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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
DOMINION NUCLEAR NORTH ANNA, LLC	)	Docket No. 52-008
	)	
(Early Site Permit for North Anna ESP Site)	)	ASLBP No. 04-822-02-ESP

DOMINION'S PRE-FILED TESTIMONY OF MARVIN L. SMITH, STEPHEN D. ROUTH, DR. WILLIAM R. LETTIS, DR. ROBIN K. MCGUIRE, AND DR. JOHN R. DAVIE ON SAFETY MATTERS

Q1. Please state your names.

A1. My name is Marvin L. Smith ("MLS").

My name is Stephen D. Routh ("SDR").

My name is William R. Lettis ("WRL").

My name is Robin K. McGuire ("RKM").

My name is John R. Davie ("JRD").

Q2. Please state your employer and position.

A2. (MLS) I am a Project Director employed by Dominion Resources Services Inc. Dominion Resources Services Inc. is a subsidiary of Dominion Resources Inc. ("DRI") and provides technical and management support services to DRI subsidiaries, including Dominion Nuclear North Anna LLC ("Dominion").

(SDR) I am a Project Manager employed by Bechtel Power Corporation ("Bechtel"). Bechtel has served as Dominion's primary contractor assisting with the preparation of Dominion's application for an Early Site Permit ("ESP"). In this role, Bechtel supplied

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personnel, systems, project management, and resources to work on an integrated team with Dominion.

(WRL) I am the President and Principal Engineering Geologist of William Lettis & Associates, Inc. ("WLA"). WLA was retained as a subcontractor to investigate the seismic geology of Dominion's ESP Site.

(RKM) I am the President of Risk Engineering, Inc. Risk Engineering, Inc. was retained as a subcontractor to perform the seismic hazard analysis of the ESP Site. I am Technical Director for seismic hazard analysis for Dominion.

(JRD) I am the Geotechnical Engineering Specialist for Bechtel for this work for Dominion.

Q3. Please describe your professional qualifications.

A3. (MLS) I hold a Bachelor of Science degree in Physics and a Master of Engineering degree in Nuclear Engineering, both from Virginia Tech. I have over thirty years experience as a nuclear engineer and manager in the nuclear power industry. A statement of my professional qualifications is attached.

(SDR) I hold Bachelor of Science and Master of Engineering degrees in Nuclear Engineering from Pennsylvania State University, and a Master of Business Administration degree from Mount Saint Mary's College. I have over 25 years of experience with nuclear engineering, licensing, safety analysis, and project management. A statement of my professional qualifications is attached.

(WRL) I hold Bachelor of Science degrees in Forestry and Geology from Humboldt State University, and Master of Science and Doctor of Philosophy degrees in Geology

from the University of California. I have over 25 years of experience in assessing geology and seismic hazards for large engineered facilities, including nuclear power plants. A statement of my professional qualifications is attached.

(RKM) I hold a Bachelor of Science in Civil Engineering from the Massachusetts Institute of Technology, a Master of Science degree in Structural Engineering from the University of California, and a Doctor of Philosophy degree in Structural Engineering from the Massachusetts Institute of Technology. I have over 20 years of experience in assessing seismic ground motion hazards for nuclear power plants. A statement of my professional qualifications is attached.

(JRD) I hold a Bachelor of Science degree in Civil Engineering from the University of Glasgow, a Master of Engineering degree in Civil Engineering from Cornell, and a Doctor of Philosophy degree in Soil Mechanics from the University of Glasgow. I have over 30 years of experience with geotechnical analysis and management of geotechnical investigations. A statement of my professional qualifications is attached.

Q4. Please describe your responsibilities with respect to Dominion's application for an Early Site Permit.

A4. (MLS) I am the Project Director responsible for Dominion's ESP application. I have been the responsible Director from the inception of this project and have provided overall supervision and management of the entire project.

(SDR) I am Bechtel's Project Manager for Dominion's ESP application. I have been the Bechtel Project Manager for this work from the beginning of the project and have supervised all Bechtel work on it.

(WRL) I am WLA's Principal Engineering Geologist supporting Dominion's ESP application.

(RKM) I performed the probabilistic seismic hazard analysis for Dominion's ESP Site and have supported the work on the seismic licensing issues from the beginning of this project.

(JRD) I have been the Geotechnical Engineering Specialist for Dominion's ESP application from the beginning of the project.

Q5. What is the purpose of your testimony?

A5. The purpose of our testimony is to describe Dominion's ESP application and explain how that application meets NRC's safety criteria and supports the Nuclear Regulatory Commission's (NRC) safety findings. Testimony on Dominion's environmental review will be provided by other witnesses.

Q6. Are you authorized to provide this testimony on behalf of Dominion?

A6. (MLS) Yes, I am authorized to provide this testimony on behalf of Dominion, and as the Project Director have also authorized Mr. Routh and Drs. Lettis, McGuire and Davie to provide this testimony.

Q7. Please describe Dominion's application.

A7. (MLS) Dominion has applied to the NRC for an ESP to establish that a parcel of land on North Anna Power Station ("NAPS") is suitable for the siting of up to two new nuclear units. This parcel is referred to as the ESP Site, and is depicted in Figure 1.0-1 of the application. For the purpose of establishing the suitability of the ESP Site, each unit is defined as consisting of a plant of one or more reactors or modules that have characteristics bounded by a

Plant Parameter Envelope ("PPE"), as described in Section 1.3 of the Site Safety Analysis Report ("SSAR"). NAPS and the ESP Site are located in Louisa County, Virginia, approximately 40 miles north-northwest of Richmond.

Q8. Please describe the applicant.

A8. (MLS) Dominion Nuclear North Anna, LLC, is an indirect wholly-owned subsidiary of DRI. Corporate information on Dominion is provided in Section 1.3 of the application. Dominion is not owned, controlled or dominated by an alien, a foreign corporation, or a foreign government.

Q9. Please explain how the application is organized.

A9. (MLS, SDR) Dominion's ESP application consists of four parts. Part 1 of the ESP application provides the general and corporate information required by 10 C.F.R. § 50.33(a)-(d). Part 2, the SSAR, provides the information required by 10 C.F.R. § 52.17(a)(1) and demonstrates compliance with radiological evaluation factors identified in 10 C.F.R. § 50.34(a)(1) and the factors and criteria governing siting in 10 C.F.R. Part 100, Subpart B. The SSAR also provides the information on emergency planning required by 10 C.F.R. § 52.17(b). Part 3 is an Environmental Report ("ER") prepared in accordance with 10 C.F.R. § 52.17(a)(2). Part 4 provides a Site Redress Plan that would be implemented if certain limited preconstruction activities are performed and the ESP expires before it is referenced in an application for a combined construction permit and operating license.

Q10. What standards were applied in preparing the application?

A10. (MLS, SDR) The application was prepared to comply with the applicable regulations and to conform to the maximum extent practicable with the NRC's review standards

and Regulatory Guides. The preparation of each section of the application began by identifying the applicable requirements in the NRC regulations and the applicable guidance in the review standards and Regulatory Guides. For the SSAR, the review standard that was followed was NRC Review Standard RS-002, Processing Applications for Early Site Permits ("RS-002"), which modified applicable sections of the NRC's Standard Review Plan (NUREG-0800) in a manner appropriate for early site permit reviews. For the ER, the NRC's Environmental Standard Review Plan, NUREG-1555 ("ESRP") was followed where applicable, as described in Attachment 3 to RS-002.

Section 1.8 of the SSAR describes the conformance of the SSAR with the applicable regulations and guidance. Section 1.8.1 identifies each applicable regulation and the sections of the SSAR that address it. Sections 1.8.2 and 1.8.3 of the SSAR identify conformance with the sections of RS-002 and the applicable Regulatory Guides respectively. Any exceptions or clarifications to guidance are noted.

Q11. Was Dominion's ESP application prepared under a Quality Assurance Program?

A11. (MLS) Yes, the preparation of Dominion's ESP application was controlled under a Quality Assurance Program. Dominion's Early Site Permit Application Development Quality Assurance Manual is included in Section 17.1 of the SSAR.

Q12. Has Dominion's ESP application been revised?

A12. (MLS) Yes, there have been nine revisions. Most of the revisions were made to incorporate responses to NRC Requests for Additional Information ("RAI"). During its review, Dominion received eleven sets of RAI from the NRC Staff related to the SSAR, containing about 115 questions, and six sets of RAI related to the ER, containing about 70 questions. In responding to these questions, Dominion identified any changes or additions to the application

made as a result of the RAI, and then periodically incorporated them into revisions to the application.

In addition, in October 2005, Dominion decided to modify its approach for cooling a third unit, changing the approach from once-through cooling to a combination of wet and dry cooling towers. Dominion made this decision, in part, to address concerns of state regulatory bodies and local residents. The changes in cooling approach and related analyses, and responses to related questions from the NRC Staff, were incorporated into Revision 6 of the application, which also increased the maximum power level per unit to correspond to the revised power level of an ESBWR that is in the process of design certification.

The final version of Dominion's ESP application is Revision 9. Dominion is submitting a complete copy of Revision 9 of the ESP application as an exhibit in this proceeding.

Q13. Was Dominion's ESP application prepared under your supervision and control?

A13. (MLS, SDR) Yes.

Q14. To the best of your knowledge, is Revision 9 of Dominion's ESP application complete and accurate in all material respects?

A14. (MLS, SDR) Yes.

Q15. Does Revision 9 of Dominion's ESP application represent Dominion's position on the matters discussed therein?

A15. (MLS) Yes.

Q16. Please identify how Dominion's ESP application satisfies the NRC's safety requirements for an early site permit.

A16. (MLS, SDR) The NRC's safety requirements for an ESP consist of siting factors and criteria in 10 C.F.R. Part 100, Subpart B, which include the radiological evaluation factors in

10 C.F.R. § 50.34(a)(1); and the emergency planning provisions in 10 C.F.R. § 52.17(b). We will describe each of these requirements and how the ESP application satisfied them.

(WRL, RKM, JRD) We will address specifically the applicable geologic and seismic criteria. The paragraphs that each of the three of us are sponsoring in the response to these questions are marked with our initials.

Population Density and Use Characteristics

(MLS, SDR) 10 C.F.R. § 100.20(a) requires that the population density and use characteristics of the site environs, including the exclusion area, the population distribution, and site-related characteristics be evaluated to determine whether individual as well as societal risk of potential plant accidents is low. (10 C.F.R. § 100.20(a) also contains an emergency planning requirement which we will address separately later.) 10 C.F.R. § 100.21 contains the following related criteria that must be met:

> (a) Every site must have an exclusion area and a low population zone, as defined in § 100.3;[1]
>
> (b) The population center distance, as defined in § 100.3,[2] must be at least one and one-third times the distance from the reactor to the outer boundary of the low population zone. In applying this guide, the boundary of the population center shall be determined upon consideration of population distribution. Political boundaries are not controlling in the application of this guide;
>
> (c) Site atmospheric dispersion characteristics must be evaluated and dispersion parameters established such that:
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> > (1) Radiological effluent release limits associated with normal operation from the type of facility proposed to be located at the site can be met for any individual located offsite; and

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[1] An exclusion area is defined in 10 C.F.R. § 100.3 as that area surrounding the reactor, in which the reactor licensee has authority to determine all activities including the exclusion or removal of personnel and property from the area. A low population zone ("LPZ") is defined in 10 C.F.R. § 100.3 as that area immediately surrounding the exclusion area which contains residents, the total number and density of which are such that there is a reasonable probability that appropriate protective measures could be taken in their behalf in the event of a serious accident.

[2] As defined in 10 C.F.R. § 100.3, the population center distance means the distance from the reactor to the nearest boundary of a densely populated center containing more than about 25,000 residents.

> (2) Radiological dose consequences of postulated accidents shall meet the criteria set forth in § 50.34(a)(1) of this chapter for the type of facility proposed to be located at the site.
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> * * *
>
> (h) Reactor sites should be located away from very densely populated centers. Areas of low population density are, generally, preferred. However, in determining the acceptability of a particular site located away from a very densely populated center but not in an area of low density, consideration will be given to safety, environmental, economic, or other factors, which may result in the site being found acceptable.

10 C.F.R. § 100.21(a)-(c), (h).

A. Exclusion Area

For the ESP Site, the exclusion area is defined as the perimeter of a 5000-ft-radius circle from the center of the abandoned North Anna Unit 3 containment (SSAR Figure 2.1-1). This is the same as the exclusion area for the two existing nuclear units located on the NAPS site (SSAR Section 2.1.1.3). There are no residents in this exclusion area (id.).

As discussed in Section 2.1.2 of RS-002, it is not necessary for an ESP applicant to demonstrate control of the exclusion area prior to issuance of an ESP. Rather, there must be reasonable assurance that the applicant would have such control prior to commencing activities allowed by 10 C.F.R. § 52.25. Currently, Virginia Electric and Power Company ("Virginia Power"), which is an affiliate of Dominion, controls all of the land within the NAPS site boundary and exclusion area. Dominion therefore cannot perform any activity allowed by 10 C.F.R. § 52.25 without first entering into an agreement with Virginia Power, with the prior approval of the Virginia State Corporation Commission, to purchase or lease the ESP Site. As discussed in Section 2.1.1.2 of the SSAR, Dominion has committed that any such agreement or conveyance documents would provide for mutual use of the NAPS site as a single exclusion area and single restricted area for all nuclear units within the NAPS property, including the new units located within the ESP Site.

ESP Condition 1 requires that this commitment be fulfilled prior to the commencement of construction, and therefore provides reasonable assurance that Dominion would have control of the Exclusion Area prior to commencing construction.

B. Population Density, Low Population Zone, and Population Centers

Dominion conducted an evaluation of the existing and projected future population densities, including transient populations, averaged over any radial distance out to 20 miles from the ESP Site. Dominion determined that these population densities would not exceed 500 persons per square mile at the time of initial site approval and within about 5 years thereafter, and would not exceed 1,000 per square mile over the life of the new units (SSAR Section 2.1.3.6). The results of this evaluation meet the population density guidelines of Regulatory Guide ("RG") 4.7, "General Site Suitability Criteria for Nuclear Power Stations," Rev. 2, April 1998.

The LPZ for the ESP Site is defined as a 6-mile radius circle centered at the North Anna Unit 1 containment building, which is the same area as the LPZ for the two existing nuclear power plants located on the NAPS site (SSAR Figure 2.1-2). The resident and transient population within the LPZ based on the year 2000 census was 16,705 with a projected increase to 56,588 by the year 2065. Recreational use of Lake Anna, which falls primarily within the LPZ, is the greatest contributor to the transient population with a total peak daily usage conservatively estimated to be less than 11,270 (SSAR Section 2.1.3.3.1 and SSAR Table 2.1-2). The only school in the LPZ is an elementary school located 5.7 miles to the north-northeast of the ESP Site (SSAR Section 2.1.3.4 and SSAR Table 2.1-3). As we will discuss later in this testimony, considering the available road network leading from the LPZ, together with the availability of private as well as public vehicles, there is reasonable assurance that the affected populace could be evacuated in a timely manner in the event of an accident (SSAR Section 2.1.3.4).

The nearest population center with more than 25,000 residents is the city of Charlottesville, with a closest point to the site of 36 miles (SSAR Section 2.1.3.5). This meets the requirement in 10 C.F.R. § 100.21(b) that the population center distance must be at least one and one third times the distance from the reactor to the outer boundary of the LPZ (8 miles for the North Anna ESP Site). The only town within 10 miles of the site is Mineral, VA and is projected to have a population less than 10,000 in 2065.

C. Compliance of EAB and LPZ with Dose Criteria

In accordance with 10 C.F.R. § 100.21(c)(2), radiological dose consequences of postulated accidents must meet the criteria in 10 C.F.R. § 50.34(a)(1) for the type of facility proposed to be located at a site. Specifically, 10 C.F.R. § 50.34(a)(1)(ii)(D) requires that accident doses calculated for an individual at the exclusion area boundary ("EAB") and LPZ not exceed 25 rem total effective dose equivalent ("TEDE").

To analyze the suitability of the proposed site, Dominion performed an analysis based on a robust and conservative set of surrogate design basis accidents ("DBA") representative of the range of reactor designs within the PPE being considered for the ESP Site. The set of accidents selected focused on three LWR designs: the AP1000, the ABWR, and the ESBWR. These three designs were chosen because they are standard designs that have recognized bases for postulated accident analyses and are expected to bound the accident radiological consequences of other reactors being considered for the ESP Site.

To determine the DBA doses, the analyses used short-term accident atmospheric dispersion factors (χ/Q) calculated using the methodology of RG 1.145, "Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants," Revision 1, November 1982; and site-specific meteorological data. Consistent with 10 C.F.R. § 50.34, the

accident doses were expressed as TEDE and calculated based on the dose conversion factors in Federal Guidance Report 11, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion," EPA-520/1-88-020 (1988); and in Federal Guidance Report 12 "External Exposure to Radionuclides in Air, Water, and Soil," EPA-402-R-93-081 (1993) (SSAR Section 15.2). Since the ABWR design certification document presents whole body and thyroid doses, an equivalent TEDE value was estimated by multiplying the thyroid dose by 0.03 and adding the product to the whole body dose in accordance with RG 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors" (July 2000) (SSAR Section 15.4).

For the AP1000 and ABWR accidents, Dominion calculated site-specific doses by multiplying the design certification doses by the ratio of the site χ/Qs to design certification χ/Qs. The doses for the ESBWR design, which has not yet been certified by the NRC, were calculated based on activity releases, including a 25 percent margin to allow for uncertainty. Although the emergency safety features are expected to prevent core damage and mitigate releases of radioactivity, the loss-of-coolant accidents ("LOCA") analyzed presume substantial core damage and the release of significant amounts of fission products. The calculated radiological doses at the EAB and LPZ boundary meet the regulatory requirements in 10 C.F.R. § 50.34(a)(1) for the proposed ESP Site (SSAR Section 15.4). As expected, the exposure from a LOCA is most limiting, but is less than half the acceptance criteria.

Nature and Proximity of Man-Made Hazards

10 C.F.R. § 100.20(b) requires that the nature and proximity of man-made hazards (*e.g.*, airports, dams, transportation routes, military and chemical facilities) must be evaluated to establish site parameters for use in determining whether a plant design can accommodate commonly occurring

hazards, and whether the risk of other hazards is very low. Pursuant to 10 C.F.R. § 100.21(e), potential hazards associated with nearby transportation routes, industrial and military facilities must be evaluated and site parameters established to show that such potential hazards will pose no undue risk to the type of facility proposed to be located at the site.

Because the ESP Site is located at an existing nuclear power station, off-site hazards have already been identified for NAPS and were confirmed for the ESP Site. There are no military bases, missile sites, manufacturing plants, chemical plants, chemical or other storage facilities, airports, major railroad lines, major water transportation, or oil and gas pipelines located within 5 miles of the ESP Site. RS-002, Section 2.2.1-2.2.2, states that facilities and activities in close proximity warrant attention and those within 5 miles need to be reviewed. There are no substantial industrial activities within 5 miles of the ESP Site. Future major industrial developments are more likely to be concentrated along the I-95 corridor rather than within 5 miles of the site (SSAR Section 2.2.2.1).

Based on lack of proximity to the site, no offsite hazards required further evaluation except aircraft hazards associated with air traffic routes. Dominion analyzed aircraft hazards in accordance with RS-002, Section 3.5.1.6. One civil airway and three military training routes pass near the ESP Site. The centerline of the civil airway is 5.5 miles west of the ESP Site, and the corridor width is 4 miles on either side of the centerline. The Federal Aviation Administration ("FAA") station at Richmond International Airport has characterized the airway as "not heavily used" and estimates traffic at no more than 200 aircraft per day (73,000 aircraft per year). The centerlines of the three military training routes are 1 mile south of the ESP Site, and the corridor width is 10 miles across. The combined number of flights using these three routes has remained fairly constant over time (6,000 aircraft per year), and each flight typically

consists of 1 or 2 aircraft, or on rare occasion 4 aircraft (SSAR Section 2.2.2.6.2). Applying the methodology of RS-002 Section 3.5.1.6, and using a conservative estimate of the facility area as 0.013 square miles, Dominion determined that aircraft accident probabilities are within the guidance acceptance criteria of less than 10^{-7} per year (SSAR Section 2.2.3.2.2).

Physical Characteristics of the Site (Seismology, Meteorology, Geology, and Hydrology)

A. Meteorology -- Local And Regional Climatology

As specified in 10 C.F.R. § 100.20(c) and 10 C.F.R. § 100.21(d), the meteorological characteristics of a proposed site are to be considered in determining the acceptability of a site for commercial power reactors. To characterize the regional and local climatology, including extreme weather phenomena, pertinent to the ESP Site, Dominion acquired data reported by the National Weather Service ("NWS") at the Richmond, Virginia first-order weather station and from a network of cooperative observer stations, as compiled and summarized by the National Climatic Data Center ("NCDC") and its predecessor agencies. Consistent with the guidelines provided in RS-002, Sections 2.3.1 and 2.3.2, information on meteorological conditions at the ESP Site was collected from a variety of sources, including the NWS stations, NCDC's Storm Events database for Virginia, the National Oceanic and Atmospheric Administration Coastal Services Center, and the National Hurricane Center (SSAR Section 2.3.1.1).

In addition to data from the nearby climatological observation stations, data collected from the meteorological monitoring system at the existing NAPS units was also used to characterize local meteorological conditions. Because the ESP Site is within the existing NAPS site, the meteorological parameters (i.e., wind speed and wind direction) collected by the onsite primary meteorological tower are representative of the ESP Site and are considered appropriate for use in describing local meteorological conditions.

Using the climatological data collected and guidance provided in well known industry standards, Dominion determined the meteorological conditions that would be used as the design and operating bases for proposed units at the ESP Site. The site characteristics developed included design basis extreme wind and winter precipitation load conditions, tornado loads, ultimate heat sink ("UHS") meteorological conditions, and air temperature and humidity values. To establish these site characteristics, Dominion considered the most severe weather phenomena and utilized accepted industry practices consistent with the guidance RS-002, Section 2.3.1 (SSAR Section 2.3.2.1).

In accordance with the guidance provided in RS-002, Section 2.3.2, Dominion also evaluated the potential influence of any new units at the ESP Site on local meteorological conditions. It was determined that operation of the proposed cooling tower systems may result in an increase in the local ambient air temperature or moisture content at the NAPS site, but would not affect ambient atmospheric and ground temperatures beyond the NAPS site boundary. This potential influence would be considered as part of detailed engineering for any new units at the ESP Site (SSAR Section 2.3.2.3).

The local meteorological data were also used to develop site atmospheric dispersion characteristics as required by 10 C.F.R. § 100.21(c). Based on guidance provided in RS-002, Section 2.3.4, Dominion determined the relative ground level air concentrations (χ/Qs) at the EAB and LPZ for potential accidental releases of radioactive material (SSAR Section 2.3.4). In addition, to estimate the radiological effluent release limits due to normal operation of new units at the ESP Site, Dominion calculated the χ/Q and relative deposition (D/Q) values due to routine releases utilizing the assumptions outlined in Revision 1 of RG 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases for Light-

Water-Cooled Reactors," July 1977, consistent with the guidelines in RS-002, Section 2.3.5 (SSAR Section 2.3.5).

B. Hydrology

10 C.F.R. §§ 100.20(c)(3) and 100.21(d) require consideration of hydrologic characteristics and a determination that any potential threat from such characteristics will pose no undue risk to the facility. As required by Section 2.4.1 of RS-002, Dominion provided a description of the general hydrology at the ESP Site in Section 2.4.1 of the SSAR, which the NRC Staff found sufficient in SER Section 2.4.1, and then evaluated the following topics specified in RS-002.

1. Flooding

The hydrologic characteristics to be considered in determining the acceptability of a proposed site, as specified in 10 C.F.R. §§ 100.20(c)(3) and 100.21(d), require a determination of the probable maximum flood ("PMF") water level conditions at the site, including an evaluation of the coincident wind-generated wave conditions that could occur with the PMF. For the ESP Site, Dominion performed a PMF analysis in accordance with RS-002, Sections 2.4.2 and 2.4.3; and the procedures outlined in ANS/ANSI-2.8-1992, "Determining Design Basis Flooding at Power Reactor Sites," July 1992. Dominion determined the PMF by estimating the runoff from the probable maximum precipitation ("PMP") for the Lake Anna drainage area, routing the runoff hydrograph through the watershed and Lake Anna, and computing the resulting peak water level at the site. The PMF elevation also took into consideration the wind setup and the runup of wind-generated waves at the site location. Based on this analysis, Dominion calculated a PMF elevation of 267.39 ft msl for Lake Anna at the ESP Site. The NRC Staff performed its own independent analysis and calculated a PMF elevation of 270 msl (SER Section 2.4.3.3), which the NRC Staff conservatively established as the site characteristic (SER Supp. 1 at A-19). This

site characteristic is below the minimum proposed site grade elevation of 271.0 ft msl. Therefore, since the ESP Site grade elevation is above the PMF level, all above-grade, safety-related structures, systems, and components of the new units would be located above the design basis flooding elevation (SSAR Sections 2.4.2.2 and 2.4.3).

2. Safety Heat Sink

As discussed in RS-002 Section 2.4.4, one of the factors to be considered is the potential for seismically-induced dam failures. The ESP Site is located adjacent to Lake Anna, which was created to supply water to the existing NAPS units, and is approximately 5 miles upstream of the North Anna Dam. No other dams exist on the North Anna River, either upstream or downstream of the ESP Site. The only impoundments in the area are small farm ponds and two small recreational lakes – Lake Louisa and Lake Orange – that are located on small tributaries to the North Anna River, and whose failures would not produce any measurable effect on Lake Anna, the North Anna Dam, or any safety-related systems (SSAR Section 2.4.4).

The design of the North Anna Dam complies with the requirements applicable to Seismic Class I structures, as discussed in the NAPS UFSAR; therefore, a seismically induced failure of the dam is not credible (SSAR Section 2.4.4). Moreover, new units would not rely upon Lake Anna as a source of safety-related cooling water. Rather, any new unit would employ either a UHS consisting of a mechanical draft cooling tower over a buried water storage basin or other water storage or passive cooling features required by the reactor design. Therefore, no safety-related structures or systems of any new units would be adversely affected by the loss of water in Lake Anna due to dam failure, even if such a failure were credible.

To meet the requirements in 10 C.F.R. § 100.23, RS-002 Section 2.4.11 provides that the site hydrological characteristics that may reduce or limit the available supply of cooling water for

normal operation, anticipated operational occurrences, and emergency conditions should be considered. Using a water budget analysis, Dominion estimated the minimum lake level with new the units to be 244.2 ft msl (SSAR Section 2.4.11.4), while NRC's estimate is 242.9 ft msl (SER Supp. 1, Section 2.4.1.3) using more conservative assumptions. Both estimates are considered acceptable from a safety perspective because they are above the shutdown elevation of 242 ft msl for both the ESP Unit 3 and NAPS Units 1 and 2, and thus would not result in frequent and sudden reliance on a UHS. Further, the water levels in Lake Anna would not affect the ability of the UHS to provide emergency cooling.

3. Ice effects

In accordance with RS-002 Section 2.4.7, Dominion conducted an investigation of ice effects at the ESP Site, including historical ice conditions at the NAPS site, and the potential for ice build-up at the intake structure and on the surface of Lake Anna. The intakes and associated pumps for the new units would not be safety-related facilities (SSAR Section 2.4.7.5). In addition, the cooling water system designs for the proposed new units would rely on separate normal cooling and emergency cooling water systems with no system interconnections or inter-system reliance. Thus, these systems would not be affected by ice conditions in Lake Anna (SSAR Section 2.4.7.2). Furthermore, emergency cooling and service water needed by any new plant design to maintain the new units in a safe mode would be supplied by a UHS separate from Lake Anna. Therefore, no safety-related facilities would be affected by ice conditions in Lake Anna (SSAR Sections 2.4.7.4 and 2.4.7.5).

4. Channel Diversions

As discussed in RS-002 Section 2.4.9, the potential for flooding adversely affecting the supply of cooling water due to channel diversion or realignment needs to be considered when evaluating

the acceptability of a proposed site to meet the requirements in 10 C.F.R. § 100.20(c). Historical information reviewed by Dominion indicates that the North Anna River has not had a major change of course in recent history and; therefore, the possibility of an upstream diversion of the North Anna River is considered extremely remote (SSAR Section 2.4.9).

5. Low Water Considerations

As discussed in RS-002 Section 2.4.11, site hydrological characteristics that may reduce or limit the available supply of cooling water supply for safety-related structures, systems, or components ("SSC") should be evaluated. Although Lake Anna would provide make-up water for the cooling towers proposed for the new units, the lake would not directly supply cooling water to any safety-related facilities and would not serve as the UHS. Thus, low water levels do not pose a safety-related risk to the new units (SSAR Section 2.4.11).

6. Groundwater

10 C.F.R. § 100.20(c)(3) states that factors important to hydrological radionuclide transport (such as groundwater velocity) must be obtained from on-site measurements. Because the existing units' groundwater monitoring wells were not considered to be of sufficient areal extent to determine groundwater levels beneath the ESP Site, nine additional observation wells were installed as part of the ESP subsurface investigation program. Water levels in these nine wells and ten of the existing units' monitoring wells were measured quarterly for one year, followed by a supplementary measurement in February 2005, to provide data on groundwater flow direction, gradient, and seasonal groundwater level fluctuations at the site.

Like the existing units, new units would be built at Elevation 271 feet msl or higher. Previous studies conducted for the NAPS site predicted that the maximum groundwater elevations beneath the site in the plant area could reach as high as Elevation 265 to 270 feet. Based on evaluations

of groundwater levels and fluctuations at the site, the effects of topography and site grading, and the presence of Lake Anna, Dominion similarly estimated that the design groundwater level in the plant area of the ESP Site would range from Elevation 265 to 270 feet msl (SSAR Section 2.4.12.4).

Consistent with the guidance provided in RS-002, Section 2.4.12, Dominion determined the present and projected local and regional groundwater uses and conducted an evaluation of the site groundwater velocity based on the estimated hydraulic gradient, hydraulic conductivity, and effective porosity at the site (SSAR Section 2.4.12.1.2). There are no known users of large quantities of groundwater within 25 miles of the ESP Site. Public water supply wells closest to the existing units are about 2.6 miles to the northwest and about 4.3 miles to the south-southeast. The residential water supply well nearest the site is about one mile to the south-southeast. Based on their distance from the site and the presence of one or more arms of Lake Anna between the site and these wells, any impact the new units may have on the groundwater beneath the site is not expected to affect withdrawal by these wells (SSAR Section 2.4.12.2).

Based on previous investigations and confirmed by the results of the ESP subsurface investigation program, Dominion determined that groundwater at the ESP Site occurs in unconfined conditions resulting in a hydrologic connection between the overburden and the bedrock. Groundwater flow beneath the site is generally northward and eastward, toward Lake Anna (SSAR Section 2.4.12.1.2). Site-specific distribution coefficients (K_d's) important to subsurface hydrological transport have been established for use in COL assessment of accidental releases of liquid effluents to ground and surface waters. Conservative values were obtained by relating on-site measurements of soil characteristics to K_d values published in the literature (SSAR Section 2.4.13 and Table 2.4-20).

As discussed in RS-002, Section 2.4.13, 10 C.F.R. Part 100 requires an evaluation of the hydrologic characteristics with respect to the consequences of radioactive materials being released from a plant constructed on the proposed site. ESP Permit Condition 4 will require that the radioactive waste systems for any new units constructed at the ESP Site include design features to preclude accidental releases of radionuclides into any potential liquid ground water pathway. Dominion intends to comply with this permit condition in preparing any COL Application based on the ESP. Safeguards would be used to minimize the potential for adverse impacts to the groundwater by construction and operation of the new units. These safeguards may include the use of lined containment structures around storage tanks and hazardous materials storage areas, emergency cleanup procedures to capture and remove surface contaminants, or other measures deemed necessary to prevent or minimize adverse impacts to the groundwater beneath the ESP Site.

C. Seismology and Geology

1. General Description of Site Area and Regional Geology

(WRL) As required by 10 C.F.R. § 100.23(c), the geological and seismological characteristics of a site and its environs must be investigated in sufficient scope and detail to allow for both an adequate evaluation of the proposed site and adequate engineering solutions to actual or potential geologic and seismic effects at the proposed site. To meet the requirements in 10 C.F.R. § 100.23(c), regional and site area geological and seismological information was developed by Dominion in accordance with the guidance presented in Section 2.5.1 of RG 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants – LWR Edition," November 1978, and RG 1.165, "Identification and Characterization of Seismic Sources and Determination of Safe Shutdown Earthquake Ground Motion," March 1997. Sources used to

develop this information included reviews of previous reports prepared for the existing NAPS Units 1 and 2, and abandoned Units 3 and 4; published geologic literature; interpretation of aerial photography; and a subsurface investigation and geologic field reconnaissance conducted for preparation of the ESP application. The previous site-specific reports reviewed included the NAPS UFSAR and the NAPS Independent Spent Fuel Storage Installation ("ISFSI") Safety Analysis Report (SSAR Section 2.5.1).

(WRL) Guidance on the level of investigation recommended at different distances from a proposed site is provided in Appendix D to RG 1.165. The site region is that area within 200 miles of the site location and the site area is defined as that area within 5 miles of the proposed site. Consistent with this guidance, an investigation of the physiography, geologic history, stratigraphy, and tectonic setting within a 200-mile radius of the ESP Site was performed, including an examination of the principal tectonic structures within this region based on their age of formation or reactivation (SSAR Section 2.5.1.1). From this investigation, it was determined that none of the principal tectonic structures reviewed are considered to be capable tectonic sources as defined in Appendix A to RG 1.1.65 (SSAR Section 2.5.1.1.4).

(WRL) As a result of the investigations performed, the only geologic hazards determined to be associated with the ESP Site are vibratory ground motion from regional earthquake activity. There is no potential for tectonic surface faulting or other forms of non-tectonic permanent ground deformation, as discussed below. The investigations found no physical evidence of any fissuring, liquefaction, landsliding, lurching, or caving of banks to indicate that past earthquake ground shaking has disturbed either the surficial sediments or bedrock beneath the site (SSAR Sections 2.5.1.2.5 and 2.5.1.2.6.d).

2. Vibratory Ground Motion

(RKM) Dominion determined the Safe Shutdown Earthquake Ground Motion ("SSE") for the ESP Site by updating EPRI's 1989 Probabilistic Seismic Hazard Analysis ("PSHA") to include more recent seismicity, more recently proposed seismic sources, and more recently developed ground motion attenuation models. This analysis was performed following the general guidelines of RG 1.165, Position 2 and Appendix E. Incorporating 2003 EPRI ground motion models and adding the seismic hazard from the newly postulated East Coast Fault System's southern fault segments (ECFS-S), Dominion calculated updated seismic hazard results for the ESP Site.

(RKM) The SSE for the ESP Site was then determined from the updated seismic hazard results using a reference probability of 5×10^{-5}, which is a mean probability of exceeding the SSE. The NRC Staff independently determined this reference probability to be conservative by comparison to SSE design levels at 29 existing nuclear plant sites in the central and eastern United States. Applying the reference probability to the updated seismic hazards results, Dominion identified two controlling earthquakes (magnitude 5.4 at 20 km and 7.2 at 308 km). Following the RG 1.165 methodology, Dominion then determined the ground motion response spectra for the two controlling earthquakes. To determine the vertical SSE spectrum, Dominion used appropriate V/H response spectral ratios.

(RKM) The Operating Basis Earthquake Ground Motion ("OBE") spectrum was selected as one-third of the SSE spectrum, as permitted by 10 C.F.R. Part 50, Appendix S (SSAR Section 2.5.2.7).

3. Surface Faulting

(WRL) As required by 10 C.F.R. § 100.23, investigations of the site area geology were performed to determine the potential for tectonic surface and nontectonic deformations at a proposed site. In accordance with the guidance provided in RG 1.165, investigations were performed by Dominion to assess the potential for surface fault rupture at and within a 5-mile radius of the ESP Site. The studies performed included a compilation and review of existing data, interpretation of aerial photography, field and aerial reconnaissance, review of seismicity, and discussions with current researchers in the area (SSAR Section 2.5.3.1).

(WRL) Based on the results of investigations performed by Dominion, it was determined that there are no geologic faults or other tectonic structures that pose a surface faulting hazard at the site (SSAR Section 2.5.3). Therefore, at the ESP Site, the potential for tectonic deformation was determined to be negligible and no evidence was found of non-tectonic deformation, such as glacially induced faulting, collapse structures, growth faults, salt migration, deep-seated landslides, or volcanic intrusion (SSAR Section 2.5.3.8).

4. Stability of Subsurface Materials and Foundations

(JRD) To comply with the requirements in 10 C.F.R. § 100.23(c), the stability of subsurface materials and foundations as they influence the safety of Seismic Category I facilities planned to be constructed on a proposed site must be demonstrated. As described in RS-002, Section 2.5.4, a subsurface investigation program was performed by Dominion in November and December 2002 over a substantial portion of the ESP Site covering the area enveloped for the new units as well as cooling towers for the new units. The ESP Site exploration program was performed using selected guidance provided in Revision 1 of RG 1.132, "Site Investigations for Foundations of Nuclear Power Plants," March 1979, and Proposed Revision 2 of RG 1.132 (DG-

1101), issued in February 2001 (SSAR Section 2.5.4.3.2). As part of the site investigation, numerous laboratory tests of soil and rock samples were conducted based on guidelines provided in RG 1.138, "Laboratory Investigation of Soils for Engineering Analysis and Design of Nuclear Power Plants," April 1978, and proposed Revision 1 of RG 1.138 (DG-1109), issued in August 2001 (SSAR Section 2.5.4.2.4).

(JRD) The geologic and geotechnical investigations performed (including geophysical and laboratory testing and analyses) on soil and rock samples included determination of index properties, shear strength (soil), compression strength (rock), consolidation and compressibility, dynamic properties, and resistance to seismic effects. The results obtained from the ESP Site investigation were consistent with results from previous site investigations for existing NAPS Units 1 and 2, and abandoned NAPS Units 3 and 4, and were determined to be adequate to serve as the basis for the design of safety-related plant structures. Based on investigations performed, it was determined that the sound bedrock at the site has adequate bearing capacity for maximum bearing pressures from any of the reactor designs being considered in this ESP (SSAR Section 2.5.4).

(JRD) As part of the site investigations, soil liquefaction analyses were performed by Dominion based on guidance in draft RG DG-1105, "Procedures and Criteria for Assessing Seismic Soil Liquefaction at Nuclear Power Plant Sites," March 2001. Based on these analyses, it was concluded that portions of the saprolitic soils at the ESP Site, classified as Zone IIA saprolites, have the potential for earthquake-induced instability resulting from liquefaction. Most safety-related structures at the ESP Site would be founded on sound bedrock, including the reactor containment building. However, if any safety-related supporting structures (*e.g.*, diesel generator, pump structures, tanks, etc.) are founded on the Zone IIA saprolitic soil, appropriate

ground improvement techniques, including removal and replacement, would be employed to reduce potential settlements to within acceptable tolerances and eliminate any liquefaction potential (SSAR Section 2.5.4.8).

5. Stability of Slopes

(JRD) To also comply with the requirements in 10 C.F.R. § 100.23, the stability of all earth and rock slopes, both natural and planned man-made, must be evaluated to determine the acceptability of a proposed site. Consistent with the guidance provided in RS-002, Section 2.5.5, Dominion conducted a slope stability analysis of the only existing slope at the ESP Site whose failure could adversely affect the safety of the new units. The slope is a 55-foot high, 2-horizontal to 1-vertical (2h:1v), slope that descends from the north of the NAPS Units 1 and 2 service water reservoir ("SWR") down to the south of the existing excavation made for the abandoned NAPS Units 3 and 4. The slope is made almost entirely out of cut material. Since the top of the slope is 200 feet from the top of the SWR embankment, any potential instability of the slope would have no impact on the stability of the SWR embankment. However, sloughing or collapse of the slope could impact the new units, depending on their final location (SSAR Section 2.5.5.6).

(JRD) The results of the slope stability analysis indicated that the existing slope was stable under long-term static conditions; however, seismic analysis of the slope showed the possibility of some liquefaction in the slope area. Therefore, measures would be taken to ensure the safety of the slope and the structures that may be located close to the bottom of the slope as part of detailed engineering for any new units at the ESP Site (SSAR Section 2.5.5.6). Furthermore, if the selected design for new units requires that a new slope be constructed, and it is deemed that any failure of the slope could impact the new units, then investigation and analysis of the slope

would be performed as part of detailed engineering and described in the COL application. If the analysis, based on the subsurface investigation results, showed an inadequate factor of safety against slope failure, then the design would be modified to eliminate any risk of slope failure (SSAR Section 2.5.5.5).

Emergency Planning

(MLS, SDR) As previously stated, 10 C.F.R. § 100.20(a) also requires identification of physical characteristics unique to the proposed site that could pose a significant impediment to the development of emergency plans. This is also a criterion in 10 C.F.R. § 100.21(g), and § 52.17(b)(1).

NAPS is an existing nuclear station with existing emergency plans that have been determined to be adequate by FEMA, and are subject to regular drills and exercises. As discussed in Section 13.3.2.1 of the SSAR, evacuation time estimates have been calculated taking into consideration the characteristics of the site, including the characteristics of the roads, seasonal recreational visitors around the lake, and school populations. These evacuation time estimates demonstrate that there are no unique physical characteristics that would be a significant impediment to emergency planning.

In addition, as stated in SSAR Section 13.3.3, during the preparation of the ESP application, Dominion met with the Virginia Department of Emergency Management ("VDEM") and risk jurisdiction response organizations. During these discussions, no impediments to the ESP were identified by the VDEM or response organizations. Subsequently, Dominion provided revised letters of agreement from the emergency response agencies acknowledging the agencies' awareness of the ESP application and stating that the existing agency arrangements would apply to prospective additional reactors at the site (SER Section 13.3.2.1).

Pursuant to 10 C.F.R. § 52.17(b)(2)(i), the major features of the emergency plan were described in the SSAR. These features of the plan are based on Supplement 2 to NUREG-0654/FEMA-REP-1, Revision 1, "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants—Criteria for Emergency Planning in an Early Site Permit Application—Draft Report for Comment," issued April 1996. The major features took advantage of the emergency planning resources, capabilities, and organization already established and currently maintained at NAPS. There were no significant differences between the major features proposed in the application and the major features of the existing plans.

A plume exposure pathway emergency planning zone ("EPZ") of about 10 miles in radius and an ingestion pathway EPZ of about 50 miles in radius were identified. This is consistent with the NAPS Emergency Plan and its associated offsite emergency plans.

Supplement 2 to NUREG-0654/FEMA-REP-1, Revision 1, provided evaluation criteria for 14 of the 16 emergency planning standards enumerated in 10 C.F.R. § 50.47(b) which were applicable at the ESP application stage. The following 13 major features were determined to be acceptable and meet the requirements of 10 C.F.R. § 52.17(b)(2)(i) and 10 C.F.R. § 52.18, and applicable elements of Appendix E to 10 C.F.R. Part 50:

- Major Feature A, Assignment of Responsibility—Organization Control
- Major Feature B, Onsite Emergency Organizations
- Major Feature C, Emergency Response Support and Resources
- Major Feature D, Emergency Classification System
- Major Feature E, Notification Methods and Procedures
- Major Feature F, Emergency Communications
- Major Feature G, Public Education and Information
- Major Feature I, Accident Assessment
- Major Feature J, Protective Response
- Major Feature K, Radiological Exposure Control
- Major Feature L, Medical and Public Health Support

- Major Feature O, Radiological Emergency Response Training
- Major Feature P, Responsibility for the Planning Effort—Development, Periodic Review, and Distribution of Emergency Plans

Major Feature H, Emergency Facilities and Equipment, was not evaluated as part of the North Anna ESP application because it was deemed premature to address, with specificity, facility and equipment features, such as location, size, structure, function, habitability, communications, staffing and training, radiological monitoring, instrumentation, data system equipment, power supplies, technical data and data systems, and record availability and management (SSAR Section 13.3.2).

Security

10 C.F.R. § 100.21(f) requires that site characteristics must be such that adequate security plans and measures can be developed. As discussed in Section 13.6 of the SSAR, the characteristics of the ESP Site are such that implementation of the applicable requirements of 10 C.F.R. § 73.55 and RG 4.7, as well as the post-9/11 NRC Orders, can be met. The NAPS site is sufficiently large to provide adequate distances between structures and the probable location of a security boundary. For the existing units, Virginia Power has a security program in place in compliance with the NRC Order for Interim Compensatory Measures dated February 25, 2002 that addresses waterborne threats to the site without the need to restrict access to the lake. In the event that new units are added to the site, it is anticipated that those requirements would continue to be met.

Conclusion

Q17. What is your conclusion regarding Dominion's ESP application?

A17. (MLS, SDR) Dominion's ESP application contains sufficient information to support the NRC's required safety findings. The information in Dominion's ESP application demonstrating compliance with the NRC's siting criteria supports the finding that reactors

having characteristics within the parameters for the site can be constructed without undue risk to the public health and safety. The application also demonstrates that site characteristics are such that adequate security plans and measures may be developed, that there is no impediment to emergency planning, and therefore that issuance of the ESP would not be inimical to the common defense and security, or health and safety of the public. The ESP Site is therefore suitable for additional nuclear units of the general size and type bounded by the PPE.

Q18. What is your opinion regarding the NRC Staff review of Dominion's ESP application?

A18. (MLS, SDR) The NRC Staff's review was thorough and complete. The NRC Staff evaluated all sections of Dominion's application to determine conformance with the applicable NRC regulations and conformance with NRC review standards and Regulatory Guides. The Staff asked numerous questions during this review, and conducted many independent or confirmatory analyses. The Staff's Safety Evaluation Report ("SER") and SER Supplement 1 describe the NRC Staff's review comprehensively and explain the bases for the NRC Staff's conclusions with respect to all of the siting criteria. Accordingly, it is our opinion that the NRC Staff's review has been sufficient to support the NRC's required safety findings.

Q19. Does this conclude your testimony?

Q20. (MLS, SDR, WRL, RKM, JRD) Yes.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
DOMINION NUCLEAR NORTH ANNA, LLC	)	Docket No. 52-008
	)	
(Early Site Permit for North Anna ESP Site)	)	ASLBP No. 04-822-02-ESP

DECLARATION OF MARVIN L. SMITH IN SUPPORT OF DOMINION'S PRE-FILED TESTIMONY ON SAFETY MATTERS

I, Marvin L. Smith, do hereby state the following:

I am the Project Director for Dominion Resources, Inc., parent corporation of Dominion Nuclear North Anna, LLC ("Dominion"). My business address is 5000 Dominion Boulevard, Glen Allen, VA 23060. I am the director responsible for Dominion's application for an Early Site Permit, and performed work related to this project involving overall project management. A statement of my professional qualifications is attached.

I am providing this declaration in support of Dominion's pre-filed testimony on safety matters filed pursuant to the Atomic Safety and Licensing Board Order of March 20, 2007.

I attest to the accuracy of those statements attributed to me (that material marked by my initials in Dominion's pre-filed testimony), support them as my own, and endorse their introduction into the record of this proceeding. I declare under penalty of perjury that those statements, and my statements in this declaration, are true and correct to the best of my knowledge, information and belief.

Marvin L. Smith

Marvin L. Smith

Marvin L. Smith, P.E.

Project Director

Dominion

SUMMARY OF QUALIFICATIONS

Project Manager
Early Site Permitting — *2000 -2007*

SPECIFIC DUTIES/RESPONSIBILITIES: PROJECT MANAGER FOR EARLY SITE PERMITTING PROJECT. RESPONSIBLE FOR LICENSING THE NORTH ANNA SITE FOR POTENTIAL NEW NUCLEAR REACTOR DEPLOYMENT AND FOR FINANCIAL AND TECHNICAL EVALUATIONS OF NEW NUCLEAR TECHNOLOGIES.

- PROJECT DIRECTOR FOR COOPERATIVE AGREEMENT PROJECT BETWEEN DOMINION, BECHTEL AND DOE FOR AN EARLY SITE PERMIT LICENSING DEMONSTRATION PROJECT FOR DOMINION'S NORTH ANNA SITE.
- PROJECT MANAGER FOR COOPERATIVE AGREEMENT WITH DOE, TVA, ENTERGY, TLG AND BECHTEL TO EVALUATE OPERATIONS AND MAINTENACE STAFFING AND COST, CONSTRUCTION SCHEDULES AND DECOMISSIONING COSTS AND FUNDING REQUIREMENTS FOR NEW NUCLEAR TECHNOLOGIES.
- PROJECT MANAGER FOR COOPERATIVE AGREEMENT PROJECT BETWEEN DOMINION, BECHTEL AND DOE TO STUDY POTENTIAL SITES FOR THE DEPLOYMENT OF NEW NUCLEAR PLANTS IN THE UNITED STATES [STUDY PUBLISHED SEPTEMBER 27, 2002]
- DEVELOPED AND OBTAINED APPROVAL OF STRATEGIC PLAN FOR EARLY SITE PERMITTING PROJECT. THIS STRATEGIC PLAN INCLUDES DEVELOPOMENT OF A PROCESS TO SCREEN POTENTIAL SITES FOR NEW NUCLEAR PLANTS AGAINST INDUSTRY, NRC AND ENVIRONMENTAL CRITERIA; REVIEW OF ADVANCED NUCLEAR POWER PLANT TECHNOLOGIES; DEVELOP THE BUSINESS CASE FOR NEW NUCLEAR GENERATION; AND PREPARE EARLY SITE PERMIT AND COMBINED CONSTRUCTION AND OPERATING LICENSE APPLICATIONS TO NRC.
- PARTICIPATED IN NEI AND INDUSTRY GROUPS TO DEVELOP PLANS FOR IMPLEMENTING NEW NUCLEAR POWER PLANTS INCLUDING THE NEI EARLY SITE PERMIT WORKING GROUP.

Principal Engineer
Nuclear Analysis and Fuels — *1999 - 2000*

SPECIFIC DUTIES/RESPONSIBILITIES: PROVIDED SPENT NUCLEAR FUEL CONSULTING SERVICES TO THE DOE AND THE COMMERCIAL NUCLEAR INDUSTRY INCLUDING VIRGINIA POWER'S FOUR NUCLEAR PLANTS, TWO DRY INDEPENDENT SPENT FUEL STORAGE INSTALLATIONS (ISFSIS) AND TWO WET POOL FACILITIES. CONSULTED ON SNF FACILITY AND CASK SYSTEM DESIGN, LICENSING, AND OPERATIONAL ISSUES. MANAGED CORPORATE EXTERNAL RELATIONS ON SPENT NUCLEAR FUEL WITH INDUSTRY, DOE, EPRI, ASTM, IAEA AND STATE GOVERNMENT.

- DEVELOPED LONG TERM PROCUREMENT AND LICENSING STRATEGY FOR SPENT NUCLEAR FUEL STORAGE AND TRANSPORT SYSTEMS.
- MEMBER, SENIOR OVERSIGHT COMMITTEE FOR COMMONWEALTH EDISON'S DRESDEN ISFSI PROJECT.
- CONSULTANT ON YUCCA MOUNTAIN OPERATIONAL EXPERIENCE REVIEW THAT LED TO RECOMMENDATIONS FOR IMPROVED FUEL HANDLING, DRY TRANSFER, AND HVAC SYSTEMS.
- REVIEWED DESIGN AND LICENSING BASIS FOR FUEL HANDLING OPERATIONS FOR THE PEACH BOTTOM ATOMIC POWER PLANT ISFSI.

- PROVIDED ISFSI ADVISORY SERVICES TO SACRAMENTO MUNICIPAL POWER DISTRICT FOR RANCHO SECO NUCLEAR STATION.
- PERFORMED BASELINE STUDY FOR THE PRIVATELY OWNED OWL CREEK DRY SPENT FUEL STORAGE SYSTEM PLANNED FOR WYOMING BY NAC. RECOMMENDED USE OF THE DOE-DEVELOPED CENTRAL INTERIM SPENT FUEL STORAGE DESIGN TO REDUCE OVERALL DESIGN AND LICENSING COSTS BY $10 MILLION.
- CONSULTED ON THE DESIGN, CONSTRUCTION, AND LICENSING OF THE NORTH ANNA ISFSI THAT RECEIVED ITS OPERATING LICENSE AND BECAME OPERATIONAL IN JULY 1998.
- PUBLISHED STUDY ON ABOVE AND BELOW BOILING THERMAL LOADING STRATEGIES FOR DISPOSAL OF WASTE PACKAGES AT YUCCA MOUNTAIN REPOSITORY.

System Engineer *1990 - 1998*
Nuclear Analysis and Fuels

SPECIFIC DUTIES/RESPONSIBILITIES: OVERSAW DEVELOPMENT OF LONG-TERM PLANS AND OPTIONS FOR SNF STORAGE AND DISPOSAL, WITH EMPHASIS ON DESIGN AND LICENSING OF THE NORTH ANNA ISFSI AND CONTINUED OPERATION OF THE SURRY ISFSI. SERVED AS COMPANY REPRESENTATIVE IN DOE INTERFACES ON SNF DISPOSAL. KEY PARTICIPANT IN DOE, INDUSTRY, IAEA AND EPRI STUDIES INVOLVING SPENT FUEL STORAGE, TRANSPORT AND DISPOSAL SYSTEMS. ALSO DEVELOPED METHODS AND PERFORMED SAFETY EVALUATIONS OF POTENTIAL OFF-SITE DOSES FROM REACTOR ACCIDENTS. SUPPORTED PROJECT TO RERACK VIRGINIA POWER SNF POOLS TO INCREASE STORAGE CAPACITY.

- CONCEIVED CONCEPT OF MULTI-PURPOSE CANISTER (MPC) TO PROVIDE FOR STORAGE, TRANSPORT AND DISPOSAL OF SPENT FUEL. PERFORMED STUDIES TO SHOW THAT WASTE PACKAGES COULD BE DISPOSED IN DRIFT RATHER THAN BOREHOLES. OBTAINED ENDORSEMENT OF UTILITY USERS GROUP FOR CONCEPT AND FUNDING BY DOE FOR PROCUREMENT OF MPC DESIGNS.
- RECEIVED EPRI TECHNOLOGY TRANSFER AWARD FOR ADVANCING NEW TECHNOLOGY IN DRY SPENT FUEL STORAGE.
- PROVIDED CONSULTING SERVICES TO NAC ON DESIGN AND LICENSING OF THE NAC UNIVERSAL MULTI-PURPOSE CANISTER SYSTEM.

Project Manager *1984 - 1990*
Spent Fuel Storage

SPECIFIC DUTIES/RESPONSIBILITIES: MANAGED A 10-PERSON OFFICE AND $50 MILLION ISFSI DESIGN/CONSTRUCT BUDGET. PROJECT MANAGER FOR DEVELOPMENT OF DRY STORAGE AT SURRY POWER STATION, WHICH WAS THE FIRST DRY STORAGE SYSTEM LICENSED IN THE UNITED STATES, AND PROGRAM MANAGER FOR VIRGINIA POWER/EPRI/DOE COOPERATIVE AGREEMENT PROGRAM ON DRY STORAGE. MANAGED FACILITY LICENSING AS WELL AS LICENSING OF THE DRY STORAGE CASKS USED AT SURRY INCLUDING THE CASTOR V/21, NAC I-28, AND WESTINGHOUSE MC-10. THIS PROGRAM INCLUDED DRY CONTAINER STORAGE THERMAL TESTING BY THE DEPARTMENT OF ENERGY AT THE IDAHO NATIONAL ENGINEERING AND ENVIRONMENTAL LABORATORY (INEEL) WITH CONTAINERS AND USED FUEL PROVIDED BY VIRGINIA POWER. PLANNED AND COORDINATED 23 SHIPMENTS OF SPENT FUEL FROM SURRY TO INEEL.

- CHAIRMAN OF TECHNICAL MANAGEMENT COMMITTEE (INCLUDING REPRESENTATIVES FROM DOE, EPRI) FOR OVERSIGHT OF THE $33 MILLION COOPERATIVE DEMONSTRATION PROJECT TO LICENSE AT REACTOR DRY STORAGE. IN THIS DEMONSTRATION PROJECT, PARTICIPANTS USED AN INTEGRATED APPROACH TO COORDINATE RESEARCH AT INEEL FUNDED BY DOE AND EPRI WITH AN NRC LICENSED DEMONSTRATION PROJECT AT VIRGINIA POWER'S SURRY ISFSI.

- Received EPRI First Use Award for developing dry spent fuel storage, which saved over $90 million (NPV) compared with constuction and operation of a new spent fuel pool.
- Led analysis effort to develop SNF burnup credit for spent fuel storage and transport packages, including interaction with ORNL to use reactor critical data for benchmarking.
- Served as U.S. representative at meetings of International Atomic Energy Agency and for exchange programs with Korea.

Project Manager *1979 - 1983*
Nuclear Plant Capital Improvements

Specific Duties/Responsibilities: Project manager for 10-person office responsible for annual budget of $25 million for all capital improvement projects at the North Anna power station including the projects required to respond to new NRC requirements developed as a result of the TMI accident.

Engineer to Supervisor *1973 - 1978*
Nuclear Fuel Design and Safety Analysis

Specific Duties/Responsibilities: Responsible for development of reload core design and safety analysis methods. During this period, promoted from entry-level engineer to supervisor. Developed reload core physics and thermal hydraulic analysis methods and obtained NRC approval of these methods. Developed the first 18 month reload core design used by a US PWR reactor and implemented low leakage loading patterns at Virginia Power's reactors.

- Designed and licensed new reload core configuration that extended the reactor operating cycle from 12 to 18 months. This design, now adopted as an industry standard, reduces refueling and replacement power costs resulting in savings of over $20 per year for each nuclear unit.
- Implemented first-of-a- kind low neutron leakage core loading patterns at Virginia Power's reactors. This loading technique is now an industry standard and reduces uranium and enrichment requirements for each reload core.

EDUCATION

Virginia Tech *1967 - 1973*

BS IN PHYSICS (1972)

M.E. IN NUCLEAR ENGINEERING (1973)

SPECIAL TRAINING: COURSES/SEMINARS/WORKSHOPS INCLUDING FUEL UTILIZATION AND PERFORMANCE ANALYSIS COMPUTER CODE SYSTEM; REACTOR PHYSICS ANALYSIS; RETRAN-REACTOR SYSTEM SAFETY ANALYSIS CODE; BASIC PWR CORE PHYSICS AND THERMAL/HYDRAULIC ANALYSIS; NON-LOCA SAFETY ANALYSIS; PWR INFORMATION; NUCLEAR DESIGN CONTROL MANUAL TRAINING; CRITICALITY ANALYSIS USING SCALE SYSTEM; 10CRF50.59 TRAINING; CORRECTIVE ACTION PROGRAM TRAINING; SELF ASSESSMENT PROGRAM TRAINING; FOREIGN MATERIAL EXCLUSION TRAINING; PROJECT MANAGEMENT; DEALING WITH THE MEDIA.

PROFESSIONAL ACTIVITIES

REGISTERED PROFESSIONAL ENGINEER (VIRGINIA)

MEMBER OF AMERICAN NUCLEAR SOCIETY

US REPRESENTATIVE ON INTERNATIONAL ATOMIC ENERGY AGENCY COMMITTEE TO DEVELOP STANDARDS FOR OPERATION OF DRY SPENT FUEL STORAGE INSTALLATIONS

AWARDS RECEIVED

EPRI FIRST USE AWARD FOR DRY STORAGE OF SPENT FUEL IN METAL CASKS

EPRI TECHNOLOGY TRANSFER AWARD FOR DRY SPENT FUEL STORAGE

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
DOMINION NUCLEAR NORTH ANNA, LLC	)	Docket No. 52-008
	)	
(Early Site Permit for North Anna ESP Site)	)	ASLBP No. 04-822-02-ESP

DECLARATION OF STEPHEN D. ROUTH IN SUPPORT OF DOMINION'S PRE-FILED TESTIMONY ON SAFETY MATTERS

I, Stephen D. Routh, do hereby state the following:

I am a Project Manager for Bechtel Power Corporation. My business address is 5275 Westview Drive, Frederick, MD 21703. I am Bechtel's Project Manager for the application of Dominion Nuclear North Anna, LLC ("Dominion") for an Early Site Permit, and performed work related to this project. A statement of my professional qualifications is attached.

I am providing this declaration in support of Dominion's pre-filed testimony on safety matters filed pursuant to the Atomic Safety and Licensing Board Order of March 20, 2007.

I attest to the accuracy of those statements attributed to me (that material marked by my initials in Dominion's pre-filed testimony), support them as my own, and endorse their introduction into the record of this proceeding. I declare under penalty of perjury that those statements, and my statements in this declaration, are true and correct to the best of my knowledge, information and belief.

Stephen D. Routh

Stephen D. Routh

Resume of
Stephen D. Routh

SUMMARY

Over 25 years of experience in nuclear engineering, licensing, and safety analysis. Has supported and managed numerous engineering and licensing efforts throughout his career including original plant licensing reviews and the current industry efforts in new nuclear generation.

EDUCATION

M.B.A., Mount St. Mary's College, 1999
MEng, Nuclear Engineering, Pennsylvania State University, 1982
B.S., Nuclear Engineering, Pennsylvania State University, 1980

PROFESSIONAL DATA

Registered Professional Engineer, Virginia
Six Sigma Champion
Member, Penn State Nuclear Engineering Society Board of Directors
Member, NEI ESP Task Force, COL Task Force, and Seismic Issues Task Force
Member, American Nuclear Society

PROFESSIONAL EXPERIENCE

2001-Present. *Project Manager, Bechtel Power Corporation, Frederick, Maryland.* Project Manager for the ESP/COL Technology Group, North Anna ESP Project, and North Anna COL Project. Also serves as Manager of Regulatory Affairs.

1999-2001. *Manager of Regulatory Affairs, Bechtel Power Corporation, Frederick, Maryland.* Responsible for licensing and regulatory oversight of Bechtel's nuclear power projects (new nuclear generation, steam generator replacement, nuclear operating plant services) and SERCH, Bechtel's generic licensing service.

1995-1999. *Licensing and Safety Analysis Supervisor, U. S. Enrichment Corporation, Bethesda, Maryland.* Responsible for the preparation of upgraded Safety Analysis Reports for the Paducah and Portsmouth Gaseous Diffusion Plants. Managed all activities for the project team including subcontractor support, detailed cost and schedule control, technical review of revised analyses, responding to NRC questions, and interface with NRC and DOE personnel. Established regulatory processes for NRC oversight.

1991-1995. *Project Engineer, Bechtel Power Corporation, Gaithersburg, Maryland.* Project Engineer for the North Anna 1, North Anna 2, and Ginna steam generator replacement projects. Responsible for managing nuclear licensing, mechanical, materials, and civil engineering activities for developing studies, evaluating alternative approaches, conceptual and detailed engineering, constructability reviews, subcontractor control, and client interface.

1987-1991. *Assistant Chief Nuclear Engineer, Bechtel Power Corporation, Gaithersburg, Maryland.* Responsible for providing nuclear licensing support to operating plant services projects in the areas of design change packages operability and safety evaluations, JCOs, Part 21s, and NRC interaction. Assisted in the administration of the nuclear department and salary planning.

1983-1987. *Nuclear/Licensing Supervisor, Bechtel Power Corporation, Gaithersburg, Maryland.* Responsible for the preparation of the SAR, Environmental Report, and license documents for the Surry plant dry cask Independent Spent Fuel Storage Installation, the first ISFSI to be licensed in the U.S. Supported several other operating plant services and SGR projects.

1982-1983. *Graduate Research and Teaching Assistant, Pennsylvania State University.*

1980-1982. *Licensing Engineer/Deputy Supervisor, Bechtel Power Corporation, Gaithersburg, Maryland.* For the Grand Gulf project, supported the licensing effort for the operating license, including final safety analysis report and environmental report preparation, technical specifications, NRC question responses, public hearings, and NRC safety evaluation report open item responses.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
DOMINION NUCLEAR NORTH ANNA, LLC	)	Docket No. 52-008
	)	
(Early Site Permit for North Anna ESP Site)	)	ASLBP No. 04-822-02-ESP

DECLARATION OF WILLIAM R. LETTIS IN SUPPORT OF DOMINION'S PRE-FILED TESTIMONY ON SAFETY MATTERS

I, William R. Lettis, do hereby state the following:

I am a consulting geologist for William Lettis & Associates, Inc. ("WLA"). My business address is 1777 Botelho Drive, Suite 262, Walnut Creek, CA 94596. I am the Project Manager for WLA's investigation of seismic geology for the application of Dominion Nuclear North Anna, LLC ("Dominion") for an Early Site Permit. A statement of my professional qualifications is attached.

I am providing this declaration in support of Dominion's pre-filed testimony on safety matters filed pursuant to the Atomic Safety and Licensing Board Order of March 20, 2007.

I attest to the accuracy of those statements attributed to me (that material marked by my initials in Dominion's pre-filed testimony), support them as my own, and endorse their introduction into the record of this proceeding. I declare under penalty of perjury that those statements, and my statements in this declaration, are true and correct to the best of my knowledge, information and belief.

William R. Lettis

WLA

WILLIAM R. LETTIS, Ph.D., C.E.G.

President, Principal Geologist

Seismic Hazard Assessment
Neotectonics
Engineering Geology

EDUCATION

University of California, Berkeley, CA: *Ph.D., Geology, 1982*
University of California, Berkeley, CA: *M.S., Geology, 1979*
Humboldt State University, Arcata, CA: *B.S., Forestry, 1977; B.S., Geology, 1977*

REGISTRATION

Certified Engineering Geologist, California, No. 1296, 1986
Professional Geologist, California, No. 4079, 1986

PROFESSIONAL HISTORY

William Lettis & Associates, Inc., Walnut Creek, CA, Senior Principal Geologist, 1990-date
Geomatrix Consultants, Inc., San Francisco, CA, Senior Geologist, 1985-1990
Bechtel Civil and Minerals, Inc., San Francisco, CA, Geologist, 1982-1985
U.S. Geological Survey, Menlo Park, CA, Geologist, 1979-1982

AFFILIATIONS AND AWARDS

American Association for the Advancement of Science
American Geophysical Union
Association of Engineering Geologists
Geological Society of America
Earthquake Engineering Research Institute
Seismological Society of America
Humboldt State University, 1998 Alumni of the Year Award
Geological Society of America, Penrose Grant, 1979
University of California Regents Fellowship, 1977-1978

REPRESENTATIVE EXPERIENCE

Dr. Lettis has over 20 years experience performing regional and site investigations to assess geologic and seismic hazards for large engineered facilities, including bridges, dams, nuclear and fossil fuel plants, pipelines, and LNG terminals. These investigations typically involve detailed site characterization to assess deterministic and probabilistic ground motions, liquefaction potential, surface fault rupture, and static and dynamic slope stability. With over 100 publications, Dr. Lettis is a recognized authority on the assessment of seismic hazards, both in California and throughout the world. He currently is serving on the California Earthquake Prediction Evaluation Council (CEPEC), an advisory committee to the Governor and Office of Emergency Services (OES) and was an invited speaker at the DSOD-sponsored seminar on earthquake engineering for the Association of State Dam Safety Officials on methods for assessing fault activity.

REPRESENTATIVE PROJECTS

Geologic and Seismic Studies for Early Site Permit Application – Vogtle Electric Generating Plant, Georgia

Dr. Lettis currently is Project Manager for geologic and seismic studies in support of an Early Site Permit for the siting of a new nuclear reactor at the existing Vogtle Electric Generating Plant in Georgia. Studies of the Coastal Plain site include a comprehensive update of existing geologic, seismic, and geophysical data bases

for the site region, detailed geologic mapping, and characterization of earthquake sources to update the Electric Power Research Institute (EPRI) seismic source model. Geologic and geomorphic mapping include analysis of aerial photography, field reconnaissance, and aerial reconnaissance in order to identify the presence of any potential capable tectonic sources or seismogenic sources that were not identified in the EPRI studies. Updating of the seismic source model for the PSHA included the development of a new model for the Charleston earthquake source, which is the most significant earthquake source in the region.

Early Site Permit, North Anna, Virginia

Dr. Lettis currently is Project Manager for characterization of seismic sources for the Dominion North Anna Early Site Permit. The source model developed for North Anna involved a thorough evaluation and update of the Electric Power Research Institute (EPRI) seismic source model developed in the late 1980's. Dr. Lettis prepared sections 2.5.1, 2.5.2, and 2.5.3 of the SSAR related to the source model, including updated source parameters for the Charleston and Central Virginia source zones, and newly identified potential fault sources that extend the entire length of the Appalachian front and Coastal Plain. Dr. Lettis documented and defended the new seismic source model with NRC staff.

Early Site Permit, Grand Gulf, Mississippi

Dr. Lettis currently is Project Manager for the Entergy Grand Gulf Early Site Permit. His responsibilities included completing all sections of 2.5.1 through 2.5.6 of the SSAR, including seismic source characterization and probabilistic seismic hazard analysis to develop the SSE design ground motion in compliance with Regulatory Guide 1.165, and geotechnical characterization of the site in partial compliance with Regulatory Guides 1.31 and 1.32. The seismic source model involved a comprehensive review and update of the Electric Power Research Institute (EPRI) source model developed in the late 1980's, including updated source parameters for the New Madrid source zone and the newly recognized Saline River source zone in the southern Untied States. Dr. Lettis documented and defended the new source model with NRC staff.

Diablo Canyon NPP, Long-Term Seismic Program

Dr. Lettis was Project Manager for a comprehensive 7-year investigation of seismic sources in central coastal California as part of the Pacific Gas and Electric Company's Long-Term Seismic Program for the Diablo Canyon NPP. The seismic source model was developed to provide an updated ground motion evaluation at the site, including both deterministic and probabilistic seismic hazard analyses. Over 20 capable and potentially capable faults were identified and characterized over a 3-year period through a comprehensive program of detailed mapping, paleoseismic trenching, and onshore and offshore geophysics. Each seismic source was characterized through the use of logic trees for input to the hazard analysis, including the Hosgri, San Simeon and Los Osos faults. Dr. Lettis documented and defended results of the seismic source characterization to NRC staff through numerous meetings and written responses over a subsequent 4-year period. Dr. Lettis is continuing to provide assistance to PG&E on the NRC-mandated Diablo Canyon Long-Term Seismic Program.

Shivta-Rogem Nuclear Power Plant, Israel

Dr. Lettis currently is Project Manager for the Shivta-Rogem Nuclear Power Plant Project in the northern Negev Desert, Israel. He is directing a team of WLA and Israeli geologists, seismologists, and geophysicists to assess seismic hazards, perform probabilistic and deterministic ground motion analyses, and prepare a Preliminary Safety Analysis Report for submittal to the Israeli Atomic Energy Commission. Dr. Lettis documented and defended the PSAR source characterization and ground motion results to the IAEC Licensing Division staff.

U.S. Bureau of Reclamation and Army Corps of Engineers, western U.S.

Dr. Lettis has conducted numerous seismic hazard evaluations for dams and water conveyance systems throughout the western United States. He was Project Manager for seismotectonic evaluations of 48 U.S. Bureau of Reclamation dams in the western United States and for two Army Corps of Engineer dams in the Sierra Nevada of California. These projects involved the geologic and seismologic characterization of known and potential earthquake sources in specific geologic provinces of the western United States, deterministic and probabilistic assessment of ground motions and assessment of liquefaction potential of alluvial foundation materials at specific dam sites.

Seismic Hazard Characterization, Conceptual Engineering for Calaveras Dam, Alameda County, CA

Dr. Lettis provided Senior Technical Peer Review for the SFPUC Calaveras Dam project. He reviewed and provided technical advise on the Calaveras Fault for evaluation of design ground motions and for potential surface fault rupture on secondary fault strands through the existing dam and potential footprints for a new dam. Dr. Lettis provided guidance for the detailed bedrock and Quaternary geologic mapping and paleoseismic trench program, in compliance with DSOD guidelines and criteria for identifying and characterizing active, conditionally active, and inactive faults.

Vulnerability Study Marin Municipal Water Agency, Marin County, California

Dr. Lettis was Project Manager for a seismic and geologic vulnerability assessment of the Marin Municipal Water District's backbone water supply system. Hazards assessed include liquefaction, earthquake-induced slope failure, surface fault rupture, and strong ground motions from three scenario earthquakes. The hazard information was used to identify, prioritize and mitigate hazard vulnerability to the MMWD system for their seismic improvement program.

EBMUD, Seneca Reservoir

As Project Manager, Dr. Lettis completed an investigation of East Bay Municipal Utility District's Seneca Reservoir to evaluate leakage along the reservoir's margins. Suspected causes included aseismic creep along secondary structures associated with the Hayward fault, complex bedrock fractures, and regions of slope instability along the western margin of the reservoir. The project included geologic mapping, placement of geotechnical boreholes and monitoring wells, and excavation of test pits in the liner system of the reservoir. Dr. Lettis worked closely with members of EBMUD and with DSOD staff during all stages of the investigation to assure compliance with existing regulations and to facilitate regulatory review.

EBMUD South Reservoir

As Project Manager, Dr. Lettis directed an investigation of potential for surface fault rupture through South Reservoir along the West Chabot fault. Based on detailed mapping, trenching, and evaluation of borehole data, the "Carlos B" strand of the West Chabot fault was determined to underlie the reservoir but was shown to be inactive in compliance with DSOD criteria. Based on review, DSOD concurred with the conclusion of fault inactivity.

New Carquinez Bridge, California (2000)

Technical Advisory Board for development of seismic design criteria for large span bridge in the San Francisco Bay Area. Reviewed seismic source characterization, ground motion analysis, selection of time histories, and geotechnical evaluation of bridge pier and abutment foundation.

Caltrans District V Historic Concrete and Steel Arch Bridges Seismic Retrofit, Highway 1, California (1995-1999)

Technical Advisor for geologic and geotechnical site characterization and foundation retrofit studies for eight historic, large-span concrete and steel arch bridges on California Highway 1, including the Bixby Creek,

Rocky Creek, Big Creek, and Cold Springs Canyon arches. The scope of work included site subsurface characterization, laboratory testing, development of seismic design/analyses criteria, foundation evaluation (spread footings, pier, and pile foundations), liquefaction and slope stability analyses, rock mass stability and response analysis, and development of retrofit foundation design. Retrofit design consisted of construction of CIDH pile-supported abutment blocks, and installation of high capacity rock anchors for overturning/uplift resistance (up to 1200 kip capacity).

Oromieh Bridge Earthquake Response Technical Review, Iran

Performed 3rd party review of probabilistic seismic hazard analysis and design spectra for a proposed new viaduct and bridge across Lake Oromieh in northern Iran that will be supported by driven or large diameter CIDH piles in layered soft to stiff lake sediments. Reviewed seismic reflection data for evaluation of potential for surface fault rupture. Prepared evaluation of regional and local seismic sources for input to revised PSHA source model.

New Tacoma Narrows Suspension Bridge technical review and advisory committee, Washington

Performed 3rd party review of probabilistic seismic hazard analysis and for proposed new large span suspension bridge. Review included evaluation of seismic source model, attenuation model, and identification of controlling earthquakes for design, with emphasis on the Cascadia subduction zone and Seattle fault system.

Chacau Bridge, Chile

Provided 3rd party peer review of seismic design and geotechnical characterization of proposed new large span suspension bridge. Reviewed seismic source model, attenuation relationships and time histories. Proposed bridge is within area of significant subduction zone tectonic subsidence from 1960 Chilean earthquake. Potential for secondary fault rupture and future tectonic subsidence was evaluated.

Pacific Gas and Electric Company Seismic Hazard Evaluations, San Francisco, CA

Dr. Lettis has conducted seismic hazard evaluations for numerous Pacific Gas and Electric Company (PG&E) facilities throughout California. He investigated the earthquake vulnerability of PG&E's entire gas supply and distribution system, including pipelines, compressor stations, terminals, and pressure-limiting stations. The project involved preparing liquefaction and slope stability hazard maps covering all of northern and central California, site assessments of above ground facilities, and assessments of fault activity at pipeline crossings, including 4 pipeline crossings of the Hayward fault. Dr. Lettis also was Project Manager for a comprehensive fault evaluation for PG&E's Lake Almanor and Butt Valley Dams in the Northern Sierra Nevada. The study involved detailed fault mapping and trenching to assess fault location, recency of activity, MCE and displacement per event. Dr. Lettis also managed a comprehensive, seven-year investigation of Quaternary faulting in central coastal California as part of PG&E's Long-Term Seismic Program for the Diablo Canyon Power Plant. For this study, Dr. Lettis directed a program of mapping, drilling, trenching and age dating to evaluate the capability and behavior of over 20 potentially capable faults including the San Simeon, Hosgri, and Los Osos faults.

Research Investigations

Dr. Lettis has been the Principal Investigator on 28 research projects sponsored by the U.S. Geological Survey, National Science Foundation and U.S. Nuclear Regulatory Commission to assess earthquake hazards in the United States. These studies have included paleoseismic investigations of the San Andreas, Calaveras, San Gregorio, Hayward, Green Valley, and Shannon-Monte Vista faults in the San Francisco Bay region, geomorphic analyses of the 1989 Loma Prieta, 1987 Whittier Narrows, 1992 Landers, and 1994 Northridge earthquakes, and liquefaction mapping of the Napa, San Francisco, and Stockton 1:100,000 scale quadrangles. For the U.S. Nuclear Regulatory Commission, Dr. Lettis performed an investigation of the late Quaternary history and seismotectonic setting of the Meers fault, Oklahoma, and prepared NUREG reports on

Methods for Dating the Age of Active Faults and Methods for Differentiating between Tectonic and Non-tectonic Faults. Dr. Lettis recently conducted post-earthquake investigations of the 1999 Kocaeli and Duzce earthquakes in Turkey, the 1999 Chi Chi earthquake in Taiwan, and was the U.S. Team Leader for the 2002 Buhj earthquake in India, all sponsored by the NSF and Earthquake Engineering Research Institute.

Technical Peer Review

Dr. Lettis provides technical advice and peer review for geological seismic hazard investigations throughout the United States and abroad. For PG&E, he has reviewed several seismic and geotechnical investigations to assess hazards to their hydroelectric facilities in the northern and central Sierra Nevada, many of which were performed in compliance with DSOD requests. He has provided technical review for geologic and seismic hazard assessments of the Los Alamos National Laboratory and Sandia National Laboratory in the Rio Grande Rift, New Mexico, for nuclear facilities in Korea, LNG terminals in Trinidad and Tobago, Peru, and Mare Island in the San Francisco Bay Area, and for various USBR and ACOE dams in California and Colorado.

Expert Witness

Dr. Lettis provides expert witness services related to the identification and characterization of geologic hazards. He provided expert testimony on the cause, timing, and failure mechanism of a large debris flow for the Yuba County Water Agency, and on the geologic setting of the San Joaquin Valley for the Westlands Water District.

Committees and Expert Panels

Member, California Earthquake Prediction Evaluation Council (CEPEC), scientific advisory board to the Governor and Office of Emergency Services (OES), 2003 to 2007

Member, California Geological Survey Geologic Mapping Advisory Committee, 2000 to present

Co-Chairman, American Nuclear Society (ANS) Working Group Committee 2.27 to develop evaluation criteria for assessing seismic hazards for nuclear materials facility, 1996 to present

Member, Ethics Committee of the Earthquake Engineering Research Institute

Member, Board of Directors, Cooperating Organizations of Northern California for Earthquake Research and Technology (CONCERT) 1993 to 1996

Member, Expert panel to assess earthquake hazards in the southeastern United States, Lawrence Livermore National Laboratory/Department of Energy, 1990 to 1996

Member, California Division of Mines and Geology Advisory Committee on Liquefaction Hazards, 1991 to present

Member, California Seismic Safety Commission, Geology/Seismology Subcommittee, 1988 to 1990

Member, NASA Science Committee, 1985

Lectures

Dr. Lettis was an invited lecturer on Evaluation and Mitigation of Seismic Hazards, sponsored by California Division of Mines and Geology, Southern California Earthquake Center, and University of California, Berkeley. He has been an invited lecturer on Quaternary Geology, regional tectonics, and remote sensing at Stanford University, 1982; University of California, Berkeley, 1982, 1984, 1985, and 1986; the Women Geoscientists of America, San Francisco Conference, 1985, and numerous professional meetings. He was invited Symposium Moderator, Earthquake Risk and Hazard Mitigation Symposium, Association of Geologists 38th Annual Meeting, 1995.

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Books

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Papers

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Baldwin, J.N., Unruh, J.R., and **Lettis, W.R.**, 1998, Neotectonic investigation of the northward extension of the Green Valley Fault, Napa County, California: Final Technical Report, U.S. Geological Survey, Award 1434-HQ-96-GR-02738, 27 p. + 2 plates. Cluff, L.S., **Lettis, W.R.**, and Slemmons, D.B., 1994, Introduction: in Alterman, I.B., McMullen, R.B., Cluff, L.S., and Slemmons, D.B., eds., Seismotectonics of the Central California Coast Ranges, Geological Society of America Special Paper 292, pp. 1-8.

Bardet, J.P., Seed, R.B., **Lettis, W.R.**, and others, R., 2000, Ground Failure and Geotechnical Effects – Soil Liquefaction, Landslides, and Subsidences: Earthquake Spectra, 1999 Kocaeli, Turkey, Earthquake Reconnaissance Report, Supplement A to Vol. 16, pp. 141-162.

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Bullard, T.F., and **Lettis, W.R.**, 1993, Quaternary fold deformation associated with blind thrust faulting, Los Angeles Basin, California: Journal of Geophysical Research, v. 98, pp. 8,349-8,369.

Hall, N.T., Angell, M., De Wit, M.W., and **Lettis, W.R.**, 1994, Late Quaternary deformation of the southern Santa Cruz Mountains, California, *in* Alterman, I. B., McMullen, R.B., Cluff, L.S., and Slemmons, D.B., eds., Seismotectonics of the Central California Coast Ranges, Geological Society of America Special Paper p. 292.

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
DOMINION NUCLEAR NORTH ANNA, LLC	)	Docket No. 52-008
	)	
(Early Site Permit for North Anna ESP Site)	)	ASLBP No. 04-822-02-ESP

DECLARATION OF ROBIN K. MCGUIRE IN SUPPORT OF DOMINION'S PRE-FILED TESTIMONY ON SAFETY MATTERS

I, Robin K. McGuire, do hereby state the following:

I am President of Risk Engineering, Inc. My business address is 4155 Darley Avenue, Suite A, Boulder, Colorado. I provided calculations and conclusions in support of the application of Dominion Nuclear North Anna LLC ("Dominion") for an Early Site Permit and performed work related to this project on seismic licensing issues. A statement of my professional qualifications is attached.

I am providing this declaration in support of Dominion's pre-filed testimony on safety matters filed pursuant to the Atomic Safety and Licensing Board Order of March 20, 2007.

I attest to the accuracy of those statements attributed to me (that material marked by my initials in Dominion's pre-filed testimony), support them as my own, and endorse their introduction into the record of this proceeding. I declare under penalty of perjury that those statements, and my statements in this declaration, are true and correct to the best of my knowledge, information and belief.

Robin K. McGuire

Curriculum Vitae

RISK ENGINEERING, INC.

ROBIN K. MCGUIRE

EDUCATION:

Ph.D Degree - Structural Engineering, Massachusetts Institute of Technology
M.S. Degree - Structural Engineering University of California, Berkeley
S.B. - Civil Engineering, Massachusetts Institute of Technology

QUALIFICATIONS:

Seismic hazard and risk analyses
Numerical methods and analyses
Statistical analyses

PRESENT POSITION:

President and Principal, Risk Engineering, Inc., Boulder, Colorado

RELEVANT EXPERIENCE

- Technical Director of seismic hazard projects for North Anna, Vogtle, Summer, Lee, Bellefonte, South Texas, Comanche, and Calvert Cliffs nuclear plant sites, to support ESP and COL applications for new generation nuclear facilities at those sites. Geologic and tectonic information developed by other consultants is integrated into the calculations. Work is performed under Quality Assurance procedures. 2002-present.
- Technical Director of project for the Electric Power Research Institute to examine seismic design levels at 28 nuclear plant sites in the eastern US, apply the ASCE 43-05 performance-based procedure. Results were compared to existing seismic design levels and to results from publishes seismic plant PRAs. 2004-2005.
- Technical Director of project for the US Nuclear Regulatory Commission to revise seismic ground motion design requirements, to achieve levels of seismic safety consistent with risk-based performance goals (balancing seismic risks with those from external and internal accidents). 1996-2001.
- Lead consultant on probabilistic performance assessment of the Yucca Mountain site as possible high-level waste repository, for the Electric Power Research Institute. This effort coordinated input from ten consultants on environmental and engineering factors that affect evaluation of the potential repository performance regarding radionuclide release and recommended site studies to balance uncertainties and risks. 1989-2001.
- Technical Director of project funded by the US Dept. of Energy to develop seismic design requirements for a Yucca Mountain nuclear waste repository. The recommendations must consider the seismic response of structures and components, safety factors in design, and probabilistic seismic hazards to achieve target seismic risk-based performance levels that are consistent with other risks to the repository. The report from this project was taken as Seismic Topical Report III. 1994-1996.
- Consultant to Senior Seismic Hazard Analysis Committee on developing and documenting methods of probabilistic seismic hazard calculations. Wrote Appendix I of SSHAC report. March 1993-September 1996.
- Technical Director of major project for Electric Power Research Institute to develop and apply methods of evaluating earthquake hazards in the central and eastern U.S. This work involved directing efforts of 50 earth scientists in characterizing the earthquake potential of the region, and in using this information to characterize the earthquake hazard. Results calculated for 57 nuclear plants in the CEUS. Oct 1984-Dec 1989.
- Consultant to numerous clients overseas on earthquake risk to major facilities, including applications to Switzerland, Japan, Korea, Italy, Taiwan, China, Norway, Germany and South Africa. March 1986-present.

EMPLOYMENT HISTORY:

Risk Engineering, Inc., 1984 – Present
Dames & Moore, 1979 – 1981 and 1983-1984
Earth Technology Corp, 1981-1983
U.S. Geological Survey, 1974-1979

PROFESSIONAL AFFILIATIONS AND AWARDS:

Member, National Academy of Engineering (elected 2007)

President, Seismological Society of America, 1991-1992, and Board of Directors, 1989-1995

Board of Directors, Earthquake Engineering Research Institute, 1989-1993, and Chair, Seismic Risk Committee, 1984-1990. Member since 1975.

Chair, Panel on Risk Assessment Techniques, Commission on Earthquake Hazards for the International Association of Seismology and Physics of the Earth's Interior, 1983-1995.

Member, Committee on Seismology, National Research Council (National Academy of Sciences), 1984-1987.

Fellow, American Society of Civil Engineers and Member, Technical Council on Lifeline Earthquake Engineering, 1982-present. Member since 1968.

Member, Society for Risk Analysis. Member since 1981.

Member, Chi Epsilon (National Civil Engineering Honorary Fraternity), Tau Beta Pi (National Engineering Honorary Fraternity), Sigma Xi (National Scientific Society).

Registered Professional Engineer, Colorado (#13654), Massachusetts (#27930)

REPRESENTITIVE PUBLICATIONS:

McGuire, R.K., *Seismic Hazard and Risk Analysis,* Monograph MNO-10, Earthq. Eng. Res. Inst., Oakland, CA, 2004.

McGuire, R.K. et al, "Technical Basis for Revision or Regulatory Guidance on Design Ground Motions: Development of Hazard and Risk-consistent Seismic Spectra for Two Sites," US Nuclear Regulatory Commission, NUREG/CR-6769, Apr. 2002.

McGuire, R.K. et al, "Technical Basis for Revision or Regulatory Guidance on Design Ground Motions: Hazard- and Risk-consistent Ground Motion Spectra Guidelines," US Nuclear Regulatory Commission, NUREG/CR-6728, Oct. 2001.

McGuire, R.K., "Probabilistic Seismic Hazard Analysis and Design Earthquakes: Closing the Loop," *Bull. Seis. Soc. Am.,* Oct. 1995.

McGuire, R.K., ed., *The Practice of Earthquake Hazard Assessment*, International Association of Seismology and Physics of the Earth's Interior and European Seismological Commission, Dec. 1993.

McGuire, R.K., "Perceptions of Earthquake Risk," Presidential Address, *Bull. Seis. Soc. Am.*, 82, 4, 1977-1982, Aug. 1992.

(A full list of publications numbering more than one hundred is available upon request.)

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
DOMINION NUCLEAR NORTH ANNA, LLC	)	Docket No. 52-008
	)	
(Early Site Permit for North Anna ESP Site)	)	ASLBP No. 04-822-02-ESP

DECLARATION OF JOHN R. DAVIE IN SUPPORT OF DOMINION'S PRE-FILED TESTIMONY ON SAFETY MATTERS

I, John R. Davie, do hereby state the following:

I am a Senior Principal Geotechnical Engineer for Bechtel Power Corporation. My business address is 5275 Westview Drive, Frederick, MD 21703. I am the Geotechnical Engineering Specialist responsible for geotechnical engineering in support of the application of Dominion Nuclear North Anna, LLC ("Dominion") for an Early Site Permit, and performed work related to this project on licensing matters. A statement of my professional qualifications is attached.

I am providing this declaration in support of Dominion's pre-filed testimony on safety matters filed pursuant to the Atomic Safety and Licensing Board Order of March 20, 2007.

I attest to the accuracy of those statements attributed to me (that material marked by my initials in Dominion's pre-filed testimony), support them as my own, and endorse their introduction into the record of this proceeding. I declare under penalty of perjury that those statements, and my statements in this declaration, are true and correct to the best of my knowledge, information and belief.

John R. Davie

John R. Davie

JOHN R. DAVIE
Senior Principal Engineer
Geotechnical Specialist

WORK HISTORY

SENIOR PRINCIPAL ENGINEER - Bechtel (28 Years)

Dr. Davie is currently a senior principal engineer and group supervisor with the Geotechnical Group in Bechtel's Frederick office, engaged in geotechnical investigations and foundation engineering for power plant facilities and other Bechtel projects, including major industrial, petroleum, and transportation work, both in the United States and overseas.

Dr. Davie's assignments for Bechtel have included onshore and offshore field and laboratory investigations; bearing capacity and settlement analyses; design and testing of pile and pier foundations; design of retaining structures, including reinforced soil walls; stability analyses; evaluation of liquefaction potential; and road and railroad foundation design. He has supervised several ground improvement projects, including installation of mini-piles and stone columns, chemical grouting, large-scale underpinning, and accelerated consolidation of soft clay using wick drains.

In 1988, Dr. Davie completed a 6-month engineering and construction assignment on the Ankara-Gerede Motorway in Turkey. From 1989 to 1999, he was an advisor to the Bechtel/Parsons Brinckerhoff geotechnical team on the Boston Central Artery/Third Harbor Tunnel Project.

GEOTECHNICAL CONSULTANT - McClelland Engineers, Inc. (5 Years)

Before joining Bechtel, Dr. Davie was a member of the staff of McClelland Engineers, Inc., geotechnical consultants in Houston, Texas. His field experience included offshore pile driving inspection and supervision of drilling operations in the Gulf of Mexico and the Persian Gulf. Dr. Davie was also involved in foundation design studies for offshore structures in various parts of the world. Onshore foundation design projects included refineries, natural gas liquefaction facilities, chemical plants and other industrial and commercial projects, and high-rise office buildings in downtown Houston.

LECTURER - University of Glasgow (4 Years)

Earlier, Dr. Davie was a member of the teaching staff at the University of Glasgow with primary teaching interests in traffic engineering and soil mechanics. His research projects included investigation of the behavior of cohesive soils under vertical uplift forces.

EDUCATION

PhD, Soil Mechanics, University of Glasgow, Scotland (1974)
ME, Civil Engineering, Cornell University (1969)
BS, Civil Engineering, University of Glasgow, Scotland (1968)

REGISTRATION/CERTIFICATION

Professional Engineer in Maryland, Oregon, Ohio and Wisconsin
Chartered Engineer, United Kingdom
NCEES Council Record Holder

PROFESSIONAL MEMBERSHIPS

Member, Institution of Civil Engineers (ICE)
Member, American Society of Civil Engineers (ASCE)
Secretary, Shallow Foundations Committee, ASCE
Member, American Society for Testing and Materials (ASTM)
Member, International Society for Soil Mechanics and Geotechnical Engineering
Member, European Federation of National Engineering Associations (FEANI)

PUBLICATIONS

Dr. Davie has written numerous project-specific geotechnical reports. In addition, he has authored or co-authored over 40 technical papers that have been published in professional journals and in national and international conference proceedings. He recently co-edited an ASCE Geotechnical Publication on the effects of construction on existing structures.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
DOMINION NUCLEAR NORTH ANNA, LLC	)	Docket No. 52-008
	)	
(Early Site Permit for North Anna ESP Site)	)	ASLBP No. 04-822-02-ESP

CERTIFICATE OF SERVICE

I hereby certify that copies of (1) "Dominion's Pre-hearing Statement," dated April 10, 2007; (2) Dominion's Pre-Filed Testimony of Marvin L. Smith, Stephen D. Routh, Dr. William R. Lettis, Dr. Robin K. McGuire, and Dr. John R. Davie on Safety Matters (including attached Statements of Qualifications and Declarations of each witness); (3) Dominion's Pre-Filed Testimony of Marvin L. Smith, Karen K. Patterson, and Jon A. Cudworth on Environmental Matters (including attached Statements of Qualifications and Declarations of each witness); (4) Dominion's Witness List on Topics in Section II.D of March 20, 2007 Order; (5) Dominion's Response to Questions in the Licensing Board's March 20, 2007 Order," dated April 10, 2007; (6) a CD containing the North Anna Early Site Permit Application, Rev. 9 (Sept. 2006); and (7) accompanying cover letter were served on the persons listed below by deposit in the U.S. mail, first class, postage prepaid, or with respect to Judge Elleman by overnight mail, this 10th day of April, 2007. In addition, where indicated by an asterisk, copies of these documents, other than the CD, were served by electronic mail, this same date.

*Administrative Judge
Alex S. Karlin, Chair
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Washington, D.C. 20555-0001
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*Administrative Judge
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*Secretary
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April 10, 2007

Administrative Judge
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Washington, D.C. 20555-0001

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Administrative Judge
Dr. Thomas S. Elleman
5207 Creedmoor Road
Raleigh, NC 27612

In the Matter of
Dominion Nuclear North Anna, LLC
(Early Site Permit for North Anna ESP Site)
Docket No. 52-008; ASLBP No. 04-822-02-ESP

Gentlemen:

Attached, please find the following documents filed by Dominion Nuclear North Anna LLC today, as required by your March 20, 2007 Order in this proceeding:

Dominion's Pre-Hearing Statement;

Dominion's Pre-Filed Testimony of Marvin L. Smith, Stephen D. Routh, Dr. William R. Lettis, Dr. Robin K. McGuire, and Dr. John R. Davie on Safety Matters (including attached Statements of Qualifications and Declarations of each witness);

Dominion's Pre-Filed Testimony of Marvin L. Smith, Karen K. Patterson, and Jon A. Cudworth on Environmental Matters (including attached Statements of Qualifications and Declarations of each witness);

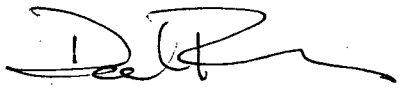
Dominion's Witness List on Topics in Section II.D of March 20, 2007 Order; and

Dominion's Response to Questions in the Licensing Board's March 20, 2007 Order.

In addition, Dominion is pre-filing the North Anna Early Site Permit Application, Revision 9 (September 2006) as an exhibit upon which Dominion intends to rely in support of its prefiled testimony and positions. For the convenience of the Board and parties, a CD containing this document is attached, and four paper copies are being delivered separately to the Board.

Finally, in accordance with paragraph III.A.5 of the Order, an electronic copy of Dominion's Exhibit List is being provided by email to the Board's law clerk.

Sincerely,



David R. Lewis
Counsel for Dominion Nuclear North Anna, LLC

Enclosures
cc: Service List