

Eugene S. Grecheck Vice President Nuclear Development

Dominion Energy, Inc. • Dominion Generation Innsbrook Technical Center 5000 Dominion Boulevard, Glen Allen, VA 23060 Phone: 804-273-2442, Fax: 804-273-3903 E-mail: Eugene.Grecheck@dom.com

April 24, 2008

U. S. Nuclear Regulatory Commission Attention: Document Control Desk Washington, D.C. 20555 NA3-08-036 Docket No. 52-008 Permit No. ESP-003 ESP/JPH

DOMINION NUCLEAR NORTH ANNA, LLC, DOMINION VIRGINIA POWER AND OLD DOMINION ELECTRIC COOPERATIVE APPLICATION FOR ORDER AND CONFORMING AMENDMENTS FOR TRANSFER OF NORTH ANNA EARLY SITE PERMIT

Pursuant to 10 C.F.R. 50.80 and 52.28, Dominion Nuclear North Anna, LLC ("DNNA"), Virginia Electric and Power Company, doing business as Dominion Virginia Power ("DVP"), and Old Dominion Electric Cooperative ("ODEC") hereby apply to the U.S. Nuclear Regulatory Commission for an order consenting to the transfer of Early Site Permit ESP-003 from DNNA to DVP and ODEC. The application is included as Enclosure 1.

The application also requests conforming amendments to ESP-003 to delete references to DNNA, reflect DVP and ODEC as the permit holders, and delete certain provisions that are no longer applicable because they applied only to DNNA. Enclosure 2 contains marked up pages showing the requested changes.

Service upon the applicants of comments, hearing requests, intervention petitions or other pleadings related to this application should be made to counsel for Dominion as follows: Lillian M. Cuoco, Senior Counsel, Dominion Resources Services, Inc., 120 Tredegar Street, RS-2. Richmond, VA 23219 (phone: 804-819-2684; e-mail: lillian.cuoco@dom.com; fax: 804-819-2183) and David R. Lewis, Pillsbury Winthrop Shaw Pittman, 2300 N. Street, N.W., Washington D.C. 20037 (phone: 202-663-8474; e-mail: david.lewis@pillsburylaw.com; fax: 202-663-8007).

If you have any questions or require additional information, please contact Joseph D. Hegner at 804-273-2770.

Very truly yours.

Eugene S. Grecheck

D074

Enclosures:

- 1. Early Site Permit Transfer Application
- 2. Marked up version of Early Site Permit No. ESP-003

Commitments made in this letter: None

cc (all enclosures):

- U. S. Nuclear Regulatory Commission, Region II
- T. A. Kevern, NRC
- J. T. Reece, NRC
- J. J. Debiec, ODEC

Enclosure 1

Application to Transfer Early Site Permit No. ESP-003
from
Dominion Nuclear North Anna, LLC
to
Dominion Virginia Power and Old Dominion Electric Cooperative

UNITED STATES OF AMERICA

, Before the Nuclear Regulatory Commission

In the Matter of)	
)	
Dominion Nuclear North Anna, LLC,)	
Virginia Electric and Power Company, and	l)	Docket No. 52-008
Old Dominion Electric Cooperative)	
)	
(ESP for North Anna ESP Site)	j	

APPLICATION FOR ORDER AND CONFORMING LICENSE AMENDMENTS TO TRANSFER EARLY SITE PERMIT NO. ESP-003

I. INTRODUCTION

Pursuant to 10 C.F.R. §§ 50.80 and 52.28, Dominion Nuclear North Anna, LLC ("DNNA"), Virginia Electric and Power Company doing business as Dominion Virginia Power ("DVP"), and the Old Dominion Electric Cooperative ("ODEC") hereby apply to the U.S. Nuclear Regulatory Commission for an order consenting to the transfer of Early Site Permit ESP-003 from DNNA to DVP and ODEC. This application also requests conforming amendments to the Early Site Permit to delete references to DNNA, reflect DVP and ODEC as the permit holders, and delete certain provisions that are no longer applicable because they applied only to DNNA. Marked up pages showing the requested changes are provided in Exhibit A.

II. STATEMENT OF PURPOSE OF THE TRANSFER AND NATURE OF THE TRANSACTION MAKING THE TRANSFER NECESSARY OR DESIRABLE.

In April 2007, the Commonwealth of Virginia enacted legislation which in essence reregulates the generation of electricity in Virginia.¹ This legislation also provides incentives for utilities with native load obligations in the form of enhanced rates of return for the development

House Bill 3068, Senate Bill 1416, Virginia Acts of Assembly Chapters 888 and 933 (2007).

of major new energy projects, including nuclear projects, approved by the Virginia State Corporation Commission. In addition, the legislation allows for recovery of the cost of work in progress during the construction period. These changes in law now make it desirable for DVP to develop the new nuclear generating capacity at the North Anna Power Station ("NAPS"), rather than DNNA.² Further, on September 18, 2007, the Virginia State Corporation Commission issued an order approving DVP as the appropriate subsidiary of Dominion Resources, Inc. ("DRI") to apply for a construction permit and operating license for a new nuclear generating facility at North Anna.³

DVP is a regulated public utility in Virginia and therefore will be able to take advantage of the incentives and rate treatment afforded under the new legislation. DVP and ODEC are the owners of NAPS, and DVP is the licensed operator of the existing nuclear units at that site. DVP and ODEC submitted a joint application on November 27, 2007, for a combined construction permit and operating license ("COL") for a new Unit 3 at NAPS. Transferring the ESP to DVP and ODEC will consolidate the responsibility for both the ESP and the COL application in entities that are seeking a license to own and operate the new unit, and will facilitate the licensing process.

To effectuate DVP's assumption of responsibilities for activities previously performed by DNNA, DNNA will be merged into DVP, with DVP being the surviving entity. As a result of this merger, DVP will assume all of DNNA's rights and obligations, including all obligations under the Early Site Permit. This merger will become effective after receipt of required

Both DNNA and DVP are subsidiaries of Dominion Resources, Inc. ("DRI"). When DNNA applied for the early site permit in September 2003, the generation of electricity in Virginia was transitioning to deregulation. DNNA was therefore established as a deregulated subsidiary to apply for the ESP.

³ Order Approving Petition, Petition of Virginia Electric and Power Company and Dominion Nuclear North Anna, LLC, For approval of an Access to Information and Property Agreement pursuant to Chapter 4, Title 56 of the Code of Virginia, Case No. PUE-2006-00035 (Sept. 18, 2007).

regulatory approvals, which include, in addition to the requested NRC order, approval of the merger by the Virginia State Corporation Commission and the North Carolina Utilities Commission.

III. SUPPORTING GENERAL INFORMATION

In accordance with 10 C.F.R. § 50.80(b)(1)(ii), the information required by 10 C.F.R. §§ 52.16 and 50.33(a)-(d), and (j) is provided below

A. Corporate Information for Virginia Electric and Power Company

Name of Applicant

Virginia Electric and Power Company

(d.b.a. Dominion Virginia Power or "DVP")

Address 120 Tredegar Street

Richmond, Virginia 23219-3932

State of Incorporation Virginia

Principal Business Location 120 Tredegar Street

Richmond, Virginia 23219-3932

Description of Business:

DVP was incorporated in 1909 as a Virginia public service corporation. DVP is a regulated public utility engaged in the power generation and electric service delivery business within a 30,000 square-mile service area in Virginia and northeastern North Carolina. DVP supplies energy at retail to approximately 2.3 million customer accounts including governmental agencies, and to wholesale customers such as rural electric cooperatives and municipalities.

Names, addresses, and citizenship of DVP directors and principal officers					
Name	Address	Citizenship			
Thomas F. Farrell, II	Chairman and Chief Executive Officer	100 Tredegar St. Richmond, VA 23219- 3932	USA		
Thomas N. Chewning	Director, Executive Vice President and Chief Financial Officer	100 Tredegar St. Richmond, VA 23219- 3932	USA		
Steven A. Rogers	Director	100 Tredegar St. Richmond, VA 23219-	USA		

	;	3932	
David A. Christian	President and Chief Nuclear Officer	5000 Dominion Boulevard Glen Allen, VA 23060- 3308	USA
Jay L. Johnson	President and Chief Operating Officer – Dominion Virginia Power	120 Tredegar St. Richmond, VA 23219- 3932	USA
Mark F. McGettrick	President and Chief Operating Officer – Generation	120 Tredegar St. Richmond, VA 23219- 3932	USA
M. Stuart Bolton Jr.	Senior Vice President – Regulatory Accounting	100 Tredegar St. Richmond, VA 23219- 3932	USA
Mary C. Doswell	Senior Vice President – Regulation and Integrated Planning	100 Tredegar St. Richmond, VA 23219- 3932	USA
David A. Heacock	Senior Vice President – Dominion Virginia Power	5000 Dominion Boulevard Glen Allen, VA 23060- 3308	USA
G. Scott Hetzer	Senior Vice President and Treasurer	100 Tredegar St. Richmond, VA 23219- 3932	USA
E. Paul Hilton	Senior Vice President – Regulation	120 Tredegar St. Richmond, VA 23219- 3932	USA
Craig S. Ivey	Senior Vice President – Transmission & Distribution	120 Tredegar St. Richmond, VA 23219- 3932	USA
James K. Martin	Senior Vice President – Business Development & Generation Construction	5000 Dominion Boulevard Glen Allen, VA 23060- 3308	USA
William R. Matthews	Senior Vice President – Nuclear Operations 3		USA
Margaret E. McDermid	Senior Vice President and	100 Tredegar St.	USA

	Chief Information Officer	Richmond, VA 23219- 3932	
J. David Rives	Senior Vice President - Fossil & Hydro	5000 Dominion Boulevard Glen Allen, VA 23060- 3308	USA
James F. Stutts	Senior Vice President and General Counsel	100 Tredegar St. Richmond, VA 23219- 3932	USA
Thomas P. Wohlfarth	Senior Vice President and Chief Accounting Officer	100 Tredegar St. Richmond, VA 23219- 3932	USA
Fred G. Wood, III	Senior Vice President – Financial Management – Generation	120 Tredegar St. Richmond, VA 23219- 3932	USA
Kenneth D. Barker	Vice President – Planning	120 Tredegar St. Richmond, VA 23219- 3932	USA
Thomas R. Bean	Vice President – Financial Management – Dominion Virginia Power	120 Tredegar St. Richmond, VA 23219- 3932	USA
Gerald T. Bischof	Vice President – Nuclear Engineering	5000 Dominion Boulevard Glen Allen, VA 23060- 3308	USA
P. Rodney Blevins	Vice President – Distribution	120 Tredegar St. Richmond, VA 23219- 3932	USA
James P. Carney	Vice President and Assistant Treasurer	120 Tredegar St. Richmond, VA 23219-3932	USA
Malcolm G. Deacon, Jr.	Vice President – Fossil & Hydro Technical Services	5000 Dominion Boulevard Glen Allen, VA 23060- 3308	USA
Pamela F. Faggert	Vice President – Chief Environmental Officer	5000 Dominion Boulevard Glen Allen, VA 23060- 3308	USA

Eugene S. Grecheck	Vice President – Nuclear Development	5000 Dominion Boulevard Glen Allen, VA 23060- 3308	USA
Leslie N. Hartz	Vice President – Nuclear Support Services	5000 Dominion Boulevard Glen Allen, VA 23060- 3308	USA
David W. Green	Vice President – Customer Service	120 Tredegar St. Richmond, VA 23219- 3932	USA
Scot C. Hathaway	Vice President – Business Development	120 Tredegar St. Richmond VA 23219-3932	USA
C. Douglas Holley	Vice President – Fossil & Hydro System Operation	5000 Dominion Boulevard Glen Allen, VA 23060- 3308	USA
Karen E. Hunter	Vice President – Tax	120 Tredegar St. Richmond, VA 23219- 3932	USA
Robert B. McKinley	Vice President – Generation Construction	701 East Cary Street, 21st Floor Richmond, VA 23219- 3927	USA
Carter M. Reid	Vice President – Governance and Corporate Secretary	120 Tredegar St. Richmond, VA 23219- 3932	USA
Ashwini Sawhney	Vice President - Accounting	701 East Cary Street 17th Floor Richmond, VA 23219- 3927	USA
David G. Shuford	Vice President – State Regulation	120 Tredegar St. Richmond, VA 23219- 3932	USA
John D. Smatlak	Vice President – Transmission	120 Tredegar St. Richmond, VA 23219- 3932	USA
Shannon L. Venable	Vice President – Integrated Resource Planning	120 Tredegar St. Richmond, VA 23219-	USA

		3932	·
Donald E. Jernigan	Site Vice President – Surry	Surry Power Station 5570 Hog Island Road Surry, VA 23883-2022	USA
Daniel G. Stoddard	Site Vice President – North Anna	1022 Haley Drive Mineral, VA 23117-4527	USA

No Foreign Ownership, Control, or Influence:

DVP is not owned, controlled, or dominated by an alien, a foreign corporation, or a foreign government.

B. Corporate Information for Old Dominion Electric Cooperative

Name of Applicant Old Dominion Electric Cooperative (ODEC)

Address 4201 Dominion Boulevard Glen Allen, VA 23060-6721

State of Incorporation Virginia

Principal Business Location

4201 Dominion Boulevard
Glen Allen, VA 23060-6721

Description of Business:

ODEC, which was incorporated under the laws of the Commonwealth of Virginia in 1948, is a not-for-profit wholesale power supply cooperative engaged in the business of providing wholesale electric service to twelve member distribution cooperatives ("Members"), which in turn are engaged in the retail sale of power to member consumers located in 77 counties throughout Virginia, Delaware, Maryland and West Virginia. ODEC's board of directors is made up of two directors from each of its Members.

Names, addresses, and citizenship of ODEC directors and officers:				
Name	Title	Address	Citizenship	
James M. Reynolds	Chairman	Community Electric Cooperative 52 West Windsor Blvd P.O. Box 267 Windsor, VA 23487-0267	USA	
Frederick L. Hubbard	Vice Chairman	Choptank Electric Cooperative 24820 Meeting House Rd P.O. Box 430	USA	

		Denton, MD 21629-1919	,
Gregory W. White	Secretary/Treasurer	Northern Neck Electric Cooperative 85 St. Johns Street P.O. Box 288 Warsaw, VA 22572-0288	USA
J. William Andrew	Director	Delaware Electric Cooperative 14198 Sussex Highway P.O. Box 600 Greenwood, DE 19950-0600	USA
M. Dale Bradshaw	Director	Prince George Electric Cooperative 7103 General Mahone Highway P.O. Box 168 Waverly, VA 23890-0168	USA
Vernon N. Brinkley	Director	A&N Electric Cooperative 21275 Cooperative Way P.O. Box 290 Tasley, VA 23441-0290	USA
Calvin P. Carter	Director	6262 Bedford Highway Lynch Station, VA 24571-3050	USA
Glenn F. Chappell	Director	17420 Old Stage Road Carson, VA 23830-2007	USA
Jeffrey S. Edwards	Director	Southside Electric Cooperative 2000 West Virginia Ave P.O. Box 7 Crewe, VA 23930-0007	USA
Kent D. Farmer	Director	Rappahannock Electric Cooperative 247 Industrial Court (zip code: 22408) P.O. Box 7388 Fredericksburg, VA 22404-7388	USA
Stanley C. Feuerberg	Director	Northern Virginia Electric Cooperative 10323 Lomond Drive (zip code: 20109) P.O. Box 2710 Manassas, VA 20108-0875	USA
William C. Frazier	Director	17225 Taylor's Creek Road	USA

		Montpelier, VA 23192-2500	
Fred C. Garber	Director	7484 South Middle Road Mount Jackson, VA 22842-2007	USA
Hunter R. Greenlaw Jr.	Director	142 Albion Lane (zip code: 22405) P.O. Box 149 Fredericksburg, VA 22404-0149	USA
Bruce A. Henry	Director	12134 Beach Highway Greenwood, DE 19950-5726	USA
Wade C. House	Director	14521 Vint Hill Road Nokesville, VA 20181-1217	USA
David J. Jones	Director	6874 Highway One Bracey, VA 23919-1514	USA .
Bruce M. King	Director	BARC Electric Cooperative 84 High Street P.O. Box 264 Millboro, VA 24460-0264	USA
John C Lee Jr.	Director	Mecklenburg Electric Cooperative 11633 Highway 92 West P.O. Box 2451 Chase City, VA 23924-2451	USA
Paul E. Owen	Director	106 Chrisfield Circle Smithfield, VA 23430-3345	USA
Myron D. Rummel	Director	Shenandoah Valley Electric Cooperative 147 Dinkel Avenue – Highway 257 P.O. Box 236 Mt. Crawford, VA 22841-0236	USA
Keith L. Swisher	Director	BARC Electric Cooperative 84 High Street P.O. Box 264 Millboro, VA 24460-0264	USA
Philip B. Tankard	Director	8410 Grapeland Farm Rd P.O. Box 69 Franktown, VA 23354-0069	USA
Carl R. Widdowson	Director	29754 Widdowson Lane Princess Anne, MD 21853-2858	USA

Elissa M. Ecker	Vice President of Human Resources	4201 Dominion Blvd Glen Allen, VA 23060-6721	USA
Lisa D. Johnson	Senior Vice President of Power Supply	4201 Dominion Blvd Glen Allen, VA 23060-6721	USA
Robert L. Kees	Senior Vice President and CFO	4201 Dominion Blvd Glen Allen, VA 23060-6721	USA .
B. Lee McDaniel	Vice President of Member and External Relations	4201 Dominion Blvd Glen Allen, VA 23060-6721	USA
Jackson E. Reasor	President and CEO	4201 Dominion Blvd Glen Allen, VA 23060-6721	USA

No Foreign Ownership, Control, or Influence:

ODEC is not owned, controlled or dominated by an alien, a foreign corporation or a foreign government.

C. Agents and Representatives

DVP is submitting this application on its own behalf and on behalf of ODEC. Otherwise, neither DVP nor ODEC is acting as agent or representative of any other person in filing this application.

D. No Restricted Data

This application does not involve any Restricted Data or other classified defense information, and it is not expected that any such information will be raised or required in connection with transfer of the Early Site Permit. However, pursuant to 10 C.F.R. § 50.37, DVP and ODEC hereby agree as part of this application that they will not permit any individual to have access to or any facility to possess restricted data or classified national security information until the individual and/or facility has been approved for such access under the provisions of 10 C.F.R. Parts 25 and/or 95.

IV. SUPPORTING TECHNICAL INFORMATION

In accordance with 10 C.F.R. § 50.80(b)(1)(ii), the information described in 10 C.F.R. § 52.17 with respect to the identity and technical qualifications of the transferee as would be required if the application were for an initial license is provided below:

A. Exclusion Area

The exclusion area for the ESP Site is currently defined as the perimeter of a 5,000-ft-radius circle from the center of the previously abandoned North Anna Unit 3 containment. ESP, App. A, at A-2. This is the same as the exclusion area for the two existing nuclear units located on the NAPS site, and is the same as the exclusion area proposed in the COL application for Unit 3.

To address the NRC requirements concerning authority over the Exclusion Area, Section 2.1.2 of the Site Safety Analysis Report ("SSAR") stated that if DNNA decided to proceed with construction, it would enter into an agreement with DVP, with the prior approval of the Virginia State Corporation Commission, to purchase or lease the ESP Site. Section 2.1.2. also stated that such agreement or conveyance documents would provide for mutual use of the NAPS site as a single exclusion area for all nuclear units within the NAPS property, including the new units located within the ESP Site. SSAR at 2-2-2 to 2-2-3.

Reflecting this information, Section 3.E(1) of the ESP imposes the following condition:

An applicant for a CP or COL referencing this ESP shall execute an agreement providing for the applicant's control of the North Anna ESP site exclusion area and shall obtain all approvals required by State law in connection with that agreement before commencement of construction of a nuclear power plant on the North Anna ESP site. The CP or COL applicant shall be deemed to control the North Anna ESP exclusion area if it obtains shared control of the exclusion area with the licensee or licensees of existing North Anna Units 1 and 2.

With the transfer of the ESP, there will no longer be any need for a purchase or lease of the ESP Site, or for any agreement for shared control of the Exclusion Area. DVP and ODEC currently own all of the land within the NAPS site boundary. As the licensed operator of all units at NAPS and as ODEC's agent, DVP has the authority to control the entire Exclusion Area. Accordingly, ESP Condition 1 is no longer required.

B. Site Redress Plan

In Part 4 of the ESP Application, DNNA submitted a Site Redress Plan to allow it to perform certain site preparation activities permitted by 10 C.F.R. § 50.10(e)(1) as it existed prior to amendments that became effective on November 8, 2007. Section 1.1 of Part 4 of the ESP Application stated that before commencing any of these activities, DNNA would obtain the appropriate regulatory approvals of an agreement between DVP and DNNA authorizing DNNA to conduct the pre-construction activities subject to DNNA's obligation to perform such site redress as may be required to comply with the Site Redress Plan. Section 1.1 also states that before commencing any of these activities, DNNA would provide to the NRC a guaranty by DRI of \$10 million as financial assurance for DNNA's obligation to comply with the Site Redress Plan.

With the transfer of the ESP to DVP, there would no longer be any need for an agreement authorizing DNNA to conduct preconstruction activities, or any need for a guaranty by DRI. DVP already controls the NAPS site, including the ESP Site, and thus already has authority to perform pre-construction activities allowed under NRC regulations, as well as the authority to perform such site redress as may be required to comply with the Site Redress Plan. As an electric utility as defined in 10 C.F.R. § 50.2, and as a company with operating revenues in

excess of \$5 billion, DVP has the financial ability to perform site redress activities without recourse to its parent. ODEC is also an electric utility as defined in 10 C.F.R. § 50.2.⁴

Although the activities that were previously allowed under 10 C.F.R. § 50.10(e)(1) are, as a result of recent amendments to that rule, no longer considered to constitute construction, DVP adopts DNNA's Site Redress Plan and the commitments therein.

The pre-construction activities previously allowed under 10 C.F.R. § 50.10(e)(1) did not include any work on safety-related systems, structures or components. Therefore, information on DNNA's technical qualifications was not required. Similarly, this application to transfer the ESP does not seek any authority to construct safety-related systems, structures or components, or to conduct any other activity that would require a demonstration of technical qualifications at this juncture.

Section 3(F)(3) of the ESP provides:

The permit holder shall obtain the right to implement the site redress plan set forth in Appendix E before initiating any activities authorized by 10 C.F.R. 52.25

A similar condition is provided in section 1.1 of the Site Redress Plan (Appendix E to the ESP). These conditions related to DNNA and should be deleted. DVP and ODEC already have and therefore have no need to "obtain" the right to implement the site redress plan. Similarly, the condition in section 1.1 of the Site Redress Plan requiring a guaranty by DRI should be deleted, as it was necessary only for DNNA.

Information on the financial qualifications of DVP and ODEC to construct Unit 3 is provided in Part 1 of the COL application.

C. <u>ESP Commitments</u>

DVP and ODEC adopt as their own all regulatory commitments that were made by

DNNA in the North Anna Early Site Permit Application, as currently revised, including adoption
of the Quality Assurance Manual contained in Chapter 15 of the Site Safety Analysis Report.

V. ENVIRONMENTAL ASSESSMENT

The transfer of the early site permit will not result in any significant environmental impact. Further, the NRC has determined that license transfers are categorically exempt from further environmental review. 10 C.F.R. § 51.22(c)(21).

VI. <u>AFFIRMATION</u>

I, Eugene S. Grecheck, being duly sworn, state that I am Vice President - Nuclear Development of Virginia Electric and Power Company and Dominion Nuclear North Anna, LLC, that I am duly authorized to execute and file this application, and that the statements in the document are true to the best of my knowledge and belief.

Eugene S. Grecheck

COMMONWEALTH OF VIRGINIA
COUNTY OF HENRICO

Acknowledged before me this 24 day of April, 2008

My registration number is 7/73057 and my

Commission expires: august 31, 2012

Notary Public

WANDA K. MARRIMAL Notary Public Commonwealth of Virginia 7173057

7173057 by Commission Explines Assa 31, 201

Enclosure 2

Markup of Early Site Permit No. ESP-003 to Support Permit Transfer

VIRGINIA ELECTRIC AND POWER COMPANY AND OLD DOMINION ELECTRIC COOPERATIVE DOMINION NUCLEAR NORTH ANNA. LLC

NORTH ANNA ESP SITE

DOCKET NO. 52-008

EARLY SITE PERMIT

Early Site Permit No. ESP-003

- The U.S. Nuclear Regulatory Commission (the NRC or the Commission) has found the following:
 - A. The application for an early site permit (ESP) filed by Dominion Nuclear North Anna, LLC (Dominion or the permit holder) complies with the applicable requirements of the Atomic Energy Act of 1954, as amended, and the applicable rules and regulations of the Commission, and all required notifications to other agencies or bodies have been duly made.
 - B. Based on consideration of the site criteria contained in Title 10, Part 100, "Reactor Site Criteria," of the *Code of Federal Regulations* (10 CFR Part 100), a reactor, or reactors, having design characteristics that fall within the site characteristics and controlling parameters of the North Anna ESP Site can be constructed and operated without undue risk to the health and safety of the public.

holders

C. There is reasonable assurance that the permit holder will comply with the regulations in 10 CFR Chapter I and the health and safety of the public will not be endangered.

holders

- D. Issuance of an ESP to the permit helder will not be inimical to the common defense and security or the health and safety of the public.
- E. There is no significant impediment to the development of emergency plans, as referenced in 10 CFR 52.17(b)(1), "Contents of Applications," and 10 CFR 52.18, "Standards for Review of Applications." The descriptions of contacts and arrangements made with Federal, State, and local governmental agencies with emergency planning responsibilities, as set forth in 10 CFR 52.17(b)(3), are acceptable. Major features A, B, C, D, E, F, G, I, J, K, L, O, and P of the emergency plan are acceptable to the extent specified in NUREG-1835, "Safety Evaluation Report for an Early Site Permit (ESP) at the North Anna ESP Site," issued September 2005.
- F. The issuance of this ESP, subject to the Environmental Protection Plan (EPP) and the conditions for the protection of the environment set forth herein, is in accordance with the National Environmental Policy Act of 1969, as amended, and with applicable sections of 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and

Related Regulatory Functions," as referenced by Subpart A, "Early Site Permits," of 10 CFR Part 52, "Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants," and all applicable requirements therein have been satisfied.

G. The site redress plan incorporated into this permit demonstrates that there is reasonable assurance that redress carried out under the plan, if required, will achieve an environmentally stable and aesthetically acceptable site suitable for whatever nonnuclear use may conform with local zoning laws, and those activities described in the site redress plan will not result in any significant adverse environmental impact that cannot

be redressed./Virginia Electric and Power Company (Dominion) and Old Dominion Electric Cooperative (collectively, the permit holders)

- 2. Based on the foregoing findings, and pursuant to Sections 103 and 185 of the Atomic Energy Act of 1954, as amended, 10 CFR Part 52, the Initial Decision of the Atomic Safety and Licensing Board, dated June 29, 2007 (LBP-07-09), and the Commission Memorandum and Order dated November 20, 2007 (CLI-07-27), the NRC hereby issues Early Site Permit No. ESP-003 to Dominion Nuclear North Anna, LLC, for a site located in Louisa County, Virginia, approximately 40 miles north-northwest of Richmond, Virginia, and adjacent to existing North Anna Power Station Units 1 and 2, for additional nuclear power units, which may be modular, designed to operate at an individual power of no more than 4500 megawatts thermal and a combined power of no more than 9000 megawatts thermal, as described in the application and amendments thereto (the application) filed in this matter by the permit holder, and as described in the evidence received at the public hearing on that application.
- 3. This ESP shall be deemed to contain and is subject to the conditions specified in the Commission's regulations in 10 CFR Chapter I; is subject to all applicable provisions of the Atomic Energy Act of 1954, as amended, and the rules, regulations, and orders of the Commission now or hereafter in effect; and is subject to the following conditions specified or incorporated below:

North Anna

- A. The characteristics of the Dominion ESP site set forth in Appendix A to this ESP are hereby incorporated into this ESP.
- B. The controlling values of parameters and design-basis accident source term plant parameters set forth in Appendix B to this ESP are hereby incorporated into this ESP.
- C. The combined license (COL) action items set forth in Appendix C to this ESP are hereby incorporated into this ESP. These COL action items identify certain matters that an applicant submitting an application that references this ESP shall address in the final safety analysis report (FSAR). These items constitute information requirements but are not the only acceptable set of information in the FSAR. An applicant may depart from or omit these items, provided that it identifies and justifies the departure or omission in the FSAR. In addition, these items do not relieve an applicant from any requirement in 10 CFR Chapter I that governs the application. After issuance of a construction permit (CP) or

COL, these items are not requirements for the permit holder or licensee unless such items are included in a permit or license condition.

- D. The values of plant parameters considered in the environmental review of the application and set forth in Appendix D to this ESP are hereby incorporated into this ESP.
- E. The following conditions apply:
 - (1) An applicant for a CP or COL referencing this ESP shall execute an agreement providing for the applicant's control of the North Anna ESP site exclusion area and shall obtain all approvals required by State law in connection with that agreement before the commencement of construction of a nuclear power plant on the North Anna ESP site. The CP or COL applicant shall be deemed to control the North Anna ESP exclusion area if it obtains shared control of the exclusion area with the licensee or licensees of existing North Anna Units 1 and 2. [Deleted]

 Applicants
 - (2) An applicant for a CP or COL referencing this ESP for a second new unit shall use a dry cooling tower system to remove waste heat from the working fluid passed through the turbine/generator set during normal operation.

 Applicants
 - (3) An applicant for a CP or COL referencing this ESP shall ensure that any new unit's radioactive waste management systems, structures, and components, as defined in Regulatory Guide 1.143, "Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants," for a future reactor include features to preclude accidental releases of radionuclides into potential liquid pathways.
 - Applicants
 An applicant for a CP or COL referencing this ESP shall excavate weathered or fractured rock at the foundation level and replace it with lean concrete before the commencement of foundation construction for safety-related structures.

holders applicants

- (5) The permit holder and an applicant for a CP or COL referencing this ESP shall not use an engineered fill with high compressibility and low maximum density, such as saprolite.
- holders perform holders

 (6) If the ESP holder performs an excavation for a safety-related structure, the ESP holder shall perform geologic mapping of such excavation, evaluate any unforeseen geologic features that are encountered, and notify the NRC no later than 30 days before any such excavation is open for NRC examination and evaluation. An Applicants applicant for a CP or COL referencing this ESP shall perform geologic mapping of any excavation for a safety-related structure,

evaluate any unforeseen geologic features that are encountered, and notify the NRC no later than 30 days before any such excavation is open for NRC examination and evaluation.

Applicants

- (7) An applicant for a CP or COL referencing this ESP shall improve Zone II saprolitic soils to reduce any liquefaction potential if safety-related structures are to be founded on them.
- F. The activities and site redress plan specified in paragraphs F, G, H, and I below were reviewed and approved in accordance with the regulations in effect on September 25, 2003, and refer to the rules in effect at that time. The site redress plan set forth in Appendix E to this ESP is hereby incorporated into this ESP.

holders

(1) The holder of this ESP may perform the activities authorized by 10 CFR 52.25, "Extent of Activities Permitted," only insofar as the site redress plan describes such activities. The holder of this ESP may perform activities not described in the site redress plan only with prior NRC approval. A request to perform such activities shall describe how such activities will be redressed, and, if the request is granted, the site redress plan shall be deemed to include this additional description of site redress.

holders

holders

- (2) The holder of this ESP may change the site redress procedures set forth in the site redress plan in Appendix E without obtaining Commission approval provided that the changes do not decrease the effectiveness of the plan.
- (3) The permit holder shall obtain the right to implement the site redress plan set forth in Appendix E-before initiating any activities authorized by 10 CFR-52.25. [Deleted]

holders

G. The permit holder shall notify the NRC Regional Administrators for Region II and the operator of North Anna Power Station of the permit holders holder's plans to begin the site preparation and preliminary construction activities described in the site redress plan at least 120 days before commencement of such activities and shall certify in that notification to the NRC that it has obtained all other permits, licenses, and certifications required for these activities.

holders

H. The holder of this ESP shall not perform any site preparation or preliminary construction activities authorized by 10 CFR 52.25 unless such holders obtain such holder obtains the certification required pursuant to Section 401 of the Federal Water Pollution Control Act from the Commonwealth of Virginia, or obtains a determination by the Commonwealth of Virginia that no certification is required and submits the certification or determination to the NRC before commencement of any such activities.

I. The following conditions apply:

obtain submit

- (1) Any activities performed pursuant to 10 CFR 52.25 are subject to the conditions for the protection of the environment set forth in the EPP attached as Appendix F to this ESP.
- Dominion shall conduct a comprehensive instream flow (2) incremental methodology (IFIM) study, 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 3 and 4 on the fishes and other aquatic resources of Lake Anna and downstream waters. Development of the scope of work for the IFIM study shall begin in 2007, and the IFIM study shall be completed before issuance of a combined license (COL) for this project. Dominion agrees to consult with VDGIF and VDEQ regarding analysis and interpretation of the results of that study and to abide by surface water management, release, and instream flow conditions prescribed by VDGIF and VDEQ upon review of the completed IFIM study, and implemented through appropriate State or Federal permits or licenses.
- (3) The CP or COL applicant will conduct an IFIM study pursuant to the Coastal Zone Management Act consistency determination.
- J. An applicant for a CP or COL referencing this ESP shall develop an EPP for construction and operation of the proposed reactor and include the EPP in the application. The portion of the EPP directed to operation shall include any environmental conditions derived in accordance with 10 CFR 50.36b, "Environmental Conditions."

holders are

- 4. The holder of this ESP is subject to the requirements of 10 CFR Part 21, "Reporting of Defects and Noncompliance," as of the date of issuance of this ESP.
- 5. This ESP is effective as of its date of issuance and shall expire at midnight on November 27, 2027.

FOR THE NUCLEAR REGULATORY COMMISSION

<u>/RA</u>

R.W. Borchardt, Director Office of New Reactors

Attachments:

Appendix A: Characteristics of the Dominion Nuclear North Anna, LLC,

ESP Site

Controlling Values of Parameters and Design-Basis Accident Source Term Plant Parameters Appendix B:

Appendix C: Combined License Action Items

Appendix D: Values of Plant Parameters Considered in the

Environmental Review of the Application

Appendix E: Site Redress Plan

Environmental Protection Plan (Nonradiological) Appendix F:

Attachments:

Appendix A: Characteristics of the Dominion Nuclear North Anna, LLC

ESP Site

Controlling Values of Parameters and Design Basis Appendix B:

Accident Source Term Plant Parameters

Appendix C: Combined License (COL) Action Items

Appendix D: Values of Plant Parameters Considered in the

Environmental Review of the Application

Appendix E: Site Redress Plan

Appendix F: Environmental Protection Plan

Distribution:

PUBLIC

Branch Reading RidsNroDnrl

RidsNroDnrlNge1/2 SGreen/PCoates

GWunder

RidsOgcMailCenter

RidsAcrsAcnwMailCenter

RidsRgnXMailCenter

KWinsburg JJolicouer Mgavrillas RidsNroDser

RidsNsirOd

RidsNroDserRap2

ADAMS ACCESSION NO: ML072110230

Office	NRO/DNRL:PM	NRO/DNRL:LA	NRO/DNRL:SPM	NRO/DSER:SPM	NRO/DSER:BC
Name	IBerrios	S.Green	GWunder	ABjornsen	RRaione
Date '	08/01/2007	09/17/2007	09/13/2007	09/17/2007	09/21/2007
Office	NRO/DNRL:BC	Technical Editor	NRO/DSER:D	NRO/DNRL:D	NSIR:OD
Name	MShuaibi	HChang	JLyons	DMatthews	RZimmerman
Date	10/25/2007	09 /05/2007	11/16 /2007	11/15/2007	11/01/2007
Office	OGC/NLO	NRO:OD			
Name	RWeisman	RWBorchardt			
Date	10/26/2007	11/27/2007		·	

OFFICIAL RECORD COPY

Appendix A: Characteristics of the Dominion Nuclear North Anna, LLC, ESP Site

Table B-2: Main Steam Line Break Outside Containment (PWR)
Isotopic time-dependent fission product release rates to the environment (values in Ci)

Ref: North Anna Nuclear, LLC Site Safety Analysis Report, Rev. 9, Table 15.4-2 Activity Releases for AP1000 Main Steam Line Break, Preexisting Iodine Spike

Isotope	0–2 hr	2–8 hr	8–24 hr	24–72 hr	Total
Kr-85m	2.30E-01	3.82E-01	2.26E-01	2.03E-02	8.58E-01
Kr-85	9.47E-01	2.83E+00	7.47E+00	2.17E+01	3.29E+01
Kr-87	9.24E-02	4.49E-02	1.76E-03	2.84E-07	1.39E-01
Kr-88	3.77E-01	4.59E-01	1.34E-01	2.72E-03	9.73E-01
Xe-131m	4.28E-01	1.27E+00	3.26E+00	8.78E+00	1.37E+01
Xe-133m	5.31E-01	1.51E+00	3.45E+00	6.69E+00	1.22E+01
Xe-133	3.95E+,01	1.15E+02	2.87E+02	7.03E+02	1.14E+03
Xe-135m	1.02E-02	4.44E-05	0.00E+00	0.00E+00	1.02E-02
Xe-135	1.04E+00	2.31E+00	2.78E+00	1.11E+00	7.24E+00
Xe-138	1.34E-02	3.81E-05	0.00E+00	0.00E+00	1.34E-02
⊢ 130	4.98E-01	4.74E-01	6.95E-01	4.36E-01	2.10E+00
⊢131	3.37E+01	4.05E+01	1.03E+02	2.67E+02	4.44E+02
l-132	4.02E+01	1.39E+01	2.68E+00	2.16E-02	5.68E+01
l-133	6.03E+01	6.35E+01	1.17E+02	1.30E+02	3.71E+02
l-134	8.24E+00	5.47E-01	4.77E-03	1.50E-08	8.79E+00
I-135	3.56E+01	2.73E+01	2.51E+01	5.60E+00	9.36E+01
Cs-134	1.91E+01	6.52E-01	1.72E+00	5.00E+00	2.65E+01
Cs-136	2.84E+01	9.57E-01	2.47E+00	6.69E+00	3.85E+01
Cs-137	1.38E+01	4.70E-01	1.24E+00	3.61E+00	1.91E+01
Cs-138	1.02E+01	3.41E-03	1.48E-06	0.00E+00	1.02E+01
Total	2.93E+02	2.72E+02	5.58E+02	1.16E+03	2.28E+03

Table B-3: Main Steam Line Break Outside Containment (PWR) Isotopic time-dependent fission product release rates to the environment (values in Ci)

Ref: North Anna Nuclear, LLC Site Safety Analysis Report, Rev. 9, Table 15.4-4 Activity Releases for AP1000 Main Steam Line Break, Accident-Initiated Iodine Spike

Isotope	0–2 hr	2–8 hr	8–24 hr	24–72 hr	Total
Kr-85m	2.30E-01	3.82E-01	2.26E-01	2.03E-02	8.58E-01
Kr-85	9.47E-01	2.83E+00	7.47E+00	2.17E+01	3.29E+01
Kr-87	9.24E-02	4.49E-02	1.76E-03	2.84E-07	1.39E-01
Kr-88	3.77E-01	4.59E-01	1.34E-01	2.72E-03	9.73E-01
Xe-131m	4.28E-01	1.27E+00	3.26E+00	8.78E+00	1.37E+01
Xe-133m	5.31E-01	1.51E+00	3.45E+00	6.69E+00	1.22E+01
Xe-133	3.95E+01	1.15E+02	2.87E+02	7.03E+02	1.14E+03
Xe-135m	1.02E-02	4.44E-05	0.00E+00	0.00E+00	1.02E-02
Xe-135	1.04E+00	2.31E+00	2.78E+00	1.11E+00	7.24E+00
Xe-138	1.34E-02	3.81E-05	0.00E+00	0.00E+00	1.34E-02
I-130	6.84E-01	3.33E+00	5.27E+00	3.30E+00	1.26E+01
I-131	3.92E-01	1.92E+02	5.18E+02	1.35E+03	2.10E+03
I-132	9.12E+01	3.26E+02	7.46E+01	6.00E-01	4.92E+02
I-133	7.75E+01	3.81E+02	7.54E+02	8.34E+02	2.05E+03
I-134	3.03E+01	6.23E+01	8.85E-01	2.78E-06	9.35E+01
I-135	5.57E+01	2.59E+02	2.61E+02	5.82E+01	6.34E+02
Cs-134	1.91E+01	6.52E-01	1.72E+00	5.00E+00	2.65E+01
Cs-136	2.84E+01	9.57E-01	2.47E+00	6.69E+00	3.85E+01
Cs-137	1.38E+01	4.70E-01	1.24E+00	3.61E+00	1.91E+01
Cs-138	1.02E+01	3.41E-03	1.48E-06	0.00E+00	1.02E+01
Total	4.09E+02	1.35E+03	1.92E+03	3.00E+03	6.68E+03

Table B-4: Main Steam Line Break Outside Containment (BWR)
Activity released to the environment (values in Ci)

Ref: North Anna Nuclear, LLC Site Safety Analysis Report, Rev. 9, Table 15.4-19a Activity Releases for ESBWR Main Steam Line Break

Isotope	Pre-Existing	Equilibrium Activity
l-131	1.96E+02	9.79E+00
l-132	1.86E+03	9.45E+01
I-133	1.35E+03	6.75E+01
I-134	3.38E+03	1.72E+02
l-135	1.92E+03	9.45E+01
Kr-85m	1.72E-02	1.72E-02
Kr-85	6.75E-05	6.75E-05
Kr-87	5.74E-02	5.74E-02
Kr-88	5.74E-02	5.74E-02
Xe-133	2.46E-02	2.46E-02
Xe-135	6.75E-02	6.75E-02
Total	8.70E+03	4.39E+02

Table B-5: Feedwater System Pipe Break (PWR or BWR) Activity released to the environment (values in Ci)

ESP

Ref: North Anna Nuclear, LLC Site Safety Analysis Report, Rev. 9, Table 15.4-5c
Activity Releases for ABWR Cleanup Water Line Break

Isotope	0-2 hr
l-131	4.39E-03
l-132	4.05E-02
l-133	2.94E-02
l-134	7.43E-02
l-135	4.05E-02
Total	1.89E-01

Table B-6: Reactor Coolant Pump Locked Rotor Accident (PWR)
Activity released to the environment (values in Ci)

Ref: North Anna Nuclear, LLC Site Safety Analysis Report, Rev. 9, Table 15.4-6 Activity Releases for AP1000 Locked Rotor Accident

Isotope	0–2 hr
Kr-85m	4.09E+02
Kr-85	3.77E+01
Kr-87	6.05E+02
Kr-88	1.05E+03
Xe-131m	1.87E+01
Xe-133m	1.02E+02
Xe-133	3.33E+03
Xe-135m	1.63E+02
Xe-135	8.01E+02
Xe-138	6.48E+02
I-130	4.15E+00
l-131	1.83E+02
l-132	1.33E+02
I-133	2.31E+02
l-134	1.44E+02
⊩ 135	2.04E+02
Cs-134	5.83E+00
Cs-136	1.85E+00
Cs-137	3.42E+00
Cs-138	3.05E+01
Rb-86	6.69E-02
Total	8.11E+03

Table B-7: Control Rod Ejection Accident (PWR)
Isotopic time-dependent fission product release rates to the environment (values in Ci)

Ref: North Anna Nuclear, LLC Site Safety Analysis Report, Rev. 9, Table 15.4-8
Activity Releases for AP1000 Rod Ejection Accident

Isotope	0–2 hr	2–8 hr	8–24 hr	24–96 hr	96–720 hr	Total
Kr-85m	2.85E+02	6.48E+01	3.87E+01	3.53E+00	5.01E-05	3.92E+02
Kr-85	1.24E+01	5.60E+00	1.49E+01	6.70E+01	5.71E+02	6.71E+02
Kr-87	4.86E+02	2.60E+01	1.03E+00	1.67E-04	0.00E+00	5.13E+02
Kr-88	7.49E+02	1.18E+02	3.49E+01	7.18E-01	1.68E-08	9.03E+02
Xe-131m	1.22E+01	5.46E+00	1.42E+01	5.72E+01	2.31E+02	3.20E+02
Xe-133m	6.62E+01	2.81E+01	6.49E+01	1.69E+02	1.06E+02	4.34E+02
Xe-133	2.18E+03	9.58E+02	2.40E+03	8.53E+03	1.68E+04	3.09E+04
Xe-135m	2.18E+02	5.30E-02	4.33E-09	0.00E+00	0.00E+00	2.18E+02
Xe-135	5.39E+02	1.72E+02	2.09E+02	8.69E+01	3.58E-01	1.01E+03
Xe-138	8.89E+02	1.38E-01	3.19E-09	0.00E+00	0.00E+00	8.89E+02
l-130	5.93E+00	7.28E+00	4.32E+00	4.06E-01	5.88E-04	1.79E+01
I-131	1.64E+02	2.45E+02	2.31E+02	6.20E+01	3.33E+01	7.35E+02
I-132	1.90E+02	9.94E+01	9.85E+00	1.65E-02	0.00E+00	2.99E+02
l-133	3.29E+02	4.40E+02	3.18E+02	4.56E+01	4.81E-01	1.13E+03
l-134	2.18E+02	2.85E+01	1.37E-01	8.96E-08	0.00E+00	2.47E+02
l-135	2.91E+02	2.97E+02	1.19E+02	4.79E+00	1.46E-04	7.12E+02
Cs-134	3.15E+01	6.22E+01	6.03E+01	1.55E+01	1.03E+01	1.80E+02
Cs-136	8.98E+00	1.75E+01	1.67E+01	4.10E+00	1.31E+00	4.86E+01
Cs-137	1.83E+01	3.62E+01	3.51E+01	9.04E+00	6.05E+00	1.05E+02
Cs-138	1.13E+02	7.05E+00	1.68E-03	0.00E+00	0.00E+00	1.20E+02
Rb-86	3.70E-01	7.27E-01	6.96E-01	1.73E-01	6.79E-02	2.03E+00
Total	6.81E+03	2.62E+03	3.57E+03	9.06E+03	1.78E+04	3.98E+04

Table B-8: Steam Generator Tube Rupture Accident (PWR)
Isotopic time-dependent fission product release rates to the environment (values in Ci)

Ref: North Anna Nuclear, LLC Site Safety Analysis Report, Rev. 9, Table 15.4-13 Activity Releases for AP1000 Steam Generator Tube Rupture, Preexisting Iodine Spike

Isotope	0–2 hr 2–8 hr		8–24 hr	Total
Kr-85m	5.67E+01	1.91E+01	2.50E-02	7.58E+01
Kr-85	2.25E+02	1.07E+02	4.44E-01	3.32E+02
Kr-87	2.46E+01	3.56E+00	3.02E-04	2.82E+01
Kr-88	9.44E+01	2.61E+01	1.80E-02	1.21E+02
Xe-131m	1.02E+02	4.82E+01	1.96E-01	1.50E+02
Xe-133m	1.26E+02	5.83E+01	2.19E-01	1.85E+02
Xe-133	9.37E+03	4.41E+03	1.75E+01	1.38E+04
Xe-135m	3.61E+00	5.78E-03	0.00E+00	3.62E+00
Xe-135	2.51E+02	1.00E+02	2.35E-01	3.51E+02
Xe-138	4.78E+00	4.99E-03	0.00E+00	4.78E+00
I-130	1.81E+00	6.12E-02	2.90E-01	2.16E+00
I-131	1.22E+02	5.97E+00	3.32E+01	1.61E+02
I-132	1.43E+02	8.53E-01	2.08E+00	1.46E+02
I-133	2.19E+02	8.68E+00	4.41E+01	2.72E+02
I-134	2.78E+01	5.16E-03	4.57E-03	2.78E+01
I-135	1.28E+02	3.06E+00	1.26E+01	1.44E+02
Cs-134	1.65E+00	6.35E-02	2.27E-01 ⁻	1.94E+00
Cs-136	2.45E+00	9.30E-02	3.30E-01	2.87E+00
Cs-137	1.19E+00	4.58E-02	1.64E-01	1.40E+00
Cs-138	5.71E-01	3.07E-06	6.00E-07	5.71E-01
Total	1.09E+04	4.79E+03	1.12E+02	1.58E+04

Table B-9: Steam Generator Tube Rupture Accident (PWR) Isotopic time-dependent fission product release rates to the environment (values in Ci)

ESI

Ref: North Anna Nuclear, LLC Site Safety Analysis Report, Rev. 9, Table 15.4-15 Activity Releases for AP1000 Main Steam Line Break, Accident-Initiated Iodine Spike

Isotope	0–2 hr	2–8 hr	8–24 hr	Total
Kr-85m	5.67E+01	1.91E+01	2.50E-02	7.58E+01
Kr-85	2.25E+02	1.07E+02	4.44E-01	3.32E+02
Kr-87	2.46E+01	3.56E+00	3.02E-04	2.82E+01
Kr-88	9.44E+01	2.61E+01	1.80E-02	1.21E+02
Xe-131m	1.02E+02	4.82E+01	1.96E-01	1.50E+02
Xe-133m	1.26E+02	5.83E+01	2.19E-01	1.85E+02
Xe-133	9.37E+03	4.41E+03	1.75E+01	1.38E+04
Xe-135m	3.61E+00	5.78E-03	0.00E+00	3.62E+00
Xe-135	2.51E+02	1.00E+02	2.35E-01	3.51E+02
Xe-138	4.78E+00	4.99E-03	0.00E+00	4.78E+00
l-130	7.30E-02	1.19E-02	3.13E-02	1.16E-01
l-131	4.90E+00	1.15E+00	3.55E+00	9.60E+00
l-132	5.79E+00	1.75E-01	2.30E-01	6.20E+00
l-133	8.79E+00	1.68E+00	4.73E+00	1.52E+01
l-134	1.12E+00	1.18E-03	5.21E-04	1.12E+00
l-135	5.15E+00	6.01E-01	1.36E+00	7.11E+00
Cs-134	1.65E+00	6.35E-02	2.27E-01	1.94E+00
Cs-136	2.45E+00	9.30E-02	3.30E-01	2.87E+00
Cs-137	1.19E+00	4.58E-02	1.64E-01	1.40E+00
Cs-138	5.71E-01	3.07E-06	6.00E-07	5.71E-01
Total	1.03E+04	4.78E+03	2.93E+01	1.51E+04

Table B-10: Failure of Small Lines Carrying Primary Coolant Outside Containment (BWR and PWR)

Isotopic time-dependent fission product release rates to the environment (values in Ci)

ESE

Ref: North Anna Nuclear, LLC Site Safety Analysis Report, Rev. 9, Table 15.4-12a Activity Releases for ESBWR Failure of Small Lines Carrying Primary Coolant Outside Containment

Isotope	0–2 hr	2–8 hr	Total
l-131	6.13E+00	1.05E+01	1.66E+01
- I-132	8.03E+00	7.35E+00	1.54E+01
I-133	1.51E+01	2.35E+01	3.86E+01
l-134	8.78E+00	4.60E+00	1.34E+01
l-135	1.39E+01	1.85E+01	3.24E+01
Total	5.19E+01	6.45E+01	1.16E+02

Table B-11: Large-Break Loss-of-Coolant Accident (PWR) Isotopic time-dependent fission product release rates to the environment (values in Ci)

Ref: North Anna Nuclear, LLC Site Safety Analysis Report, Rev. 9, Table 15.4-20
Activity Releases for AP1000 Loss-of-Coolant Accident

Kr-85m 6.31E+02 3.14E+03 1.87E+03 1.71E+02 2.43E-03 5.82E+03 Kr-85 3.22E+01 2.64E+02 7.05E+02 3.17E+03 2.70E+04 3.12E+04 Kr-87 6.87E+02 1.26E+03 4.97E+01 8.11E-03 0.00E+00 1.99E+03 Kr-88 1.50E+03 5.76E+03 1.70E+03 3.49E+01 8.16E-07 8.99E+03 Xe-131m 3.20E+01 2.62E+02 6.79E+02 2.74E+03 1.11E+04 1.48E+04 Xe-133m 1.74E+02 1.37E+03 3.15E+03 8.21E+03 5.15E+03 1.80E+04 Xe-133m 1.74E+02 1.37E+03 3.15E+03 8.21E+05 5.15E+03 1.39E+06 Xe-133m 3.33E+01 2.62E+00 2.14E+07 0.00E+00 0.00E+00 3.59E+01 Xe-135 1.31E+03 8.33E+01 1.58E+07 0.00E+00 0.00E+00 1.20E+02 4.130 3.22E+01 4.58E+01 2.96E+00 1.11E+00 1.99E-02 8.21E+01 H-131 9.13E+02 </th <th>Isotope</th> <th>0–2 hr</th> <th>2–8 hr</th> <th>8–24 hr</th> <th>24–96 hr</th> <th>96–720 hr</th> <th>Total</th>	Isotope	0–2 hr	2–8 hr	8–24 hr	24–96 hr	96–720 hr	Total
Kr-85 3.22E+01 2.64E+02 7.05E+02 3.17E+03 2.70E+04 3.12E+04 Kr-87 6.87E+02 1.26E+03 4.97E+01 8.11E-03 0.00E+00 1.99E+03 Kr-88 1.50E+03 5.76E+03 1.70E+03 3.49E+01 8.16E-07 8.99E+03 Xe-131m 3.20E+01 2.62E+02 6.79E+02 2.74E+03 1.11E+04 1.48E+04 Xe-133m 1.74E+02 1.37E+03 3.15E+03 8.21E+03 5.15E+03 1.80E+04 Xe-135m 3.33E+01 2.62E+00 2.14E-07 0.00E+00 0.00E+00 3.59E+01 Xe-135 1.31E+03 8.33E+03 1.01E+04 4.21E+03 1.73E+01 2.40E+04 Xe-138 1.14E+02 6.83E+00 1.58E-07 0.00E+00 0.00E+00 1.20E+02 I-130 3.22E+01 4.58E+01 2.96E+00 1.11E+00 1.99E-02 8.21E+01 I-131 9.13E+02 1.45E+03 1.56E+02 3.74E+02 1.12E+03 4.01E+03 I-132 8.77E+02 <th></th> <th></th> <th></th> <th> </th> <th><u> </u></th> <th>·</th> <th></th>				 	<u> </u>	·	
Kr-87 6.87E+02 1.26E+03 4.97E+01 8.11E-03 0.00E+00 1.99E+03 Kr-88 1.50E+03 5.76E+03 1.70E+03 3.49E+01 8.16E-07 8.99E+03 Xe-131m 3.20E+01 2.62E+02 6.79E+02 2.74E+03 1.11E+04 1.48E+04 Xe-133m 1.74E+02 1.37E+03 3.15E+03 8.21E+03 5.15E+03 1.80E+04 Xe-135m 3.33E+01 2.62E+00 2.14E-07 0.00E+00 0.00E+00 1.39E+06 Xe-135 1.31E+03 8.33E+03 1.01E+04 4.21E+03 1.73E+01 2.40E+04 Xe-135 1.31E+03 8.33E+03 1.01E+04 4.21E+03 1.73E+01 2.40E+04 Xe-138 1.14E+02 6.83E+00 1.58E+07 0.00E+00 0.00E+00 1.20E+02 H130 3.22E+01 4.55E+03 1.56E+02 3.74E+02 1.12E+03 4.01E+03 L131 9.13E+02 7.64E+03 1.56E+02 3.74E+02 1.12E+03 4.01E+03 L133 1.81E+03							
Kr-88 1.50E+03 5.76E+03 1.70E+03 3.49E+01 8.16E-07 8.99E+03 Xe-131m 3.20E+01 2.62E+02 6.79E+02 2.74E+03 1.11E+04 1.48E+04 Xe-133m 1.74E+02 1.37E+03 3.15E+03 8.21E+03 5.15E+03 1.80E+04 Xe-133 5.71E+03 4.62E+04 1.16E+05 4.11E+05 8.10E+05 1.39E+06 Xe-135m 3.33E+01 2.62E+00 2.14E-07 0.00E+00 0.00E+00 3.59E+01 Xe-138 1.14E+02 6.83E+00 2.16E+04 4.21E+03 1.73E+01 2.40E+04 Xe-138 1.14E+02 6.83E+00 1.58E-07 0.00E+00 0.00E+00 1.20E+02 H30 3.22E+01 1.45E+02 1.56E+07 0.00E+00 0.00E+00 1.20E+02 H31 9.13E+02 1.45E+03 1.56E+07 0.00E+00 1.99E-02 8.21E+01 H131 9.13E+02 1.45E+03 1.56E+02 3.74E+02 1.12E+03 4.01E+03 H133 1.81E+03						-	
Xe-131m 3.20E+01 2.62E+02 6.79E+02 2.74E+03 1.11E+04 1.48E+04 Xe-133m 1.74E+02 1.37E+03 3.15E+03 8.21E+03 5.15E+03 1.80E+04 Xe-133 5.71E+03 4.62E+04 1.16E+05 4.11E+05 8.10E+05 1.39E+06 Xe-135m 3.33E+01 2.62E+00 2.14E-07 0.00E+00 0.00E+00 3.59E+01 Xe-135 1.31E+03 8.33E+03 1.01E+04 4.21E+03 1.73E+01 2.40E+04 Xe-138 1.14E+02 6.83E+00 1.58E-07 0.00E+00 0.00E+00 1.20E+02 I-130 3.22E+01 4.58E+01 2.96E+00 1.11E+00 1.99E-02 8.21E+01 I-131 9.13E+02 1.45E+03 1.56E+02 3.74E+02 1.12E+03 4.01E+03 I-133 1.81E+03 2.70E+03 2.16E+02 3.74E+02 1.62E+01 4.91E+03 I-134 7.16E+02 3.04E+02 1.26E+01 1.07E-07 0.00E+00 1.02E+03 I-135 1.53E+03 <td></td> <td></td> <td></td> <td>· · · · · · · · · · · · · · · · · · ·</td> <td></td> <td>-</td> <td></td>				· · · · · · · · · · · · · · · · · · ·		-	
Xe-133m 1.74E+02 1.37E+03 3.15E+03 8.21E+03 5.15E+03 1.80E+04 Xe-133 5.71E+03 4.62E+04 1.16E+05 4.11E+05 8.10E+05 1.39E+06 Xe-135m 3.33E+01 2.62E+00 2.14E-07 0.00E+00 0.00E+00 3.59E+01 Xe-135 1.31E+03 8.33E+03 1.01E+04 4.21E+03 1.73E+01 2.40E+04 Xe-138 1.14E+02 6.83E+00 1.58E-07 0.00E+00 0.00E+00 1.20E+02 I-130 3.22E+01 4.58E+01 2.96E+00 1.11E+00 1.99E-02 8.21E+01 I-131 9.13E+02 1.45E+03 1.56E+02 3.74E+02 1.12E+03 4.01E+03 I-132 8.77E+02 7.93E+02 7.64E+00 2.29E-02 0.00E+00 1.68E+03 I-133 1.81E+03 2.70E+03 2.16E+02 1.63E+02 1.62E+01 4.91E+03 I-134 7.16E+02 3.04E+02 1.26E+01 1.07E-07 0.00E+00 1.02E+03 S-134 1.46E+02							
Xe-133 5.71E+03 4.62E+04 1.16E+05 4.11E+05 8.10E+05 1.39E+06 Xe-135m 3.33E+01 2.62E+00 2.14E-07 0.00E+00 0.00E+00 3.59E+01 Xe-135 1.31E+03 8.33E+03 1.01E+04 4.21E+03 1.73E+01 2.40E+04 Xe-138 1.14E+02 6.83E+00 1.58E-07 0.00E+00 0.00E+00 1.20E+02 I-130 3.22E+01 4.58E+01 2.96E+00 1.11E+00 1.99E-02 8.21E+01 I-131 9.13E+02 1.45E+03 1.56E+02 3.74E+02 1.12E+03 4.01E+03 I-132 8.77E+02 7.93E+02 7.64E+00 2.29E-02 0.00E+00 1.68E+03 I-133 1.81E+03 2.70E+03 2.16E+02 1.63E+02 1.62E+01 4.91E+03 I-134 7.16E+02 3.04E+02 1.26E+01 1.07E-07 0.00E+00 1.02E+03 I-135 1.53E+03 1.97E+03 8.31E+01 9.55E+00 4.95E-03 3.59E+03 Cs-136 4.15E+01		-					
Xe-135m 3.33E+01 2.62E+00 2.14E-07 0.00E+00 0.00E+00 3.59E+01 Xe-135 1.31E+03 8.33E+03 1.01E+04 4.21E+03 1.73E+01 2.40E+04 Xe-138 1.14E+02 6.83E+00 1.58E-07 0.00E+00 0.00E+00 1.20E+02 I-130 3.22E+01 4.58E+01 2.96E+00 1.11E+00 1.99E-02 8.21E+01 I-131 9.13E+02 1.45E+03 1.56E+02 3.74E+02 1.12E+03 4.01E+03 I-132 8.77E+02 7.93E+02 7.64E+00 2.29E-02 0.00E+00 1.68E+03 I-133 1.81E+03 2.70E+03 2.16E+02 1.63E+02 1.62E+01 4.91E+03 I-134 7.16E+02 3.04E+02 1.26E-01 1.07E-07 0.00E+00 1.02E+03 I-135 1.53E+03 1.97E+03 8.31E+01 9.55E+00 4.95E-03 3.59E+03 Cs-136 4.15E+01 6.13E+01 2.25E+00 1.88E-01 1.59E+00 3.72E+02 Cs-137 8.50E+01							
Xe-135 1.31E+03 8.33E+03 1.01E+04 4.21E+03 1.73E+01 2.40E+04 Xe-138 1.14E+02 6.83E+00 1.58E-07 0.00E+00 0.00E+00 1.20E+02 I-130 3.22E+01 4.58E+01 2.96E+00 1.11E+00 1.99E-02 8.21E+01 I-131 9.13E+02 1.45E+03 1.56E+02 3.74E+02 1.12E+03 4.01E+03 I-132 8.77E+02 7.93E+02 7.64E+00 2.29E-02 0.00E+00 1.68E+03 I-133 1.81E+03 2.70E+03 2.16E+02 1.63E+02 1.62E+01 4.91E+03 I-134 7.16E+02 3.04E+02 1.26E-01 1.07E-07 0.00E+00 1.02E+03 I-135 1.53E+03 1.97E+03 8.31E+01 9.55E+00 4.95E-03 3.59E+03 Cs-134 1.46E+02 2.16E+02 8.06E+00 1.88E-01 1.59E+00 3.72E+02 Cs-137 8.50E+01 1.26E+02 4.70E+00 1.10E-01 9.39E-01 2.17E+02 Cs-138 2.67E+02							
Xe-138 1.14E+02 6.83E+00 1.58E-07 0.00E+00 0.00E+00 1.20E+02 I-130 3.22E+01 4.58E+01 2.96E+00 1.11E+00 1.99E-02 8.21E+01 I-131 9.13E+02 1.45E+03 1.56E+02 3.74E+02 1.12E+03 4.01E+03 I-132 8.77E+02 7.93E+02 7.64E+00 2.29E-02 0.00E+00 1.68E+03 I-133 1.81E+03 2.70E+03 2.16E+02 1.63E+02 1.62E+01 4.91E+03 I-134 7.16E+02 3.04E+02 1.26E-01 1.07E-07 0.00E+00 1.02E+03 I-135 1.53E+03 1.97E+03 8.31E+01 9.55E+00 4.95E-03 3.59E+03 Cs-134 1.46E+02 2.16E+02 8.06E+00 1.88E-01 1.59E+00 3.72E+02 Cs-136 4.15E+01 6.13E+01 2.25E+00 4.72E-02 2.03E-01 1.05E+02 Cs-137 8.50E+01 1.26E+02 4.70E+00 1.10E-01 9.39E-01 2.17E+02 Cs-138 2.67E+02							
H130 3.22E+01 4.58E+01 2.96E+00 1.11E+00 1.99E-02 8.21E+01 H131 9.13E+02 1.45E+03 1.56E+02 3.74E+02 1.12E+03 4.01E+03 H132 8.77E+02 7.93E+02 7.64E+00 2.29E-02 0.00E+00 1.68E+03 H133 1.81E+03 2.70E+03 2.16E+02 1.63E+02 1.62E+01 4.91E+03 H134 7.16E+02 3.04E+02 1.26E-01 1.07E-07 0.00E+00 1.02E+03 H135 1.53E+03 1.97E+03 8.31E+01 9.55E+00 4.95E-03 3.59E+03 Cs-134 1.46E+02 2.16E+02 8.06E+00 1.88E-01 1.59E+00 3.72E+02 Cs-136 4.15E+01 6.13E+01 2.25E+00 4.72E-02 2.03E-01 1.05E+02 Cs-137 8.50E+01 1.26E+02 4.70E+00 1.10E-01 9.39E-01 2.17E+02 Cs-138 2.67E+02 5.25E+01 6.92E-04 0.00E+00 0.00E+00 3.19E+02 Rb-86 1.72E+00 2.54E+00 9.37E-02 2.03E-03 1.05E-02 4.37E+00 Sb-127 1.10E+01 2.01E+01 7.13E-01 1.16E-02 1.60E-02 3.18E+01 Sb-129 2.63E+01 3.65E+01 4.83E-01 1.01E-04 1.00E-09 6.33E+01 Te-127m 1.42E+00 2.64E+00 9.83E-02 2.27E-03 1.77E-02 4.18E+00 Te-129 1.35E+01 9.71E+00 8.54E-03 7.27E-10 0.00E+00 2.32E+01 Te-132 1.46E+02 2.68E+02 9.42E+00 1.44E-01 1.60E-01 4.24E+02 Sr-89 4.16E+01 7.74E+01 2.87E+00 6.54E-02 4.60E-01 1.22E+02 Sr-90 3.59E+00 6.68E+00 2.48E-01 5.82E-03 4.97E-02 1.06E+01 Sr-91 4.64E+01 7.52E+01 1.74E+00 2.76E-03 1.44E-05 1.23E+02 Sr-90 3.59E+00 6.68E+00 2.48E-01 5.82E-03 4.97E-02 1.06E+01 Sr-91 4.64E+01 7.52E+01 1.74E+00 2.76E-03 1.44E-05 1.23E+02 Sr-90 3.59E+00 6.68E+00 2.48E-01 5.82E-03 4.97E-02 1.06E+01 Sr-91 4.64E+01 7.52E+01 1.74E+00 2.76E-03 1.44E-05 1.23E+02 Sr-90 3.59E+00 6.68E+00 2.48E-01 5.82E-03 4.97E-02 1.06E+01 Sr-91 4.64E+01 7.52E+01 1.74E+00 2.76E-03 1.44E-05 1.23E+02 Sr-90 3.59E+00 6.68E+00 2.76E-03 1.44E-05 1.23E+02 Sr-90 3.59E+00 6.68E+00 2.76E-03 1.44E-05 1.23E+02 Sr-90 3.	<u> </u>	1.31E+03			4.21E+03	1.73E+01	2.40E+04
Hard	Xe-138	1.14E+02	6.83E+00	1.58E-07	0.00E+00	0.00E+00	1.20E+02
1-132	l-130	3.22E+01	4.58E+01	2.96E+00	1.11E+00	1.99E-02	8.21E+01
I-133 1.81E+03 2.70E+03 2.16E+02 1.63E+02 1.62E+01 4.91E+03 I-134 7.16E+02 3.04E+02 1.26E-01 1.07E-07 0.00E+00 1.02E+03 I-135 1.53E+03 1.97E+03 8.31E+01 9.55E+00 4.95E-03 3.59E+03 Cs-134 1.46E+02 2.16E+02 8.06E+00 1.88E-01 1.59E+00 3.72E+02 Cs-136 4.15E+01 6.13E+01 2.25E+00 4.72E-02 2.03E-01 1.05E+02 Cs-137 8.50E+01 1.26E+02 4.70E+00 1.10E-01 9.39E-01 2.17E+02 Cs-138 2.67E+02 5.25E+01 6.92E-04 0.00E+00 0.00E+00 3.19E+02 Rb-86 1.72E+00 2.54E+00 9.37E-02 2.03E-03 1.05E-02 4.37E+00 Sb-127 1.10E+01 2.01E+01 7.13E-01 1.16E-02 1.60E-02 3.18E+01 Sb-129 2.63E+01 3.65E+01 4.83E-01 1.01E-04 1.00E-09 6.33E+01 Te-127m 1.42E+00 <td>I-131</td> <td>9.13E+02</td> <td>1.45E+03</td> <td>1.56E+02</td> <td>3.74E+02</td> <td>1.12E+03</td> <td>4.01E+03</td>	I-131	9.13E+02	1.45E+03	1.56E+02	3.74E+02	1.12E+03	4.01E+03
I-134 7.16E+02 3.04E+02 1.26E-01 1.07E-07 0.00E+00 1.02E+03 I-135 1.53E+03 1.97E+03 8.31E+01 9.55E+00 4.95E-03 3.59E+03 Cs-134 1.46E+02 2.16E+02 8.06E+00 1.88E-01 1.59E+00 3.72E+02 Cs-136 4.15E+01 6.13E+01 2.25E+00 4.72E-02 2.03E-01 1.05E+02 Cs-137 8.50E+01 1.26E+02 4.70E+00 1.10E-01 9.39E-01 2.17E+02 Cs-138 2.67E+02 5.25E+01 6.92E-04 0.00E+00 0.00E+00 3.19E+02 Rb-86 1.72E+00 2.54E+00 9.37E-02 2.03E-03 1.05E-02 4.37E+00 Sb-127 1.10E+01 2.01E+01 7.13E-01 1.16E-02 1.60E-02 3.18E+01 Sb-129 2.63E+01 3.65E+01 4.83E-01 1.01E-04 1.00E-09 6.33E+01 Te-127m 1.42E+00 2.64E+00 9.83E-02 2.27E-03 1.77E-02 4.18E+00 Te-129 4.85E+00 <td>l-132</td> <td>8.77E+02</td> <td>7.93E+02</td> <td>7.64E+00</td> <td>2.29E-02</td> <td>0.00E+00</td> <td>1.68E+03</td>	l-132	8.77E+02	7.93E+02	7.64E+00	2.29E-02	0.00E+00	1.68E+03
I-135 1.53E+03 1.97E+03 8.31E+01 9.55E+00 4.95E-03 3.59E+03 Cs-134 1.46E+02 2.16E+02 8.06E+00 1.88E-01 1.59E+00 3.72E+02 Cs-136 4.15E+01 6.13E+01 2.25E+00 4.72E-02 2.03E-01 1.05E+02 Cs-137 8.50E+01 1.26E+02 4.70E+00 1.10E-01 9.39E-01 2.17E+02 Cs-138 2.67E+02 5.25E+01 6.92E-04 0.00E+00 0.00E+00 3.19E+02 Rb-86 1.72E+00 2.54E+00 9.37E-02 2.03E-03 1.05E-02 4.37E+00 Sb-127 1.10E+01 2.01E+01 7.13E-01 1.16E-02 1.60E-02 3.18E+01 Sb-129 2.63E+01 3.65E+01 4.83E-01 1.01E-04 1.00E-09 6.33E+01 Te-127m 1.42E+00 2.64E+00 9.83E-02 2.27E-03 1.77E-02 4.18E+00 Te-129m 4.85E+00 9.00E+00 3.33E-01 7.47E-03 4.79E-02 1.42E+01 Te-131m 1.46E+01	l-133	1.81E+03	2.70E+03	2.16E+02	1.63E+02	1.62E+01	4.91E+03
Cs-134 1.46E+02 2.16E+02 8.06E+00 1.88E-01 1.59E+00 3.72E+02 Cs-136 4.15E+01 6.13E+01 2.25E+00 4.72E-02 2.03E-01 1.05E+02 Cs-137 8.50E+01 1.26E+02 4.70E+00 1.10E-01 9.39E-01 2.17E+02 Cs-138 2.67E+02 5.25E+01 6.92E-04 0.00E+00 0.00E+00 3.19E+02 Rb-86 1.72E+00 2.54E+00 9.37E-02 2.03E-03 1.05E-02 4.37E+00 Sb-127 1.10E+01 2.01E+01 7.13E-01 1.16E-02 1.60E-02 3.18E+01 Sb-129 2.63E+01 3.65E+01 4.83E-01 1.01E-04 1.00E-09 6.33E+01 Te-127m 1.42E+00 2.64E+00 9.83E-02 2.27E-03 1.77E-02 4.18E+00 Te-127 9.83E+00 1.59E+01 3.65E-01 5.63E-04 2.72E-06 2.61E+01 Te-129m 4.85E+00 9.00E+00 3.33E-01 7.47E-03 4.79E-02 1.42E+01 Te-131m 1.46E+0	l-134	7.16E+02	3.04E+02	1.26E-01	1.07E-07	0.00E+00	1.02E+03
Cs-136 4.15E+01 6.13E+01 2.25E+00 4.72E-02 2.03E-01 1.05E+02 Cs-137 8.50E+01 1.26E+02 4.70E+00 1.10E-01 9.39E-01 2.17E+02 Cs-138 2.67E+02 5.25E+01 6.92E-04 0.00E+00 0.00E+00 3.19E+02 Rb-86 1.72E+00 2.54E+00 9.37E-02 2.03E-03 1.05E-02 4.37E+00 Sb-127 1.10E+01 2.01E+01 7.13E-01 1.16E-02 1.60E-02 3.18E+01 Sb-129 2.63E+01 3.65E+01 4.83E-01 1.01E-04 1.00E-09 6.33E+01 Te-127m 1.42E+00 2.64E+00 9.83E-02 2.27E-03 1.77E-02 4.18E+00 Te-127 9.83E+00 1.59E+01 3.65E-01 5.63E-04 2.72E-06 2.61E+01 Te-129m 4.85E+00 9.00E+00 3.33E-01 7.47E-03 4.79E-02 1.42E+01 Te-131m 1.46E+01 2.60E+01 8.29E-01 6.86E-03 1.60E-03 4.14E+01 Te-132 1.46E+0	l-135	1.53E+03	1.97E+03	8.31E+01	9.55E+00	4.95E-03	3.59E+03
Cs-137 8.50E+01 1.26E+02 4.70E+00 1.10E-01 9.39E-01 2.17E+02 Cs-138 2.67E+02 5.25E+01 6.92E-04 0.00E+00 0.00E+00 3.19E+02 Rb-86 1.72E+00 2.54E+00 9.37E-02 2.03E-03 1.05E-02 4.37E+00 Sb-127 1.10E+01 2.01E+01 7.13E-01 1.16E-02 1.60E-02 3.18E+01 Sb-129 2.63E+01 3.65E+01 4.83E-01 1.01E-04 1.00E-09 6.33E+01 Te-127m 1.42E+00 2.64E+00 9.83E-02 2.27E-03 1.77E-02 4.18E+00 Te-127 9.83E+00 1.59E+01 3.65E-01 5.63E-04 2.72E-06 2.61E+01 Te-129m 4.85E+00 9.00E+00 3.33E-01 7.47E-03 4.79E-02 1.42E+01 Te-129 1.35E+01 9.71E+00 8.54E-03 7.27E-10 0.00E+00 2.32E+01 Te-132m 1.46E+01 2.60E+01 8.29E-01 6.86E-03 1.60E-03 4.14E+01 Te-132 1.46E+0	Cs-134	1.46E+02	2.16E+02	8.06E+00	1.88E-01	1.59E+00	3.72E+02
Cs-138 2.67E+02 5.25E+01 6.92E-04 0.00E+00 0.00E+00 3.19E+02 Rb-86 1.72E+00 2.54E+00 9.37E-02 2.03E-03 1.05E-02 4.37E+00 Sb-127 1.10E+01 2.01E+01 7.13E-01 1.16E-02 1.60E-02 3.18E+01 Sb-129 2.63E+01 3.65E+01 4.83E-01 1.01E-04 1.00E-09 6.33E+01 Te-127m 1.42E+00 2.64E+00 9.83E-02 2.27E-03 1.77E-02 4.18E+00 Te-127 9.83E+00 1.59E+01 3.65E-01 5.63E-04 2.72E-06 2.61E+01 Te-129m 4.85E+00 9.00E+00 3.33E-01 7.47E-03 4.79E-02 1.42E+01 Te-129 1.35E+01 9.71E+00 8.54E-03 7.27E-10 0.00E+00 2.32E+01 Te-131m 1.46E+01 2.60E+01 8.29E-01 6.86E-03 1.60E-03 4.14E+01 Te-132 1.46E+02 2.68E+02 9.42E+00 1.44E-01 1.60E-01 4.24E+02 Sr-89 4.16E+01	Cs-136	4.15E+01	6.13E+01	2.25E+00	4.72E-02	2.03E-01	1.05E+02
Rb-86 1.72E+00 2.54E+00 9.37E-02 2.03E-03 1.05E-02 4.37E+00 Sb-127 1.10E+01 2.01E+01 7.13E-01 1.16E-02 1.60E-02 3.18E+01 Sb-129 2.63E+01 3.65E+01 4.83E-01 1.01E-04 1.00E-09 6.33E+01 Te-127m 1.42E+00 2.64E+00 9.83E-02 2.27E-03 1.77E-02 4.18E+00 Te-127 9.83E+00 1.59E+01 3.65E-01 5.63E-04 2.72E-06 2.61E+01 Te-129m 4.85E+00 9.00E+00 3.33E-01 7.47E-03 4.79E-02 1.42E+01 Te-129 1.35E+01 9.71E+00 8.54E-03 7.27E-10 0.00E+00 2.32E+01 Te-131m 1.46E+01 2.60E+01 8.29E-01 6.86E-03 1.60E-03 4.14E+01 Te-132 1.46E+02 2.68E+02 9.42E+00 1.44E-01 1.60E-01 4.24E+02 Sr-89 4.16E+01 7.74E+01 2.87E+00 6.54E-02 4.60E-01 1.22E+02 Sr-90 3.59E+00<	Cs-137	8.50E+01	1.26E+02	4.70E+00	1.10E-01	9.39E-01	2.17E+02
Sb-127 1.10E+01 2.01E+01 7.13E-01 1.16E-02 1.60E-02 3.18E+01 Sb-129 2.63E+01 3.65E+01 4.83E-01 1.01E-04 1.00E-09 6.33E+01 Te-127m 1.42E+00 2.64E+00 9.83E-02 2.27E-03 1.77E-02 4.18E+00 Te-127 9.83E+00 1.59E+01 3.65E-01 5.63E-04 2.72E-06 2.61E+01 Te-129m 4.85E+00 9.00E+00 3.33E-01 7.47E-03 4.79E-02 1.42E+01 Te-129 1.35E+01 9.71E+00 8.54E-03 7.27E-10 0.00E+00 2.32E+01 Te-131m 1.46E+01 2.60E+01 8.29E-01 6.86E-03 1.60E-03 4.14E+01 Te-132 1.46E+02 2.68E+02 9.42E+00 1.44E-01 1.60E-01 4.24E+02 Sr-89 4.16E+01 7.74E+01 2.87E+00 6.54E-02 4.60E-01 1.22E+02 Sr-90 3.59E+00 6.68E+00 2.48E-01 5.82E-03 4.97E-02 1.06E+01 Sr-91 4.64E+01<	Cs-138	2.67E+02	5.25E+01	6.92E-04	0.00E+00	0.00E+00	3.19E+02
Sb-129 2.63E+01 3.65E+01 4.83E-01 1.01E-04 1.00E-09 6.33E+01 Te-127m 1.42E+00 2.64E+00 9.83E-02 2.27E-03 1.77E-02 4.18E+00 Te-127 9.83E+00 1.59E+01 3.65E-01 5.63E-04 2.72E-06 2.61E+01 Te-129m 4.85E+00 9.00E+00 3.33E-01 7.47E-03 4.79E-02 1.42E+01 Te-129 1.35E+01 9.71E+00 8.54E-03 7.27E-10 0.00E+00 2.32E+01 Te-131m 1.46E+01 2.60E+01 8.29E-01 6.86E-03 1.60E-03 4.14E+01 Te-132 1.46E+02 2.68E+02 9.42E+00 1.44E-01 1.60E-01 4.24E+02 Sr-89 4.16E+01 7.74E+01 2.87E+00 6.54E-02 4.60E-01 1.22E+02 Sr-90 3.59E+00 6.68E+00 2.48E-01 5.82E-03 4.97E-02 1.06E+01 Sr-91 4.64E+01 7.52E+01 1.74E+00 2.76E-03 1.44E-05 1.23E+02	Rb-86	1.72E+00	2.54E+00	9.37E-02	2.03E-03	1.05E-02	4.37E+00
Te-127m 1.42E+00 2.64E+00 9.83E-02 2.27E-03 1.77E-02 4.18E+00 Te-127 9.83E+00 1.59E+01 3.65E-01 5.63E-04 2.72E-06 2.61E+01 Te-129m 4.85E+00 9.00E+00 3.33E-01 7.47E-03 4.79E-02 1.42E+01 Te-129 1.35E+01 9.71E+00 8.54E-03 7.27E-10 0.00E+00 2.32E+01 Te-131m 1.46E+01 2.60E+01 8.29E-01 6.86E-03 1.60E-03 4.14E+01 Te-132 1.46E+02 2.68E+02 9.42E+00 1.44E-01 1.60E-01 4.24E+02 Sr-89 4.16E+01 7.74E+01 2.87E+00 6.54E-02 4.60E-01 1.22E+02 Sr-90 3.59E+00 6.68E+00 2.48E-01 5.82E-03 4.97E-02 1.06E+01 Sr-91 4.64E+01 7.52E+01 1.74E+00 2.76E-03 1.44E-05 1.23E+02	Sb-127	1.10E+01	2.01E+01	7.13E-01	1.16E-02	1.60E-02	3.18E+01
Te-127 9.83E+00 1.59E+01 3.65E-01 5.63E-04 2.72E-06 2.61E+01 Te-129m 4.85E+00 9.00E+00 3.33E-01 7.47E-03 4.79E-02 1.42E+01 Te-129 1.35E+01 9.71E+00 8.54E-03 7.27E-10 0.00E+00 2.32E+01 Te-131m 1.46E+01 2.60E+01 8.29E-01 6.86E-03 1.60E-03 4.14E+01 Te-132 1.46E+02 2.68E+02 9.42E+00 1.44E-01 1.60E-01 4.24E+02 Sr-89 4.16E+01 7.74E+01 2.87E+00 6.54E-02 4.60E-01 1.22E+02 Sr-90 3.59E+00 6.68E+00 2.48E-01 5.82E-03 4.97E-02 1.06E+01 Sr-91 4.64E+01 7.52E+01 1.74E+00 2.76E-03 1.44E-05 1.23E+02	Sb-129	2.63E+01	3.65E+01	4.83E-01	1.01E-04	1.00E-09	6.33E+01
Te-129m 4.85E+00 9.00E+00 3.33E-01 7.47E-03 4.79E-02 1.42E+01 Te-129 1.35E+01 9.71E+00 8.54E-03 7.27E-10 0.00E+00 2.32E+01 Te-131m 1.46E+01 2.60E+01 8.29E-01 6.86E-03 1.60E-03 4.14E+01 Te-132 1.46E+02 2.68E+02 9.42E+00 1.44E-01 1.60E-01 4.24E+02 Sr-89 4.16E+01 7.74E+01 2.87E+00 6.54E-02 4.60E-01 1.22E+02 Sr-90 3.59E+00 6.68E+00 2.48E-01 5.82E-03 4.97E-02 1.06E+01 Sr-91 4.64E+01 7.52E+01 1.74E+00 2.76E-03 1.44E-05 1.23E+02	Te-127m	1.42E+00	2.64E+00	9.83E-02	2.27E-03	1.77E-02	4.18E+00
Te-129m 4.85E+00 9.00E+00 3.33E-01 7.47E-03 4.79E-02 1.42E+01 Te-129 1.35E+01 9.71E+00 8.54E-03 7.27E-10 0.00E+00 2.32E+01 Te-131m 1.46E+01 2.60E+01 8.29E-01 6.86E-03 1.60E-03 4.14E+01 Te-132 1.46E+02 2.68E+02 9.42E+00 1.44E-01 1.60E-01 4.24E+02 Sr-89 4.16E+01 7.74E+01 2.87E+00 6.54E-02 4.60E-01 1.22E+02 Sr-90 3.59E+00 6.68E+00 2.48E-01 5.82E-03 4.97E-02 1.06E+01 Sr-91 4.64E+01 7.52E+01 1.74E+00 2.76E-03 1.44E-05 1.23E+02	Te-127	9.83E+00	1.59E+01	3.65E-01	5.63E-04	2.72E-06	2.61E+01
Te-129 1.35E+01 9.71E+00 8.54E-03 7.27E-10 0.00E+00 2.32E+01 Te-131m 1.46E+01 2.60E+01 8.29E-01 6.86E-03 1.60E-03 4.14E+01 Te-132 1.46E+02 2.68E+02 9.42E+00 1.44E-01 1.60E-01 4.24E+02 Sr-89 4.16E+01 7.74E+01 2.87E+00 6.54E-02 4.60E-01 1.22E+02 Sr-90 3.59E+00 6.68E+00 2.48E-01 5.82E-03 4.97E-02 1.06E+01 Sr-91 4.64E+01 7.52E+01 1.74E+00 2.76E-03 1.44E-05 1.23E+02	Te-129m	4.85E+00	9.00E+00	3.33E-01	7.47E-03	4.79E-02	1.42E+01
Te-131m 1.46E+01 2.60E+01 8.29E-01 6.86E-03 1.60E-03 4.14E+01 Te-132 1.46E+02 2.68E+02 9.42E+00 1.44E-01 1.60E-01 4.24E+02 Sr-89 4.16E+01 7.74E+01 2.87E+00 6.54E-02 4.60E-01 1.22E+02 Sr-90 3.59E+00 6.68E+00 2.48E-01 5.82E-03 4.97E-02 1.06E+01 Sr-91 4.64E+01 7.52E+01 1.74E+00 2.76E-03 1.44E-05 1.23E+02	Te-129	1.35E+01	9.71E+00				2.32E+01
Te-132 1.46E+02 2.68E+02 9.42E+00 1.44E-01 1.60E-01 4.24E+02 Sr-89 4.16E+01 7.74E+01 2.87E+00 6.54E-02 4.60E-01 1.22E+02 Sr-90 3.59E+00 6.68E+00 2.48E-01 5.82E-03 4.97E-02 1.06E+01 Sr-91 4.64E+01 7.52E+01 1.74E+00 2.76E-03 1.44E-05 1.23E+02	Te-131m	1.46E+01	2.60E+01	8.29E-01	***************************************	 	
Sr-89 4.16E+01 7.74E+01 2.87E+00 6.54E-02 4.60E-01 1.22E+02 Sr-90 3.59E+00 6.68E+00 2.48E-01 5.82E-03 4.97E-02 1.06E+01 Sr-91 4.64E+01 7.52E+01 1.74E+00 2.76E-03 1.44E-05 1.23E+02	1						
Sr-90 3.59E+00 6.68E+00 2.48E-01 5.82E-03 4.97E-02 1.06E+01 Sr-91 4.64E+01 7.52E+01 1.74E+00 2.76E-03 1.44E-05 1.23E+02		· · · · · · · · · · · · · · · · · · ·					
Sr-91 4.64E+01 7.52E+01 1.74E+00 2.76E-03 1.44E-05 1.23E+02							
Oloz 0.00E-01 T.00E-01 .0.ZQE-01 1.00E-00 0.00E-00 1.00E-00	Sr-92	3.80E+01	4.50E+01	3.26E-01	1.06E-05	0.00E+00	8.33E+01

Table B-11: Large-Break Loss-of-Coolant Accident (PWR) Isotopic time-dependent fission product release rates to the environment (values in Ci) (cont.)

Ref: North Anna Nuclear, LLC Site Safety Analysis Report, Rev. 9, Table 15.4-20
Activity Releases for AP1000 Loss-of-Coolant Accident

Isotope	0–2 hr	2–8 hr	8–24 hr	24–96 hr	96–720 hr	Total
Ba-139	3.64E+01	2.98E+01	4.73E-02	2.03E-08	0.00E+00	6.63E+01
Ba-140	7.35E+01	1.36E+02	5.00E+00	1.05E-01	4.41E-01	2.15E+02
Mo-99	9.77E+00	1.78E+01	6.19E-01	8.79E-03	7.72E-03	2.82E+01
Tc-99m	7.30E+00	1.10E+01	1.94E-01	1.08E-04	2.73E-08	1.85E+01
Ru-103	7.82E+00	1.45E+01	5.38E-01	1.21E-02	8.11E-02	2.30E+01
Ru-105	4.19E+00	5.87E+00	7.97E-02	1.82E-05	2.40E-10	1.01E+01
Ru-106	2.57E+00	4.79E+00	1.78E-01	4.16E-03	3.46E-02	7.58E+00
Rh-105	4.71E+00	8.45E+00	2.76E-01	2.64E-03	8.48E-04	1.34E+01
Ce-141	1.76E+00	3.26E+00	1.21E-01	2.71E-03	1.72E-02	5.16E+00
Ce-143	1.59E+00	2.84E+00	9.20E-02	8.29E-04	2.34E-04	4.51E+00
Ce-144	1.32E+00	2.47E+00	9.19E-02	2.14E-03	1.77E-02	3.91E+00
Pu-238	4.13E-03	7.70E-03	2.86E-04	6.71E-06	5.73E-05	1.22E-02
Pu-239	3.63E-04	6.77E-04	2.52E-05	5.90E-07	5.04E-06	1.07E-03
Pu-240	5.34E-04	9.92E-04	3.69E-05	8.65E-07	7.39E-06	1.57E-03
Pu-241	1.19E-01	2.23E-01	8.30E-03	1.94E-04	1.66E-03	3.52E-01
Np-239	2.04E+01	3.72E+01	1.27E+00	1.67E-02	1.17E-02	5.89E+01
Y-90	3.68E-02	6.70E-02	2.32E-03	3.25E-05	2.75E-05	1.06E-01
Y-91	5.35E-01	9.94E-01	3.69E-02	8.43E-04	6.09E-03	1.57E+00
Y-92	4.18E-01	5.46E-01	5.77E-03	5.86E-07	0.00E+00	9.70E-01
Y-93	5.81E-01	9.48E-01	2.25E-02	4.05E-05	2.91E-07	1.55E+00
Nb-95	7.20E-01	1.34E+00	4.95E-02	1.11E-03	7.23E-03	2.12E+00
Zr-95	7.17E-01	1.33E+00	4.94E-02	1.13E-03	8.29E-03	2.11E+00
Zr-97	6.66E-01	1.15E+00	3.26E-02	1.38E-04	7.58E-06	1.84E+00
La-140	7.66E-01	1.38E+00	4.58E-02	4.84E-04	1.97E-04	2.19E+00
La-141	5.37E-01	7.26E-01	8.69E-03	1.31E-06	0.00E+00	1.27E+00
La-142	3.47E-01	3.06E-01	6.67E-04	6.96E-10	0.00E+00	6.53E-01
Nd-147	2.79E-01	5.16E-01	1.89E-02	3.88E-04	1.49E-03	8.16E-01
Pr-143	6.28E-01	1.16E+00	4.27E-02	9.01E-04	3.95E-03	1.84E+00
Am-241	5.40E-05	1.00E-04	3.74E-06	8.75E-08	7.48E-07	1.59E-04
Cm-242	1.27E-02	2.37E-02	8.81E-04	2.04E-05	1.64E-04	3.75E-02
Cm-244	1.56E-03	2.91E-03	1.08E-04	2.53E-06	2.16E-05	4.61E-03
Total	1.72E+04	7.52E+04	1.35E+05	4.30E+05	8.54E+05	1.51E+06

Table B-12: Large-Break Loss-of-Coolant Accident (BWR) Isotopic time-dependent fission product release rates to the environment (values in Ci)

Ref: North Anna Nuclear, LLC Site Safety Analysis Report, Rev. 9, Table 15.4-23a
Activity Releases for ESBWR Loss-of-Coolant Accident

Isotope	0–2 hr	2–8 hr	8–24 hr	24–96 hr	96–720 hr	Total
Co-58	2.28E-03	2.22E-02	3.89E-02	4.18E-02	2.61E-02	1.31E-01
Co-60	2.19E-03	2.16E-02	3.76E-02	4.10E-02	2.89E-02	1.31E-01
Kr-85	6.59E+00	3.23E+02	2.72E+03	2.08E+04	5.31E+04	7.70E+04
Kr-85m	1.14E+02	3.01E+03	5.21E+03	8.50E+02	0.00E+00	9.19E+03
Kr-87	1.17E+02	8.60E+02	1.08E+02	0.00E+00	0.00E+00	1.09E+03
Kr-88	2.68E+02	5.12E+03	4.30E+03	1.63E+02	0.00E+00	9.85E+03
Rb-86	1.38E-01	1.00E+00	1.72E+00	1.79E+00	8.25E-01	5.48E+00
Sr-89	3.53E+00	3.46E+01	6.01E+01	6.43E+01	3.88E+01	2.01E+02
Sr-90	3.48E-01	3.42E+00	5.98E+00	6.51E+00	4.63E+00	2.09E+01
Sr-91	3.95E+00	3.06E+01	2.63E+01	5.00E+00	0.00E+00	6.58E+01
Sr-92	3.18E+00	1.45E+01	2.88E+00	1.25E-01	0.00E+00	2.06E+01
Y-90	6.34E-03	1.70E-01	9.06E-01	2.51E+00	4.25E+00	7.84E+00
Y-91	4.59E-02	4.70E-01	8.96E-01	1.03E+00	6.38E-01	3.08E+00
Y-92	4.89E-01	1.01E+01	8.31E+00	3.75E-01	0.00E+00	1.93E+01
Y-93	4.94E-02	3.87E-01	3.45E-01	7.25E-02	0.00E+00	8.54E-01
Zr-95	6.39E-02	6.26E-01	1.09E+00	1.18E+00	7.25E-01	3.68E+00
Zr-97	6.16E-02	5.28E-01	6.10E-01	2.25E-01	0.00E+00	1.43E+00
Nb-95	6.43E-02	6.30E-01	1.11E+00	1.20E+00	8.25E-01	3.83E+00
Mo-99	8.30E-01	7.86E+00	1.23E+01	9.88E+00	1.00E+00	3.19E+01
Tc-99m	7.46E-01	7.24E+00	1.19E+01	1.01E+01	8.75E-01	3.09E+01
Ru-103	6.66E-01	6.52E+00	1.13E+01	1.21E+01	6.88E+00	3.75E+01
Ru-105	3.48E-01	2.09E+00	8.88E-01	3.75E-02	0.00E+00	3.36E+00
Ru-106	2.33E-01	2.28E+00	3.99E+00	4.34E+00	3.04E+00	1.39E+01
Rh-105	4.05E-01	3.88E+00	5.85E+00	3.74E+00	1.25E-01	1.40E+01
Sb-127	9.09E-01	8.69E+00	1.40E+01	1.23E+01	1.75E+00	3.76E+01
Sb-129	2.18E+00	1.30E+01	5.25E+00	1.25E-01	0.00E+00	2.05E+01
Te-127	9.29E-01	8.96E+00	1.49E+01	1.39E+01	3.13E+00	4.18E+01
Te-127m	1.22E-01	1.20E+00	2.09E+00	2.29E+00	1.54E+00	7.24E+00
Te-129	2.41E+00	1.62E+01	1.15E+01	6.75E+00	3.50E+00	4.04E+01
Te-129m	4.09E-01	4.02E+00	6.98E+00	7.35E+00	4.13E+00	2.29E+01
Te-131m	1.22E+00	1.11E+01	1.53E+01	8.75E+00	2.50E-01	3.66E+01

Table B-12: Large-Break Loss-of-Coolant Accident (BWR) Isotopic time-dependent fission product release rates to the environment (values in Ci) (cont.)

Ref: North Anna Nuclear, LLC Site Safety Analysis Report, Rev. 9, Table 15.4-23a Activity Releases for ESBWR Loss-of-Coolant Accident

Isotope	0–2 hr	2–8 hr	8–24 hr	24–96 hr	96–720 hr	Total
Te-132	1.24E+01	1.19E+02	1.88E+02	1.59E+02	1.88E+01	4.96E+02
I-131	6.66E+01	5.13E+02	9.33E+02	1.44E+03	7.00E+02	3.65E+03
I-132	7.88E+01	3.44E+02	2.45E+02	1.89E+02	2.25E+01	8.79E+02
I-133	1.31E+02	9.10E+02	1.22E+03	7.63E+02	1.25E+01	3.04E+03
I-134	4.96E+01	5.10E+01	3.75E-01	0.00E+00	0.00E+00	1.01E+02
I-135	1.11E+02	6.07E+02	4.16E+02	5.38E+01	0.00E+00	1.19E+03
Xe-133	1.08E+03	5.19E+04	4.08E+05	2.51E+06	1.20E+06	4.18E+06
Xe-135	3.68E+02	1.40E+04	5.13E+04	3.80E+04	0.00E+00	1.04E+05
Cs-134	1.16E+01	8.50E+01	1.48E+02	1.63E+02	1.14E+02	5.21E+02
Cs-136	4.03E+00	2.92E+01	5.00E+01	5.05E+01	2.00E+01	1.54E+02
Cs-137	7.54E+00	5.52E+01	9.60E+01	1.05E+02	7.50E+01	3.39E+02
Ba-139	2.96E+00	7.50E+00	3.00E-01	0.00E+00	0.00E+00	1.08E+01
Ba-140	6.26E+00	6.10E+01	1.04E+02	1.06E+02	4.00E+01	3.18E+02
La-140	1.40E-01	4.41E+00	2.37E+01	5.83E+01	4.35E+01	1.30E+02
La-141	4.50E-02	2.56E-01	9.13E-02	2.50E-03	0.00E+00	3.95E-01
La-142	2.84E-02	8.09E-02	4.50E-03	0.00E+00	0.00E+00	1.14E-01
Ce-141	1.49E-01	1.46E+00	2.54E+00	2.69E+00	1.46E+00	8.30E+00
Ce-143	1.35E-01	1.23E+00	1.75E+00	1.05E+00	2.50E-02	4.19E+00
Ce-144	1.21E-01	1.19E+00	2.08E+00	2.26E+00	1.55E+00	7.20E+00
Pr-143	5.46E-02	5.40E-01	9.68E-01	1.06E+00	4.63E-01	3.09E+00
Nd-147	2.38E-02	2.31E-01	3.94E-01	3.95E-01	1.39E-01	1.18E+00
Np-239	1.69E+00	1.59E+01	2.44E+01	1.88E+01	1.38E+00	6.21E+01
Pu-238	2.98E-04	2.93E-03	5.11E-03	5.54E-03	4.00E-03	1.79E-02
Pu-239	3.59E-05	3.53E-04	6.19E-04	6.80E-04	4.75E-04	2.16E-03
Pu-240	4.65E-05	4.56E-04	7.98E-04	8.75E-04	6.13E-04	2.79E-03
Pu-241	1.35E-02	1.33E-01	2.31E-01	2.53E-01	1.78E-01	8.08E-01
Am-241	6.08E-06	5.97E-05	1.06E-04	1.15E-04	9.25E-05	3.79E-04
Cm-242	1.43E-03	1.40E-02	2.44E-02	2.65E-02	1.76E-02	8.39E-02
Cm-244	6.91E-05	6.77E-04	1.19E-03	1.29E-03	9.13E-04	4.14E-03
Total	2.46E+03	7.82E+04	4.76E+05	2.58E+06	1.25E+06	4.39E+06

Table B-13: Fuel Handling Accidents (PWR and BWR)
Activity released to the environment (values in Ci)

Ref: North Anna Nuclear, LLC Site Safety Analysis Report, Rev. 9, Table 15.4-24 Activity Releases for AP1000 Fuel Handling Accident

Isotope	0–2 hr
Kr-85m	2.68E-03
Kr-85	1.10E+03
Xe-131m	5.36E+02
Xe-133m	1.29E+03
Xe-133	6.94E+04
Xe-135m	4.37E-01
Xe-135	1.32E+02
I-130	3.52E-02
I-131	2.90E+02
I-132	1.54E+02
I-133	1.91E+01
I-135	1.36E-02
Total	7.29E+04

Table B-14: Reactor Cleanup Water Line Break Activity released to the environment (values in Ci)

ESP

Ref: North Anna Nuclear, LLC Site Safety Analysis Report, Rev. 9, Table 15.4-30
Activity Releases for ESBWR Cleanup Water Line Break

Isotope	0–2 hr
I-131	3.48E+01
I-132	7.05E+01
I-133	9.28E+01
I-134	1.22E+02
l-135	9.59E+01
Total	4.16E+02

Appendix E: Site Redress Plan

1. Site Redress

This section describes early site permit (ESP) site preparation activities that might occur after the U.S. Nuclear Regulatory Commission (NRC) issues an ESP. This section also describes the site redress plan that would be implemented if those site preparation activities were performed but the ESP then expired before being referenced in a combined license (COL) application.

1.1 Description of Site Preparation Activities

was submitted

The Dominion Nuclear North Anna, LLC (Dominion) submitted the site redress plan pursuant to Title 10, Section 52.17(c) of the Code of Federal Regulations (10 CFR 52.17(c)) to allow the holders of the ESP Dominion to perform, after being granted the ESP, the site preparation activities for new nuclear units at the ESP site allowed by 10 CFR 50.10(e)(1).

 $\hbox{the holders of the ESP for the North Anna ESP Site} \\ \hbox{The site preparation activities that } \frac{}{\text{Dominion}} \text{ may perform include the following:}$

- preparation of the site for construction of the facility (including such activities as clearing, grading, construction of temporary access roads, and preparation of borrow areas)
- installation of temporary construction support facilities (including items such as warehouse and shop facilities, utilities, concrete mixing plants, docking and unloading facilities, and construction support buildings)
- excavation for facility structures
- construction of service facilities (including items such as roadways, paving, railroad spurs, fencing, exterior utility and lighting systems, switchyard interconnects, and sanitary sewage treatment facilities)
- construction of structures, systems, and components that do not prevent or mitigate the
 consequences of postulated accidents that could cause undue risk to the health and
 safety of the public, including but not limited to the following:
 - cooling towers
 - intake and discharge structures
 - circulating water lines
 - fire protection equipment
 - switchyard and onsite interconnections
 - microwave towers

- underground utilities
 the permit holders

 Before commencing any of these activities after the ESP is granted, Dominion would do the following:
- Create a record of the existing site conditions within the proposed ESP site by way of photographs, surveys, listings of existing facilities and structures, or other documentation. This record would serve as the baseline for redressing the site if ESP site preparation activities are terminated as a result of project cancellation or expiration of the ESP.
- 2. Obtain any State and local permits and authorizations necessary to perform the site preparation activities.
- 3. Obtain the appropriate regulatory approvals of an agreement between Virginia Power and Dominion. This agreement would authorize Dominion to conduct the preconstruction activities subject to Dominion's obligation to perform such site redress as may be required to comply with the site redress plan approved by the NRC.
- 4. Provide to the NRC a guaranty by Dominion Resources, Inc. (DRI) of \$10 million as financial assurance for Dominion's obligation to comply with the site redress plan. Dominion is an indirect, wholly owned subsidiary of DRI. DRI is the largest fully integrated natural gas and electric provider in the United States with over \$37 billion in assets, over \$10 billion in annual revenue, and over \$2 billion in annual operating cash flow.

1.2 Site Redress Plan

the permit holders'

This section constitutes Dominion's plan for redress of the North Anna site in the event that activities allowed by 10 CFR 50.10(e)(1) are performed but the ESP then expires before being referenced in an application for a combined license under 10 CFR Part 52, "Early Site Permits; Standard Design Certifications; and Combined Licenses for Nuclear Power Plants," Subpart C, "Combined Licenses." This site redress plan provides reasonable assurance that redress carried out under the plan would achieve an environmentally stable and aesthetically acceptable site condition suitable for whatever nonnuclear use may conform with local zoning laws. The following sections describe the objective of the site redress plan and activities that would be considered to redress the site; a general description of proposed redress activities; and the procedure for NRC notification and final acceptance of the redressed site.

1.2.1 Site Redress Plan Objective and Considerations

The objective of the site redress plan is to ensure that the site, should it not be fully developed for the intended purpose of new nuclear power generation, would be returned to an unattended, environmentally stable, and aesthetically acceptable condition suitable for such nonnuclear use as is consistent with local zoning laws. Site redress activities would be commensurate with the level of site modification created by the proposed site preparation activities. Redress activities would reflect applicable land use and/or zoning requirements of local, State, and Federal agencies. Redress activities would consider the following:

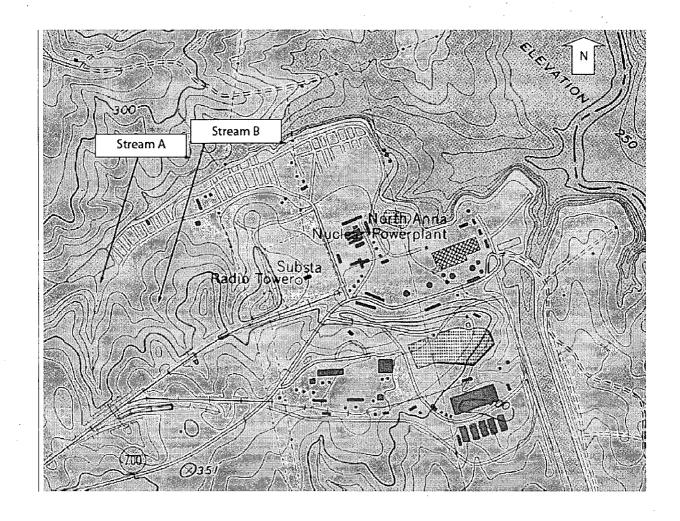


Figure 3 (Revision 9 ER Figure 1.2-1). Ephemeral Stream Locations Source: Lake Anna West, VA, USGS 7.5 Minute Topographic Map, 1983.

1.2.3 NRC Notification upon Completion

The permit holders

Dominion Nuclear North Anna, LLC, will notify the NRC upon completion of activities addressed by this site redress plan. The site would be made available for inspection, and any documentation that the NRC may require would be provided to confirm the satisfactory completion of the redress activities.

1.0 Objectives of the Environmental Protection Plan

The purpose of the environmental protection plan (EPP) is to provide for protection of nonradiological environmental resources during any site preparation or preliminary construction activities authorized by Title 10, Section 52.25, "Extent of Activities Permitted," of the *Code of Federal Regulations* (10 CFR 52.25). The principal objective of the EPP is to inform the U.S. Nuclear Regulatory Commission (NRC) of the environmental effects of any site preparation or preliminary construction activities and of actions taken to control those effects.

Environmental concerns identified in the final environmental impact statement (FEIS) that relate to water quality matters will be regulated by way of the permit holder's National Pollutant Discharge Elimination System (NPDES) permit.

2.0 Environmental Protection Issues

North Anna

In the FEIS dated December 2006, the staff considered the environmental impacts associated with the construction of reactors with characteristics that fall within the plant parameter envelope identified in Appendix D of this permit at the Dominion early site permit (ESP) site. The environmental impacts associated with the site preparation or preliminary construction activities authorized by 10 CFR 52.25 and in accordance with this permit will be less than or equal to the impacts assessed in the FEIS.

3.0 Consistency Requirements

3.1 Site Preparation and Preliminary Construction Activities

holders

The permit holder shall take the necessary mitigating actions identified in Revision 9 of the environmental report of the application and Chapter 4.0 of the FEIS (and summarized in Section 4.10 of the FEIS) to avoid any unnecessary adverse environmental impacts from the site preparation and preliminary construction activities described in the site redress plan.

holders

The permit holder shall maintain records of all site preparation and preliminary construction activities; these records shall include an assessment of whether the environmental impact of such activities is consistent with that evaluated in the EIS.

3.2 Reporting Related to the NPDES Permit and State Certification

holders

The permit helder shall provide the NRC with Section 401 certification (a Virginia Water Protection Permit under Virginia's State Water Control Law at Virginia Code Section 62.1-44.15:20 constitutes the certification required under the Federal Water Pollution Control Act Section 401), issued by the Commonwealth of Virginia, within 30 days of approval. The permit helder shall report any changes to the Virginia Water Protection Permit to the NRC within 30 days of the date the change is approved.

holders

4.0 Environmental Conditions

4.1 Unusual or Important Environmental Events

holders

The permit holder shall evaluate and report to the NRC Operations Center within 24 hours (followed by a written report in accordance with Subsection 5.4) any occurrence of an unusual or important event that indicates or could result in a significant environmental impact causally related to the site preparation or preliminary construction activities authorized (pursuant to 10 CFR 52.25) under this permit. The following are examples of unusual or important environmental events:

- excessive impacts on birds
- onsite plant or animal disease outbreaks
- mortality or unusual occurrence of any species protected by the Endangered Species Act of 1973
- fish kills
- unusual increase in nuisance organisms or conditions
- unanticipated or emergency discharge of waste water or chemical substances

Routine monitoring programs are not required to implement this condition.

5.0 Administrative Procedures

5.1 Review and Audit

Audit holders

The permit holder shall provide for review and audit of compliance with the EPP. The audits shall be conducted independently; the individual or groups responsible for performing the specific activity may not conduct the audit. The permit holder shall maintain and make available for inspection a description of the organizational structure utilized to achieve the independent review and audit function and results of the audit activities.

5.2 Records Retention

holders

The permit holder shall make and retain records associated with this EPP in a manner convenient for review and inspection and shall make them available to the NRC on request.

holders

The permit holder shall retain records of site preparation and preliminary construction activities determined to potentially affect the continued protection of the environment until the date of termination of the permit. If an application for a construction permit (CP) or combined license (COL) references this ESP and the CP or COL is issued, then the permit holder or licensee holders or should retain these records until the date of termination of that permit or license. The permit holder or licensee shall retain all other records relating to this EPP for 5 years or, where applicable in accordance with the requirements of other agencies.

holders or licensees

5.3 Changes in the Environmental Protection Plan

Requests for changes in the EPP shall include an assessment of the environmental impact of the proposed change and a supporting justification. Implementation of such changes in the EPP shall not commence before the NRC approves the proposed changes in the form of a permit amendment incorporating the appropriate revision to the EPP.

5.4 Reporting Requirements

holders

The permit holder shall submit a written report to the NRC within 30 days of occurrence of any event described in Section 4.1 of this plan. The report should (1) describe, analyze, and evaluate the event, including the extent and magnitude of the impact and site preparation and preliminary construction activities underway at the time of the event, (2) describe the likely cause of the event, (3) indicate the action taken to correct the reported event, (4) indicate the corrective action taken to preclude repetition of the event and to prevent similar occurrences involving similar site preparation and preliminary construction activities, and (5) indicate the agencies notified and their preliminary responses. For events reportable under this subsection that also require reports to other Federal, State, or local agencies, the permit holder shall report in accordance with those reporting requirements in lieu of the requirements of this subsection. The permit holder shall provide the NRC with a copy of such report at the time it submits the report to the other agency.

holders

holders