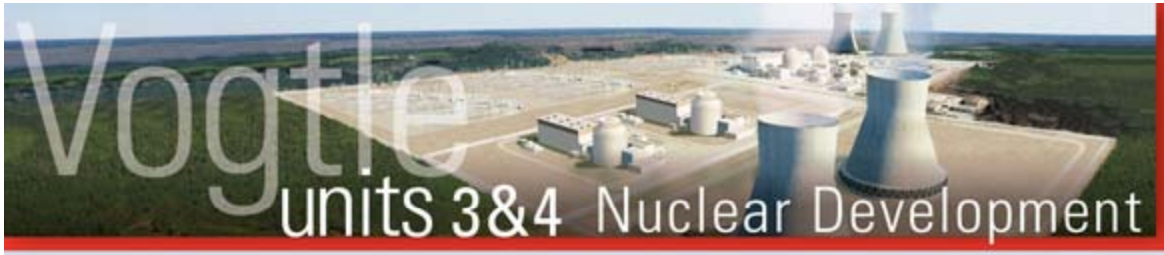

Southern Nuclear
Vogtle 3 & 4 Project
Piping DAC Closure
May 24, 2011



SOUTHERN COMPANY Westinghouse Shaw

AP1000 DCWG - Plan for Piping Design Acceptance Criteria (DAC)

Amy Aughtman/Kevin Pigg
AP1000 DCWG

Piping DAC Background

As-designed Piping Analysis

Risk significant piping packages as defined by COL information item 3.9-7 to be all Class 1 piping greater than 1” in diameter and Class 2/3 lines included in Table 3.9-20 of the DCD

Original scope was 48 piping packages as determined by the NRC to be the risk significant piping that demonstrates all aspects of the piping design. The number of packages has been increased due to reorganization of lines included in each package (DCD criteria for scope is being followed)

As-designed Piping Analysis

Piping packages analysis scope includes:

- Piping stress analysis
- Support analysis/evaluation
- ASME Class 1 fatigue analysis (12 lines)
- Hard Rock High Frequency (HRHF) evaluation for Class 1,2,3 piping

Methodology/scope outlined in the DCD Table 3.9-19 (and referenced sections)

WESTEMS computer code used for ASME Class 1 fatigue analysis (Discussed in further detail on later slides)

Piping Design COL ITAAC

Design Commitment

- Piping classified ASME Section III is designed in accordance with ASME Section III requirements.

Inspections, Tests, Analyses

- Inspection of ASME Design Reports (NCA-3550) and required documents will be conducted for the set of lines chosen to demonstrate compliance.

Acceptance Criteria

- ASME Design Report(s) (NCA-3550) exist and conclude that the design of the piping for lines chosen to demonstrate all aspects of the piping design complies with the requirements of ASME Section III.

As-designed Pipe Rupture Hazards Analysis (PRHA)

- As-designed PRHA scope is defined by COL information item 3.6-1
- Methodology is outlined and approved in the DCD (Section 3.6.1.3.2 and 3.6.2.5)
- Mitigation evaluation is performed by building & room
- Deliverable is as-designed pipe rupture hazards report

PRHA COL ITAAC

Design Commitment

- Systems, structures and components (SSCs), that are required to be functional during and following a design basis event shall be protected against or qualified to withstand the dynamic and environmental effects associated with analyses of postulated failures in high and moderate energy piping.
  - High-energy fluid systems are analyzed for the effects of pipe whip, jet impingement, flooding, room pressurization, and temperature effects.
  - Moderate-energy fluid systems are analyzed for wetting from spray, flooding and other environmental effects, as appropriate.

PRHA COL ITAAC

Inspections, Tests, Analyses

- The as-designed pipe rupture hazards report documents the postulated break locations and determines appropriate protection features to mitigate the consequence of a pipe break.

Acceptance Criteria

- An as-designed pipe rupture hazard analysis report exists and concludes that the analysis performed for high and moderate energy piping confirms the protection of systems, structures, and components required to be functional during and following a pipe rupture.

Piping DAC Closure Plan

Piping DAC Closure Plan

- From Appendix 14A of the DCD, methods available for DAC closure (applies to both as-designed piping analysis and PRHA)
  - Resolve through amendment to DCD
  - Resolve during COL review
  - Resolve after COL is issued
- For AP1000, the method is to close after the COL is issued following the ITAAC closure process for COL
- "One issue, one review, one position" for subsequent COL holders

Piping DAC Closure Plan

- Phased completion in combination with a benchmarking report
  - A report will be used to document benchmarking of the Piping Fatigue Analysis Methodology
  - Explore efficiency through a phased completion of piping packages and notification of availability
  - Submit final ITAAC closure letter upon completion of all piping packages

ITAAC Maintenance

ITAAC Maintenance

- Not applicable for as-designed piping design and as-designed PRHA ITAAC
  - It is recognized that piping design packages will likely be changed as the plant is built. These changes are required to be reconciled by the ASME Code and will be inspected as part of a separate ITAAC or set of system based ITAAC at each site that will specifically look at reconciliation of the as-built design.
- ITAAC maintenance is applicable for the as-built piping system and as-built PRHA ITAACs

Piping DAC
Fatigue Analysis Methodology

Piping Fatigue Analysis Methodology - Status

May 24, 2011

Piping Fatigue Analysis Methodology - Background

- During technical review of Class 1 Piping held in October of 2008 NRC reviewed Westinghouse Piping Fatigue Methodology including the application of WESTEMS™
- NRC issued RAI requesting WESTEMS™ be added to Table 3.9-15 of the DCD
- NRC requested audit on WESTEMS™ computer code in May of 2009
- Follow-up audit on SER open items held in June of 2010
- Draft procedure for use of WESTEMS™ provided for staff review in August of 2010
- NRC comments on procedure resulted in the retraction and revision of the RAI response that introduced WESTEMS™ to the DCD and DCA review and deferred resolution of NRC comments on fatigue analysis methodology to post COL during Piping DAC resolution

Piping Fatigue Analysis Methodology - Status

- **Issues identified in: Summary of the AP1000 Design Certification – Regulatory on-site and off-site reviews of open items for the WESTEMS™ computer code, Docket No. 52-006**
  - OI-SRP 3.9.1-EMB-05
  - OI-SRP 3.9.1-EMB-06
  - OI-SRP 3.9.1-EMB-07

Piping Fatigue Analysis Methodology - Status

OI-SRP 3.9.1-EMB-05

- **Concern:**
  - "WESTEMS™ allowed use of algebraic summation of three orthogonal moment vectors to generate stress histories for selection of peak and valley times."
- **Action Taken:**
  - The default setting for NB3600 peak and valley moments option input was changed to use the SRSS method of moment summation.
  - WESTEMS™ Version 4.5.3 validated and released in accordance with Westinghouse QA procedures

Piping Fatigue Analysis Methodology - Status

OI-SRP 3.9.1-EMB-06

- **Concern:**
  - Outside surface thermal stress equation was not correct.
  - Impact was insignificant since the pipe inside surface controls piping fatigue evaluation due to more severe thermal stress from transients being applied at the inside surface
- **Action Taken:**
  - Immediately identified in Corrective Actions Program
  - The computer program was corrected to calculate the correct outside surface stress.
  - WESTEMS™ Version 4.5.3 validated and released in accordance with Westinghouse QA procedures

Piping Fatigue Analysis Methodology - Status

OI-SRP 3.9.1-EMB1-07

- **Concern:**
  - WESTEMS™ options for peak and valley selection allow “user intervention” in the analysis process
  - NRC reviewed draft Westinghouse Level 3 Quality procedure for WESTEMS™ NB-3600 Fatigue Analysis and Verification and concluded that the procedure required additional guidance to ensure effective application of piping fatigue methodology.
- **Planned Action:**
  - Update the WESTEMS™ Design Analysis Users Manual to incorporate all addenda created and clarifications included in response to NRC RAIs.
  - Develop a benchmark problem and validate the procedure with the benchmark evaluation. (See next slide.)

Piping Fatigue Analysis Methodology - Status

OI-SRP 3.9.1-EMB1-07

- **Procedure Benchmarking Plan:**
  - Evaluate a complex fatigue case (e.g., spray line component). The example will be developed to test each step of the procedure, including proper application of the WESTEMS™ NB3600 moment input options and peak selection and editing options.
  - Apply the WESTEMS™ NB3600 procedure in the benchmark problem evaluation process and document any areas for improvement.
  - Enlist independent industry expert to validate procedure benchmark.
  - Finalize the procedure based on benchmark results and NRC feedback.

Piping Fatigue Analysis Methodology - Status

OI-SRP 3.9.1-EMB1-07

- **Additional Fatigue Analysis Methodology Benchmarking:**
  - Perform additional alternate calculations in the benchmarking process
  - Document and verify the alternate calculations

Piping Fatigue Analysis Methodology - Status

- Path Forward
  - Utilize WESTEMS™ as tool for implementing fatigue analysis methodology.
  - Westinghouse completes Benchmarking actions.
  - Westinghouse responds to audit open items and provides topical report as appropriate.
    - Update of WESTEMS™ User's Manual to address NRC comments.
  - Request NRC write a SE on a topical report, as appropriate and add WESTEMS™ to DCD Table 3.9-15 via Standard Departure in accordance with 10 CFR 52 Appendix D Section VIII.
  - Activities complete prior to NRC review of ASME Design Reports on piping selected as being within the scope of the DAC.

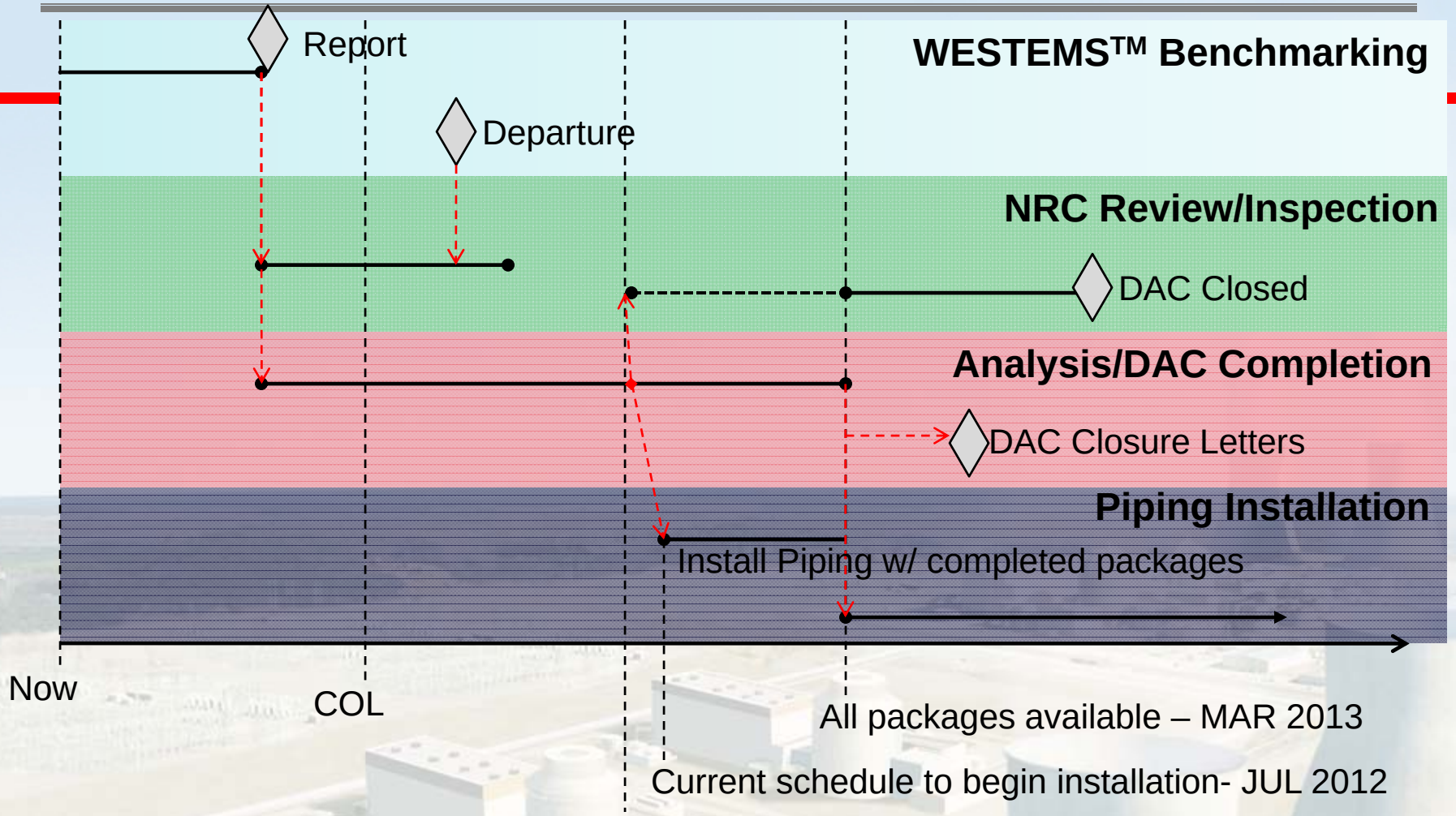
Questions

Piping DAC Closure Plan

Piping DAC Closure Plan

- Benchmarking Report
  - Will describe the application of WESTEMS NB-3600 as used for the piping fatigue analysis
- Phased completion and notification process
  - Based on completion of piping package milestones
- Submit final ITAAC closure letter upon completion of all piping packages

Piping Design/PRHA DAC Schedule



Questions