NRC Safety Pre-Application Meeting

North Anna Power Station (NAPS)

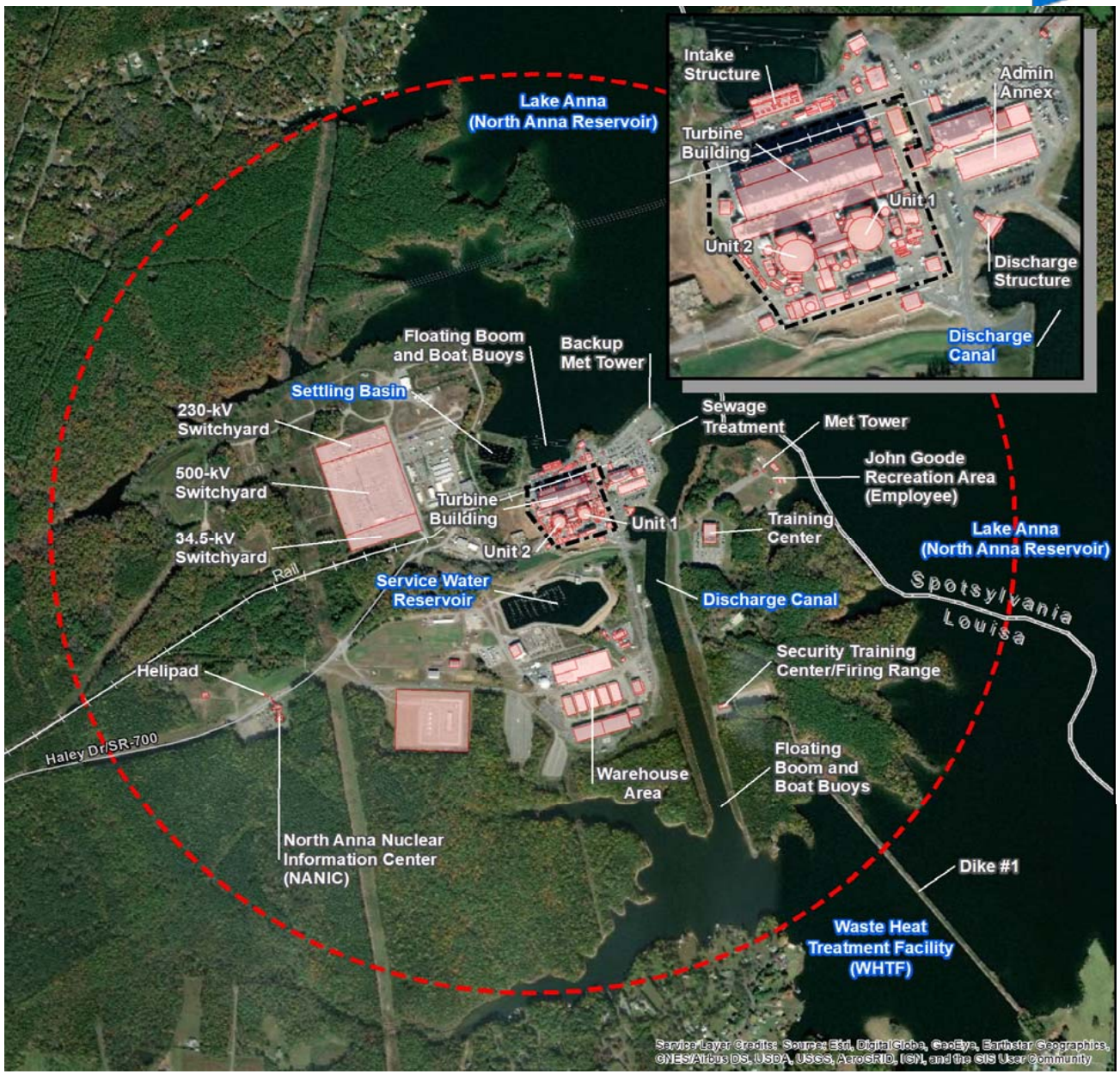
April 9, 2020

North Anna Overview

- Two Westinghouse 3-loop PWRs
- Net Capacity: Each unit is
- ~800 MW_{net} => 2940 MW_t
- Sister Plant to Surry Power Station
- Located in Louisa County, VA

	OLs	40 Yrs	60 Yrs	80 Yrs
Unit 1	1978	2018	2038	2058
Unit 2	1980	2020	2040	2060

Plant Aerial



Discussion Topics

- Same experienced team using same methodologies from Surry
- Insights from Surry SLR were incorporated into the North Anna SLRA to the extent practical
- Commonality in plant designs and many Fleet AMPs
- Safety portion based on NUREG-2192, NEI 17-01, and RG 1.188
- Aging Management Reviews performed with high degree of consistency with NUREG-2191 and recent NRC draft ISGs
- Aging Management Programs developed to maximize consistency with NUREG-2191 and recent NRC draft ISGs
- TLAAs address first LR TLAAs and extensive review performed for new TLAAs

Integrated Plant Assessment

- NEI 17-01 methodology utilized through-out IPA process
- North Anna methodology was consistent with Surry:
  - Re-validation of various design inputs for in-scope determinations
  - (a)2 methodology consistent with current standards and expectations
- Higher degree of AMR consistency with GALL-SLR:
  - > 99% Consistency (only 11 of 7495 lines with F-J Notes)
  - 60 Note E Lines (plant specific AMPs and/or AMP exceptions)
- 10-Year OE Search identified no new aging effects - GALL-SLR comprehensive
- FER items requiring plant specific review resulted in aging management considerations

New SLR AMPs

- XI.M32 - One-Time Inspection
- XI.M33 - Selective Leaching
- XI.M35 - ASME Code Class 1 Small Bore Piping
- XI.E3B - Inaccessible Instrument and Control Cables Not Subject to 10 CFR 50.49
- XI.E3C - Inaccessible Low-Voltage Power Cables Not Subject to 10 CFR 50.49
- XI.E6 - Electrical Cable Connections Not Subject to 10 CFR 50.49
- XI.E7 - High Voltage Insulators

AMPs With Exceptions

- XI.M3 Reactor Head Closure Stud Bolting
  - Yield strength and ultimate tensile strength (SPS)
- XI.M20 Open-Cycle Cooling Water System
  - Recirculation spray HT EX test interval (SPS)
- XI.M27 Fire Water System
  - Fire pump suction strainer
  - Main drain test frequency (SPS)
- XI.M29 Atmospheric Metallic Storage Tanks
  - Caulking/sealant and concrete missile shield (SPS)
- XI.M42 Internal Coatings/Linings (ISG-TBD)

AMPs With Enhancements

- 12 consistent with GALL - no enhancements
- 13 minimal enhancements:
  - Scope and/or standard GALL language enhancement
  - 4 or less enhancements with straight forward guidance to be incorporated
- 11 many enhancements:
  - >4 enhancements to be incorporated
  - more involved enhancements to be incorporated

Incorporation of Revisions to GALL-SLR

- AMPs XI.M2 & XI.M21A EPRI Chemistry Guidelines
- AMP XI.M12 Thermal Aging Embrittlement
- AMP XI.M16A PWR Vessel Internals (MRP-227-R1A)
- *AMP XI.M42 Internal Coatings/Linings*
- AMP XI.E7 High Voltage Insulators
- AMP XI.S1 ASME Section XI, Subsection IWE
- *AMP XI.S8 Protective Coatings*
- AMR items: Table 3.5-1
- *AMR items: Generic F-J Notes (15 items)*

Flaw Tolerance Evaluation for RCS CASS

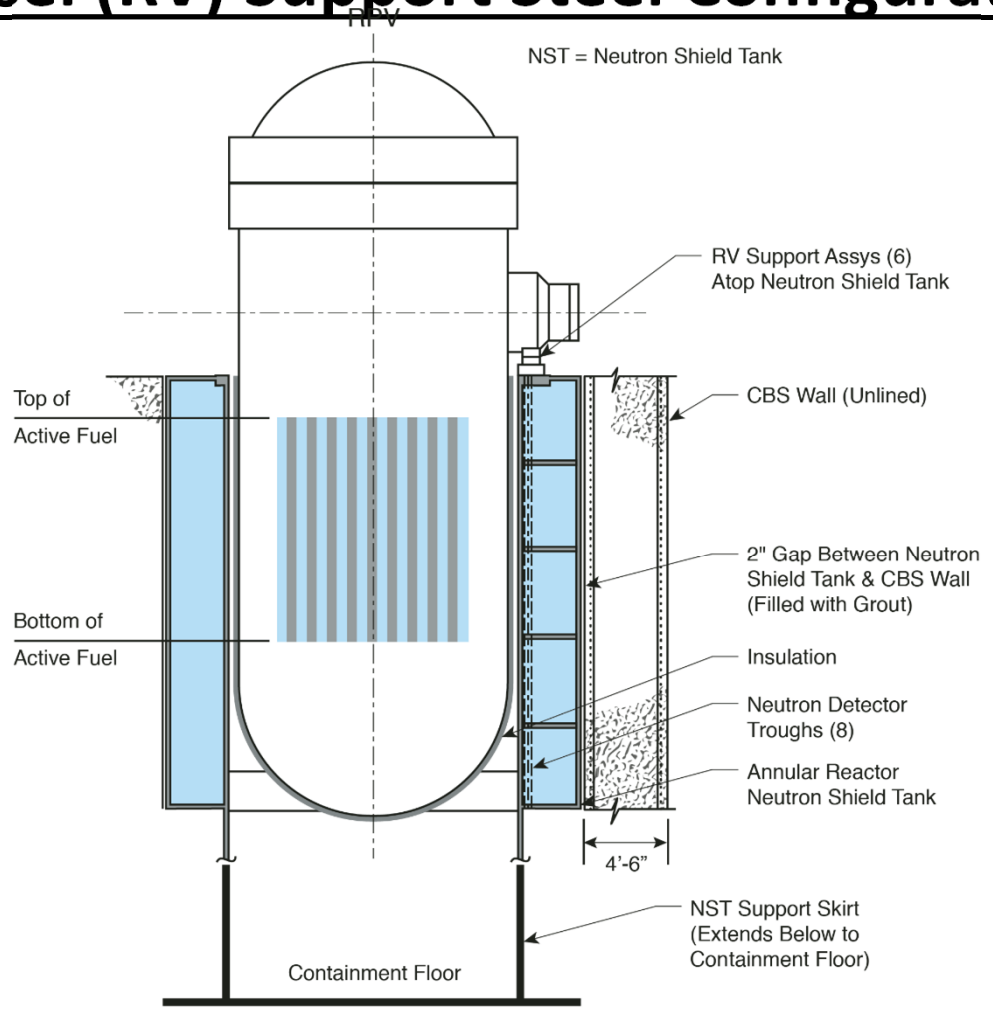
- Flaw tolerance evaluation is consistent with Grimes's Letter and NUREG-2191 Section XI.M12, Thermal Aging Embrittlement of CASS
- Evaluation consistent with IWB-3640 and Appendix C of ASME Section XI.
- Delta ferrite for check chemistry is less than 25% and evaluated with ASME Section XI Appendix C or ASME Section XI Code Case N-838, as applicable, based on delta ferrite content
- The Unit 1 crossover leg delta ferrite content per Hull's Equivalent Factors for Ladle and Check chemistry conditions is 24.57% and 28.29%.
- Delta ferrite for one ladle value greater than 25% is evaluated using Category 2 weld Z-factors from Table C-6330-1 of the 2019 Edition of Section XI. Use of the Category 2 weld Z-factor provided in Table C-6330-1 of the 2019 Edition of Section XI for delta ferrite greater than 25% is a more stringent penalty factor compared to the SAW Z-factor for delta ferrite between 14% and 25%.
- A Plant Specific Evaluation will be included for assessment of the fitting with ladle value greater than 25% delta ferrite.

Reactor Internals AMP – FER 3.1.2.2.9

80 Year Reference basis for developing and defining the aging management of PWR reactor vessel internals components:

- MRP-191 R2 (3002013220) Screening, Categorization, Ranking (ML19081A057 and ML19081A060)
- MRP-227 R1-A (3002017168) PWR Reactor Internals Inspection and Evaluation Guidelines including NRC Safety Evaluation and associated RAI responses (ML19339G364)
- MRP 2018-022, Interim Guidance for PWR Internals I&E Guidelines, MRP-227-A, for SLR: Westinghouse and Combustion Engineering (ML19081A061)
- Recent & related Industry operating experience:
  - Lower Girth Welds: MRP 2019-009 (ML19249B102)
  - CRGT Sheaths and C-Tubes: WCAP-17451 Rev 2 (ML19262E593)

Reactor Vessel (RV) Support Steel Configuration



Reactor Vessel Support Configuration

Irradiation of Concrete: FER 3.5.2.2.2.6

- Fluence Projections:
  Concrete biological shield (CBS) fluence projections at 72 EFPY are below the fast neutron (E> 0.1 MeV) fluence threshold of $1x10^{19}$ n/cm^2 and the gamma dose threshold of $1x10^{8}$ Gy ($1x10^{10}$ rad)
  [Westinghouse Proprietary Report]
- CBS Concrete Maximum Temperature:
  The maximum temperature in the CBS concrete including radiation-induced heating is less than FER 3.5.2.2.2.2 limit of 200^{o}F for local areas and 150^{o}F for general areas with sufficient margin.
  (Gamma heating reference: EPRI TR 3002013051)

Irradiation of RV Support Steel

- NAPS Reactor Vessel Support is through a Neutron Thermal Shield configuration like Surry
- Dominion will use fracture mechanics (NUREG-1509) to demonstrate structural integrity through the SPEO.
- Some differences between Surry and NAPS:
  - Loading on NST for SPS based upon Framatome Break Opening Time (BOT) previously analyzed for evaluation of the reactor vessel slide foot support.
  - Loading on NST for NAPS will be based upon original BOT which is overly conservative.
  - Fracture toughness for SPS was based upon KIR/KIa curve while the fracture toughness for NAPS will be based upon the KIc curve

Reactor Vessel Integrity

- Fluence Projection
  - Regulatory Guide 1.190
  - Fluence values updated to 72 EFPY
  - Extended beltline materials identified
- Materials Properties Confirmation
  - Material properties reviewed and updated (PWROG-18005-NP) to ensure consistency with ASME Code & BTP 5-3
  - Generic Rotterdam USE, Cu, Ni values for Rotterdam Welds and Forgings (PWROG-17090)
- LTOP
  - LTOP enable temperature is 269F – System is enabled per Technical Specification LCO 3.4.12.
- Pressurized Thermal Shock (PTS)
  - RT_{PTS} screening criteria values satisfied through SLR (72 EFPY)

Reactor Vessel Integrity

- Upper Shelf Energy (USE)
  - USE values are above 50 ft-lbs at 72 EFPY except for
    - Unit 1 inlet nozzle forging 11 equal to 50 ft-lbs at 72 EFPY, and
    - Unit 2 intermediate forging 04 less than 50 ft-lbs at 72 EFPY
  - Equivalent Margins Analysis completed by PWROG 19407 for USE items and will be submitted for NRC review and approval.
- Heat-up and Cooldown Curves
  - Confirmed that existing PT curves are acceptable through 72 EFPY
- Surveillance Capsule Withdraw Schedule
  - Letter 19-390 submitted November 25, 2019 requesting NRC review and approval to amend the SC withdrawal schedules.
  - Early withdrawal dates correspond to the first RFO after when the capsules will reach a fluence equal to 80 years of fluence
  - For SLR, potential withdraw dates correspond to the first RFO after when the capsules will reach a fluence equal to 100 years of fluence.
- Reference: WCAP-18363-NP and WCAP-18364-NP

EAF – Components & Vessels

- ASME Code Section III components and vessels
- Retained all NUREG 6260 locations
- F_{en} methodology from NUREG/CR-6909
- NB-3200 evaluations reduced CUF and F_{en} multiplier so CUF_{en} below unity
  - CRDMs
  - Reactor Vessel inlet nozzle, outlet nozzle and CETNA
  - Pressurizer locations
  - Steam Generator locations
  - Reactor Coolant Pump
- Fatigue for ASME Code Section III components managed by Fatigue Monitoring program (cycle counting) or eddy current testing of the steam generator tubing

EAF - Piping

- Reactor coolant loop (RCL) piping was designed to USAS B31.7
  - Piping classified into thermal zones/transient sections
  - Retained all NUREG 6260 locations
  - F_{en} methodology from NUREG/CR-6909
  - One material is not used to screen out another material
  - Common basis stress evaluation (EPRI- 1024995) used for one zone
  - U_{en} based upon design transients for one zone with use of Code Case N-779 (K_e) and Code Case N-902 (EPRI 3002014121 – thickness and gradient factors)
  - U_{en} based upon design transients in one zone using 1979 Edition of B31.7
- Fatigue for USAS B31.7 piping will be managed by Fatigue Monitoring program (Appendix L – 4 locations)
- Revised Pressurizer Surge Line weld inspection for Initial License Renewal submitted to NRC in March 2020
  - Appendix L inspection (10 year frequency) for weld that attaches the reactor coolant hot leg nozzle to the pressurizer surge line piping
  - The hot leg nozzle to reactor coolant hot leg piping is protected by a thermal sleeve thus EAF is not a concern

Other Plant Specific TLAAs

- 3 PWROG Reports with NRC Safety Evaluations generically address TLAAs
  - RCP Flywheel Fatigue Crack Growth Analysis (PWROG-17011-NP-A Rev 2 - ML19198A056)
  - Cracking Associated With Weld Deposited Cladding (PWROG-17031-NP-A Rev 1 - ML-TBD)
  - Reactor Coolant Pump Code Case N-481 (PWROG-17033-NP/P-A Rev 1 – ML19266A666)
- 4 First License Renewal TLAAs dispositions updated
- 1 new Plant Specific TLAAs
  - Steam Generator Tube Wear Analysis

Documents To Be Docketed With SLRA

- **PWROG-18005-NP**, Revision 2, "Determination of Unirradiated RTNDT and Upper-Shelf Energy Values of the North Anna Units 1 and 2 Reactor Vessel Materials," September 2019
- **WCAP-18015-NP**, Revision 2, "Extended Beltline Pressure Vessel Fluence Evaluations Applicable to North Ann Units 1 & 2," September 2018
- **WCAP-18363-NP, Rev. 1**, "North Anna Units 1 and 2 Heatup and Cooldown Limit Curves for Normal Operation," March 2020
- **WCAP-18353-NP**, Rev 0, "Reactor Internals Fluence Evaluation for a Westinghouse 3-Loop Plant with Two Units," October 2018
- **WCAP-18364-NP, Rev. 1**, "North Anna Units 1 and 2 Time-Limited Aging Analysis on Reactor Vessel Integrity for Subsequent License Renewal (SLR)," March 2020
- **WCAP-11163-P, Revision 1**, "Technical Justification for Eliminating Large Primary Loop Pipe Rupture as the Structural Design Basis for North Anna Units 1 and 2 Nuclear Power Plants for the Subsequent License Renewal Program (80 Years) Leak-Before-Break Evaluation," October 2019

Documents Previously Docketed

- **WCAP-14040-A, Rev. 4,** "Methodology Used to Develop Cold Overpressure Mitigating System Setpoints and RCS Heatup and Cooldown Limit Curves," May 2004 (ML050120209)
- **PWROG-19047-P,** North Anna Reactor Vessel Upper-Shelf Fracture Toughness Equivalent Margin Analysis (ML-TBD)
- **PWROG-17011-NP-A**, Revision 2, "Update for Subsequent License Renewal: WCAP-14535A, 'Topical Report on Reactor Coolant Pump Flywheel Inspection Elimination' and WCAP-15666-A, 'Extension of Reactor Coolant Pump Motor Flywheel Examination,'" January, 2019 (ML19198A056)
- **PWROG-17031-NP-A**, Revision 1, "Update for Subsequent License Renewal: WCAP-15338-A, A Review of Cracking Associated with Weld Deposited Cladding in Operating PWR Plants," May 2018 (ML-TBD)
- **WCAP-15338-A**, "A Review of Cracking Associated with Weld Deposited Cladding in Operating PWR Plants," October 2002 (ML083530289)
- **PWROG-17033-NP-A,** Revision 1, "Update for Subsequent License Renewal: WCAP-13045, 'Compliance to ASME Code Case N-481 of the Primary Loop Pump Casings of Westinghouse Type Nuclear Steam Supply Systems,'" November 2019 (ML19266A666)

Closing Remarks

- North Anna is a sister plant to Surry – Many Fleet AMPs
- Dominion is highly experienced with SLR
- Dominion has been engaged and integrated with the development of GALL-SLR ISGs and industry guidance
- North Anna SLRA has incorporated Surry RAIs
- North Anna SLRA will have a higher degree of consistency with GALL-SLR
- Dominion will submit a higher quality application to support an efficient NRC review
- The North Anna SLRA is ahead of schedule with expected submittal in 3Q20