August 17, 2012

Dominion 6/7/2012 North Anna 3 COLA Meeting Presentation: Seismic Closure Plan

North Anna 3

North Anna 3 COLA

Seismic Closure Plan

June 7, 2012 Meeting with NRC

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Introduction and Agenda

- Introduction
- Purpose
- Background
- Overview of Seismic Closure Plan (SCP) Strategy
- Details of Significant Changes
- RAI Evaluation
- Plans for S-COLA Submissions

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Presenters

- Purpose, Background, Overview: G. Borsh
- Mineral, VA Earthquake: D. Fenster
- Vibratory Ground Motion: J. Litehiser
- V_s Profiles: J. Davie
- FIRS: A. Hashemi
- Seismic Analyses: L. Todorovski
- RAI Evaluation: G. Borsh
- Plans for S-COLA Submission: J. Hegner

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Purpose of Meeting

- Provide NRC staff with overview of planned revisions to S-COLA resulting from SCP work
- Answer NRC questions
- Obtain NRC feedback

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Background

- NRC requested seismic schedules for DCD, R-COLA, and S-COLA:
  - February 2012: Dominion submitted limited S-COLA SCP (FSAR 2.5, 2.5.1, 2.5.3)
  - March 2012: MHI submitted latest DCD SCP
  - April 2012: Luminant submitted R-COLA SCP
  - May 2012: Dominion submitted comprehensive S-COLA SCP

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Background (cont)

May 2012 S-COLA SCP addresses:

- US-APWR DCD seismic changes
- New CEUS SSC model
- August 23, 2011 Mineral earthquake near North Anna site

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Overview of SCP Strategy

- COLA changes will:
  - Use the new CEUS SSC model and RG 1.208 to develop PSHA and GMRS
  - Incorporate seismic-related changes to the standard plant, with departures as required to reflect site-specific changes
  - Incorporate seismic-related changes to site-specific structures
- Submit changes by letter: July 2012 – May 2013
- Submit final RAI responses by June 2013
- Submit COLA revision in late 2013

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Overview of SCP Strategy (cont)

- Gather geologic information and perform field reconnaissance activities related to August 23, 2011 Mineral, VA earthquake
- Develop revised site-specific hard rock PSHA and GMRS
- Update V_s profiles for structures to reflect revised Unit 3 layout
- Develop revised FIRS and strain-compatible soil profiles for each seismic Cat I structure and for T/B and E/R

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Overview of SCP Strategy (cont)

- Update designs and seismic analyses for:
  - Reactor Building (R/B) Complex (includes PCCV, R/B, A/B, ESWPT Segment 2, and east and west PS/Bs)
  - UHSRS
  - PSFSVs
  - ESWPT
- Perform SSI analysis of T/B, including E/R
- Update miscellaneous chapters impacted by seismic changes (e.g., FSAR Ch 8)
- Compare key equipment TRs to Unit 3 seismic results

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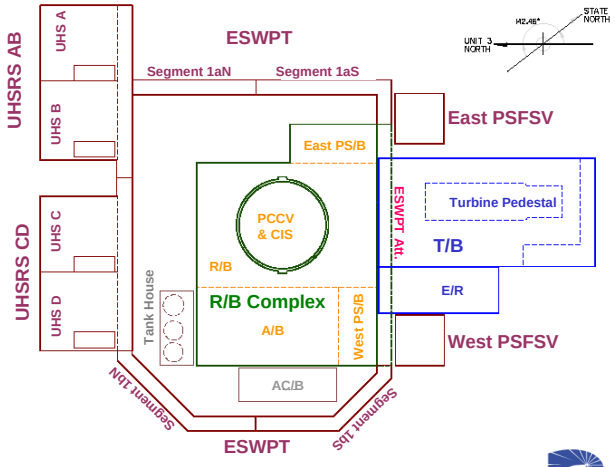
Overview of SCP Strategy (cont)



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Details: Mineral, VA Earthquake

- **M** 5.8 Mineral, VA, earthquake on August 23, 2011 in Central Virginia Seismic Zone
- Geologic field reconnaissance in vicinity of site:
  - Discussions with VGS, USGS and others
  - Compiled geologic maps
  - Obtained LiDAR data, derivative maps and photos
  - Reviewed aftershock seismology data
  - Performed field study
- No evidence of surface faulting

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Details: Mineral, VA Earthquake (cont)

- Impact on Current COLA
  - Update information on Quaternary tectonic features in FSAR Section 2.5.1.1.4
  - Add a description of the event in a new FSAR Section 2.5.1.1.6
- Affected FSAR Sections
  - Geologic descriptions in Sections 2.5.1 and 2.5.3
  - Potential for impact on PSHA in Section 2.5.2

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Overview: FSAR Section 2.5.2, Vibratory Ground Motion

- SSAR Section 2.5.2 will be replaced:
  - Use 2012 publication of the CEUS SSC report:
    - New seismicity catalog through 2008
    - New seismic source characterization [SSC] model
  - Post CEUS SSC report information will consider:
    - Updated seismicity through mid-December 2011
    - Updated SSC, if needed: e.g., to incorporate implications of more recent seismicity (the 2011 Mineral, VA, earthquake)
  - Re-run PSHA using the new/updated SSC
  - Develop GMRS based on RG 1.208 at the common basemat foundation elevation for the R/B Complex
  - Revise and expand ESP VAR 2.0-4 - Vibratory Ground Motion

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Overview: FSAR Section 2.5.2, Vibratory Ground Motion (cont)

- CEUS SSC, updated seismicity catalog, and Mineral EQ require a complete rewrite of Section 2.5.2
  - 2.5.2.1 Seismicity
  - 2.5.2.2 Geologic and Tectonic Characteristics of the Site and Region
  - 2.5.2.3 Correlation of Earthquake Activity with Seismic Sources
  - 2.5.2.4 Probabilistic Seismic Hazard Analyses and Controlling Earthquake
  - 2.5.2.5 Seismic Wave Transmission Characteristics of the Site
  - 2.5.2.6 Ground Motion Response Spectrum

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Details: FSAR Section 2.5.2.1

- CEUS SSC report (Chapter 3) presents a completely new seismicity catalog
  - Following same procedure as in the CEUS SSC report, seismicity will be updated for the entire CEUS SSC coverage area:
    - For 2009 to mid-December 2011, there were 200 additional independent events of **M** 2.9 and greater

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Details: FSAR Sections 2.5.2.2, 2.5.2.3

- CEUS SSC report presents a completely new seismic source characterization model
  - Regional source zones
    - **Mmax Zones** – 3 versions [Wide, Narrow, Study]
    - **Seismotectonic Zones** – 4 versions [Wide PEZ/RCGr, Wide PEZ/RCGm, Narrow PEZ/RCGr, Narrow PEZ/RCGm]
  - RLME [Repeated Large-Magnitude Earthquakes] sources
- Review new information and update CEUS SSC, if necessary
  - Seismicity update [after 2008]
  - Evaluation of hazard input regarding 2011 Mineral, VA, earthquake [SSHAC Level 2]

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Details: FSAR Section 2.5.2.4

- New SSC requires new PSHA
  - Same median GMPE – EPRI (2004)
  - Updated GMPE uncertainties – EPRI (2006)
  - M_{min} for PSHA = **M** 5.0, no CAV filtering
  - Logic tree branches to be trimmed or compressed (see Chapter 9 of CEUS SSC Report), analogous to identification of 99%-hazard contribution EPRI-SOG sources

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Details: FSAR Section 2.5.2.5

- New PSHA requires re-evaluation of site response [still follows NUREG/CR-6728 Approach 2A]
  - GMRS horizon elevation at new bottom of R/B Complex foundation
  - GMRS soil column is the same as for current S-COLA FSAR; no new soil profile simulation required
  - Explicitly following RG 1.208, site response will be run using horizontal high-frequency [HF] and low-frequency [LF] deaggregated hard rock 10^{-4} and 10^{-5} uniform hazard response spectra (UHRS)

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Details: FSAR Section 2.5.2.6

- New PSHA and site response analysis leads to new GMRS
  - Reg. Guide 1.208 performance-based procedure results in horizontal GMRS
  - Site response results in broadband 10^{-4} and 10^{-5} UHRS at the GMRS horizon
  - V/H from ESPA SSAR (and S-COLA) is used to develop vertical GMRS

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Details: FSAR Section 2.5.2.7

- FSAR Section 2.5.2.7
  - Will be deleted from S-COLA FSAR
  - Operating basis earthquake (OBE) is addressed in FSAR Section 3.7.1.1

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Details: Shear Wave Velocity Profiles

- Update current shear wave velocity (V_s) profiles in FSAR Section 2.5.4 to address:
  - Revised Unit 3 layout with new configuration of US-APWR standard plant
  - Redesign of site-specific structures
- Updates are outlined in the following slides

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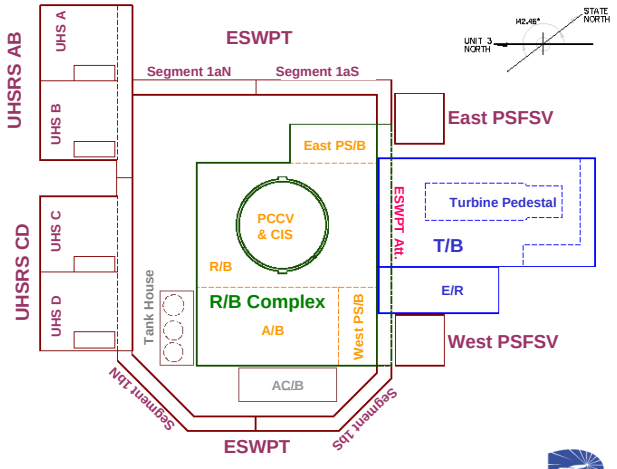
Shear Wave Velocity Profiles (cont)



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Details: V_s Profile of R/B Complex

- In-situ V_s profile used for the previous R/B basemat configuration will be used for the enlarged common mat
- V_s profile will reflect the changed average thickness of concrete fill under the enlarged mat

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Details: V_s Profiles of PSFSVs and T/B-E/R

- V_s profiles similar to the previous PSFSV profiles will be used
- V_s profile for the T/B and E/R will be developed:
  - Use three (3) power block Vs borings
  - Average soil/rock profiles beneath T/B and E/R mats
  - Profile was not developed previously

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Details: V_s Profiles of UHSRS

- UHSRS A and B, and half the UHSRS Pipe Chase, will now be placed on a common mat, as will UHSRS C and D and the other half of the UHSRS Pipe Chase
- V_s profile for UHSRS AB will be similar to the previous profile
  - Some adjustments to zone thicknesses
- New V_s profile for UHSRS CD
  - Based on the V_s borings closest to the common mat
  - Average soil/rock profiles beneath the mat

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Details: V_s Profiles of ESWPT

- East and West ESWPT segments will each be divided into two separate segments
- New V_s profile for each of the 4 segments:
  - Based on the V_s borings closest to each tunnel segment, and
  - Average soil/rock profile beneath each segment

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Details: Liquefaction, Slope Stability, Lateral Earth Pressure

- Determine if the ground surface peak ground acceleration (PGA) increases based on the revised seismic analysis
- Revise analyses for liquefaction (FSAR 2.5.4.8), slope stability (FSAR 2.5.5) and dynamic lateral earth pressure (FSAR 2.5.4.10) if needed:
  - Factors of safety (FS) against liquefaction and slope failure for the existing PGA are more than adequate; therefore, these FS should remain adequate even for an increased PGA
  - Because dynamic lateral earth pressure is proportional to the PGA, a revision in PGA will result in an update in dynamic lateral earth pressure

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FSAR Chapter 2 Submittal Dates

- Section 2.0, Site Characteristics: February 2013
  - Revise tables and figures to reflect revised DCD and S-COLA seismic information
- Section 2.1, Geography and Demography: October 2012
  - Revise site plan to reflect new plant layout
- Section 2.4, Hydrology: November 2012
  - Revise figure backgrounds

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FSAR Chapter 2 Submittal Dates (cont)

- Sections 2.5, Geology, Seismology, and Geotechnical Engineering; 2.5.1, Basic Geologic and Seismic Information; and 2.5.3, Surface Faulting: July 2012
- Sections 2.5.2, Vibratory Ground Motion; and Section 2.5.4, Stability of Subsurface Materials and Foundations: January 2013
- Section 2.5.5, Slope Stability: February 2013

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Details: FIRS, SSI Input Soil Profiles, and SSI Input Time-Histories

- Revision of Section 3.7.1 due to:
  - Updated hard rock motion based on new PSHA results (Section 2.5.2)
  - Updated soil and rock profiles and their variation due to plant layout changes (Section 2.5.4)
  - Revised licensing basis from RG 1.165/Draft ASCE 43-05 to RG 1.208

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Details: FIRS, SSI Input Soil Profiles, and SSI Input Time-Histories: Analysis Methodology

- Step-by-step Methodology:
  - Soil Profile Simulation (No change)
  - Site Response Analysis (will be updated per RG 1.208)
  - Horizontal and Vertical FIRS Development (will be updated per RG 1.208)
  - SSI Soil Profile Development (will be updated per RG 1.208)
  - SSI Input Response Spectra Development
    - NEI Check (ISG-017), Upward Smoothing (No change)
    - Minimum Required Spectrum (per 10 CFR 50, App. S) (No change)
  - Time History Generation
    - Outcrop Time-Histories (Matched to SSI Input Response Spectra) (No change)
    - In-Column Time-Histories (for SSI Analysis as Embedded) (No change)
  - OBE calculation (No change)

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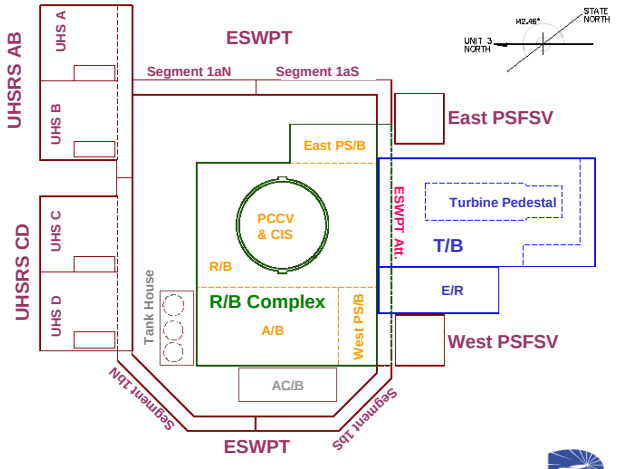
Details: Section 3.7.2, Seismic System Analysis



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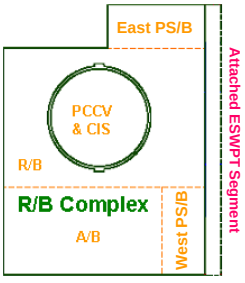
Details: R/B Complex

- Updated US-APWR Standard Plant Design includes a new configuration of the Reactor Building (R/B) Complex with common basemat supporting:
  - Pre-stressed Concrete Containment Vessel (PCCV)
  - Containment Internal Structure (CIS)
  - Reactor Building (R/B)
  - Auxiliary Building (A/B)
  - East and West Power Source Buildings (PS/Bs)
- North Anna Unit 3 Plant will have the south segment of ESWPT integrated to the R/B Complex basement



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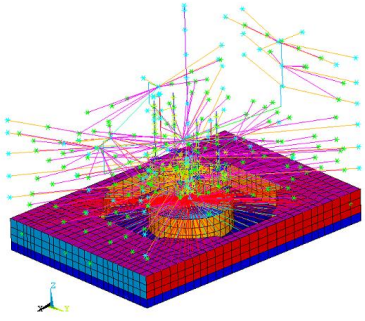
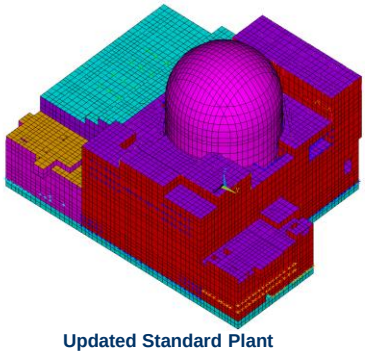
Details: R/B Complex (cont)

- Site-specific seismic response analyses of R/B Complex will use the dynamic finite element model (FEM), documented in MHI Technical Report MUAP-10006(R3), with NA3 site-specific modifications



R/B Complex LMSM used for previous revisions of DCD and S-COLA



Updated Standard Plant Design Basis R/B Complex Dynamic FEM

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Details: R/B Complex (cont)

- Structural properties used for NA3 site-specific and standard design SSI analyses of R/B Complex

Structure	Structural Properties		DCD Standard Design		S-COLA (*)
	Stiffness	Damping	ISRS	SSE Loads	ISRS and SSE Loads
CIS	Full (uncracked)	4%	X	X	X
	Reduced (cracked)	5%	X	X	X(***)
PCCV	Full (uncracked)	3%	X	X	X
	Reduced (cracked)	5%	X	X	X(***)
R/B, A/B, PS/Bs	Full (uncracked)	4%	X		X (**)
	Reduced (cracked)	7%	X	X	X(***)

(*) Structural models with upper bound full (uncracked concrete) stiffness properties will provide higher responses due to high frequency content of NA3 site-specific motion

(**) SDOF oscillators are used to capture out-of-plane response of cracked slabs and walls

(***) Used for cracking study based on SSI analyses of surface foundation with coherent motion

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Details: R/B Complex (cont)

- Types of site-specific soil-structure interaction (SSI) analyses to be performed on NA3 R/B Complex Dynamic FEM

Model	Input Profiles	Input Motion	Purpose
Surface Foundation	Truncated Column SLB, SBE, SUB	Incoherent	Define design ISRS at high frequencies where incoherency effects are significant
Embedded Foundation	Full Column ELB, EBE, EUB	Coherent	Define design ISRS at lower frequencies where incoherency effects are insignificant. Used to evaluate site specific seismic demands on R/B Complex structures
Surface Foundation	Truncated Column SLB, SBE, SUB	Coherent	
Embedded Foundation	Full Column EUB	Incoherent	Study to demonstrate that surface foundation analyses provide adequate design ISRS
Surface Foundation (*)	Truncated Column SLB, SBE, SUB	Coherent	Study to demonstrate that NA3 site-specific and standard design ISRS bound concrete cracking effects

(*) Structural model with reduced (cracked concrete) stiffness properties will be used

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Details: R/B Complex (cont)

- SSI analyses of NA3 R/B Complex will be performed using:
  - SSI input motions compatible to envelope of minimum earthquake (1/3 of CSDRS) and revised site-specific FIRS based on the new CEUS model
  - Truncated and full column profiles of best estimate (BE), lower bound (LB), upper bound (UB) dynamic soil properties strain-compatible to revised site-specific ground motion
  - Updated Surface Foundation Dynamic FEMs capable of capturing responses with frequencies higher than 70 Hz
  - Cut-off frequency of 70 Hz for SSI analyses with SUB profile to capture energy of input motion at high frequencies
  - Updated Embedded Foundation Dynamic FEMs capable of capturing responses with frequencies up to 50 Hz for EUB profile that represent the actual site-specific configuration when modeling the contact of the basement walls with surrounding soil
  - Modified subtraction method (MSM) for embedded foundation SSI analyses (applicability of MSM will be demonstrated for standard design)

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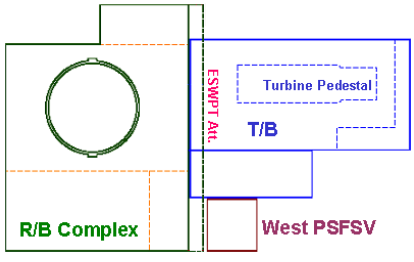
Details: R/B Complex (cont)

- Structure-Soil-Structure Interaction (SSSI) effects:
  - Coherent surface foundation SSI analyses of stand alone R/B Complex Dynamic FEM will provide field responses at locations of nearby foundations
  - Field nodes acceleration response spectra will be compared to input ground motion spectra to assess general importance of SSSI for NA3 site
  - Responses obtained from coherent surface foundation analyses of combined model of R/B Complex, T/B, West PSFSV will be used to further address SSSI effects on R/B Complex design basis



Dominion

Details: R/B Complex (cont)

- Seismic analyses for the R/B Complex will:
  - Demonstrate the acceptability of the site-specific seismic design basis by evaluating effects of revised ground motions on structural integrity
  - Demonstrate the structural integrity of the integrated ESWPT segment
  - Confirm that standard plant structural design is bounding for all structural members of the North Anna Unit 3 R/B Complex
  - Provide new site-specific design basis ISRS
  - Confirm stability and provide new dynamic bearing pressures

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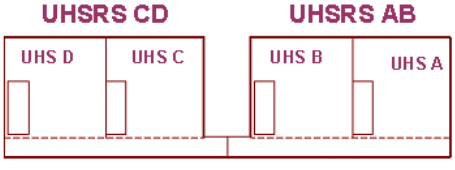
Details: UHSRS

- Seismic analyses will incorporate enhanced design of UHSRS that includes:
  - UHSRS A and B, and half the UHSRS Pipe Chase, will now be placed on a common basemat, as will UHSRS C and D and the other half of the UHSRS Pipe Chase in order to improve their stability



Dominion

Details: UHSRS (cont)

- Seismic response and static design analyses of UHSRS will use FEMs that:
  - Reflect updated configuration and design enhancements
  - Include field nodes at nearby ESWPT foundations
  - Use OBE structural damping and full (uncracked concrete) in-plane stiffness of walls and slabs that provide higher responses for high frequency NA3 site-specific design ground motion
  - Use best estimate out-of-plane stiffness of walls and slabs based on concrete cracking stress evaluation
  - Consider two bounding loading cases:
    1. AB with two basins full of water
    2. ABE with basin B being full and basin A empty
  - Consider impulsive and sloshing modes of vibration of basin water

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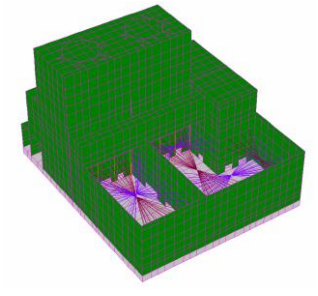
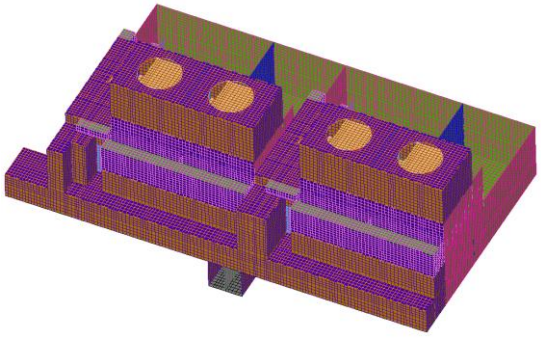
Details: UHSRS (cont)

- UHSRS FEM



UHSRS Dynamic FEM used for SSI analyses in the previous revision of FSAR



Updated FEM of adjacent UHSRS integrated by sharing common wall in the middle

Dominion

Details: UHSRS (cont)

- Types of SSI analyses to be performed for NA3 UHSRS

Model	Input Profiles	Input Motion	Purpose
Surface Foundation	Truncated Column SLBe, SLBw, SBEe, SBEw, SUBe, SUBw	Coherent	Develop design basis ISRS and SSE Loads and provide base reaction time histories
Surface Foundation (*)	Truncated Column SLBw	Coherent	Study concrete cracking assumptions on design basis
Embedded Foundation	Full Column EUBe	Coherent	Embedment study to demonstrate that surface foundation analyses provide adequate design basis
Surface Foundation (**)	Truncated Column SBEe	Coherent	Basin water fluctuation study to demonstrate that AB and ABE models provide bounding design

(*) UHSRS AB structural model with reduced (cracked concrete) stiffness properties will be used

(**) Basin water fluctuation study model will consider UHS B full A and UHS A half full

Dominion

Details: UHSRS (cont)

- SSI analyses of NA3 UHSRS will be performed using:
  - SSI input motions compatible to envelope of minimum earthquake (1/3 of CSDRS) and revised site-specific FIRS based on new CEUS model
  - Truncated column profiles of east and west best estimate (BEe and BEw), lower bound (LBe and LBw), upper bound (UBe and UBw) dynamic soil properties strain-compatible to revised site-specific ground motion
  - Updated FEMs capable of capturing responses with frequencies at least 70 Hz and cut-off frequency of 70 Hz for SUB soil case to capture energy of input motion at high frequencies
  - SSI models without symmetry conditions to capture responses of stand alone UHSRS AB and ABE as well as SSI models with symmetry conditions to capture possible SSSI effects between UHSRS AB and CD
  - Embedment study ABE FEM capable of capturing responses with frequencies up to 50 Hz using direct method for modeling embedment

Dominion

Details: UHSRS (cont)

- Seismic analyses for the UHSRS will:
  - Demonstrate the acceptability of the site-specific seismic design basis by evaluating the effects of the revised UHSRS design and ground motions on the structural integrity of the new combined UHSRS structure
  - Provide new site-specific design basis ISRS
  - Confirm stability and provide new dynamic bearing pressures

Dominion

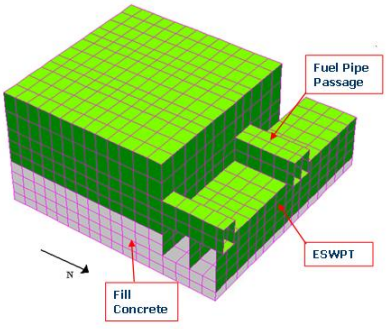
Details: PSFSVs

- Seismic analyses will incorporate revised design of East and West PSFSVs:
  - Segments of ESWPT that were previously integrated with PSFSV will be detached and integrated to R/B Complex
- Seismic response and static design analyses will use revised FEMs that:
  - Reflect updated configuration and design changes
  - Use OBE structural damping and full (uncracked concrete) in-plane stiffness of walls and slabs that provide higher responses for high frequency NA3 site-specific design ground motion
  - Use best estimate out-of-plane stiffness of walls and slabs based on concrete cracking stress evaluation

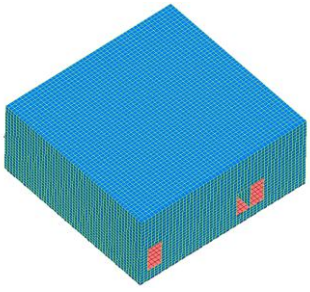
Dominion

Details: PSFSVs (cont)

- PSFSV FEM



UHSRS Dynamic FEM used for previous revision of FSAR



Updated FEM of PSFSV having the adjacent segment of ESWPT removed

Dominion

Details: PSFSVs (cont)

- Types of SSI analyses to be performed for NA3 PSFSVs

Model	Input Profiles	Input Motion	Purpose
Surface Foundation	Truncated Column SLB, SBEe, SBEw, SUB	Coherent	Develop design basis ISRS and SSE loads and provide base reaction time histories
Embedded Foundation	Full Column ELB, EBEe, EBEw, EUB	Coherent	Include embedment effects into design basis ISRS and calculate dynamic earth pressures
Surface Foundation (*)	Truncated Column SLB	Coherent	Study concrete cracking assumptions on design basis

(*) Structural model with reduced (cracked concrete) stiffness properties will be used

Dominion

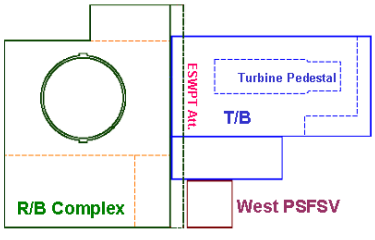
Details: PSFSVs (cont)

- SSI analyses of NA3 PSFSVs will be performed using:
  - SSI input motions compatible to envelope of minimum earthquake (1/3 of CSDRS) and revised site-specific FIRS based on the new CEUS model
  - Truncated and full column profiles of lower bound (LB), upper bound (UB) east and west best estimate (BE) dynamic soil properties strain-compatible to revised site-specific ground motion
  - Updated surface foundation FEMs capable of capturing responses with frequencies at least 70 Hz soil and cut-off frequency of 70 Hz for SUB soil case to capture energy of input motion at high frequencies
  - Updated Embedded Foundation FEMs capable of capturing responses with frequencies up to 50 Hz for EUB profile that represent actual site-specific configuration when modeling contact of basement walls with surrounding soil
  - Modified subtraction method (MSM) for embedded foundation SSI analyses (applicability of MSM will be demonstrated)

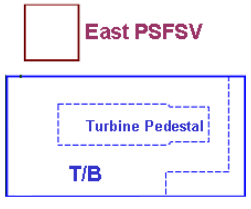
Dominion

Details: PSFSVs (cont)

- Structure-Soil-Structure Interaction (SSSI) effects on PSFSV design basis will be addressed by:
  1. Surface Foundation SSSI Analysis of Combined Model of West PSFSV, R/B Complex and T/B
  2. Embedded Foundation SSSI Analysis on Combined Model of East PSFSV and T/B



1. Surface Foundation SSSI Analysis



2. Embedded Foundation SSSI Analysis

Dominion

Details: PSFSVs (cont)

- Revised seismic analyses and structural evaluations for PSFSVs will:
  - Demonstrate acceptability of site-specific seismic design basis by evaluating effects of enhanced PSFSVs design and ground motions on structural integrity
  - Provide new site-specific design basis ISRS
  - Demonstrate stability and provide new dynamic bearing pressures

Dominion

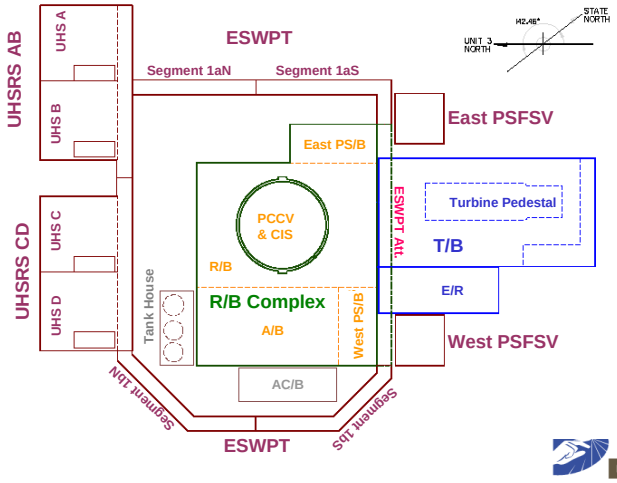
Details: ESWPT

- FSAR will incorporate the revised design of ESWPT which includes:
  - The segment of ESWPT located along the south end of R/B Complex will be integrated to the R/B complex
  - The cross sections of ESWPT segments will be modified to reflect changes in essential water pipes configuration
  - The overpass tunnels connecting East PSFSV with East PSB will be integrated to ESWPT Segment 1aS to address changes in R/B Complex standard plant configuration

Dominion

Details: ESWPT (cont)

- Configuration of ESWPT segments



Dominion

Details: ESWPT (cont)

- Seismic response and static design analyses of underground segments of ESWPT segments will use revised FEMs that:
  - Reflect the updated configuration and design changes of Segments 1a and 1b
  - Use OBE structural damping and two stiffness levels representing:
    - Full (uncracked concrete) stiffness used for SSI analyses of ELB, EBE, and EUB soil cases
    - Reduced (cracked concrete) stiffness used for study SSI analyses of ELB soil case to address effects of concrete cracking on ISRS
  - Have refined mesh of SASSI models capable of transmitting frequencies up to 50 Hz for EUB soil case

Dominion

Details: ESWPT(cont)

- Types of SSI analyses to be performed for NA3 ESWPT

Model	Input Profiles	Input Motion	Purpose
Underground straight segment 1aN	Full Column ELB, EBEe, EUB	Coherent	Develop design basis ISRS and SSE Loads
Underground and 1bS L-Shape segment 1aS	Full Column ELB, EBEe, EUB	Coherent	
Underground skewed segment 1bN and 1bS	Full Column ELB, EBEw, EUB	Coherent	

Dominion

Details: ESWPT (cont)

- SSI analyses of NA3 ESWPT Segments will be performed using:
  - SSI input motions compatible to the envelope of minimum earthquake (1/3 of CSDRS) and revised site-specific FIRS based on the new CEUS model
  - Full column profiles of lower bound (LB), upper bound (UB) and best estimate (BE) dynamic soil properties strain-compatible to revised site-specific ground motion
  - Updated FEMs capable of capturing responses with frequencies up to 50 Hz for EUB profile
  - Modified subtraction method (MSM) for modeling SSI embedment (applicability of MSM will be demonstrated)
  - Input acceleration time histories compatible to the ground motion design response spectra that are amplified for SSSI effects based on field node responses obtained from SSI analyses of UHSRS

Dominion

Details: ESWPT (cont)

- Revised FSAR seismic analyses for the ESWPT segments will:
  - Demonstrate the acceptability of the site-specific seismic design basis by evaluating the effects of the revised designs of the ESWPT segments and ground motions on structural integrity
  - Provide new site-specific design basis ISRS

Dominion

Details: T/B and E/R

- Site-specific design for T/B and E/R departs from DCD:
  - Separate basemats with different elevations
  - Other structural configuration changes
- Impacted S-COLA Section 1.2 – General Arrangement drawing
- Structural model for the SSI analysis will:
  - Represent both T/B and E/R structures
  - Use stiffness properties: full (uncracked concrete) stiffness for foundation
  - Use damping properties: OBE values

Dominion

Details: T/B and E/R (cont)

- SSI analysis of NA3 T/B and E/R will be performed using:
  - Full column profiles of lower bound (LB), upper bound (UB), and best estimate (BE) dynamic soil properties strain-compatible to revised site-specific ground motion
  - SSI input design motion compatible to the envelope of minimum earthquake (1/3 of CSDRS) and revised site-specific FIRS based on the new CEUS model
  - Updated FEMs capable of capturing responses with frequencies up to 50 Hz for EUB profile
  - Direct method for embedded foundation SSI analysis

Dominion

Details: T/B and E/R

- Purpose of SSI analysis for T/B, including E/R, is to:
  - Provide seismic load for structural design
  - Ensure adequate gaps exist between these structures and adjacent Cat I structures
  - Provide input for evaluating stability and dynamic bearing pressure

Dominion

FSAR Chapter 3 Revisions and Submittal Schedule

- Section 3.5.1.6, Aircraft Hazards: November 2012
  - Revise total effective plant areas and accident probabilities to reflect new plant layout
- Section 3.7, Seismic Design: April 2013
  - Revise FIRS to reflect RG 1.208, new hard rock motions, and new plant layout
  - Revise SSI analyses, and incorporate site-specific structures' analyses in Chapter 3 appendices (delete COLA Part 11)

Dominion

FSAR Chapter 3 Revisions and Submittal Schedule (cont)

- Section 3.7 (cont)
  - Revise Sections 3.7.6, 3.7.2.3.2 - 3.7.2.3.4, 3.7.2.3.6.1, and 3.7.2.4 to incorporate the DCD by reference
  - Address departures from DCD:
    - T/B and E/R foundations
    - South segment of ESWPT attached to R/B Complex

Dominion

FSAR Chapter 3 Revisions and Submittal Schedule (cont)

- Section 3.8, Design of Category I Structures: May 2013
  - Revise GA of ESWPT, UHSRS and PSFSVs to reflect new plant configuration
  - Revise discussion to reflect new ESWPT interfaces and analyses
  - Sections 3.8.4.4.2, 3.8.5.1.2 and 3.8.5.4.3: Incorporate the DCD text by reference
  - Revise to reflect common R/B Complex basemat, sliding/overturning analyses for R/B Complex

Dominion

FSAR Chapter 3 Revisions and Submittal Schedule (cont)

- Appendix 3H: May 2013
  - Incorporate the DCD by reference
- Appendix 3KK, UHSRS: May 2013
  - Create as a new appendix for UHSRS to incorporate updated input ground motion, new model of combined foundations, revised SSI analysis results, study of SSSI effects, and design and stability evaluations

Dominion

FSAR Chapter 3 Revisions and Submittal Schedule (cont)

- Appendix 3LL, ESWPT: May 2013
  - Revise to incorporate updated input ground motion, revised models, revised SSI analyses results, including SSSI effects, and design evaluations
- Appendix 3MM, PSFSVs: May 2013
  - Add as a new appendix to incorporate updated input ground motion, revised configuration, revised SSI and SSSI analyses results, and design and stability evaluations

Dominion

FSAR Chapter 3 Revisions and Submittal Schedule (cont)

- Appendix 3NN, R/B Complex (formerly Standard Plant Seismic Category I Structures):
  - Revise to reflect updated input ground motion, updated configuration of R/B Complex, revised SSI analysis results, study of SSSI effects, and stability evaluations

Dominion

FSAR Chapter 3 Revisions and Submittal Schedule (cont)

- Appendix 3.OO, Site Response Analysis and Development of SSI Analysis Input: April 2013
  - Revise to reflect the new FIRS, SSI input profiles, and SSI input ground motions for seismic Category I structures

Dominion

Details: Other COLA Parts and FSAR Chapters

- FSAR Chapter 1, Introduction:
  - Sect 1.2 : Plot plan changes due to new plant layout
  - Sect 1.8 : Update of Departures
  - Sect 1.9: Add exception to RG 1.132 for borings and revise conformance evaluations for RG 1.208 and RG 1.165
  - Submittal Date: May 2013

Dominion

Details: Other COLA Parts and FSAR Chapters

- FSAR Section 6.4, Habitability Systems:
  - May revise Table 6.4-201 (MCR Toxic Gas Concentrations) to reflect changes in MCR Habitability analysis due to T/B moving south
  - Submittal Date: October 2012
- FSAR Chapter 8, Electric Power:
  - Revise Figure 8.2-202 (Switchyard Arrangement) to reflect new standard plant layout and site-specific changes
  - Revise ground grid and lightning protection systems in Section 8.3 to reflect new standard plant layout and site-specific changes
  - Submittal Date: December 2012

Dominion

Details: Other COLA Parts and FSAR Chapters

- FSAR Chapter 9, Auxiliary Systems:
  - Section 9.2.5:
    - Revise Figure 9.2.5-1R (UHS Flow Diagram) and text to eliminate the UHSRS Pipe Chase
  - Section 9.4:
    - Revise cooling and heating loads to reflect revisions due to building size changes and equipment layout
  - Section 9.5:
    - Revise Figure 9.5-201, 9.5-204, 9A-13R, -14R, -20R and-27R (Fire zones and Arrangements) to reflect new plant layout
    - Update Fire Hazard Analysis Summary and Fire Zone/Fire Area interfaces
  - Submittal Date: November 2012

Dominion

Details: Other COLA Parts and FSAR Chapters

- FSAR Chapter 11, Radwaste Management System:
  - Revise Figures 11.5-2aR through -2kR (Radiation Monitor Locations) to reflect new plant layout
  - Submittal Date: December 2012
- FSAR Chapter 12, Radiation Protection:
  - Revise Figures 12.3-1R through -6R, and -11R (Radiation Zone Maps) to reflect building arrangement changes and new concrete wall thicknesses
  - Submittal Date: December 2012
- FSAR Chapter 19, PRA and Severe Accident Evaluation:
  - May revise seismic margins and external events PRA
  - Submittal Date: January 2013

Dominion

Details: Other COLA Parts and FSAR Chapters

- COLA Part 7, Departures
  - NAPS DEP 3.7(1): Delete section of departure associated with PS/B basemat design and update descriptions relating to interfaces with ESWPT
  - Delete NAPS DEP 3.7(2), 3.7(4), 3.7(5)
  - NAPS DEP 3.7(6): Add NAPS DEP 3.7(6) to describe differences in seismic methodologies based on site-specific characteristics
  - NAPS DEP 10.4(1): Revise to reflect departure from GA of T/B
  - NAPS ESP VAR 2.0-4: Revise to incorporate variances from ESP and SSAR
  - Submittal date: May 2013

Dominion

Details: Other COLA Parts and FSAR Chapters

- COLA Part 8, Security:
  - Revise to reflect new plant layout
  - Submittal Date :PSP, LOLA: November 2012
  - Submittal Date: Supplements to HAE and Physical Security Element Review: January 2013
  - Submittal Date: PSPSR: February 2013
- COLA Part 10, Tier 1/ITAAC:
  - Revise figures to reflect new plant layout and update concrete wall thicknesses
  - Submittal Date: December 2012
- COLA Part 11,Model Properties and Seismic Analysis of Site-Specific Cat I Structures
  - Delete Part 11
  - Submittal Date: May 2013

Dominion

Plans for S-COLA Submissions

- See handout

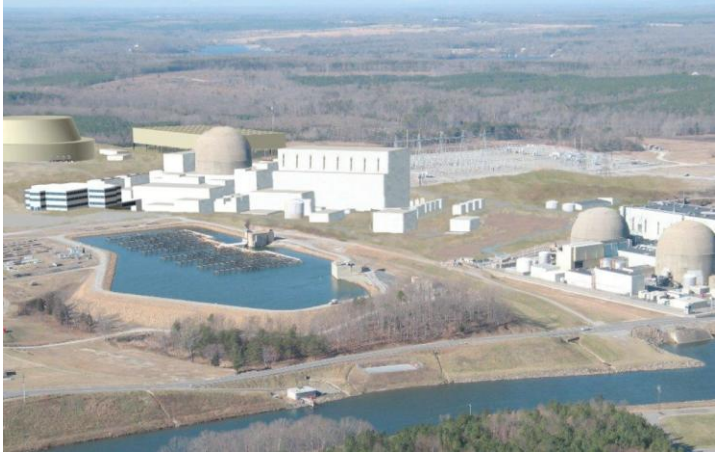
Dominion

Summary

- Revising COLA to address DCD seismic changes, new CEUS SSC model, and August 23, 2011 Mineral earthquake
- Providing seismic submittals by letter from July 2012 through June 2013
- S-COLA revisions will be submitted in time frames that maximize support of NRC work

Dominion

Questions?



Dominion