NRC Safety Pre-Application Meeting

Surry Power Station

April 17, 2018

Surry Overview

Surry Power Station
Lead SLR Plant

Lifetime Generation over 460,000,000 MWhrs

- Two Westinghouse 3-loop PWRs
- Net Capacity: Each unit is 838 MW (net) => 1676 MW (includes MUR uprate)
- Capital Improvements ~ $1B since initial LR

	OLs	40 Yrs	60 Yrs	80 Yrs
Unit 1	1972	2012	2032	2052
Unit 2	1973	2013	2033	2053

Discussion Topics

- Safety portion based on NUREG-2192, NEI 17-01, and RG 1.188 (pending)
- Integrated Plant Assessment was performed to current standards
- Aging Management Reviews performed with high degree of consistency with NUREG-2191
- Aging Management Programs developed to maximize consistency with NUREG-2191
- Overview of TLAAs
- Closing Remarks

Integrated Plant Assessment

- NEI 17-01 methodology utilized through-out IPA process
- Surry approach utilized a full review, not a gap approach
  - Re-validation of various design inputs for in-scope determinations
  - (a)(2) methodology consistent with current standards and expectations
  - Security building will be the only System or Structure included in initial LR but excluded in SLR

Integrated Plant Assessment

- AMR consistency with GALL-SLR:
  - > 99% Consistency
    (currently 16 of 6195 lines with F-J Notes)
  - 130 Note E Lines
- 10-Year OE Search identified no new aging effects - GALL-SLR comprehensive
- FER items requiring plant-specific review resulted in aging management considerations

Surry SLR AMP Considerations

- NEI involvement, collaboration with EPRI, and PWROG participation informed AMPs with New Industry Guidance and R&D products
- Incorporation of operating experience (OE):
  - Industry and plant-specific OE reviewed for a 10-year period
  - Reviewed Industry RAIs for AMP insights
  - Participation in Industry Peer Reviews
  - SLR Lead Plant Alignment
- AMP Effectiveness Reviews performed on all initial license renewal AMPs using elements of NEI 14-12

Surry SLR – Initial License Renewal AMPs

All initial license renewal AMPs will be continued and incorporated into GALL-SLR AMPs:

- No initial LR AMPs discontinued
- Some initial LR AMPs are consistent with GALL-SLR AMPs
- Several initial LR AMPs will require enhancement for consistency with GALL-SLR AMPs
- Several initial LR AMPs will be subdivided into other GALL-SLR AMPs
- 8 new AMPs required for SLR
- No plant-specific AMPs required for SLR

Surry SLR – 47 GALL-AMPs

	Consistent with GALL-SLR	With Enhancement	With Exception	Exception and Enhancement	Plant Specific
Existing 39	8	22	1	8	0
New 8	6	0	2	0	0
Total 47					

New SLR AMPs

- XI.M12 - Thermal Embrittlement
- 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.M2 - Water Chemistry
- XI.M3 - Reactor Head Closure Stud Bolting
- XI.M20 - Open-Cycle Cooling Water System
- XI.M21A - Closed Treated Water Systems
- XI.M27 - Fire Water System
- XI.M29 - Atmospheric Metallic Storage Tanks
- XI.M30 - Fuel Oil Chemistry
- XI.M35 - ASME Code Class 1 Small Bore Piping
- XI.M42 - Internal Coatings/Linings
- XI.E4 - Metal Enclosed Bus
- XI.E7 - High Voltage Insulators

Types of AMP Exceptions

- 4 AMP Exceptions – plant-specific configurations
- 3 AMP Exceptions - test frequency and/or inspection technique alternatives proposed
- 2 AMP Exceptions - EPRI Chemistry guideline revision
- 1 AMP Exception - management of a different component type

Electrical AMPs

- Electrical AMPs Included:
  - 5 existing and
  - 4 new AMPs
- Electrical AMPs Not Required:
  - XI.E5 - Fuse Holders
- AMPs with Exceptions to GALL:
  - XI.E4 - Metal Enclosed Bus- Exceptions for Bus Alignment and Maintenance
  - XI.E7 - High Voltage Insulators- Exception for Including Medium Voltage Components

Structural AMPs

Alkali-Silica Reaction (ASR)

Surry has collaborated with EPRI to develop guidance for management of degradation due to ASR

- Identification of Leading Indicator Structures
- Augmented ASR Inspection Guidelines to identify
  - Pattern cracking with darkened crack edges
  - Water ingress
  - Misalignment (Install reference points for baseline and future comparison)
- Evaluation of results

Structural AMPs

Irradiation of Concrete

EPRI Project underway to address Reduction of Strength and Mechanical Properties of Concrete Due to Irradiation

- EPRI model based on Surry:
  - configuration and material properties (reactor vessel, neutron shield tank, concrete primary shield wall)
  - fluence inputs for model based on Surry core data
- Actual irradiation data to be compared to limits
  - 1×10^{19} neutrons/cm^2 neutron radiation (fluence cutoff energy E > 0.1 MeV), and
  - 1×10^{8} Gy (1×10^{10} rad) gamma dose

Reactor Internals AMP – GAP Analysis

MRP guidance, expert panels, and operating experience will be used to inform XI.M16A - AMP Gap Analysis

- MRP-175 R1 (SLR) Degradation Screening/Thresholds:
  - Informed by MRP-211 Stainless Steel material properties
  - Conservative screening criteria & assumptions
  - Technical aspects of initial license renewal validated and do not need to be re-addressed
- MRP-191 R2 (SLR) Screening, Categorization, Ranking
  - Surry Reactor Internals components identified in MRP-191 component list
  - Expert panel process will categorize and rank components based on updated knowledge and consideration of SLR
  - Failure modes, effects, and criticality assessment (FMECA) review and severity categorization in progress

Reactor Internals AMP – GAP Analysis

MRP expert panels/evaluation to provide interim Inspection and Evaluation guidance for MRP-227

- Incorporate lessons learned and OE from MRP-227 R1
- Identify changes to the existing MRP-227-A program characteristics or criteria such as:
  - inspection categories,
  - inspection criteria, or
  - primary-to-expansion component criteria & relationships
- Gap analysis results documented in SLRA Appendix C and AMP XI.M16A, PWR Vessel Internals

Reactor Vessel Integrity

No changes in evaluation method for SLR reactor vessel integrity

- Fluence Projection
  - Regulatory Guide 1.190
  - Projected to 68 EFPY for all vessel locations
  - Extended beltline materials identified
- Materials Properties Confirmation
  - CMTRs and C of C reviewed
  - RT_{NDT} and USE confirmed to BTP 5-2/5-3
  - Generic values for USE, Cu, Ni applicable to Rotterdam welds and forgings (PWROG-17090)
- LTOP
  - Existing setpoints and limits remain applicable through 68 EFPY

Reactor Vessel Integrity

- Pressurized Thermal Shock (PTS)
  - RT_{PTS} screening criteria values satisfied through SLR (68 EFPY)
  - Anticipated changes to Emergency Response Guidelines
- Upper Shelf Energy (USE)
  - Most of the reactor vessel materials are projected to remain above the 50 ft-lb threshold throughout SLR period
  - A new EMA has been perform for the Surry materials that will drop below the threshold during the SLR period
    - The PWROG submitted the EMA topical reports to the NRC for review/approval in December 2017
  - Dominion Energy will evaluate the progress of the NRC Staff review and determine whether a plant-specific evaluation will be required to be included in the SLRA
- Heat-up and Cooldown Curves
  - Confirmed that existing 48 EFPY curves bound operation through 68 EFPY

Reactor Vessel Integrity

Surveillance Capsule Withdrawal Schedule

- Updated withdrawal schedule submitted to NRC in 2017
  - Intent is to optimize the use of remaining capsules
  - Next proposed capsule withdrawal will have fluence values that bound 80 years of plant operation
- For SLR, Dominion Energy anticipates removal and testing another capsule to bound 100 years of plant operation during the SLR period

EAF – Components & Vessels

- Designed to ASME Section III
- All NUREG-6260 locations evaluated
- F_{en} methodology from NUREG/CR-6909
- Locations of interest
  - Two CRDMs
  - RV inlet nozzle, RV outlet nozzle, Bottom head juncture
  - Three Pressurizer locations (spray, surge, heater)
  - Steam Generator tubing
- NB-3200 evaluations reduced CUF and/or F_{en} multiplier so CUF_{en} below unity
- Fatigue Management
  - Fatigue Monitoring program for ASME Section III components
  - NEI 97-06 inspection program for SG tubing

EAF – Piping

- Reactor coolant loop (RCL) piping was designed to USAS B31.1
  - RCL and branch line piping fabricated from stainless steel – No Inconel
- Common basis stress evaluation (EPRI-1024995)
  - Piping classified into thermal zones
  - All NUREG-6260 locations evaluated
  - F_{en} methodology from NUREG/CR-6909
- Confirmed one new fatigue sensitive location for RHR
- Appendix L Flaw tolerance evaluations will be completed for new fatigue sensitive (RHR) and sentinel locations
- ISI on 10-year frequency to manage fatigue

Other Plant-Specific TLAAs

- Three PWROG Reports generically address TLAAs
  - RCP Flywheel Fatigue Crack Growth Analysis (PWROG-17011-NP)
  - Cracking Associated with Weld Deposited Cladding (PWROG-17031-NP)
  - RCP Code Case N-481 (PWROG-17033-NP)
- Four initial LR Misc. TLAAs updated
- Two new plant-specific TLAAs
  - Unit 2 Reactor Vessel Inlet Nozzle to Shell Weld Flaw
  - Steam Generator Tube Cracking Analysis

Closing Remarks

- Dominion Energy has been engaged and integrated with the development of GALL-SLR and industry guidance
- Dominion Energy team is experienced with LR/SLR and requirements
- Dominion Energy is supporting recent and SLR application reviews and reviewing recent RAI responses
- Dominion Energy will submit a high quality application to support an 18-month NRC review
- Surry Project Team is on or ahead of schedule for a 1st quarter 2019 submittal