NEI Steam Generator Task Force

NRC/Industry Update

August 12, 2010

NUCLEAR ENERGY INSTITUTE

Agenda

8:30 am Introductions - NRC

Opening Remarks - NRC and Industry

NEI Steam Generator Task Force Update - Industry

1. Preservice inspection guidance
2. Design and analysis of plugs and response to operating experience
3. Automatic data analysis
4. Update on inspection technique qualification for U-bend
5. Divider plate cracking update

12:00 pm Lunch

1:00 pm NEI Steam Generator Task Force Update (continued) – Industry

Agenda (Continued)

1:00 pm NEI Steam Generator Task Force Update (continued) – Industry

6. Follow up on previous meetings
   - Updating SG programs
   - AVB position verification
   - Deposit modeling and guidance
   - Adequacy of in situ guidelines
   - TSTF-510
   - Cracking/inspection of -2 sigma tubes
7. Upcoming Changes to Industry Documents
8. Recent SG Operating Experience
9. Future topics

4:30 pm NRC feedback on various issues - NRC and Industry (e.g., TSTF-510, Primary and Secondary Side Fouling)

4:45 pm Address Public Questions/Comments - NRC and Industry

5:00 pm Adjourn

Preservice Inspection Guidance

Gary Boyers, FPL

Preservice Inspection Guidance

NRC Comment regarding Preservice Examination of SG tubing:

- IWB-2200(c) of Section XI of the ASME Code indicates that steam generator tube examination shall be governed by the plant Technical Specification. The technical specifications do not address preservice inspections. Discuss with the industry a path forward to address this issue (e.g., incorporating preservice inspections into TSTF-510, modifying the ASME Code).

Preservice Inspection Guidance

IWB-2200 PRESERVICE EXAMINATION

(a) Examinations required by this Article (with the exception of Examination Category B-P, and the visual VT-3 examination of the internal surfaces of Categories B-L-2 and B-M-2, of Table IWB-2500-1) shall be completed prior to initial plant startup. In addition, these preservice examinations shall be extended to include essentially 100% of the pressure retaining welds in all Class 1 components, except in those components exempted from examination by IWB-1220(a), (b), or (c). However, in the case of Examination Category B-O (Table IWB-2500-1), the examination shall be extended to include essentially 100% of the welds in the installed peripheral control rod drive housings only.

(b) Shop and field examinations may serve in lieu of the on-site preservice examinations provided:

(1) in the case of vessels only, the examination is performed after the hydrostatic test required by Section III has been completed;

(2) such examinations are conducted under conditions and with equipment and techniques equivalent to those that are expected to be employed for subsequent inservice examinations;

(3) the shop and field examination records are, or can be, documented and identified in a form consistent with those required in IWA-6000.

(c) Steam generator tube examination shall be governed by the plant Technical Specification.

Preservice Inspection Guidance

Industry consensus:

- Adding preservice examination requirements to the Technical Specifications is not appropriate
- 8/3/10 – ASME Working Group on Inspections and Components opened Code action item BC 10-1340
  - Revise wording in IWB-2200(c) such that:
    - SG tubing is not exempted
    - Add wording similar to "Additional requirements for steam generator tubing may be specified by the Owner."
    - The action was approved in the working group and will proceed through the ASME approval process.

Design and Qualification of Plugs and Operating Experience

Steve Fluit & Nick Idvorian, B&W Canada
Jeff Fleck, AREVA
Herm Lagally, Westinghouse

Design and Qualification of Mechanical Plugs and Operating Experience

NRC Comment regarding plugs:

- **As a result of interactions with the ASME Code and international operating experience (the French experience as discussed in the last meeting), obtain a better understanding of the design of the various type of tube plugs, how they have been designed (i.e., what are the design criteria for the plug), and their qualification.**
- **Provide update on foreign experience with plugs including St. Alban and Flamanville. At Flamanville, a welded plug installed during fabrication may have "collapsed" due to the flow diode effect. The corrective actions in France based on the St. Alban operating experience may have been finalized.**

Design and Qualification of Mechanical Plugs and Operating Experience

- All three vendors have or are in the process of qualifying mechanical plugs for the US SG market
- In general, the plugs are an ASME Section III item, installed under Section XI
- Mechanical plugs are either of ribbed or rolled joint configuration
- ASME Section XI IWA-4713
  - First appears in 2001 Edition with 2003 Addenda
  - Invoked by customer PO to vendors
  - Not all US plants have updated to the Code year where these requirements exist
  - Defines detailed requirements for mechanical plugging
  - All 3 vendors' plugs meet the requirements of IWA-4713

Design and Qualification of Mechanical Plugs and Operating Experience

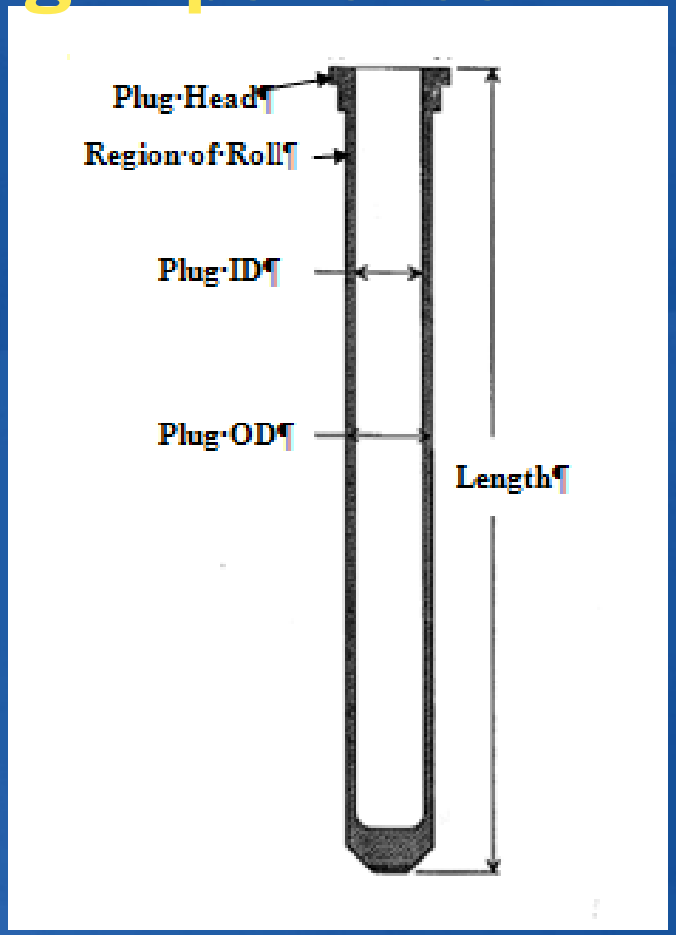
- **Summary of Mechanical Plug Designs**

Characteristic	AREVA	B&W	Westinghouse
Designs	Rolled	Rolled	Ribbed (long and short) Rolled
Sizes	Tube OD sizes (inch) 0.875, 0.750, 0.688, 0.625	Tube OD sizes (inch) 0.625	Tube OD sizes (inch) 0.875, 0.750, 0.688, 0.625
Material	Alloy 690 TT Barstock	Alloy 690 TT Barstock	Alloy 690 TT Barstock
Expansion Process	Mechanical roll	Mechanical roll (nickel plated)	Mandrel pull – land engagement Mechanical roll (nickel plated)
Designed for removal	Yes	Yes	Yes
Installation position	Plug head protrudes from tube end	Plug head protrudes from tube end	Ribbed – Can be installed within tubesheet Rolled - Plug head protrudes from tube end

Design and Qualification of Mechanical Plugs and Operating Experience

- **AREVA ROLLED MECHANICAL PLUG**
  - Alloy 690 material
  - Roll expansion in region near tube end – becomes new pressure boundary
  - Leak-limiting pressure boundary
  - Plug OD and ID varies depending on the applicable tube size
  - Geometry of lower region of the plugs has evolved for some applications to address industry findings, such as increasing the wall thickness of the lower end of the plug to provide greater margin against plug collapse due to over-pressurization of the plugged tube
  - Plug end has been modified for some applications to improve remote installation and to allow attachment of a stabilizer
  - Installation and subsequent removal of the AREVA NP mechanical roll plugs does not compromise the structural integrity of the tube or the tubesheet. After removal, another mechanical roll plug may be installed

Design and Qualification of Mechanical Plugs and Operating Experience

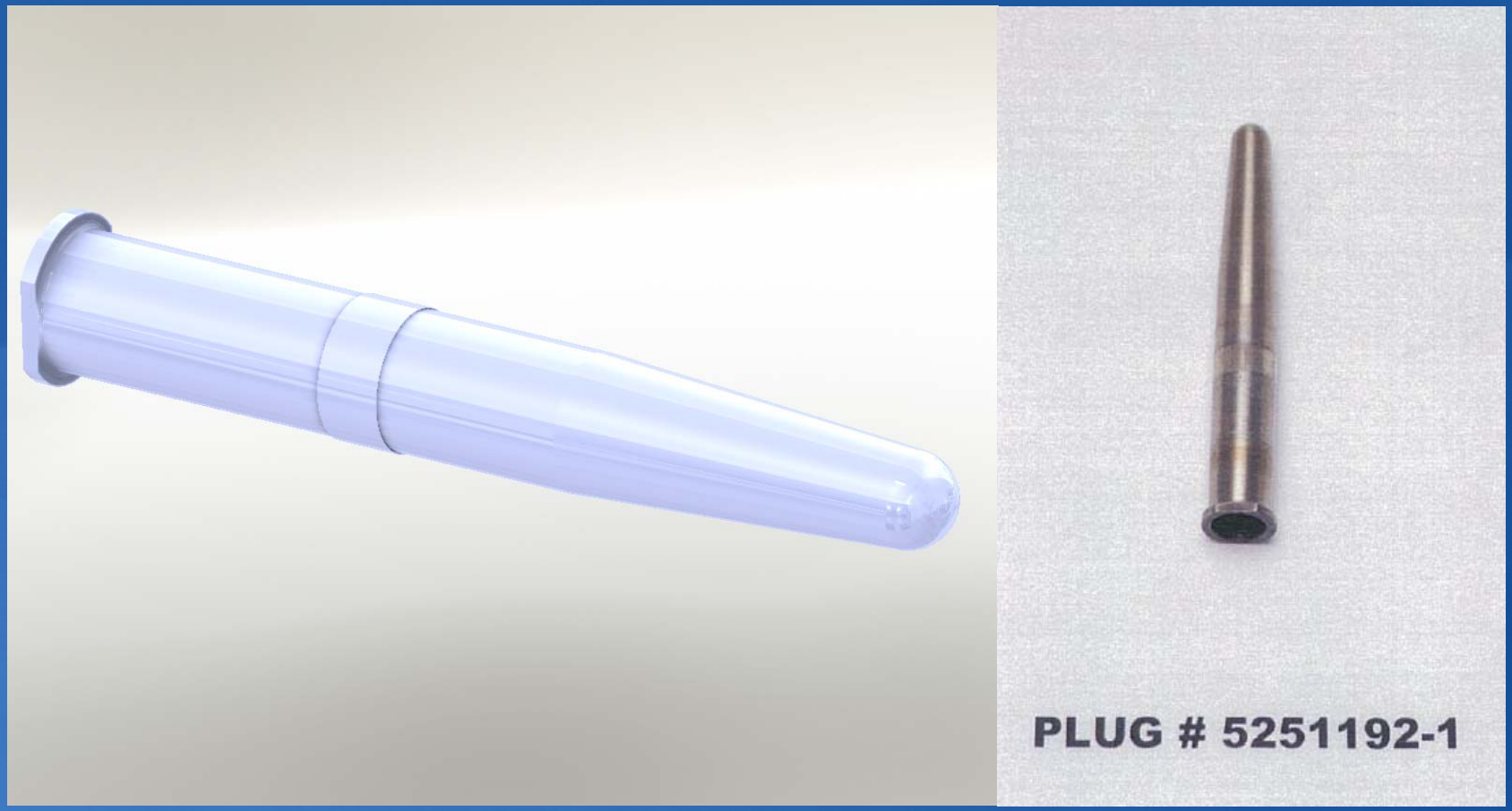


AREVA Rolled Plug

Design and Qualification of Mechanical Plugs and Operating Experience

- **B&W ROLLED MECHANICAL PLUG**
  - Machined from Alloy 690 material
  - Nickel plated band in rolled zone ensures plug is leak-tight for normal and faulted conditions
  - Plug designed for tube over-pressurization – tube will burst before plug ejects
  - Plug installation and removal does not affect compromise integrity of tube or tubesheet
  - Full qualification of replugged tubes has been performed

Design and Qualification of Mechanical Plugs and Operating Experience



B&W Rolled Plug

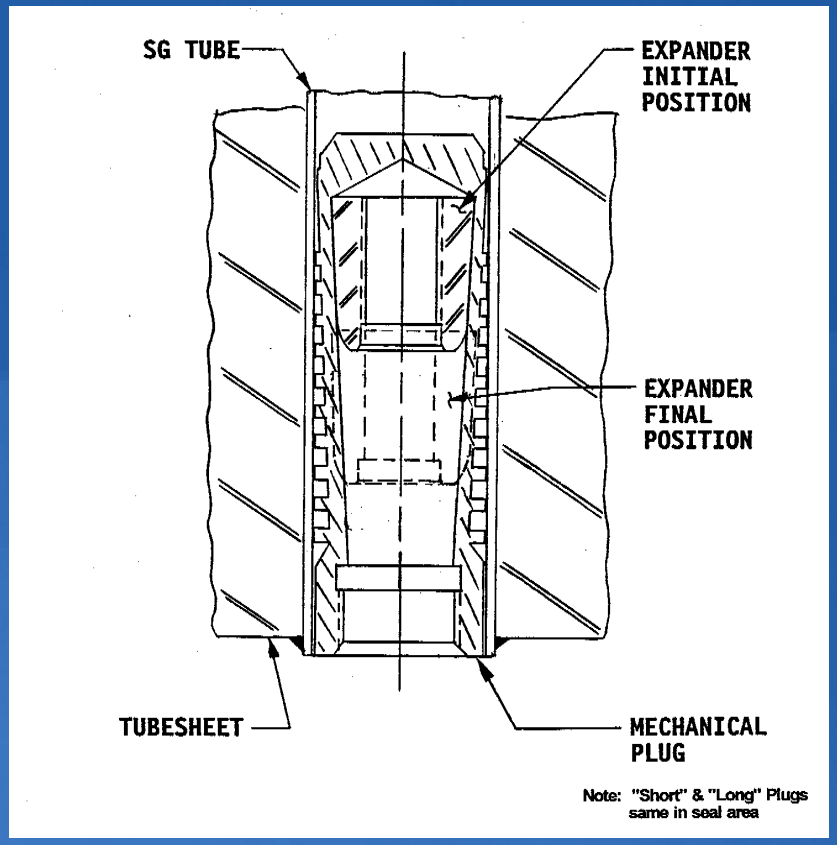
Design and Qualification of Mechanical Plugs and Operating Experience

- **WESTINGHOUSE MECHANICAL ROLLED PLUGS**
  - Leak tight up to 10,000 psi
  - Easily removed
  - Can accommodate tube-end damage
  - Machined from Alloy 690 bar
  - Nickel plating at center of roll zone
  - Flared or straight end to accommodate tooling
  - Bull nose permits installation through conduit

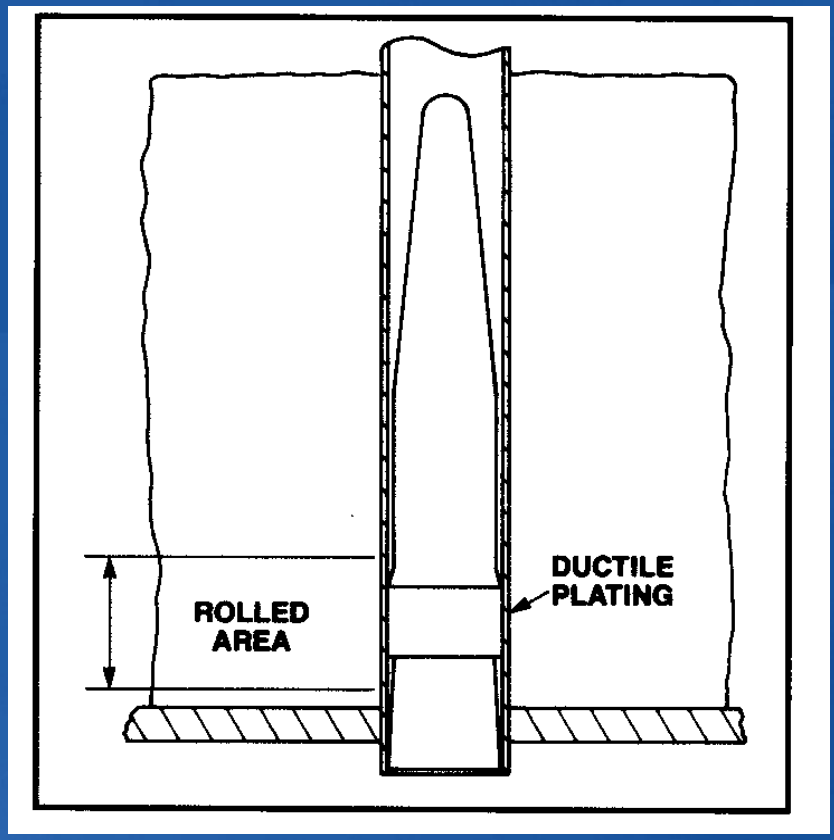
Design and Qualification of Mechanical Plugs and Operating Experience

- **WESTINGHOUSE MECHANICAL RIBBED PLUG**
  - **"LONG" AND "SHORT" DESIGNS**
  - **May be elevated in tubesheet**
  - **Not sensitive to moisture and tube ID surface condition**
  - **Removable with some effort**
  - **Shell material - Alloy 690**
  - **OD has ribs ("LANDS")**
  - **ID of shell is tapered**
  - **Expander has tapered OD and Threaded ID**
  - **Plug portion above top sealing land designed to section III OF ASME B&PV code**
  - **Plug portion at lands:**
    - **Semi-empirical determination of interference fit contact pressure between plug and tube**
  - **Interference fit adequate for all steam generator analyzed conditions for plug anchorage and leakage resistance**

Design and Qualification of Mechanical Plugs and Operating Experience



Ribbed Plug



Rolled Plug

Westinghouse Mechanical Plugs

Design and Qualification of Mechanical Plugs and Operating Experience

- **Qualification of Mechanical Plugs**
  - Initial qualification by AREVA and Westinghouse performed prior to the current requirements of Section XI, Paragraph IWA-4713
    - AREVA and Westinghouse documentation updated to show qualifications met these requirements
    - Current and recent qualifications by all three vendors meet IWA-4713
  - Based on testing and analysis

Design and Qualification of Mechanical Plugs and Operating Experience

- **Qualification of Mechanical Plugs**
  - **Test Variables:**
    - **Leak tests –leak-limiting capability of the roll joint**
    - **Thermal and pressure cycling –heatup and cooldown transients**
    - **Load Tests –structural integrity of the roll joint**
  - **System Variables:**
    - **Geometric variations of plugs and tubes**
    - **Installation torque ranges**
    - **Single/double rolls**
  - **Materials**
    - **Corrosion tests**

Design and Qualification of Mechanical Plugs and Operating Experience

Typical Testing Program

Test Variables

Normal operating ΔP

Faulted ΔP

Proof ΔP (3 x normal / 1.43 faulted)

Tube burst ΔP

Pressure cycling

Thermal cycling

Corrosion testing

System Variables

Small/large tubesheet bores

Single/double rolls

High/low torques

Tubesheet hole dilation

Attached stabilizer

Measurements

Leakage

Tubesheet ligament distortion

Plug movement

Plug distortion

Complete qualification scope is required only for initial qualification; reduced testing and analysis programs for application to different model SGs and design/application evolution

Design and Qualification of Mechanical Plugs and Operating Experience

Mechanical Plug Qualification Program

- **Leak Testing**
  - Leakage limit - leakage from plugged tubes will represent a small portion of the allowable leakage defined in the technical specifications. It is the responsibility of the owner to confirm that the conservative predicted plug leakage is in fact an acceptable portion of the total allowable primary-to-secondary leakage and secondary-to-primary leakage
  - Performed at room and operating temperatures
  - Performed prior to and following thermal and pressure cycling
  - Testing has shown that the predicted leakage is much less than the allowable limits
  - Removal of field installed plugs has confirmed that the plug provides an essentially leak-tight seal

Design and Qualification of Mechanical Plugs and Operating Experience

Mechanical Plug Qualification Program

- **Cyclic Testing**
  - Performed after initial leak tests
  - Plug position monitored before and after cycling to check for movement of plug
  - Pressure cycles bound plant heatup and cooldown cycles
  - Thermal cycles
    - Typically 10 cycles at accelerated heatup and cooldown rates compared to plant conditions
    - Held at or above design temperature to ensure complete heating of entire mockup
    - One cycle includes thermal soak of a minimum of 30 hours

Design and Qualification of Mechanical Plugs and Operating Experience

Mechanical Plug Qualification Program

- **Load Testing**
  - Plugs are pressure tested at a minimum of the higher of 1.43 times the maximum differential pressure during accident conditions or 3.0 times NOP
  - Pressure applied to secondary side of plug – bounding for primary pressure
  - Plugs will not eject (become a loose part) at pressures well above the operating and accident conditions of the applicable plants, including over-pressurization of a tube due to in-leakage
  - Testing has shown that the tube will burst before the plug will eject
  - Fatigue testing with a stabilizer attached has shown that the structural integrity and leak-limiting capability of the roll joint is not affected by an attached stabilizer (AREVA)
  - Testing has shown that the leak-limiting capability and structural integrity of the roll joint of the plugs is acceptable during worst-case tubesheet distortion due to tubesheet bowing

Design and Qualification of Mechanical Plugs and Operating Experience

Mechanical Plug Qualification Program

- **Alloy 690 Material Evaluation**
  - Material acceptable for radiation environment
  - Resistant to general corrosion and PWSCC
  - Acceptable for repair of alloy 600 and alloy 690 SG tubing
  - Tested plug material and actual plug material reconciled per Section XI of the ASME Code

Design and Qualification of Mechanical Plugs and Operating Experience

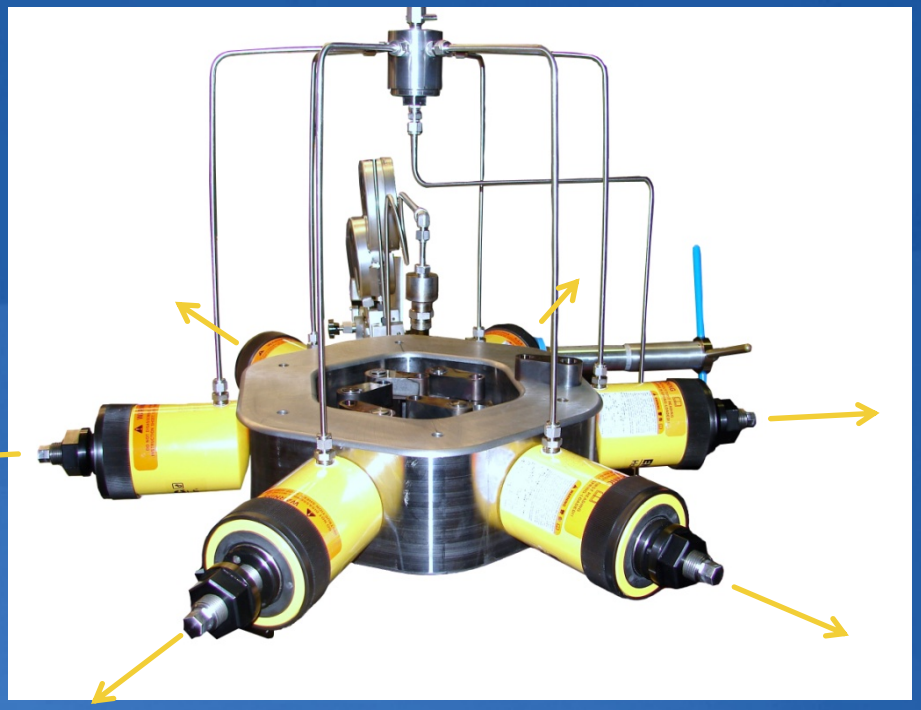
Mechanical Plug Qualification Program

- **Structural Analysis**
  - Per the requirements of Section III of the ASME Code
  - Finite element ANSYS model of the plug and tubesheet
  - Joint of plug is evaluated for contact pressure during normal and upset conditions, including changes in tubesheet bore dilation
  - Radial, hoop, and axial stress components are computed in the limiting cross sections of the plug for the base loading conditions
  - Stresses are calculated for design, operating, and accident conditions and compared to the applicable allowable stresses defined in the ASME code
  - Evaluation for exemption from fatigue analysis/testing (AREVA, Westinghouse)
  - Full fatigue analysis of plugs performed (B&W)

Design and Qualification of Mechanical Plugs and Operating Experience

- **Additional Ribbed Plug Qualification Considerations (Westinghouse)**
  - Input: plug-to-tube mechanical interference fit contact pressure
  - Structural analysis (finite elements): calculate changes to contact pressure - calculated for all SG analyzed conditions
  - Contact pressure changes due to: thermal growth mismatch, differential pressure tightening & tubesheet hole dilation or reduction in diameter
  - Plug resistance to movement and leakage shown to exceed applied loads and fluid pressures with margin

Design and Qualification of Mechanical Plugs and Operating Experience



Typical Test Rig for Cyclic Testing

Design and Qualification of Mechanical Plugs and Operating Experience

Tube Burst Samples – No Plug Ejection

Design and Qualification of Mechanical Plugs and Operating Experience

- Typical Documentation
  - Equipment Specification
    - Defines the structural and design requirements to qualify a plug for a specific installation (SG model and or specific plant SG)
    - Approved by utility and stamped by professional engineer
  - Design Verification Report
    - Provides a summary of the testing, stress analysis, and material evaluation, which provides the basis of the qualification of the plug for installation in a steam generator

Design and Qualification of Mechanical Plugs and Operating Experience

- Typical Documentation (cont.)
  - Plugging Procedure Specification (PPS)
    - Defines the essential parameters for each plug design, per ASME Section XI, IWA-4713
      - Plug, Tube, and Tubesheet Materials
      - Key Dimensions, Plug OD & ID and Tube OD & Wall Thickness
      - Expansion Method and Joint Length
      - Qualified Torque Range and Measurement Method
        - Target torque is identified in field procedure
      - Qualified Roll Expander Designs (unchanged over the history of the alloy 690 mechanical roll plugs)
      - Cleaning Requirements & Qualified Lubricants

Design and Qualification of Mechanical Plugs and Operating Experience

- **Typical Documentation (cont.)**
  - **Stress Report**
    - **Provided for utility review and approval**
    - **Stamped by a professional engineer who certifies that the plug meets the requirements of the Equipment Specification, the applicable Editions of the ASME Boiler and Pressure Code, Sections II, III and XI as defined in the Equipment Specification, and Regulatory Guide 1.29**
    - **Includes a summary of the qualification testing, stress analysis, and material evaluation, as well as any required ASME Code reconciliations**

Design and Qualification of Mechanical Plugs and Operating Experience

- **Typical Documentation (cont.)**
  - **QA Data Package**
    - **Supplied to the utility with the plugs, identifies the plugs by heat and serial number for traceability and typically includes:**
      - **Certificate of Conformance**
      - **Fabrication Routing Documents**
      - **Quality Control Inspection Reports**
      - **Liquid Penetrant Examination**
      - **Heat Treatment Furnace Chart**
      - **Receipt Inspection Record**
      - **Consumables Certification Sheets**
      - **Analysis Results for extraneous material (any additional material used during plug installation that remains in the SG)**
      - **Certified Material Test Report**
      - **Plug Cleaning Process and Expendable Materials Qualification**

Design and Qualification of Mechanical Plugs and Operating Experience

- Foreign Experience
  - The SGTF does not have any additional information regarding the cause of the plug failures at St. Alban and Flamanville
  - The USA divisions of service providers are not involved with plugging in the French SGs

Automatic Data Analysis

Steve Swilley, EPRI

Automatic Data Analysis

NRC request:

- **Provide staff with understanding of industry practice/process for adjusting generically qualified sorting algorithms (e.g., do essential variables have ranges). Is site specific qualification just as rigorous as generic AAPDD qualification.**

Automatic Data Analysis

- Addressed in EPRI PWR Steam Generator Examination Guidelines, Revision 7 Section 6.3.3.3
  - Modes
    - Detection Only
    - Interactive
    - Fully Automated
  - Application is limited to the mode qualified
  - Performance Demonstration
    - Initial generic qualification
      - Automated Analysis Performance Demonstration Database (AAPDD)
      - Mechanisms per Table G-1

Automatic Data Analysis

- Addressed in EPRI PWR Steam Generator Examination Guidelines, Revision 7 Section 6.3.3.3
  - Site Use
    - Initial generic performance algorithms uses as source for site specific algorithms
    - Appendix G Site Specific Performance Demonstration (SSPD)
    - SSPD qualification shall be demonstrated independent of human intervention
      - i.e. Analyst deleting, adding, or changing a result
    - Algorithm Adjustments
      - Conservative
      - Non-conservative
    - Key Points
      - Must establish control of algorithm revisions
      - Oversight
      - Coverage
      - Damage Mechanisms
      - Independent Systems
        - » Manual review of data if auto analysis systems are not independent
      - Sizing/Characterization

Automatic Data Analysis

- SGMP has formed ad hoc committee to address fully automated systems
  - Kick off meeting conducted on Wednesday July 14, 2010 in Vail, CO
    - Team includes both utility and vendor personnel
    - Plan to address:
      - Qualification
      - Verification
      - Dual auto
        - Premise was two teams/two software systems
      - Manual review by one team for sizing/characterization
      - Use of the SSPD
      - Use of the AAPDD

Update on Inspection Technique Qualification for U-bend

Steve Swilley, EPRI

Update on Inspection Technique Qualification for U-bend

NRC request:

- **Provide update on qualifying an inspection technique for detecting ODSCC in the U-bends.**

Update on Inspection Technique Qualification for U-bend

- **ETSSs complete awaiting Peer Review (August 23rd-27th), "Detection of Axial ODSCC in Low Row U-Bends":**
- **Coil Technology**
  - **Plus Point Coil (Miz80iD/EddynetSuite analysis software)**
    - **Detection**
    - **Sizing - Phase and Amplitude**
  - **X-Probe (Miz80iD/EddynetSuite analysis software)**
    - **Detection**
  - **Intelligent Probe (Miz80iD/EddynetSuite analysis software and MHI MIDAS analysis software)**
    - **Detection**

Divider Plate Cracking Update

Chris Casino, Westinghouse

License Renewal RAI

- Although these SG divider plate cracks may not have a significant safety impact in of themselves, such cracks could impact adjacent items, such as the tubesheet and the channel head, if they propagate to the boundary with these items.
- For the tubesheet, PWSCC cracks in the divider plate could propagate to the tubesheet cladding with possible consequences to the integrity of the tube/tubesheet welds.
- For the channel head, the PWSCC cracks in the divider plate could propagate to the SG triple point and potentially affect the pressure boundary of the SG channel head.

Background

- **EPRI SGMP Engineering Study complete**
  - **LOCA Transient Analysis**
  - **Non-LOCA Transient Analysis**
  - **ARC Impact**
  - **SG Tube Plug and Sleeve Impact**
  - **Review if ASME Code Stress Reports are affected by degraded DP condition**

Background

- **Conclusions**
  - Worst case crack opening area (COA): 16 in^2
  - The bounding COA equals ~20 tubes
  - A fully degraded divider plate does NOT adversely affect SG performance during LOCA or non-LOCA events.
  - A fully degraded divider plate is NOT a safety concern during plant operations
  - No changes in current analyses would result from a degraded DP

Divider Plate Inspections at EdF

- **Inspection Methodology**
  - Visual examination to identify cracking
  - PT to establish length
  - UT if PT indicates at least 5 mm long to establish depth

EdF Experience

- Performed nearly 100 SG inspections
  - No detected crack growth into the thickness of the DP during the last 15 years
  - No actions taken to repair a cracked DP
  - In negotiations with their regulator to eliminate inspections
- Some very shallow surface cracks have coalesced
- Current operational experience suggests that residual stresses are minimal and relieved by whatever slight level of cracking occurs.

Divider Plate Inspections in US

- Inspections of divider plate region are not warranted based on OE and analysis
  - ASME Code classifies the divider plate as not needing inspection
  - Divider plate is not a pressure boundary
  - No credible evidence that cracks may propagate as proposed by the staff based on EdF OE

SGMP Engineering Study

- Engineering study concluded that divider plate cracks would have to exceed 40% of the divider plate thickness, and extend along the entire length of the tubesheet to affect the tubesheet displacement
- The worst case location for a crack is at the center of the divider plate
- The stress state in the divider plate region is such that a crack will continue to grow in the same general plane that it began in

SGMP Engineering Study

- Related analysis results suggest that stresses are compressive in the region of interest.
  - Tubesheet and triple point
- Cracks cannot propagate through a compressive stress field.

Operational Experience with Crack Growth

- It is well known from service experience that stress corrosion cracks stop when they reach a non-susceptible material
  - V.C. Summer reactor vessel outlet nozzle axial flaw extended over the entire cross section of the Alloy 182 weld between the main coolant pipe and the reactor vessel nozzle, but did not extend into either of the other materials
- There is no analytical evidence or OE to suggest that a crack can propagate from the plate to the surrounding materials.

Conclusion

- First principles arguments concludes that cracks cannot propagate in the manner proposed by the staff
- OE confirms crack propagation in a manner proposed by the staff does not occur

Follow Up on Previous Meetings

Gary Boyers, FPL

Follow Up on Previous Meetings

Updating SG Programs

- Guidance on when to update steam generator programs (clarifying when plant-specific and vendor procedures should be updated)
- Currently in the Administrative Guidelines Revision 3 Draft:
  - *Implementation of the guidelines is considered complete when requirements are incorporated into site or fleet procedures. It is understood that some guideline requirements would necessitate changes in vendor procedures which could only be verified just prior to a steam generator inspection outage.*

Follow Up on Previous Meetings

AVB Position Verification

- In light of French operating experience and IN 2005-29, have U.S. plants (even those with SS supports) verified the position of their AVBs and if not in the "design position," taken corrective action (e.g., additional analysis to confirm stability)?
- SGMP letter issued July 19, 2010 summarizes the guidance and communications that have been published and concludes that existing guidance is adequate
  - Information Notice IN 2007-37 describes three tube failures at EdF
  - NRC Bulletin 88-02, "Rapidly Propagating Fatigue Cracks in Steam Generator Tubes."
  - Information Notice IN 2005-29 describes the importance of comparing the as-found condition of the steam generator to the steam generator design.
  - Steam Generator Management Program: Steam Generator Integrity Assessment Guidelines, Revision 3, 1019038, Chapter 10 contains additional information on maintenance of secondary side integrity.

Follow Up on Previous Meetings

Deposit Modeling and Guidance

- Tools are being developed that utilities can use as input to secondary side maintenance plans
  - Dynamic Analysis
    - Provide information on the effects of TSP buildup on water inventory, circulation ratio, water level drift, and stability
    - Estimated project completion date – December 2012
  - Prediction of TSP Blockage
    - Provide an empirical model to predict blockage of broached hole openings at the top TSP over time
    - Estimated project completion date – June 2011

Follow Up on Previous Meetings

Adequacy of In Situ Pressure Test Guidelines

- Guidelines Revision Committee reviewed the adequacy of the axial ODSCC screening values with respect to the destructive results for R11 C62 removed from Vogtle Unit 1 SG
- The review validates that the current 1.0 volt threshold screen is conservative
  - Tube was plastically deformed and the indication was damaged during tube pull operations
    - Pre-pull data: +Point™/0.71 volts
    - Post-pull data: +Point™/6.14 volts Bobbin/24.9 volts
  - Grain elongation near ID surface indicates flaw was not through-wall
  - Many field test results with larger voltages did not leak at SLB
  - If this indication was 100% through wall in the field, the voltage should have been higher based on industry database

Follow Up on Previous Meetings

TSTF-510 Update

- February 4, 2010: Electronic message from M. Honcharik (NRC) to B. Mann (TSTF), "TSTF-510 RAIs"
- June 29, 2010: Letter TSTF-10-08 Transmitted the Response to Request for Additional Information and TSTF-510, Rev. 1 "Revision to Steam Generator Program Inspection Frequencies and Tube Sample Selection"

Follow Up on Previous Meetings

TSTF-510 Update

- **Three Additional Changes Incorporated into TSTF-510, Revision 1**
  - TS 5.5.9.d.3 to state, "If crack indications are found in any SG tube, then the next inspection for each ***affected and potentially affected*** SG for the degradation mechanism that caused the crack indication shall not exceed 24 effective full power months or one refueling outage (whichever results in more frequent inspections)." The added words are underlined italic.
  - TS 5.5.9.d.2 [600MA] is revised to state, "Each 60 effective full power month inspection period may be extended up to 3 effective full power months to include a SG inspection outage in an inspection period ***and the subsequent inspection period begins at the conclusion of the included SG inspection outage***." The added words are underlined italic. Similar changes are made to TS 5.5.9.d.2 [600TT and 690TT].
  - Technical Specification 5.5.9 and the Bases of the Steam Generator Tube Integrity Specification use the terms "interval" and "period" when referring to the steam generator inspections. For consistency, the term "period" is used throughout.

Follow Up on Previous Meetings

Cracking/Inspection of -2 Sigma Tubes

- SGMP issued a letter Aug. 9, 2010 to retract the -2 Sigma screening guidance for SGs with Alloy 600TT tubing
  - Methodology is no longer considered a reliable predictor of ODSCC at tube supports or freespan region
  - -2 sigma tubes will be included within the general tube population for sampling
  - Licensees will conduct inspection sampling and scope expansions according to the Examination Guidelines
    - Screening results will not provide a basis to limit initial sample size and scope expansion

Upcoming Changes to Industry Documents

Jim Benson, EPRI

SGMP Industry Document Status and Revision Schedule

Guideline Title	Current Rev #	Report #	Last Pub Date	Implementation Date(s)	Interim Guidance	Review Date	Comments
Steam Generator Integrity Assessment Guidelines	3	1019038	Nov-09	9/1/2010	SGMP-IG-09-03 SGMP-IG-10-01	2012	
EPRI Steam Generator In Situ Pressure Test Guidelines	3	1014983	Aug-07	3/14/2008 6/14/2008	none		Revision 4 in progress, draft scheduled to be complete 2010
PWR Steam Generator Examination Guidelines	7	1013706	Oct-07	9/1/2008	SGMP-IG-08-04	2010	Revision 8 in progress
PWR Steam Generator Primary-to-Secondary Leakage Guidelines	3	1008219	Dec-04	7/17/2006 10/17/2006	none		Rev 4 in progress. Expected to be issued by Dec 2011
PWR Primary Water Chemistry Guidelines	6	1014986	Dec-07	6/17/2008 9/17/2008	SGMP-IG-09-01	2010	
PWR Secondary Water Chemistry Guidelines	7	1016555	Feb-09	8/20/2009 11/20/2009	none	2011	
Steam Generator Management Program Administrative Procedures	2	1015482	Sep-07	01/03/2008 04/03/2008	SGMP-IG-08-01 SGMP-IG-08-02 SGMP-IG-08-03		Rev 3 in progress. Expected to be issued by Dec 2010
Steam Generator Degradation Specific Flaw Handbook	1	1021224	Apr-10	n/a	none	2012	

SG Integrity Assessment Guidelines

- **Interim Guidance Letters**
  - One IG Letter issued since last SGTF meeting
  - Interim Guidance regarding Steam Generator Integrity Assessment Guidelines, Revision 3
    - Letter issued April 7, 2010.
    - Requires the immediate use of the new ETSSs developed under Appendix I of the SG Examination Guidelines for the assessment of tube integrity
    - Clarifies definitions as discussed with staff
    - Provide a discussion of recently identified inconsistencies in implementation of requirements in the Integrity Assessment Guidelines
      - Documenting comparison of CM results to prior OA
      - CM for tubes that cannot be inspected by eddy current

In Situ Pressure Test Guidelines

- Revision 4 in progress
- Planned Actions
  - Update the data in the document with in situ pressure test field results since 2006 and verify that screening values remain accurate
    - All data will be verified
    - Screening values will be assessed for “change”
  - Establish screening criteria for foreign object wear
    - Data gathering complete
    - Burst and leak test matrix will be developed
    - Criteria will be established by September 2010
  - Perform an independent review of equations, calculations, and examples

In Situ Pressure Test Guidelines

- **Planned Actions**
  - Develop screening for indications susceptible to bending loads
  - Review Section 4, “Screening Parameters/Tube Selection” for clarity and incorporate field experience
  - Review and provide basis for all “needed” elements
- **Schedule**
  - Complete draft by Dec 2010 & send out for broad based review

SG Examination Guidelines

- Actions approved at the June 2010 NDE TAC meeting
  - Issue Interim Guidance
    - Approval to address auto analysis requirements with respect to new vendor software applications that provide a single system approach
  - Develop Guideline Revision
    - Approval to begin Revision 8 process
      - Budget, schedule, volunteers, structure, etc.
      - Noise will most likely involve a change to the SG Integrity Assessment Guidelines through Interim Guidance

PWR Primary-to-Secondary Leak Guidelines

- Revision 4 in progress
- Planned Actions
  - Revision started in January 2009
    - Chapter 2 (Technical Basis): Re-organized and re-worded for clarity.
    - Chapter 3 (Action Levels): No new requirements. More clearly stating requirements.
- Schedule
  - Complete draft & send out for broad based review by early 2011

PWR Primary Water Chemistry Guidelines

- **Review Status**
  - 2010: Required annual review performed on June 2010
    - Consensus vote – Revision not needed
  - Dec 2010: Details of review will be published in an EPRI Technical Update
  - June 2011: Next Review

PWR Secondary Water Chemistry Guidelines

- **Review Status**
  - **Sept 2010: Required review planned**
  - **Dec 2010: Details of review will be published in an EPRI Technical Update**

Steam Generator Management Program Administrative Procedures

- Revision process began in 2010 to incorporate:
  - NEI 03-08, Revision 2 changes
  - Interim guidance
  - Changes in organization structure and committee names
  - Self assessment recommendations
  - Revision 2 lessons learned
- Scheduled issue date is Dec. 2010

NEI 97-06 Revision 3

- **Revision process started**
  - **Initial meeting at NEI 8-10-2010**
  - **Target issue date is end of 2010**

Recent SG Operating Experience
2010

Russ Lieder, Nextera Energy Seabrook, LLC

Update on Top of Tubesheet Denting

- Ginna, Alloy 690TT tubing has reported denting at the top of the tubesheet
  - No cracking
- Almaraz 1 & 2, Siemens SGs with Incoloy 800 tubing
  - Denting has been present since 2004 in AL-2, 2008 in AL-1
  - Both units experiencing circumferential ODSCC associated with the denting
  - No correlation between denting amplitude and cracking
    - All cracks are in dented tubes
  - Denting correlated with hard sludge
  - Considering possible mitigation strategies
    - The use of alternative amines and perhaps dispersants
    - Increasing blow-down flow as far as possible
    - Chemical cleaning and/or hard inner bundle sludge lancing

Update on Top of Tubesheet Denting

- Asco 1 & 2, Siemens SGs Incoloy 800 tubing
  - Denting started around 2006 and grew after condenser leaks
  - ODSCC associated with dented tubes
- Possible Mitigation Strategies
  - Begin following EPRI Secondary Chemistry Guidelines Revision 7
  - Increase SG Blowdown flow
  - In-bundle hard sludge lancing
  - Chemical cleaning
- EPRI is working with Almaraz, ASCÓ, and DöEL to qualify the use of PAA.

Update on Top of Tubesheet Denting

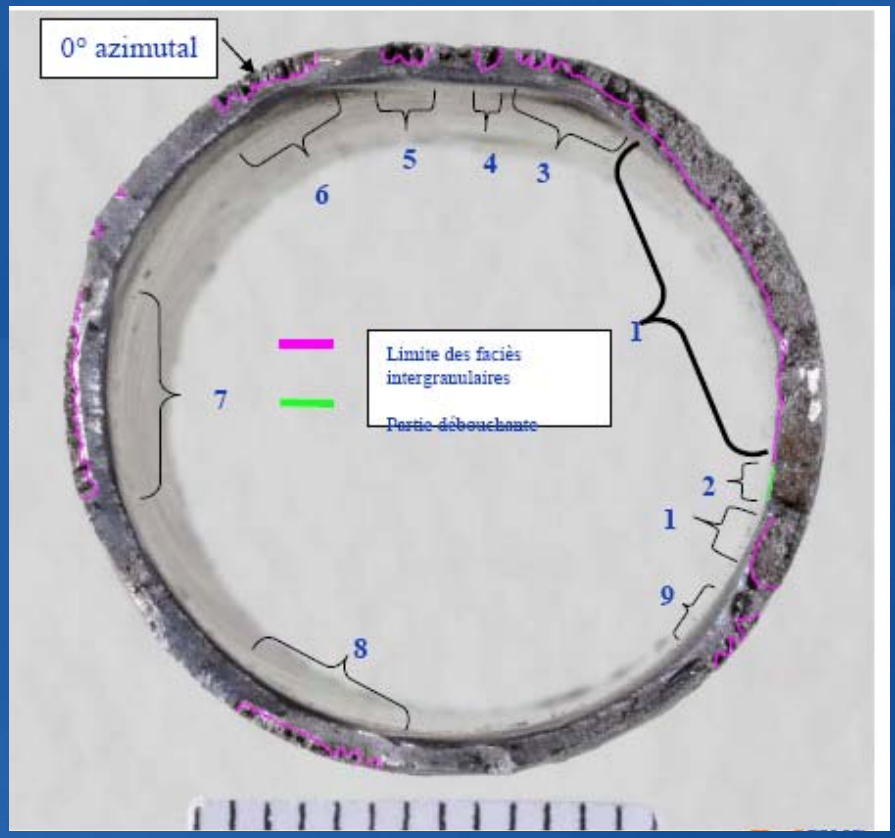
- Belleville 2, Framatome SGs with Alloy 600TT tubing also report denting and OD Circumferential cracking
  - Sludge is compact and resistant to High Pressure Cleaning
- Mitigation strategies
  - Chemical cleaning of the TTS in 2010
  - Considering pulling a tube
  - Start a program to understand the root cause of this new kind of denting
  - Collaboration with the program at EPRI dedicated to denting at TSP and TTS

Update on Bugey 3

- Identified circumferential cracking at 2nd tube support plate
- Pulled the tube to confirm
- Tube broke at the 1st tube support plate
  - Cracking undetected by eddy current technique

Update on Bugey 3

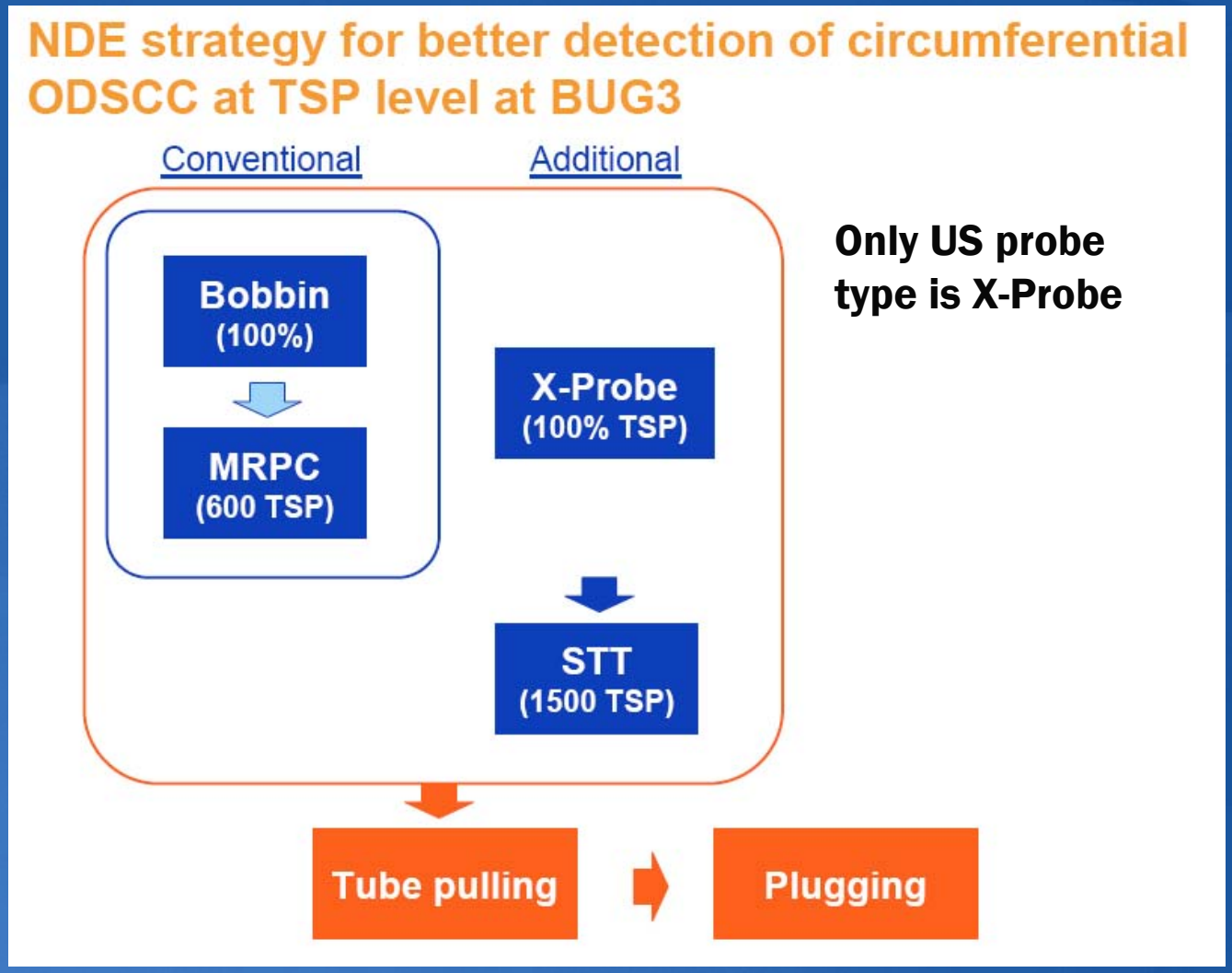
- Met results reveals the presence of large intergranular damage on the secondary side
- A mix of IGA and IGSCC (circumferential and axial cracks)
- Not typical of the degradations already seen in such configuration
- 11 additional tubes have been pulled



Update on Bugey 3

- Inspection strategy changed
  - EDF-specific STT probe (rotating probe) is qualified under French specifications for circ cracks on top of tubesheet : detection of 40%-50° cracks is guaranteed taking into account all influential parameters
  - Bobbin coil is not sensitive to circ crack
  - STT probe is too slow for a 100% inspection
  - X-Probe was chosen for its ability to give a quick and more precise inspection of the bundle.

New Inspection Strategy for Bugey 3



X-Probe Inspection

- Vendor – Westinghouse USA and Germany
  - No X-Probe experience in France
- Used modified US analysis guidelines
- Results:
  - 268 circ cracks at TSPs
  - 454 axial cracks at TSPs
  - Corrosion (IGA) reported on about 8,500 TSPs

STT Probe Inspection

- Vendors: Intercontrole (AREVA) and Cegelec
- All X-Probe SCIs inspected
- Largest amplitude indications from bobbin inspected
- All TSPs not inspected by X-Probe
- Results
  - 35 indications report above the threshold (40%-50º)
    - All 35 indications were reported by X-Probe
- 148 tubes plugged

Update on Bugey 3

- They were able to report to their regulator that they had done a thorough inspection
- It was demonstrated that there was no increased risk of tube failure during a shortened operational cycle
- For economic reasons, they are planning SG replacement this summer

Fessenheim 2

- Alloy 600MA tubing, drilled CS support plates
- In an outage at the same time as Bugey 3
- Not allowed to restart until demonstration of thorough inspection
- Conducted bobbin and rotating coil probe examination
- 3 tubes were pulled

Fessenheim 2

- Generalized Intergranular Corrosion (IGA)
- Short axial IGSCC cracks propagating into IGA areas
- No circumferential cracks

Fessenheim 2

- They were able to show structural integrity with pulled tubes
- Preventive plugging with a very conservative criteria based on bobbin coil measurement
  - SG # 1 : 22 tubes plugged
  - SG # 2 : 8 tubes plugged
  - SG # 3 : 28 tubes plugged

Gravelines 3

- Alloy 600MA tubing, drilled CS support plates
- Outage during spring 2010
- Based on Bugey 3 and Fessenheim 2 experience, the inspection program used bobbin coil + rotating probe
  Only two circumferential indications were detected
- Plugging according to the criteria defined after Bugey 3
  - SG # 1 : 1 tube plugged
  - SG # 2 : 0 tube plugged
  - SG # 3 : 4 tubes plugged

Replacement SG Wear Issues

- Palo Verde 1 with preventive plugging will now be able to operate 2 cycles.

ANO Unit 1

- Wear at tube supports and tie rod bowing identified in 1st ISI after replacement
- Three inspections performed to date
- Rate of increase in lateral bow is diminishing with each interval
- Current maximum bow is approximately 1.2”
- Life of component design requirement is achievable
- Will perform 100% inspection next outage fall 2011 to get fourth data point
- Anticipating skipping 1-2 cycles after next inspection

Future Topics

NRC feedback on various issues

- TSTF-510
- Primary and Secondary Side Fouling

Address Public Questions/Comments

Adjourn