NEI Steam Generator Task Force Update

May 14, 2008

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Today's Agenda

- Introductions NRC
- Opening Remarks - NRC and Industry
- Eddy Current Noise Monitoring for Tube Integrity - Industry
- Steam Generator Divider Plate Evaluation - Industry
- Operating Experience Handling - Industry
- Proposed Revision to Technical Specifications for Tube Sampling - Industry
- NEI Steam Generator Task Force Action Items Industry
- NRC Issues (10 - 15 minutes) - NRC
- Address Public Questions/Comments (10 - 15 minutes) - NRC and Industry
- Adjourn

Eddy Current Noise Monitoring for Tube Integrity Industry

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Eddy Current Noise Monitoring for Tube Integrity Industry

- EPRI SGMP Products Recently Published
  - Technical Report 1016554, “Measuring and Monitoring Noise in Steam Generator Tubing Eddy Current Data for Tube Integrity Applications
  - Software Application 1016553, “Model Assisted Probability of Detection”

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Eddy Current Noise Monitoring for Tube Integrity Industry

- EPRI SGMP project team continues to work with eddy current vendors to incorporate noise measurement software in their acquisition products
- Pilot projects will be necessary prior to adding requirements in SGMP Guidelines
- Update NRC at next SGTF Meeting

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Steam Generator Divider Plate Evaluation

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Phased Array Inspection of Divider Plate Welds

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Preliminary Investigation

Phased Array Inspection of Divider Plate Welds

- **Objective:** To demonstrate the use of ultrasonic phased array technology for the detection of flaws in steam generator divider plate welds.

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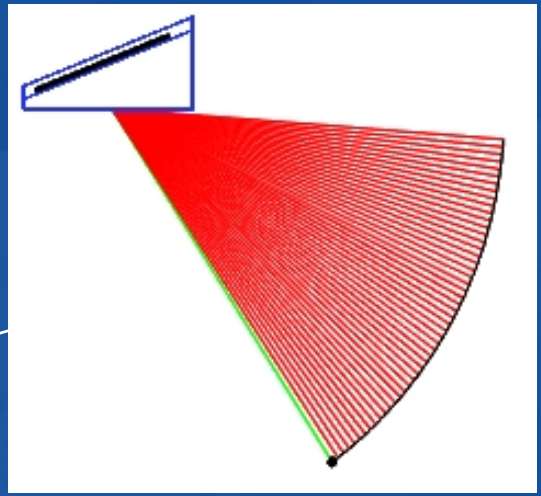
Preliminary Investigation

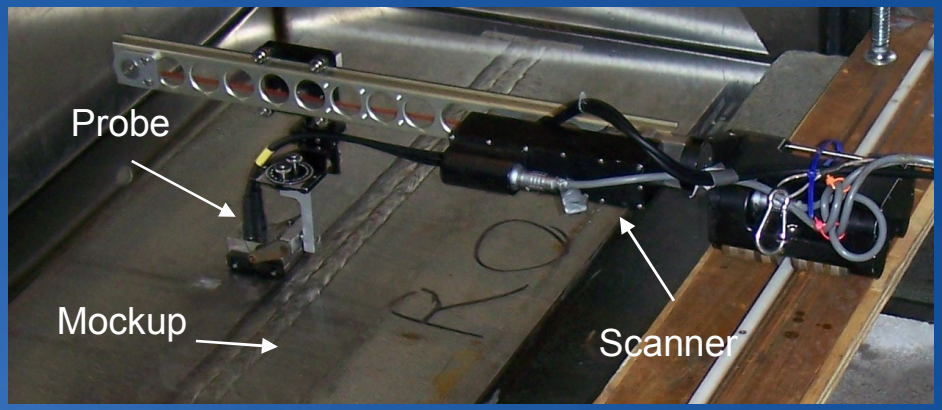
Phased Array Inspection of Divider Plate Welds

Preliminary Investigation:

- –2.0 MHz, 3X10 element dual array probe (~1.8” by 1.2”)
- –35° to 86°Longitudinal-wave sector scans
- –35° to 70°Shear-wave sector scans
- –2-inch and 2.7-inch thick BWRVIP Core Shroud Mockups
- –Multiple line scans (4) of encoded data collected along weld
- –Longitudinal and Shear wave data acquired simultaneously

Sector Scan





Preliminary Investigation

Phased Array Inspection of Divider Plate Welds

- Conclusions
- All flaws detected when both sides of weld were accessible for a given inspection surface (same or opposite surface).
- Longitudinal waves were more effective than Shear waves.
- Maximum RMS Depth and Length Sizing Error estimated

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Preliminary Investigation

Phased Array Inspection of Divider Plate Welds

- Future plans
  - Publish results in an EPRI report
    - In progress (1016915)
  - Present results at the EPRI NDE Issues meeting in June
  - Present results at the SG NDE Workshop in July.
  - Further development work will be contingent on final results from the engineering analysis

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Operating Experience & Degradation Assessment

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Operating Experience & Degradation Assessment

- Potential exists for the industry to issue new applicable operating experience after the unit's degradation assessment has been approved for the upcoming/present outage.
- Operating experience is expected to be addressed
- SGMP Integrity Assessment committee is tasked with revising the assessment guidelines to specify plant actions for handling of operating experience

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Operating Experience & Degradation Assessment

- Schedule for Integrity Assessment Guideline
  - Draft out for industry/NRC review December 2008
  - Independent review of data, examples, and equations early 2009
  - Target for publication Sept. 2009

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Tube Support Plate Fouling

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Tube Support Plate Fouling

- Several instances of steam generator secondary side fouling leading to tube fatigue failure and primary-to-secondary tube leaks in recent years at Cruas in France.
- Historically comparable events in the U.S. fleet were attributed in part to locked tubes at dented, drilled carbon-steel support plates and irregular AVB insertion depths.

Tube Support Plate Fouling

- Section 10 of the EPRI SG Integrity Assessment Guidelines requires measures be taken to maintain SG secondary-side integrity with a recommendation to include tube support plate and upper bundle fouling in a utility's SG secondary side integrity plan.
- Industry operating experience is a key element in the SG degradation assessment and is also a potential input to the secondary side integrity plan.

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Tube Support Plate Fouling

- To better understand the recent tube failures at Cruas, the EPRI SGMP has authorized a research project
  - "Thermal-Hydraulic and Flow Induced Vibration/Fatigue Analysis of Model 51 Steam Generators"
- The objective of this project is to perform a parametric study to understand how blockage and design features affect the fatigue response of tubes near the tube free lane.

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Tube Support Plate Fouling

- Using ATHOS/SGAP software, thermal hydraulic conditions will be compared between the SG design used at Cruas with and without tubes in the center region under clean and fouled conditions.
  - For these conditions, a fatigue analysis of select tubes will be performed using SGFW.
- The project is scheduled for completion by the end of 2008.

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NEI Steam Generator Task Force

New TSTF Wording for 5.5.9.d.2

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New TSTF Wording for 5.5.9.d.2

- Problem Statement
- TS 5.5.9.d.2 (TSTF-449, Rev. 4) presents implementation issues for plants with 600TT and 690TT tubing
  - Wording prevents completing inspections by the “refueling outage nearest the end of the period” as intended
  - Combination of mid-point and end point requirements in a 60-month inspection interval prevents operating more than one cycle for plants with 600TT and 690TT tubing even when no cracking is detected

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New TSTF Wording for 5.5.9.d.2

Goals

- Revise Wording and Bases
  - Reduce scheduling impacts
  - Retain intent of inspection frequency & sample size
    - Tubing type, SG age, SG condition, Cycle length
- Address previous NRC Comments
  - Address time dependence of degradation
  - Retain limits on front end & back end loading of inspections
  - Address other administrative changes and clarifications such as TS 5.5.9.a (insert “or” into the last sentence between “ . . . inspected, plugged, . . .”

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New TSTF Wording for 5.5.9.d.2

Projected Schedule

- 5.5.9.d.2 draft wording approved by IIG 3/08
- TSTF Traveler development funded via PWROG Licensing Subcommittee 6/08
  - Initial draft by 8/08
    - Staff experience observations requested by 8/08
  - PWROG/SGMP/TSTF iteration through 11/08
  - PWROG/SGMP/TSTF approval by 12/08
  - Submittal to NRC by 1/09

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New TSTF Wording for 5.5.9.d.2

600MA Plants

[2. After the first inservice inspection, inspect each SG every 24 effective full power months or one refueling outage (whichever is less). In addition, inspect 100% of the tubes every 60 effective full power months.[1]

[1] 600MA sampling levels are retained (note that TSTF-449, Rev. 4 does not have a midpoint requirement).

New TSTF Wording for 5.5.9.d.2

600TT Plants

[2. After the first inservice inspection, inspect each SG every 48 effective full power months or two refueling outages (whichever is less). In addition, the minimum sample size at each scheduled inspection shall be the number of tubes in each SG divided by the number of inspections scheduled in each period as defined in a, b, and c below. Each inspection period defined below may be extended up to 3 effective full power months provided that the cumulative effect of such extensions does not exceed 12 effective full power months. If only one inspection is scheduled during a period, the sample size shall be 100% of the tubes.[1]

[1] Wording is added to prevent front or back end loading of inspections in a period with multiple inspections.

New TSTF Wording for 5.5.9.d.2

600TT Plants (Cont')

a. After the first inservice inspection, inspect 100% of the tubes during the next 120 effective full power month period.[2] Then,

b. During the next 96 effective full power month period, inspect 100% of the tubes.[3] Then,

c. During the remaining life of the SGs, inspect 100% of the tubes every 72 effective full power month period.[4]

[2] The 120 EFPM period is unchanged, and the midpoint is deleted.

[3] The 90 EFPM period is increased slightly to 96 EFPM to permit inspecting every two cycles for 600TT plants on 12, 18 and 24 month cycles. The midpoint is deleted.

[4] The 60 EFPM period is lengthened to 72 EFPM to permit inspecting every two cycles for 600TT plants on 12, 18 and 24 month cycles, and the midpoint is deleted.

New TSTF Wording for 5.5.9.d.2

690TT Plants

[2. After the first inservice inspection, inspect each SG every 72 effective full power months or three refueling outages (whichever is less). In addition, the minimum sample size at each scheduled inspection shall be the number of tubes in each SG divided by the number of inspections scheduled in each period as defined in a, b, c and d below. Each inspection period defined below may be extended up to 3 effective full power months provided that the cumulative effect of such extensions does not exceed 12 effective full power months. If only one inspection is scheduled during a period, the sample size shall be 100% of the tubes.[1]

[1] Wording is added to prevent front or back end loading of inspections in a period with multiple inspections.

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New TSTF Wording for 5.5.9.d.2

690TT Plants (Cont')

a. After the first inservice inspection, inspect 100% of the tubes during the next 144 effective full power month period.[2] Then,
b. During the next 120 effective full power month period, inspect 100% of the tubes.[3] Then,
c. During the next 96 effective full power month period, inspect 100% of the tubes.[4] Then,
d. During the remaining life of the SGs, inspect 100% of the tubes every 72 effective full power month period.[5]

[2] The 144 EFPM period is unchanged and the midpoint is deleted.

[3] The 108 EFPM period is increased slightly to 120 EFPM to permit inspecting every three cycles for 690TT plants on 12, 18 and 24 month cycles. The midpoint is deleted.

[4] The 72 EFPM period is increased to 96 EFPM to permit inspecting every three cycles for 690TT plants on 12, and 18 month cycles. The midpoint is deleted.

[5] The 60 EFPM periods are lengthened to 72 EFPM to permit inspecting every three cycles for 690TT plants on 12, 18 and 24 month cycles based on IIG phone call 3/5/08

SGTF – NRC Issues List Update

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Issue #1 – Guidance on Site Qualified Techniques

- Industry continues to recommend closure
  - Restatement of issue pending from NRC.
- EPRI requested an advance copy of an ANL report.
  - Need status

Issue #2 – Accident Induced Leakage vs. Operational Leakage

- SGMP issued an information letter
  - SGMP-IL-06-01 March 13, 2006
- Licensees are expected to review RIS for applicability
- No further SGTF action
- Recommend closure

Issues #5 and #6

- Issue #5 – Divider Plate Cracking
  - Update on industry project a subject of this meeting
- Issue #6 – Noise
  - Update on industry project a subject of this meeting

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Issue #9 – Time Dependent Crack Growth

- Industry is funding a project with ANL and AREVA to better understand the ANL test results and provide guidance if necessary
- Project status
  - EPRI Report (1015123) published 2007
    - Recommended additional ANL work
    - No current need for additional guidance
  - ANL work is scheduled to be completed by end of July
  - Final EPRI report end of 2008

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Issues #11 and #12

- Issue #11 - Control Data (Judas Tube)
  - No new action
  - Closed
- Issue #12 – Tube Inspection Sampling Plans vs. TSTF 449
  - Issued APC Letter December 10, 2007
  - Update a subject of this meeting

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Issue #13 – Site Specific Technique Qualification – Technique Extension

- EPRI has a project funded in 2008 and 2009 to develop an eddy current data analysis guideline and datasets for detection of loose parts and loose parts wear.

- Agenda Status
  - NRC Issues / Discussion
  - Address Public Questions/Comments
- Action items
- Next meeting
- Adjourn

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