generic Site

Quantitative Attributes		Present Value Estimate ($) Best[a]	Maximum[b]
Health	Public	366	3660[c]
	Occupational	38	76
Property	Offsite	157	1570[c]
	Onsite	NA[d]	NA[d]
Cleanup and decontamination	Onsite	1167	1591
Replacement power		2900	34,486
Total		4628	41,383

(a) "Best Estimate" is based on mean release frequency and "best estimate parameter values" (GEH 2006).
(b) Maximum estimate is based on mean release frequency and high estimate parameter values.
(c) Estimate is based on a factor of 10 increase in estimated dose or public property values.
(d) Not analyzed.

As indicated above, the design certification applicant estimated the total present dollar value equivalent associated with complete elimination of severe accidents at a single ESBWR unit site to range between $4628 and $41,383. The estimated cost of replacement power has the largest effect on the averted cost. For any SAMDA to be cost beneficial, the enhancement cost must be less than $41,383. Based on this cost estimate, the design certification applicant concluded that none of the SAMDA candidates are cost beneficial.

M.2.5 Staff Evaluation

In 10 CFR 52.47(a)(27), the NRC requires that an applicant for design certification perform either a plant-specific or a site-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 and do not impact excessively on the plant. The set of potential design improvements considered for the ESBWR includes those from generic boiling-water reactor SAMA reports and from the ABWR design. The ESBWR design already incorporates many design enhancements related to severe accident mitigation. Such design improvements have resulted in a CDF that is about an order of magnitude less than that of the ABWR design. For example, the ESBWR design can cope with a station blackout (SBO) for 72 hours (i.e., no reliance on A.C. power for the first 72 hours), thus eliminating CDF sequences that contributed more than 40 percent of CDF in the ABWR design.

The design certification applicant's estimates of risk do not account for uncertainties either in CDF or in offsite radiation exposures resulting from a core damage event. The uncertainties in both of these key elements are fairly large because key safety features of the ESBWR design are unique, and their reliability has been evaluated through analysis and testing programs rather than through operating experience. In addition, the estimates of CDF and offsite exposures do not account for the added risk from earthquakes.

M.3 North Anna Site-Specific SAMDA Review

The discussion above evaluates SAMDAs for the ESBWR at a generic site. The following discussion updates that evaluation to include consideration of NAPS site-specific factors, including meteorological conditions, population distribution, and land use. It also updates the evaluation to include the results of the most recent PRA for the generic design. The last part of this discussion deals with procedural SAMAs.

M.3.1 Risk Estimates

The NRC staff evaluated the potential risks associated with severe accidents for an ESBWR using NAPS site-specific data in the North Anna ESP EIS (NRC 2006). Table 5-20, in the ESP EIS reports a CDF of 2.9×10^{-8} yr^{-1}, and population dose and cost risks of 3.3×10^{-3} person-rem yr^{-1} and \$4.85 yr^{-1}, respectively. These risks are based on internally initiated events that occur while the reactor is at power. CDF estimates in NEDO-33306, Revision 1 (GEH 2007) indicate that the total CDF for all events including externally initiated events and events while the reactor is shutdown is about a factor of 2.5 higher than listed in the ESP EIS.

The Dominion COL application (Dominion 2007) references an ESBWR design that is more recent than the design reviewed by the staff in the ESP EIS. Dominion reviewed the evaluation in the ESP EIS and concluded that there was no new and significant information. The NRC staff considers the change in ESBWR design to be significant because it the change has the potential to impact the staff's evaluation with respect to potential impacts of severe accidents. Consequently, the staff has evaluated the effects of the change in design on reactor-specific input to the consequence assessment. The staff compared the reactor core inventory, release fractions, and CDFs for the ESBWR design referenced in the COL application with the reactor core inventory, release fractions, and CDFs for the design reviewed in the ESP EIS.

There were only minor changes in release core inventories that would result in increases in consequences of less than 5 percent. The staff adjusted the population dose and cost consequences for each ESBWR release category in the ESBWR severe accident analysis in the ESP EIS to account for changes in CDFs. Although the total CDF for the current ESBWR is lower than that of the ESBWR design evaluated in the ESP EIS, there were several release categories for which the CDFs increased. The net result of the changes in release category

CDFs are (1) an increase in the population risk from 3.3×10^{-3} person-rem yr^{-1} to 7.0×10^{-3} person-rem yr^{-1} and (2) an increase in cost risks from \$4.85 yr^{-1} to \$12.45 yr^{-1}. When external initiating events and events when the reactor is shutdown are considered, the risks are increased by about a factor of 5.5.

The staff also considered changes in noble gas, cesium, and iodine release fractions for each of the release categories. There were only minor changes in the noble gas release fractions. The cesium and iodine release fractions decreased in 8 of the 10 release categories, including all of the release categories that contribute significantly to risk. The decreases ranged from about a factor of 2 to a factor 40. The risk estimates reported in the ESP EIS (NRC 2006) have not been adjusted to account for changes in release fractions because the total risk estimates are low, and the contribution to risk of individual isotopes is not readily available.

Based on the comparisons of core inventories, CDFs, and release fractions, the staff believes that the severe accident risks of the current ESBWR design are not significantly different than those of the design evaluated in the ESP EIS (NRC 2006). The staff concludes that those risks are of SMALL significance. Finally, the staff believes that ESBWR severe accident risks discussed in the ESP EIS adjusted for differences in release category CDFs, externally initiated events, and events while the reactor is shut down are appropriate for use in the NAPS site-specific evaluation of ESBWR SAMAs.

M.3.2 Cost-Benefit Comparison

In assessing the risk reduction potential of design improvements for the ESBWR, the NRC staff has based its evaluation on the applicant's risk reduction estimates for the various design alternatives, in conjunction with an assessment of the potential impact of uncertainties on the results. Using the methodology described above, the NRC staff revised the averted cost estimates in Table M-2 to reflect the updated ESBWR PRA (GEH 2008a) and NAPS site-specific parameters. The results are presented in Table M-3.

The analysis presented in Tables M-2 and 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, the applicant for design certification concluded that no candidate alternative from an initial list of 177 alternatives would be cost beneficial. The NAPS site-specific values are lower than those estimated for a generic site and are far below the minimum estimated cost for a design change.

Table M-3. Summary of Estimated Averted Costs for the NAPS Site

Quantitative Attributes		Present Value Estimate ($)			
		GEH[(a)]		NAPS Site[(b)]	
		Best[(c)]	Maximum[(d)]	7% Discount	3% Discount
Health	Public	366	3660[(e)]	1072[(f)]	2120[(f)]
	Occupational	38	76	33	147
Property	Offsite	157	1570[(e)]	955[(f)]	1888[(f)]
	Onsite	NA[(g)]	NA[(g)]	NA[(g)]	NA[(g)]
Cleanup and Decontamination	Onsite	1167	1591	1021	2020
Replacement Power		2900	34,486	462	5488
Total		4628	41,383	3543	11,662

(a) GEH estimates are based on a CDF of 7.54×10^{-8} yr^{-1} from PRA Revision 1 (GEH 2006).
(b) NRC staff estimates are based on PRA Revision 3 CDF estimates and NAPS site-specific parameters.
(c) "Best estimate" is based on mean release frequency (from PRA Revision 1) and "best estimate" parameter values.
(d) Maximum estimate is based on mean release frequency (PRA Revision 1) and high estimate parameter values.
(e) Estimate is based on a factor of 10 increase in estimated dose or public property.
(f) North Anna specific value based on risk from ESP EIS adjusted for changes in release category CDFs.
(g) Not analyzed.

The original list of 177 ESBWR SAMDAs included 29 candidate alternatives that were procedural or administrative in nature. These items were eliminated from consideration because they did not involve design changes. However, these candidate alternatives fall within the scope of the SAMA review that the NRC staff conducts as part of its environmental review of applications. The staff reviewed the candidate alternatives that were previously removed from consideration because they did not involve design changes. Following are examples of items removed from consideration for this reason:

- enhance procedural guidance for use of cross-tied component cooling or service water pumps

- implement procedures for alignment of a spare diesel to shutdown board after loss of offsite power and failure of diesel normally supplying it

- emphasize steps in recovery of offsite power after an SBO

- develop a severe weather conditions procedure

- develop procedures for replenishing diesel fuel
- increase frequency for valve leak-testing
- improve inspection of rubber expansion joints on the main condenser.

Such SAMAs generally involve procedures that would not have been developed for a reactor and are typically not developed until construction has been completed and the plant is approaching operation. Based on the staff evaluation, none of these SAMAs could reduce the CDF or risk to zero for an ESBWR at the NAPS site. Therefore, they likely would not be cost effective if the procedures that are referenced actually existed.

Dominion (2007) has stated that it will consider the procedural and administrative SAMAs when it is developing its procedures, as long as they do not exceed the maximum averted cost. It is the staff expectation that risk mitigation will be considered in development and implementation of procedures and training programs. Further, the staff notes that the cost of implementing risk mitigation measures during procedure development is significantly less expensive than modifying existing procedures to include comparable mitigation measures. Dominion has also stated, and regulations require, that programs and procedures be in place prior to loading fuel into the reactor.

M.3.3 Conclusions

Based on its evaluation of the ESBWR PRA (GEH 2008a), the ESBWR SAMDA analysis (GEH 2007), and its independent review and update of the severe accident consequence assessment performed as part of the North Anna ESP review, the NRC staff concludes that there are no ESBWR SAMDAs that would be cost beneficial at the NAPS site. The staff further concludes that detailed consideration of procedural SAMAs should be deferred until procedures and training programs are being developed. The staff has a reasonable expectation that risk mitigation measures will be considered when procedures and training programs are developed, and that procedure development will be completed prior to loading fuel into the reactor.

M.4 References

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10. SUPPLEMENTARY NOTES

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11. ABSTRACT *(200 words or less)*

This supplemental environmental impact statement (SEIS) includes the U.S. Nuclear Regulatory Commission (NRC) staff's analysis that considers and weighs the environmental impacts of constructing and operating a new nuclear unit (Unit 3) at the North Anna Power Station (NAPS) site near Mineral, Virginia, and the mitigation measures available for reducing or avoiding adverse impacts.

The NRC staff's preliminary recommendation to the Commission, considering the environmental aspects of the proposed action, is that the COL be issued. This recommendation is based on (1) the application, including the Environmental Report (ER) submitted by Dominion; (2) the staff's review conducted for the ESP application and documented in the ESP EIS; (3) consultation with Federal, State, Tribal, and local agencies; (4) the staff's own independent review of potential new and significant information available since preparation of the ESP EIS; (5) the staff's consideration of comments received during the public scoping process; and (6) the assessments summarized in this SEIS, including the potential mitigation measures identified.

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