March 18, 1999

LICENSEE: Baltimore Gas and Electric Company

FACILITY: Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2

SUBJECT: SUMMARY OF THE FEBRUARY 25, 1999, MEETING REGARDING THE CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NOS. 1 AND 2 - 1999 STEAM GENERATOR TUBE INSPECTION

On February 25, 1999, the U.S. Nuclear Regulatory Commission (NRC) staff held a meeting at the NRC offices in Rockville, Maryland, with representatives from Baltimore Gas and Electric Company, the licensee for Calvert Cliffs, Unit No. 2, to discuss the licensee's plans for inspecting steam generator tubing in an upcoming refueling outage. The list of meeting attendees is included in Enclosure 1. Enclosure 2 is a copy of the slides presented by the licensee at the meeting.

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At the conclusion of the presentation, the NRC staff stated that the licensee's plans for addressing the upper bundle freespan degradation appeared to be appropriate.

Original signed by:

Alexander W. Dromerick, Senior Project Manager
Project Directorate I-1
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-317
and 50-318

Enclosures: 1. List of Attendees
2. Meeting Handouts

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

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LIST OF ATTENDEES

BALTIMORE GAS AND ELECTRIC COMPANY

CALVERT CLIFFS NUCLEAR POWER PLANT, UNIT NOS. 1 AND 2

FEBRUARY 25, 1999

| NAME | ORGANIZATION |
|---|---|
| A. Dromerick | NRC/NRR |
| G. Tesfaye | BGE |
| J. Mate | BGE |
| E. Flick | BGE |
| A. Saccavino | BGE |
| A. Thornton | BGE |
| T. Hoeg | NRC/RI |
| C. Beardslee | NRC/EMGB |
| A. Keim | NRC/EMCB |
| S. Coffin | NRC/EMCB |
| J. Tsao | NRC/EMCB |
| P. Rush | NRC/EMCB |

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# CALVERT CLIFFS

# 1999 Unit 2 SG Inspection

## NRC Presentation
## White Flint, Maryland
## February 25, 1999



Enclosure 2

# NRC Meeting Agenda
# Calvert Cliffs Unit 1 Steam Generator Inspection

1. Introduction — A. Thornton
2. Primary Side Activities — A. Saccavino
   A. Eddy current inspection scope
   B. Inspection protocol
   C. Tube repairs
   D. Insitu pressure tests
   E. Upper bundle inspection
   F. Summary of Examination
3. Secondary Side Activities — J. Mate
4. NRC Interactions — A. Thornton

# Steam Generator Inspection Team

BGE:

| | |
|---|---|
| Al Thornton | SG Project Manager |
| Elliott [illegible]ick | SG System Manager |
| Joe Ma[illegible] | SG System Engineer |
| Antho[illegible]accavino | SG NDE Engineer |
| Getachew [illegible]esfaye | SG Regulatory Engineer |

APTECH Engineering:

Primary tube integrity assessment vendor

Framatome/Rockridge Technologies:

Primary tube inspection and repair vendor

BGE

# Background Information

* CE Model 67 SGs
  - 8519 tubes per SG
  - tube OD/wall - 0.75"/0.048"
  - tube material - Alloy 600 HT/MA
  - 8 egg crates, 2 solid drilled TSPs
  - tube plugs - Alloy 690
* 15.9 EFPY
* $T_{hot}$ 594 F (since start up)
* Plugging history
  SG 21- 704  SG 22 - 443

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# SG Work Scope Objectives

* Maintain SG tube integrity between inspections
* Proactively inspect and repair SG tubes
* Operate full cycle between inspections
* Meet regulatory requirements and commitments
* Apply site and industry experience

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# Exam Preparations

* Degradation Assessment
  - site specific degradation
  - industry degradation
  - eddy current techniques
  - expansion criteria
  - repair criteria
* Site specific analysis guidelines
* Site specific analysts' exam
* Free span cracking structural integrity assessment

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# Examination Philosophy

* Focus Plus Point probe use on areas with the highest potential for structurally limiting degradation
  - H/L TTS - axial and circ ODSCC
  - Steam blanket region - axial ODSCC (R 6-15)
* Upper bundle free span cracking not a structural threat
  - degradation morphology
  - pulled tube burst tests
  - insitu pressure tests

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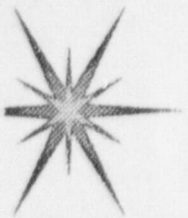

# Eddy Current Exam

Bobbin exam:

* 100% full length

Plus Point Exam:

* 100% H/L top of tubesheet
* 100% Steam Blanket
* 20% low row U-bends
* 20% C/L top of tubesheet
* 20% dented intersections
* Upper bundle -performance based

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# Expansion Strategy

* Evaluate the need to expand the exam based on:
  - ➢ eddy current parameters
  - ➢ location of indications
  - ➢ indication density
  - ➢ metallurgical considerations
  - ➢ eddy current probe and technique capabilities

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# Examination Protocol

* Independent primary and secondary analysis teams
* Independent utility analysts
* All analysts are QDA qualified
* Analyst feedback system
* Primary and secondary data management

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# Tube Repairs

* Disposition bobbin indications with Plus Point exam
* Repair based on detection or confirmation by Plus Point
* Tube repair method is plugging
* Stabilizers will be installed in tubes containing:
  - circumferential defects
  - loose part degradation

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# Insitu Pressure Tests

* Insitu pressure testing of SG tubes:
  - insitu pressure tests anticipated on 5 - 10 tubes
  - evaluate as found tube conditions
  - benchmark the performance based tube integrity model
  - tubes selected based on limiting eddy current parameters and previous insitu test results

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# Upper Bundle Exam

* Degradation History,
  - 1997 Exam - 20% Plus Point
  - Plus Point expansions to bound cracks
  - SG 21 - 7 axial cracks
  - SG 22 - 2 axial cracks
  - crack characteristics consistent with previously insitu or burst pressure tested axial tube flaws - structural integrity maintained at 3 delta $P_{NOP}$.
* Performance based inspection is appropriate

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# Upper Bundle Exam

* Multi-cycle model (APTECH Eng. )
  - ➢ Monte Carlo simulation
  - ➢ predicts amount and severity of degradation
  - ➢ accounts for tube repairs
  - ➢ quantifies Probability of Burst(POB)
* Model Parameters
  - ➢ defect initiation function
  - ➢ defect growth rate
  - ➢ defect length
  - ➢ tube material properties
  - ➢ inspection POD

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# Upper Bundle Exam

* Unit 2 Steam Generator Model
  - initiation function based on 1997 exam results
  - inspection technique POD is based on CCNPP SG pulled tube data
  - inspection technique POD validated by 1998 Unit 1 exam
  - Bounding burst equation results evaluated against a POB = 0.01
  - in outage validation of key parameters

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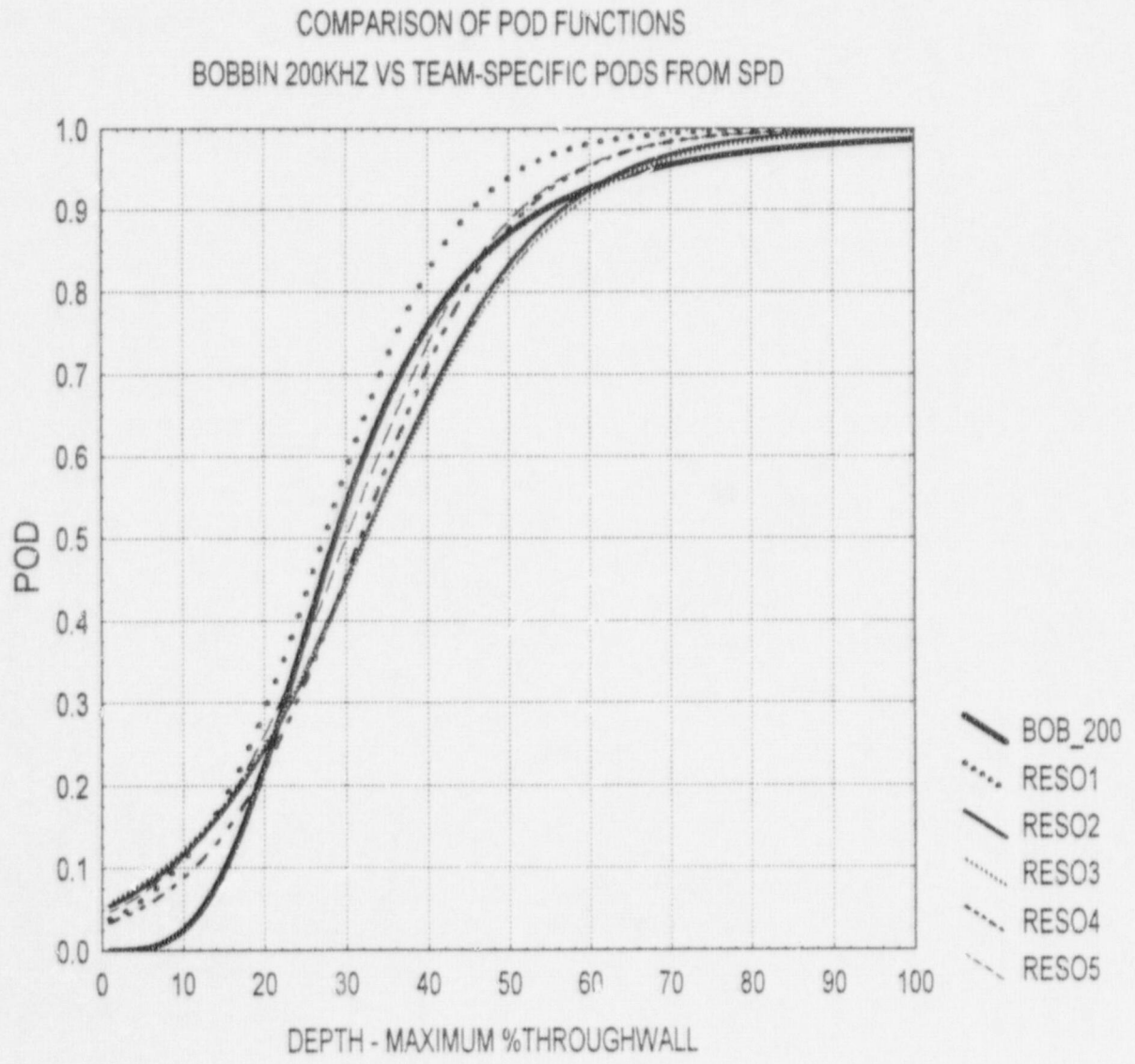
# Upper Bundle Exam



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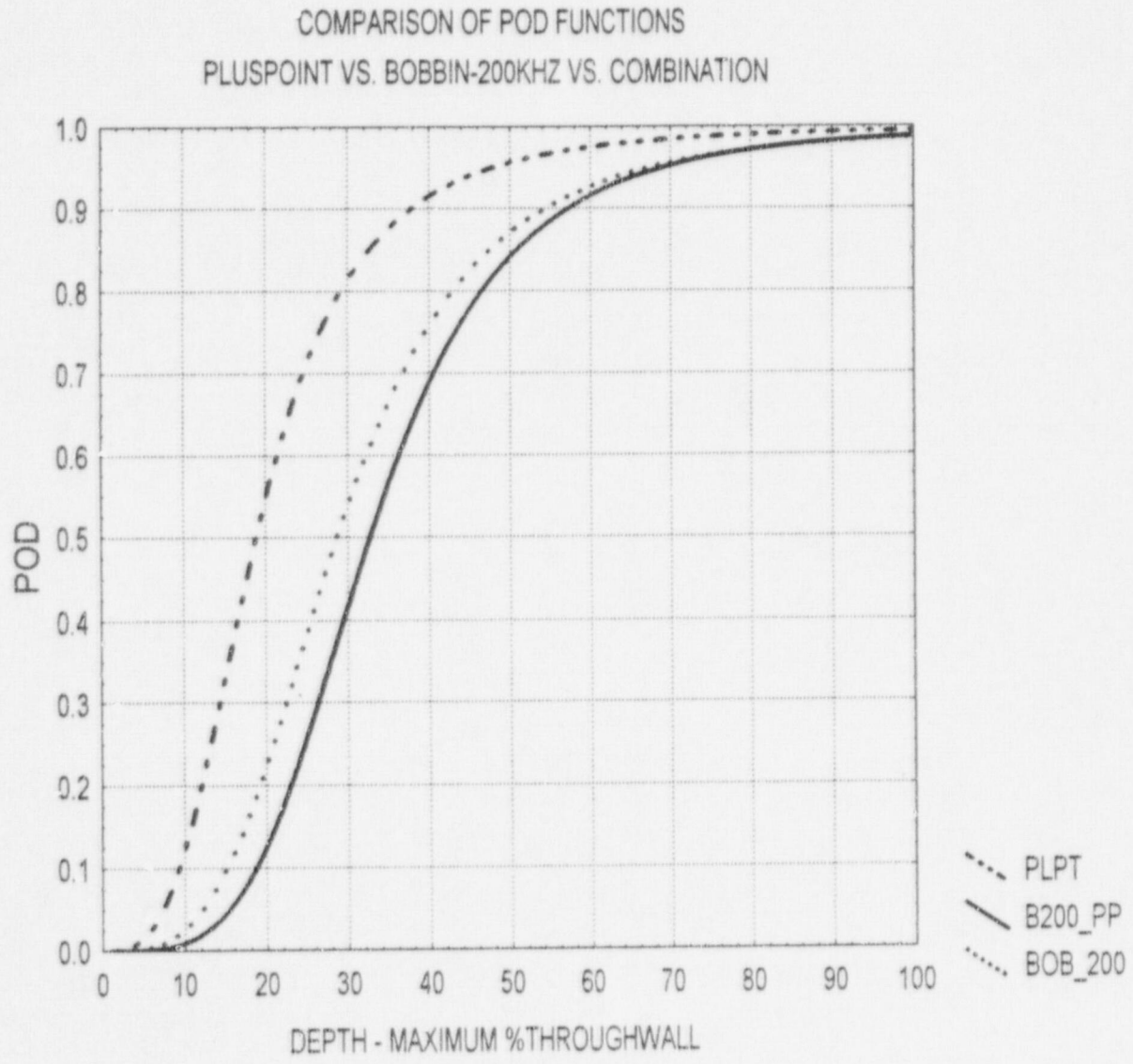

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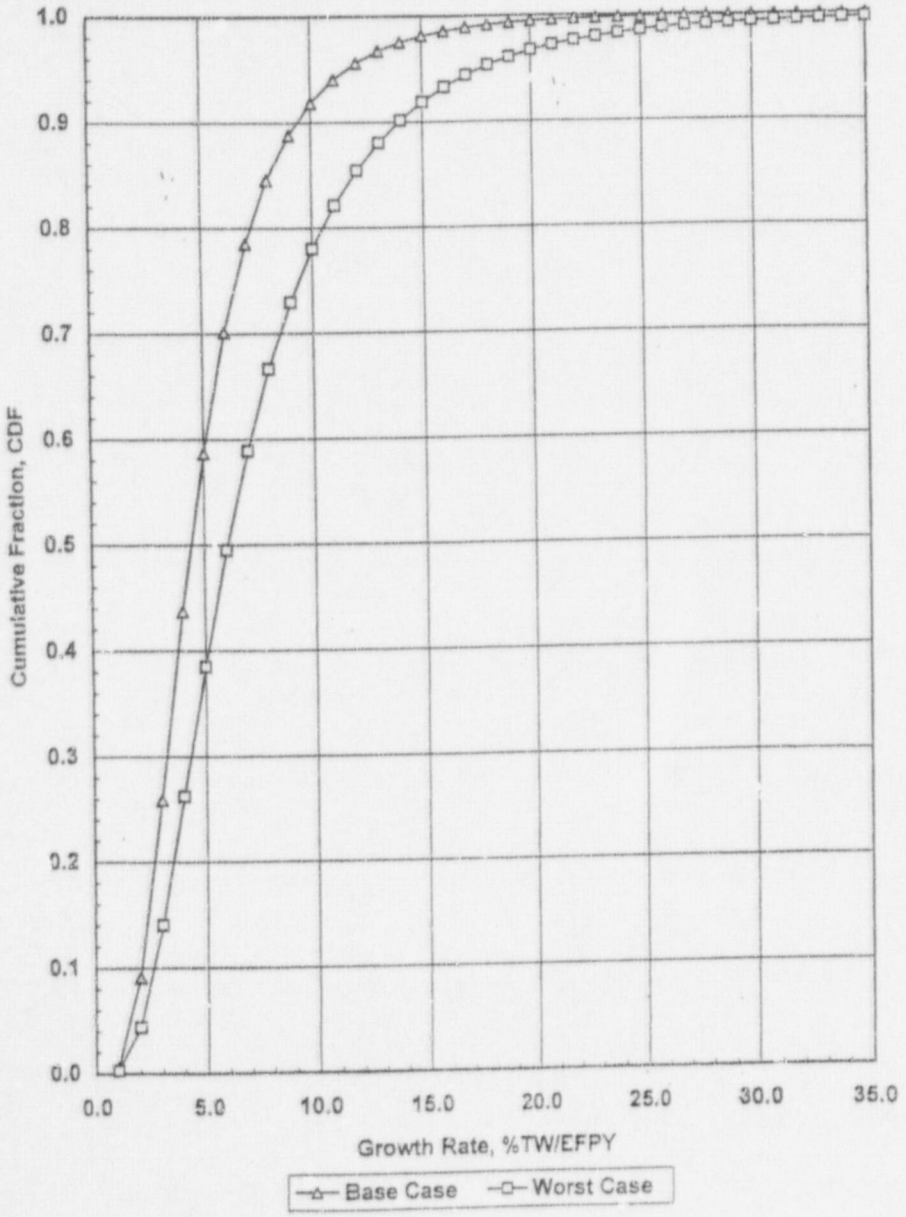


Freespan ODSCC Growth Rate Distributions.

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# Upper Bundle Exam

Inspection Plan

* 100% Bobbin exam (200khz)
* Plus Point confirmation and characterization of bobbin exam indications
* Model validated by exam?
  - ➢ Yes - no expansion
  - ➢ No - evaluate the need to expand the Plus Point inspection scope

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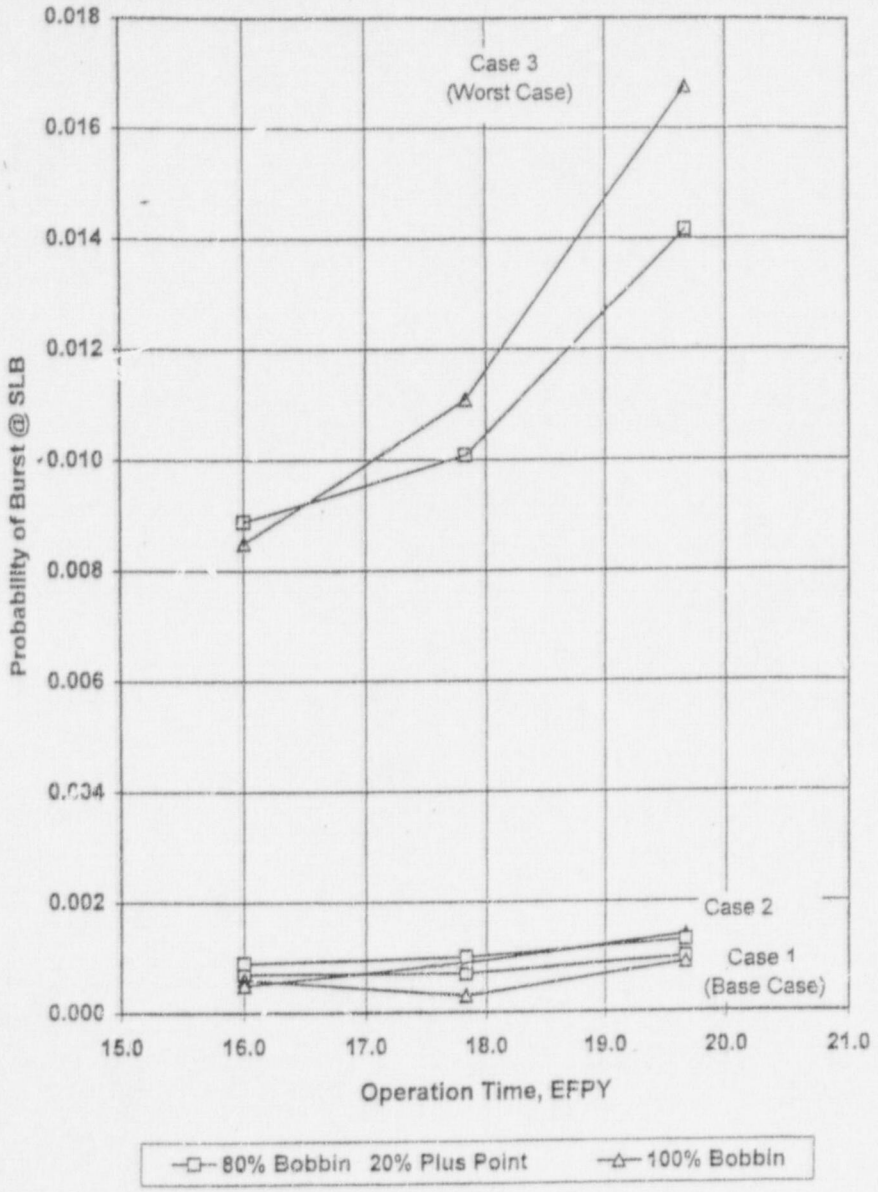
# Upper Bundle Exam

* Three cases analyzed
  - ➢ Case 1: Base Case
    - initiation function - correspond to median number of indications present in 1997
    - growth rate - corresponds to CCNPP Unit 1 and PVNGS Unit 3 data
  - ➢ Case 2: Limiting Initiation Case
    - initiation function - 1997 exam results correspond to the 5% lower bound of indications present
  - ➢ Case 3: Limiting Case
    - initiation function - from Case 2
    - growth rate - limiting value for axial free span cracking in CE Steam Generators

# Upper Bundle Exam




Probability of Tube Burst at Steam Line Break.

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# Upper Bundle Exam

Conclusions:

* The 200 khz bobbin technique POD curve has been confirmed by the 1998 Unit 1 Steam Generator examination results.
* A 100% bobbin exam using the 200khz technique maintains acceptable structural margin against tube burst.

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# Examination Summary

Exam maintains SG tube integrity:

* 100% Plus Point inspection of areas with highest potential for structurally limiting degradation
* Upper bundle approach maintains POB margin:
  - Validated bobbin POD
  - Pulled tube burst pressures
  - Very low probability of burst
  - Model validation
* Conservative tube repair policy

# Secondary Side Activities

* Steam Generator Internals Visual Inspection
  - ➢ Similar to 1998 Unit 1 Inspection
  - ➢ Egg Crates (1 - 8) - Six drop locations
    - 4 hot leg
    - 2 cold leg
  - ➢ Solid Support Plates (9 & 10)
  - ➢ Baffle Support Lugs
  - ➢ Flow assisted corrosion (FAC) is primary degradation of concern

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# Secondary Side Activities

* If Secondary Side Internals FAC is identified
  - ➢ expand inspection - identify extent of degradation
  - ➢ Upper Bundle Flush and Sludge Lance - removal of corrosion products
  - ➢ Pre-outage analysis - CEOG reports and additional egg crate degradation scenarios
  - ➢ Repairs - tube plugging and stabilization

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# NRC Interactions

Objective: Maintain open communications with the NRC

* Brief the NRC Resident Inspector prior to the SG inspection
* Communications flow through the Resident Inspector
* Resident Inspector
  - ➢ access to daily report
  - ➢ weekly SGOC meeting
* C3 inspection results notification to the region

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# Conclusion

The 1998 SG work scope:

* maintains CCNPP's focus on nuclear safety
* aggressively identifies and repairs degraded tubes
* provides for inspection scope expansions as necessary to maintain tube integrity