



Presentation to the Advisory Committee on Reactor Safeguards

Safety Review of the North Anna Early Site Permit Application

**Presented by
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Purpose

- Brief the Committee on the North Anna early site permit (ESP) application and the status of the NRC staff's safety review of that application
- Support the Committee's review of the application and subsequent interim letter to the Commission
- Answer the Committee's questions



Agenda

- Background and Milestones 5 min
- North Anna ESP Application 5 min
- Draft Safety Evaluation Report (DSER) 5 min
- DSER Issues 5 min
- Future-Oriented Items 5 min
- Conclusions 5 min
- Discussion / Committee questions



Background and Regulatory Framework

- Subpart A to 10 CFR Part 52 governs ESPs
- Subpart B to 10 CFR Part 100 contains applicable siting evaluation factors
- 10 CFR 52.23 requires ACRS to report to Commission on portions of application that pertain to safety (i.e., Site Safety Analysis Report)
- Purpose of ESP process is to resolve issues related to siting at early stage
- North Anna is first of three ESP applications the NRC staff is currently reviewing - others follow at two-month intervals



Purpose of ESP Process

- Separates, to extent feasible, review of site from review of design
- Allows resolution of site-related issues before expenditure of significant resources
- Allows ESP holder to “bank” site for future use



Future Milestones

- ACRS interim letter to the Commission assumed 03/18/05
- Staff provides final SER (FSER) to ACRS late May 2005 (prior to final division director and Office of the General Counsel concurrence)
- Staff issues FSER 06/16/05
- ACRS letter to the Commission assumed 07/25/05
- Staff incorporates ACRS letter and issues FSER as NUREG 08/29/05
- Mandatory hearings begin fall 2005
- Commission decision assumed mid 2006



North Anna ESP Application

- Submitted for a site wholly within the existing North Anna Power Station (NAPS) site, adjacent to existing North Anna units 1 and 2 and partially overlaying site of canceled units 3 and 4 (partially constructed in early 1980s; most structures subsequently removed)
- NAPS is owned by Virginia Power and Old Dominion Electric Cooperative and controlled by Virginia Power
- ESP applicant, Dominion, is a wholly-owned subsidiary of Dominion Resources, Inc. (as is Virginia Power)
- Dominion seeks authorization for limited work in accordance with 10 CFR 52.17(c) and 10 CFR 50.10(e)(1)



North Anna ESP Application

- Rock site
- Regional geologic faults
- Seismic hazard characterized using Regulatory Guide (RG) 1.165 method
 - Low-frequency earthquake M7.2 at 300 km
 - High-frequency earthquake M5.4 at 20 km



North Anna ESP Application

- Unit 3 to use once-through cooling
- Unit 4 to use “dry” closed-loop (radiative/convective) cooling to atmosphere to eliminate/minimize lake temperature increase and water demand on lake
- Underground ultimate heat sink (UHS) if design selected requires a UHS
- Dominion considering use of intake and discharge structure of canceled units 3 and 4
- Dominion seeks 20-year ESP term



DSER

- First-of-a-kind evaluation of safety aspects of an ESP application
- Benefited from resolution of a number of generic issues prior to application submittal
- Review guidance is RS-002, “Processing Applications for Early Site Permits”
- Some “generic” issues arose during application review and needed to be resolved during DSER development



Safety Review Areas and Lead Staff Reviewers

- Meteorology: Brad Harvey
- Hydrology: Goutam Bagchi (contract support from Pacific Northwest Laboratory) (PNL)
- Site Hazards: Kaz Campe (contract support from PNL)
- Geology/seismology: Cliff Munson (support from U.S. Geologic Survey)
- Demography/Geography: Jay Lee
- Emergency Planning: Bruce Musico (consultation with Federal Emergency Management Agency)
- Quality Assurance: Paul Prescott
- Physical Security: Al Tardiff
- Radiological Consequence Analysis: Jay Lee



Issues - Emergency Planning

- Dominion has elected to seek acceptance of “major features” of emergency plans as provided in 10 CFR 52.17(c)(ii)
- Concept is not defined in detail in regulations
- NRC/FEMA have issued draft guidance document, Supplement 2 to NUREG-0654
- Generic industry concern with degree of finality associated with major features
- Staff can grant finality as to the overall description but will need to address implementation details at COL



Issues - Seismic

- Dominion proposed new “performance-based” approach for determining safe shutdown earthquake (SSE) - Not entirely consistent with NRC-approved method in RG 1.165
 - Staff advised Dominion that time required for review of this method would likely result in delay in issuance of staff’s review products for the ESP application
 - Applicant ultimately elected to use RG 1.165 method
- Because North Anna is a rock site, site SSE exceeds design SSE at high frequencies for designs certified to date (COL item)



Issues - Site Characteristics vs Design Inputs

- Issue is what is needed and/or appropriate at ESP
 - Staff has given Dominion credit for appropriate consideration of most severe natural phenomena including margin
 - Dominion concerned that ESP should not specify design bases, but rather may specify site characteristics that would serve as minimum site-related design inputs at COL



Issues - Design/Site Interface

- Several examples involving interface between site (intended to be subject of ESP) and design (intended to be subject of design certification and/or COL)
 - Potential interferences between new and existing plants
 - Potential underground UHS in presence of water table near surface
 - Potential for frazil and anchor ice
- These individual items are discussed in backup slides



Future-Oriented Items in DSER

- Open items – Staff needs additional information prior to developing FSER
- Confirmatory item – Staff needs to verify applicant's planned actions as stated in its responses to requests for additional information
- COL action items – Site-related items that are more appropriately addressed at COL stage
- Permit conditions – Conditions the staff proposes be imposed on holder of the ESP should one be issued



DSER Conclusions

- DSER defers general regulatory conclusion regarding site safety and suitability to FSER after open items addressed
- Some conclusions from individual sections without open items
 - Applicant has provided appropriate quality assurance measures equivalent to those in 10 CFR Part 50 Appendix B
 - Site characteristics are such that adequate security plans and measures can be developed



DSER Conclusions

- Additional conclusions from individual sections without open items
 - Population center distance, as defined in 10 CFR 100.3, is at least one and one-third times the distance from the reactor to the outer boundary of the low population zone and compliant with 10 CFR 100.21(b) and (h)
 - Applicant has established appropriate atmospheric dispersion characteristics to support radiological calculations
 - Based on PPE and site characteristics, site meets radiological dose consequence criteria in 10 CFR 50.34(a)(1)



DSER Conclusions

- Additional conclusion from individual section without open items
 - Potential hazards associated with nearby transportation routes, industrial and military facilities pose no undue risk to facility that might be constructed on the site



Presentation Conclusions

- Staff has issued first-of-a-kind DSER for North Anna ESP application
- Most open item responses expected by March 3, 2005
- Because of first-of-a-kind nature of this action, staff is working through some issues identified during the review
- Looking forward to seeing interim ACRS letter and to briefing the Subcommittee and the full Committee this summer on final results of staff's review of this application
- Staff is identifying lessons learned for possible inputs to future rulemakings and revisions to guidance



Backup Slides



Issues - Seismic

- Dominion proposed new “performance-based” approach for determining safe shutdown earthquake (SSE)
 - Not entirely consistent with NRC-approved method in RG 1.165
 - ASCE Standard 43-05 describes this approach
 - Risk-based approach that targets performance goal
 - 1×10^{-5} annual probability of unacceptable performance of Category 1 systems, structures, and components
 - Target seismic risk based on core damage frequencies for existing nuclear power plants



Issues - Seismic

- Because staff had not reviewed or approved the performance-based approach, staff advised Dominion that time required for review of this method would likely result in delay in issuance of staff's review products for the ESP application
- Applicant ultimately elected to use RG 1.165 method with justification for use of reference probability 5×10^{-5} per year

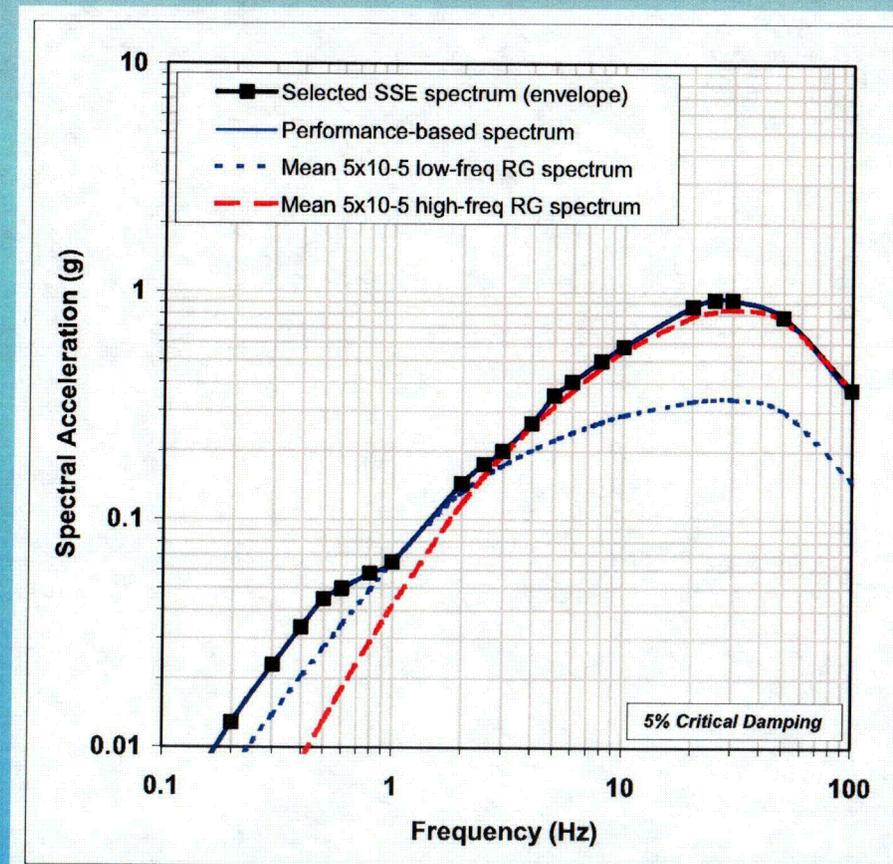


Issues - Seismic

- Because North Anna is a rock site, site SSE exceeds design SSE at high frequencies for designs certified to date
- COL applicant would need to resolve disparity if one exists (dependent on design selected)
- See SSE vs. RG 1.60 diagram

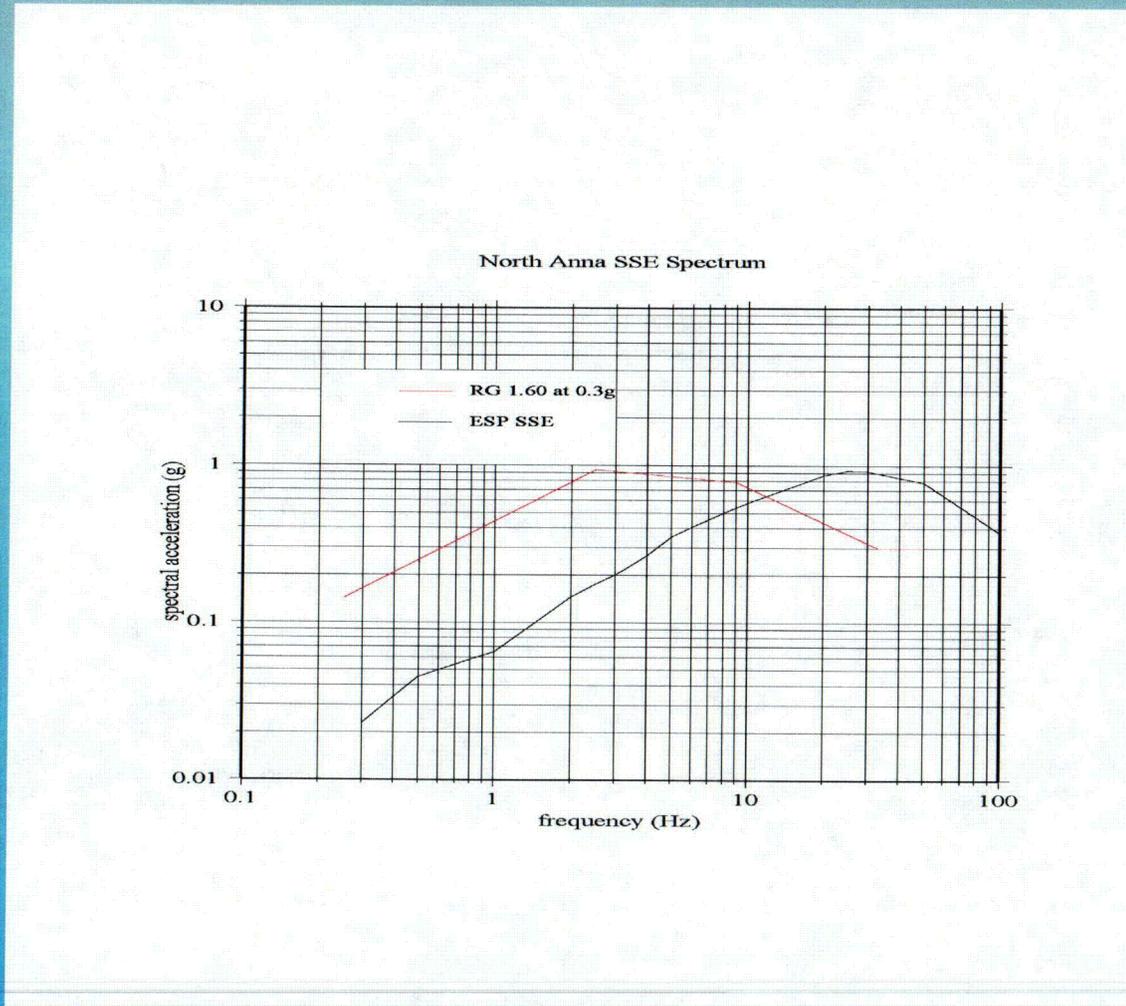


North Anna SSE





SSE vs RG 1.60





Open Items

- 2.1-1, Control of exclusion area
 - Applicant must have control over exclusion area or irrevocable right to obtain control
 - Legal issue being addressed in Office of General Counsel
- 2.3-1, Basic wind speed (fastest mile)
 - Dominion used 100-year return fastest mile value from industry standard
 - Observed data point exceeds 100-year return from standard
 - Dominion has chosen to provide 100-year return 3-second gust in lieu of fastest mile



Open Items

- 2.3-2, Snowpack weight vs snow load
 - Regulatory Guide 1.70 states weight of 100-year snowpack and 48-hour probable max winter precipitation (PMWP) should be used to provide weight of snow and ice on safety-related structures
 - Staff branch technical position provides clarification:
 - Normal winter precipitation load should be weight of 100-year snowpack
 - Extreme winter precipitation load should be weight of 100-year snowpack plus 48-hour PMWP
 - Dominion plans to provide 100-year snowpack, 48-hour maximum snowfall, and 48-hour winter PMP
 - COL applicant will determine how to combine these characteristics for comparison with design for extreme environmental load category unless otherwise justified



Open Items

- 2.3-3, Site characteristic to assess potential for freezing in UHS
 - Dominion plans to submit accumulated degree-days below freezing
 - Issues remain regarding choice of weather station and methodology for calculating
- 2.3-4, Impact of dry cooling on atmospheric temperature
 - Dominion plans to provide qualitative or semi-quantitative assessment
 - Approach recognizes system not designed
- 2.4-1, Coordinate reference system
 - Dominion plans to submit reference system and units of measure



Open Items

- 2.4-2, Minimize distance to existing systems, structures, and components (SSCs)
 - Existing NAPS Units 3 and 4 discharge tunnel likely within 1 foot of Units 1 and 2 service water piping
 - What will happen if COL applicant finds it cannot use existing structure?
 - Dominion states:
 - Not feasible or necessary to specify vertical separation distance
 - Only one of many examples of possible interferences that can and will be addressed at construction stage
 - 10 CFR 50.59 review of changes provides protection for operating plant



Open Items

- 2.4-3, Impacts of low-flow conditions
 - Dominion plans to propose minimum lake level same as for NAPS units
- 2.4-4, Ice jam formation and breakup
 - Dominion plans to show impact bounded by already-analyzed impact of breach of upstream dams
- 2.4-5, Minimum intake water temperature
 - No clear quantitative site characteristic regarding frazil ice
 - Dominion plans to note in application that frazil ice conditions could occur at the site
 - COL applicant would need to describe engineered measures to handle frazil ice



Open Items

- 2.4-6, Stability of underground UHS against ground water pressure head
 - Water table near surface, could lift empty or partially full UHS
 - Absent construction details, would have site characteristic for groundwater elevation
- 2.4-7, Correlate ground water level measurements taken in support of the ESP application with data from long-term piezometers
 - Dominion states they do not correlate well (different purposes and locations)
 - Need to show post-drought data not anomalous
 - Dominion plans to take additional data
 - Dominion will need to assess impact of lack of correlation



Open Items

- 2.4-8, Conservative hydraulic conductivity
 - Dominion plans to provide more conservative method
- 2.4-9, Upward hydraulic gradients
 - Dominion plans to show such gradient is small fraction of horizontal flow and bound its impact
- 2.4-10, Variation in hydraulic gradient
 - Dominion plans to provide additional seasonal data
- 2.4-11, Onsite measurement of adsorption and retention coefficients
 - Dominion plans to use onsite measurements of soil conditions and a lookup table from the Environmental Protection Agency to determine coefficients



Open Items

- 2.5-1, Criteria for ground motion model weighting in the model clusters for the EPRI 2003 ground motion evaluation
 - Dominion has responded to this item
 - Staff has questions regarding evaluation
 - Heavy weighting in one cluster for three ground motion models
 - Seismic attenuation parameter for three models in one cluster
 - Criteria for overall weighting for clusters not clearly explained



Open Items

- 2.5-2, Incorporate site-specific geologic properties and their uncertainties into the determination of safe-shutdown earthquake (SSE)
 - Dominion plans to determine SSE at hypothetical rock outcrop consistent with NRC guidance and determine transfer function
 - Dominion has provided method to staff, and staff has no questions on it



Open Items

- 13.3-1, Offsite laboratories
- 13.3-2, Orange County emergency notification program
- 13.3-4, Reliance on DOE for plume tracking
- 13.3-5, Various additional details on offsite emergency response measures
- 13.3-7, Guidance and authority for exceeding exposure limits
- 13.3-8, Capabilities of hospital and emergency services
- 13.3-9, Qualification for directors of emergency response
- 13.3-10, Cross-references to NUREG-0654 Supplement 2 and review of Orange County emergency response program

Applicant has provided information to address the above open items, and staff has no additional questions on them



Open Items

- 13.3-3, Adequacy of technical support center, emergency operations facility, and operational support center
 - Applicant does not plan to provide details on these subjects and plans to withdraw request for the associated major feature
- 13.3-6, Additional information on evacuation time estimate (ETE)
 - Applicant referenced existing NAPS ETE
 - Staff has a number of questions on details of the plan
 - Dominion is reviewing document against staff questions



COL Action Items

- Identify/highlight work needed at COL
- Similar to established concept in design certifications
- Regulatory standing under discussion (unlike design certification, not written into a rule)
- Not all-inclusive
- Applicant believes some are unnecessary when already required by regulations
- Specific items in backup slides
- Based on staff's evaluation of open item responses, some of these items may be changed or deleted in FSER



COL Action Items

- 2.1-1, Specific unit locations
- 2.1-2, Agency control of water bodies within exclusion area
- 2.2-1, Hazards of nearby industrial area
 - Currently undeveloped
 - Zoning could permit hazardous operations in future
- 2.2-2, Design-specific interactions between NAPS and new facility
 - Depends on layout and design of new units



COL Action Items

- 2.3-1, Dispersion of radionuclides to control room
- 2.3-2, Release point characteristics and receptor locations for routine release dose computations
- 2.4-1, Restriction on operations posed by low-water conditions
- 2.5-1, Additional soil borings
- 2.5-2, Compare plot plans with subsurface profile and material properties
- 2.5-3, Submit excavation and backfill plans



COL Action Items

- 2.5-4, Evaluate groundwater impact on foundation stability and dewatering plans
- 2.5-5, Perform soil column amplification/attenuation analyses
- 2.5-6, Analyze stability of safety-related structures
- 2.5-7, Provide design-related structural criteria
- 2.5-8, Provide plans for ground improvement
- 2.5-9, Verify average shear-wave velocity of materials underlying containment



COL Action Items

- 2.5-10, Provide more detailed slope stability analysis
- 2.5-11, Provide plans for safety-related slopes
- 13.6-1, Provide designs for protected area barriers



Proposed Permit Conditions

- Should an ESP be issued for the site, NRC staff believes the ESP holder needs to be constrained by these conditions
- Based on staff's evaluation of open item responses, some of these items may be changed or deleted in FSER
- May also reclassify some of these as COL action items
- Dominion plans to identify technical concerns with some of these items



Proposed Permit Conditions

- 2.1-1, Obtain authority to restore site before undertaking limited work activities
- 2.4-1, Maintain minimum separation distance from NAPS SSCs
 - This item likely to be revised based on Dominion's response to open item 2.4-2
- 2.4-2, Maximum water budget
 - Dominion believes minimum lake level is adequate limit



Proposed Permit Conditions

- 2.4-3, Design slopes based on drainage without need for engineered drainage systems that can be blocked
- 2.4-4, Locate safety-related facilities above maximum water level from local intense precipitation
- 2.4-5, Minimum free-surface elevation of UHS
 - This item may be revised based on applicant's response to open item 2.4-6
- 2.4-6, Minimum UHS storage capability
- 2.4-7, Design UHS capacity to address potential for freezing



Proposed Permit Conditions

- 2.4-8, No reliance on Lake Anna for safety-related water supply
- 2.4-9, Locate ingress/egress opening for safety-related SSCs above 271 ft MSL
- 2.4-10, Provide erosion protection for slopes at intake
- 2.4-11, No compromise of flood control measures for existing NAPS units during construction of new units
- 2.4-12, Locate new units where ground water level does not exceed 270 ft MSL
 - Dominion believes appropriate condition is distance above water table

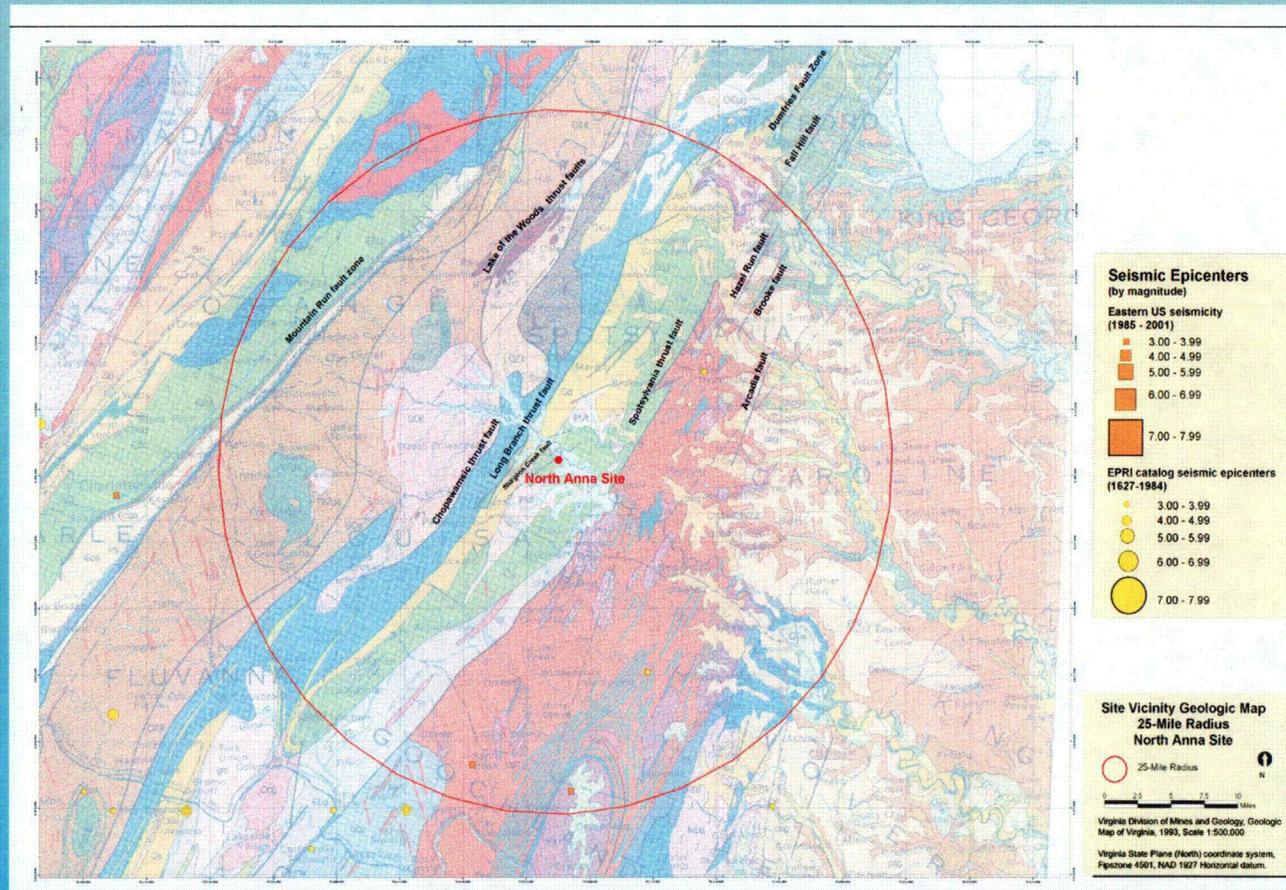


Proposed Permit Conditions

- 2.5-1, Replace fractured/weathered rock at foundations
- 2.5-2, Perform additional borings to identify weathered or fractured rock at foundations
- 2.5-3, Do not use saprolite as engineered fill
- 2.5-4, Perform geologic mapping of future excavations for safety-related facilities
- 2.5-5, Improve Zone II saprolitic soils if locating safety-related structures on them



Site Geologic Map





Area Seismic Zones

