



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

January 15, 1992

Docket No. 50-338

LICENSEE: Virginia Electric and Power Company (VEPCO)
FACILITY: North Anna, Unit 1 (NA-1)
SUBJECT: MEETING SUMMARY OF JANUARY 6, 1992

On January 6, 1992, representatives of the NRC, VEPCO, and Westinghouse met to discuss the status of the mid-cycle NA-1 steam generator (SG) inspection. A list of attendees is provided in Enclosure 1.

The purpose of the meeting was to present the SG inspection plans, establish a licensing basis for restart and licensing actions required to support restart (see Enclosure 2). Present schedules call for the unit being on line by February 24, 1992. The licensee also indicated that since the current NA-1 operating interval was being extended from 18 months to 22 months, relief will be required for some surveillance procedures. The majority of these surveillances are not due until December 1992.

Items discussed for the SG inspection program included the scope of the inspection plan, degradation mechanisms, evolution of the inspection program, inspection plan and basis, analyst qualifications, revised eddy current analysis guidelines and tube plugging criteria. Reanalysis of the 1991 refueling outage data with revised interpretation guidelines indicated that 8 x 1 eddy current data contain more information than previously recognized. Finally, the licensee addressed certain licensing actions needed to support unit startup. Items included: (1) NRC approval for restart when one or more SG is classified Category C-3, (2) because of increased tube plugging, the current minimum allowed reactor coolant system flow rates must be revised, and (3) possible restriction of NA-1 rated thermal power by about 5% due to the impact of additional plugging on loss-of-coolant accident analyses. The staff indicated to the licensee that it found no problems at this time with the licensee's need for surveillance relief or licensing actions.

The NRC staff indicated that several technical issues regarding the SG inspection plan still needed resolution. The staff indicated that a random sample of rotating pancake coil inspections, for purposes of validating the adequacy of 8 x 1 probe inspections as a screening inspection, should be evaluated. Also, since lift-off effects make it more difficult to identify crack indications at the SG support plates, an assessment should be made

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January 15, 1992

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whether a reduced probe speed could improve lift-off performance and improve the sensitivity of the test. The staff indicated these concerns would be specifically provided to the licensee in the next few days.

/s/

Leon Engle, Project Manager
Project Directorate II-2
Division of Reactor Projects - I/II
Office of Nuclear Reactor Regulation

Enclosures:

1. Attendance List
2. Meeting Handout

cc w/enclosures:
See next page

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OFC	:LA:PDII-2	:PM:PDII-2	:D:PDII-2	:	:	:
NAME	:D. N. [Signature]	:L. Engle	:H. Berkow	:	:	:
DATE	:1/15/92	:1/15/92	:1/15/92	:	:	:

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Virginia Electric & Power Company

North Anna Power Station
Units 1 and 2

cc:

Mr. William C. Porter, Jr.
County Administrator
Louisa County
P.O. Box 160
Louisa, Virginia 23093

Michael W. Maupin, Esq.
Hunton and Williams
P.O. Box 1535
Richmond, Virginia 23212

Dr. W. T. Lough
Virginia State Corporation Commission
Division of Energy Regulation
P.O. Box 1197
Richmond, Virginia 23209

Old Dominion Electric Cooperative
4201 Dominion Blvd.
Glen Allen, Virginia 23060

Mr. E. Wayne Harrell
Vice President - Nuclear Operations
Virginia Electric and Power Co.
5000 Dominion Blvd.
Glen Allen, Virginia 23060

Mr. Patrick A. O'Hare
Office of the Attorney General
Supreme Court Building
101 North 8th Street
Richmond, Virginia 23219

Senior Resident Inspector
North Anna Power Station
U.S. Nuclear Regulatory Commission
Route 2, Box 78
Mineral, Virginia 23117

C.M.G. Buttery, M.D., M.P.H.
State Health Commissioner
Office of the Commissioner
Virginia Department of Health
P.O. Box 2448
Richmond, Virginia 23218

Regional Administrator, RII
U.S. Nuclear Regulatory Commission
101 Marietta Street, N.W., Suite 2900
Atlanta, Georgia 30323

Mr. G. E. Kane, Manager
North Anna Power Station
P.O. Box 402
Mineral, Virginia 23117

Mr. J. C. O'Hanlon
Vice President - Nuclear Services
Virginia Electric and Power Company
5000 Dominion Blvd.
Glen Allen, Virginia 23060

Mr. Martin Bowling
Manager - Nuclear Licensing
Virginia Electric and Power Co.
Glen Allen, Virginia 23060

Mr. W. L. Stewart
Senior Vice President - Nuclear
Virginia Electric and Power Co.
5000 Dominion Blvd.
Glen Allen, Virginia 23060

VEPCO/WESTINGHOUSE/NRC MEETING

JANUARY 6, 1992

ATTENDANCE LIST

NRC

H. Ableson
H. Berkow
J. Blake
C. Y. Cheng
H. Conrad
N. Economos
L. Engle
G. Holahan
R. Jones
K. Karwoski
M. Lesser
E. Merschhoff
T. Murley
E. Murphy
J. Partlow
J. Richardson
J. Scarborough
J. Thoma
S. Varga
J. Wechselberger

VEPCO

M. Bowling
D. Dodson
E. Grecheck
L. Hartz
J. Lee
J. O'Hanlon
J. Stall
W. Stewart
E. Throckmorton

WESTINGHOUSE

T. Pitterle
D. Malinowski

SERCH/BECHTEL

M. Barth

MEETING SUMMARY DATED January 15, 1992

DISTRIBUTION:

Docket File
NRC & Local PDRs
PDII-2 RDG
T. Murley
F. Miraglia
S. Varga
G. Loinas
H. Berkow
B. Buckley
D. Miller
OGC
H. Ableson
J. Blake
C. Y. Cheng
H. Conrad
E. Economos
G. Holahan
R. Jones
K. Karwoski
M. Lesser
E. Merschoff
T. Murley
E. Murphy
J. Partlow
J. Richardson
J. Scarborough
J. Thoma
J. Wechselberger
ACRS (10)
E. Jordan, MNBB 3701
M. Sinkule RII

VIRGINIA POWER



**North Anna Unit 1 Restart Issues Meeting
Steam Generator Mid-Cycle Inspection Outage**

January 6, 1992

ENCLOSURE 2

VIRGINIA POWER



Introduction / Objectives

J. P. O'Hanlon
Vice President - Nuclear Operations

Meeting Objectives

- Present Steam Generator Inspection Plan
- Establish Licensing Basis for Restart
- Identify NRC Approvals Required for Restart

Agenda

North Anna Unit 1 Restart Issues Meeting Steam Generator Mid-Cycle Inspection Outage

January 6, 1991

Introduction / Objectives

J. P. O'Hanlon

Outage Plans

J. A. Stall

Steam Generator Tube Inspection Plan

E. S. Grecheck

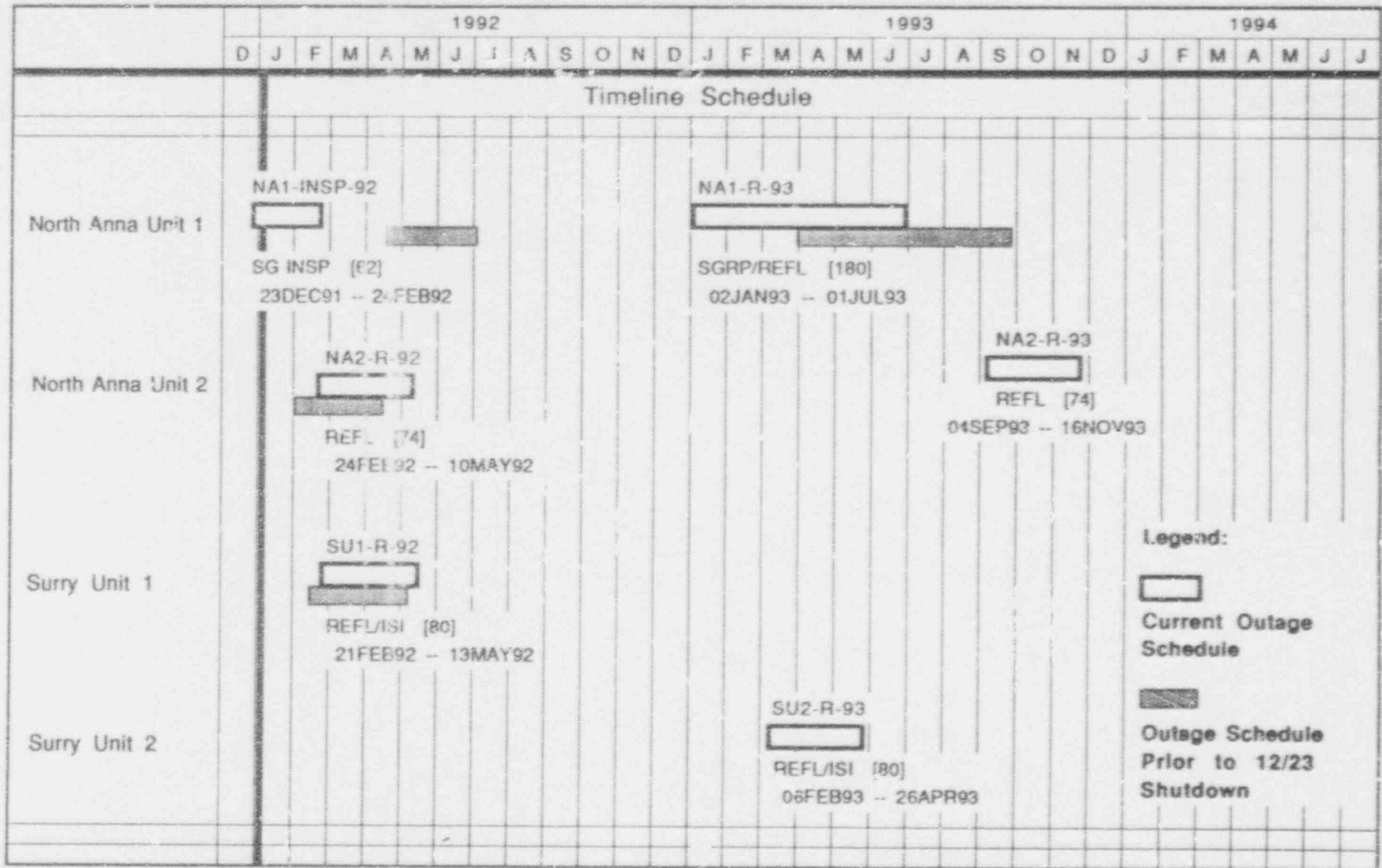
Basis for Inspection Program

D. D. Malinowski

Licensing Actions to Support Unit Startup

M. L. Bowling

OUTAGE FORECAST SCHEDULE 1992-1993 NORTH ANNA AND SURRY POWER STATIONS



VIRGINIA POWER



Outage Plans

J. A. Stall
Assistant Station Manager

Outage Plans

- Current Steam Generator Inspection Outage
- Impact of Surveillance Testing on Current Outage

Unit 1 1992 Mid-Cycle Outage Major Milestones

12/23/91	Unit Shutdown
12/24/91	Enter Mode 5, Break Containment Vacuum
12/29/91	Commence Steam Generator Inspection Activities
01/07/92	Commence Eddy Current Activities
02/11/92	Completion of Steam Generator Inspection Activities
02/15/92	Commence Containment Closeout Activities
02/19/92	Enter Mode 4
02/21/92	Reactor Startup
02/24/92	Place Unit Online

Basis for Surveillance Interval Extension

- Operating interval is being extended from 18 months to 22 months.
- Majority of 18-month interval surveillance procedures are not due until December of 1992.
- Refueling / steam generator replacement outage rescheduled for early January 1993.
- Deferred surveillances will be performed during steam generator replacement outage.
- Current monthly, quarterly, and cold shutdown surveillances confirm operability of systems and equipment important to plant safety.

VIRGINIA POWER



Steam Generator Tube Inspection Plan

E. S. Grecheck

Manager - ISI / NDE and Engineering Programs

Steam Generator Tube Inspection Plan

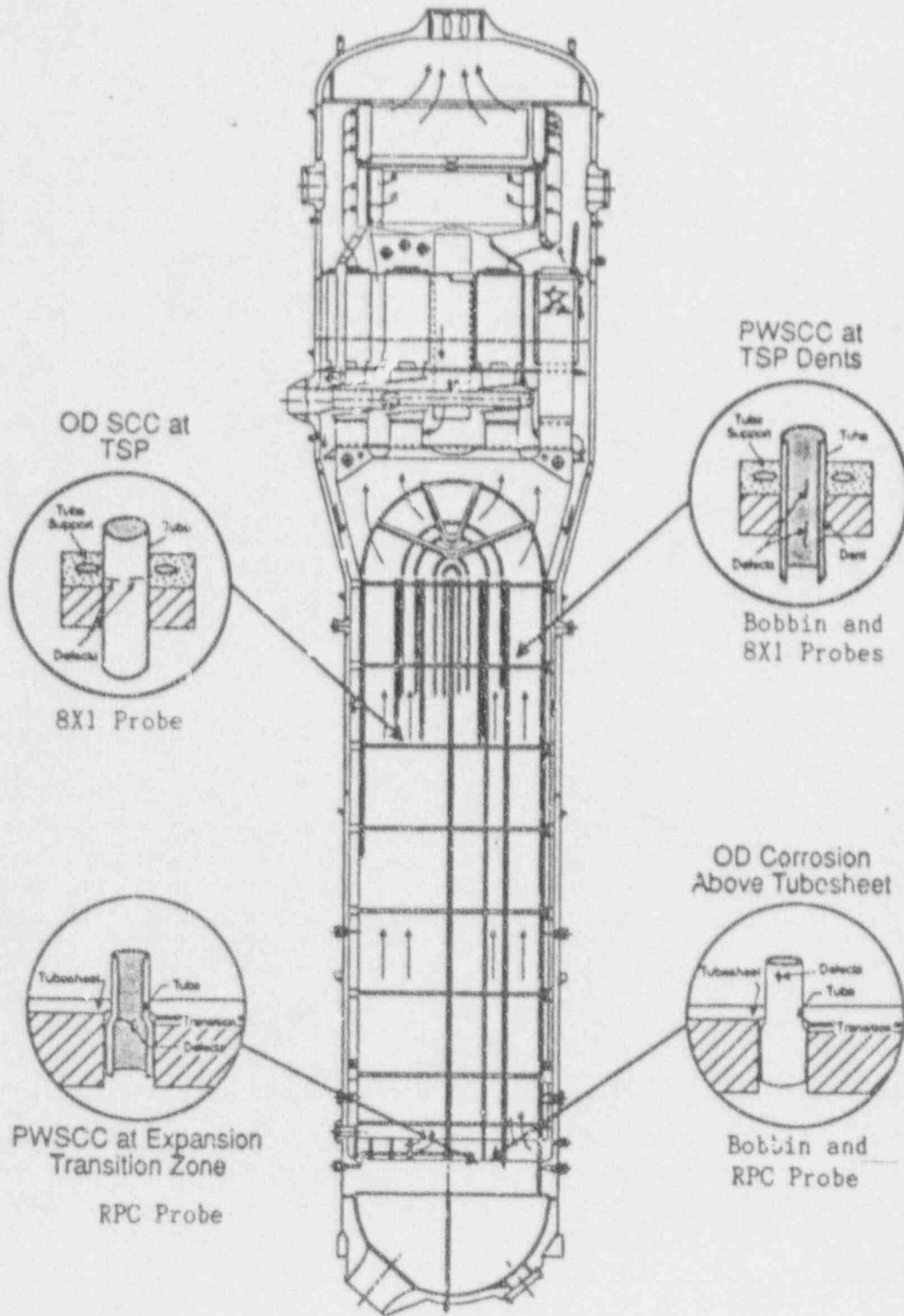
- Steam Generator Inspection Scope
 - Degradation Mechanisms
 - Evolution of Inspection Program
 - Inspection Plan
 - Inspection Basis

- Analyst Qualifications

- Revised Eddy Current Analysis Guidelines

- Tube Plugging Criteria

Major Degradation Mechanisms Steam Generator



Evolution of the North Anna Unit 1 Steam Generator Inspection Program

- Prior to 1985** - Standard Technical Specification inspection program using Bobbin probe.
- 1985**
- Committed to the examination of 21% of tubes in 2 steam generators as part of steam generator maintenance agreement.
 - Bobbin based program.
 - Expansion based on Technical Specification program.
 - Two steam generator tubes pulled.
- 1987**
- Began use of 8x1 probe to determine cracking at top of tubesheet (result of leaking tube).
 - Began use of RPC to help resolve actual flaws from other indications.
 - Began use of written rule base and testing of E/C analysts as the result of tube failure.
 - Three steam generator tubes pulled.

Evolution of the North Anna Unit 1 Steam Generator Inspection Program (Continued)

- 1989
- Began 100% Bobbin program.
 - Expanded, on sample basis, the 8x1 program to look for indications at the tube support plates.
- 1991
- Performed sample inspection with 8x1 to 7th tube support plate. 100% of remaining tubes were examined by 8x1 to 4th tube support plate.
 - Discontinued use of 8x1 at top of tubesheet. Started use of RPC as screening tool.
 - In response to findings at Farley, dropped requirement for minimum voltage level for call of indications.
 - One steam generator tube pulled.

Resulting Steam Generator Operating Performance

- Adequate tube integrity has been provided over previous operating cycles by these inspection methodologies.
- Low primary-to-secondary leakage since November 1985 refueling outage.
 - No forced outages for the major active degradation mechanisms even with leakage limits lowered by a factor of 10.
 - Maximum leakage experienced was ~15 GPD.
- Primary-to-secondary leakage just prior to the mid-cycle outage shutdown was < 5 GPD.

**North Anna Unit 1
Steam Generator Inspection Plan
1992 Mid-cycle Outage**

- Tubesheet Videoscan
 - 100% visual examination of hot leg and cold leg tubesheet performed with ~450 psig water on secondary side.
 - Performed before start of eddy current and at completion of tube plugging.
- Extensive Eddy Current Program

Summary of Eddy Current Program North Anna Unit 1 1992 Mid-cycle Inspection Outage

<u>Inspection Performed</u>	<u>Extent of Inspection</u>	<u>Reason</u>
Bobbin Probe	100% available tubes. Full-length.	Detection of axial indications.
8x1 Probe	100% tubes thru 7th tube support plate (TSP) on hot leg side. (4th TSP in 1991)	Detection of circumferentially oriented or volumetric degradation at the support plates and detection of indications at the support plates not found by Bobbin probe.
Rotating Pancake Coil (RPC) Probe	100% at top of tubesheet. All available Row 2 U-bends and any potentially pluggable bobbin and/or 8x1 probe indications. Fatigue susceptible areas.	Detection of circumferential indications at the top of tubesheet. Detect U-bend degradation. Confirm Bobbin or 8x1 probe indications.
	Review status of potential indications identified in the re-review of Unit 1 data.	Identify changes since March 1991 inspection.

Basis for Inspection Program

- Inspection program has proven effective in preventing any significant leakage over last four operating cycles.
- Eddy current techniques are consistent with safety analysis model.
- Ten-month operating interval until steam generator replacement.
- Meets Technical Specification inspection requirements.
- Provides adequate detection of all known degradation mechanisms.
- Developed from the extensive database on degradation mechanisms active in the North Anna Unit 1 steam generators.

Analyst Qualification Requirements

- Must meet ASNT-TC-1A Level II~~A~~ or Level III requirements.
- Must pass a site specific examination on the specific probe type (i.e., 8x1, Bobbin, RPC) to perform analysis.
- Site specific examination contains flaw signals from previous North Anna evaluations.
- Reviewed and approved by Virginia Power NDE Level III.

Data Analysis Rule Changes

Bobbin Probe

- No frequency correlation required. (1992 revision)
- A call by either reviewing analyst will require RPC examination. (1992 revision)
- No voltage limit. (1991 revision)

8x1 Probe

- No frequency correlation required. (1992 revision)
- Top and bottom of each intersection evaluated independently. (1992 revision)
- A call by either reviewing analyst will require RPC examination. (1992 revision)
- No voltage limit. (1991 revision)

RPC Probe (tube support plate intersections, PI, DI, and percent through-wall resolution)

- Top and bottom of each intersection evaluated independently. (1992 revision)

Tube Plugging Criteria

- If percent through-wall can be called, then plug tube if greater than 39%.
 - If percent through-wall call cannot be made, then the indication is called either:
 - "DI" - Distorted Indication (found by Bobbin at tube support plate)
 - "PI" - Possible Indication (found by 8x1 at tube support plate)
 - "TI" - Tubesheet Indication (found by Bobbin)
- and TI's, DI's, and PI's will be examined by RPC probe.
- Tube will be plugged unless the RPC data, when considered with initial screening data, can demonstrate acceptability.

Westinghouse

Basis for Inspection Program

D. D. Malinowski

Basis for Inspection Program

- Basis for Growth Rate Estimates
- Threshold of Detection
- Adequacy of 8x1 Probe as a Screening Tool

NORTH ANNA #1

BASIS FOR GROWTH RATE ESTIMATES

GROWTH RATE FOR CIRCUMFERENTIAL EXTENSION OF CRACKS IS DERIVED FROM COMPARISONS OF OBSERVED AZIMUTHAL EXTENTS IN CONSECUTIVE INSPECTIONS

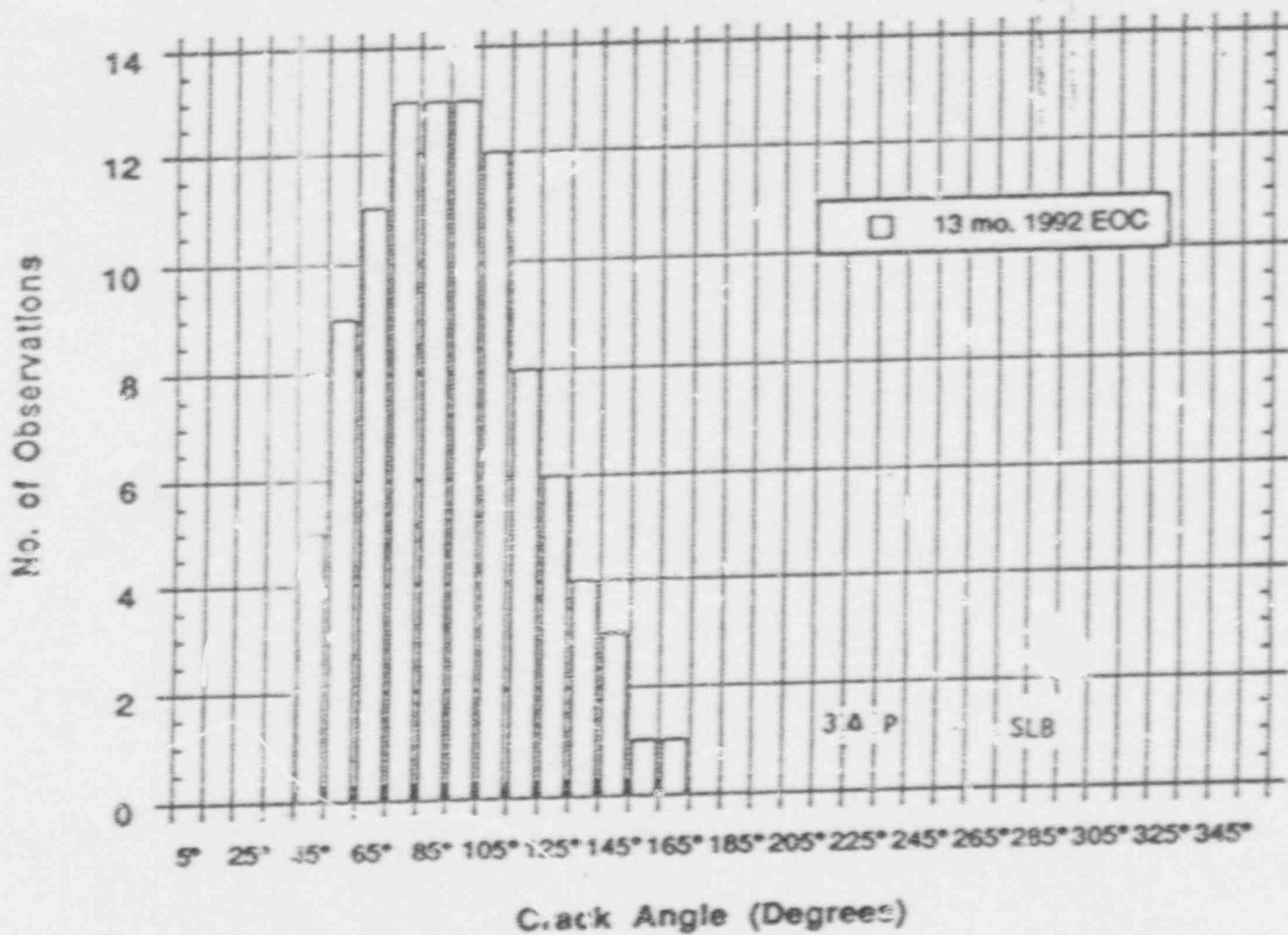
ORDINARILY, DETECTED CIRCUMFERENTIAL CRACKS, ARE PLUGGED; COMPARISON OF 1989 AND 1991 REFUELING OUTAGE RESULTS FROM THE 8X1 PROGRAM WERE USED TO DERIVE GROWTH RATES

GROWTH RATES DERIVED FROM 8X1 DATA WERE CONVERTED TO AZIMUTHAL ARCS BY BOUNDING THE CORRELATION WITH CORRESPONDING RPC EXTENTS FOR 1991 REFUELING DATA

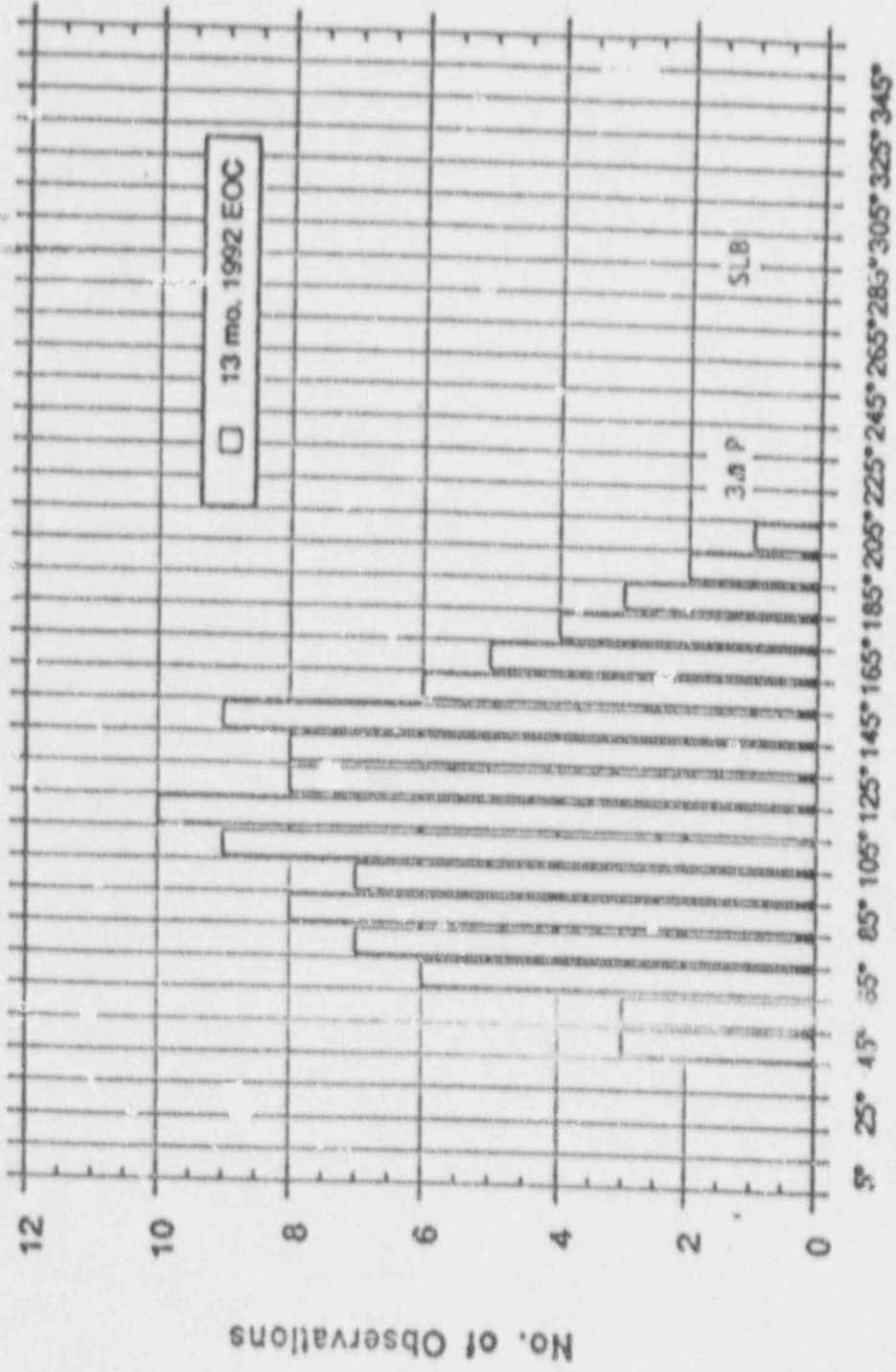
A SMALL NUMBER OF TUBES WITH KNOWN RPC INDICATIONS WERE IDENTIFIED DURING THE RE-REVIEW OF THE 1991 REFUELING OUTAGE RPC DATA. THESE WILL BE RE-TESTED DURING THE 1992 MID-CYCLE OUTAGE WITH RPC TO PERMIT DIRECT AZIMUTHAL CHANGE DETERMINATION

INSPECTION DATA OBTAINED DURING THE 1992 MID-CYCLE OUTAGE WILL BE EMPLOYED TO VALIDATE THE RPC-BASED GROWTH RATE

TSP 1992 EOC Projections with
90° Threshold for 13 Month Operation



TSP 1992 EOC Projections with
150° Threshold for 13 Month Operation



NORTH ANNA #1

THRESHOLD OF DETECTION FOR CIRCUMFERENTIAL CRACKS

AVAILABLE STUDIES ON 8x1 AND RPC PROBES
DEMONSTRATE COMPARABLE PERFORMANCE FOR BOTH PROBES
PROVIDED THE COILS ENCOUNTER THE CRACKS.

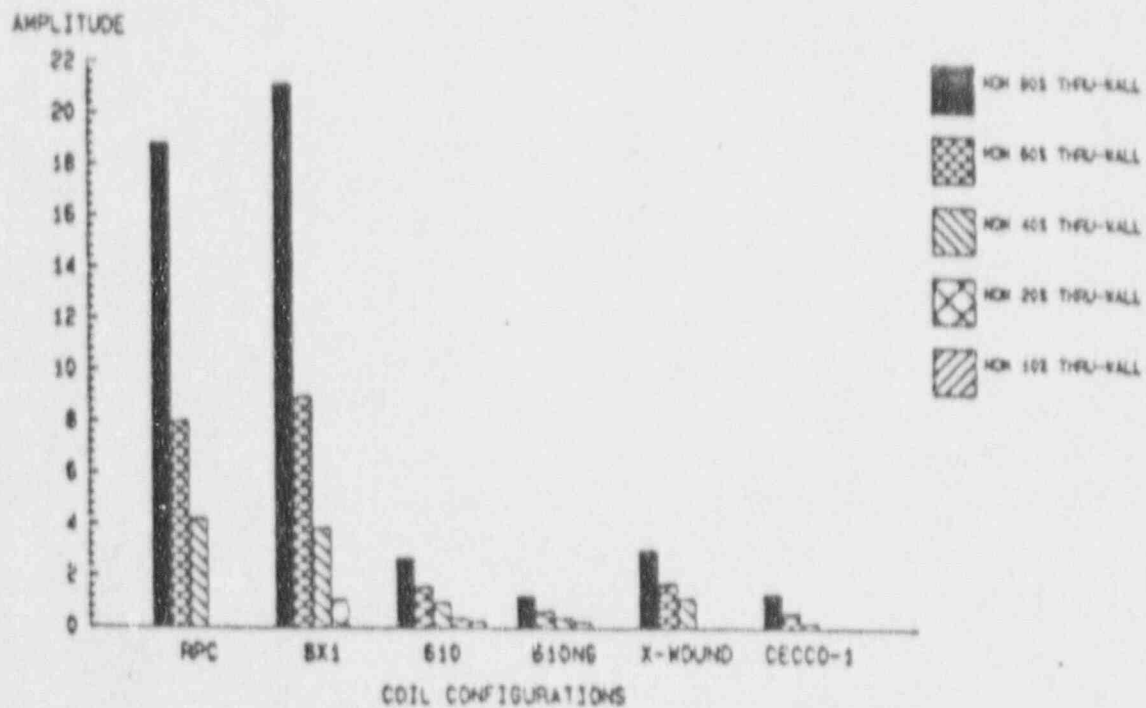
DETECTION THRESHOLD ARGUMENTS PRESENTED IN WCAP-
13034 FOR THE JUST CONCLUDED INTERVAL MADE
CONSERVATIVE ESTIMATES BASED ON GEOMETRICAL
CHARACTERISTICS OF THE PROBE

RE-EVALUATED DATA FROM R11C14 SHOWED 8x1
DETECTION ON BOTH EDGES OF THE #1 TSP

REANALYSIS OF THE 1991 (~300 TUBES) REFUELING
OUTAGE DATA WITH REVISED INTERPRETATION GUIDELINES
DEMONSTRATED THAT 8x1 DATA CONTAINS MORE
INFORMATION THAN PREVIOUSLY RECOGNIZED

EPRI NP:6990 COMPARATIVE PROBE PERFORMANCE

Circumferential EDM Notches

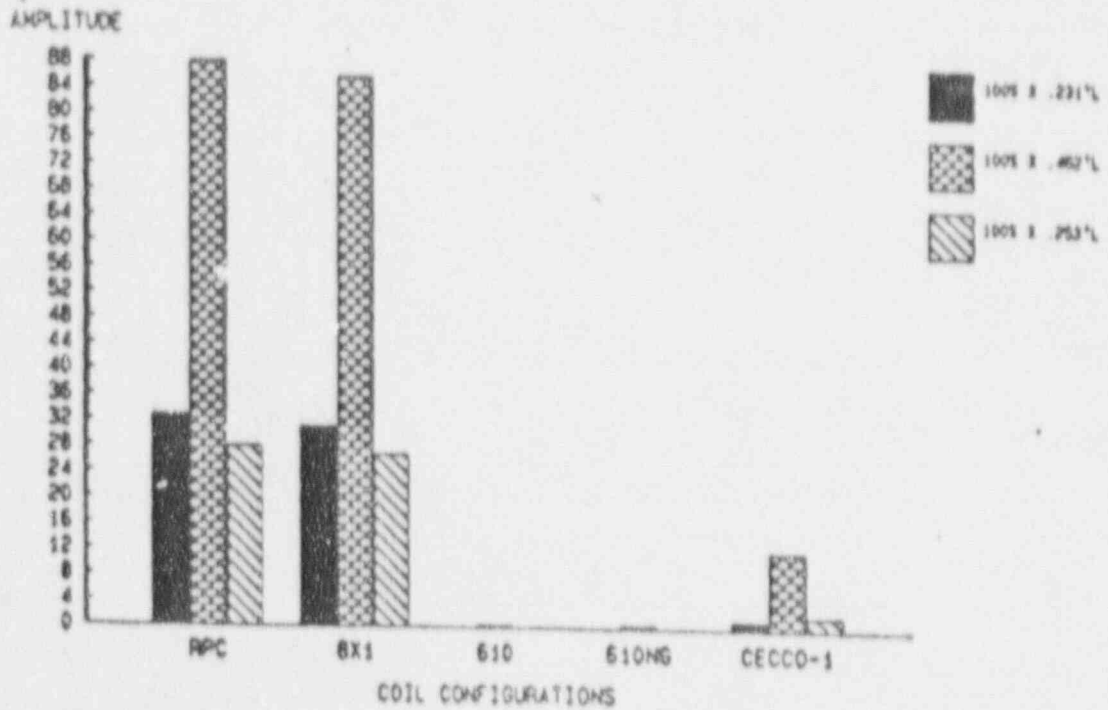


RPC AT 250 KHZ & BX1 AT 200 KHZ
 610 AT 300 KHZ & 610NG AT 550 KHZ
 X-WOUND AT 100 KHZ & CECCO-1 AT 400 KHZ

Figure 3-3. Sensitivity test of different probe coil configurations to varying depths of 90-degree circumferential notches.

EPRI NP:6990 COMPARATIVE PROBE PERFORMANCE

Through Wall Circumferential Fatigue Cracks



RPC AT 250 KHZ & BX1 AT 200 KHZ
 610 AT 300 KHZ & 610 AT 550 KHZ
 CECCO-1 AT 400 KHZ

Figure 3-5. Sensitivity test of different probe coil configurations to varying lengths of through-wall fatigue cracks.

NORTH ANNA #1

VALIDATION OF 8x1 PROBE SCREENING

DETECTION CAPABILITY OF PANCAKE COILS ON 8x1 ARRAY PROBE IS EQUIVALENT TO THAT OF THE ROTATING PANCAKE COIL (RPC)

LABORATORY STUDIES PERFORMED BY EPRI (EPRI NO:6990, OCTOBER 1990) SHOWED SUPERIOR RESPONSE FOR 8x1 FOR ALL FLAW TYPES TESTED INCLUDING PLANAR CIRCUMFERENTIAL FLAWS

RELATIVE S/N DIFFERENCES BETWEEN RPC AND 8x1 ARE ELIMINATED AS FOLLOWS:

1. USE OF A 400/100KHZ SUPPRESSION MIX ELIMINATES INFLUENCE OF SUPPORT PLATE
2. NORTH ANNA #1 SUPPORT PLATE DENTING PRODUCES SIGNALS EQUIVALENT TO A 0.001" RADIAL DENT, MUCH SMALLER THAN 0.007" DENT USED IN STUDY.

CIRCUMFERENTIAL CRACKS WITH LENGTHS SIGNIFICANT WITH RESPECT TO THE REG. GUIDE 1.121 ANALYSIS - GREATER THAN 100 DEGREES (150 DEGREES ACCEPTABLE WITH 1989-1991 GROWTH RATE) - HAVE A HIGH PROBABILITY OF DETECTION.

ONLY KNOWN INSTANCE OF AN RPC DETECTED CRACK NOT FOUND BY 8x1 : 97 DEGREES BY RPC ANALYSIS.

REVISED INTERPRETATION GUIDELINES WILL RESULT IN IDENTIFICATION OF MORE OF THE SMALLER INDICATIONS.

RPC WILL BE USED TO DETERMINE ACTUAL CRACK ARLENGTH AFTER 8x1 IDENTIFICATION.

SUMMARY OF CRITICAL DATA ANALYSIS RULE CHANGES FOR DETECTION OF CIRCUMFERENTIAL CRACKS AT TSPs

- * 8x1 INSPECTION GUIDELINES DO NOT REQUIRE FREQUENCY CORRELATION
- * 8x1 ANALYSIS REQUIRES PARTICULAR SENSITIVITY TO:
 - ANY VERTICAL EXCURSIONS IN THE LISSAJOUS
 - SEPARATE ANALYSIS OF THE UPPER AND LOWER EDGE OF THE TSP
 - QUANTIFYING THE NUMBER OF COIL HITS
- * INCONCLUSIVE RPC DATA CANNOT CLEAR A POTENTIAL INDICATION. THE COMPLETE BODY OF EDDY CURRENT DATA MUST BE CONSIDERED PRIOR TO REMOVING A TUBE FROM THE PLUG LIST

CIRCUMFERENTIAL INDICATION DISPOSITION 1992 MID-CYCLE INSPECTION

RPC PROBE RESULT

8x1 PROBE RESULT	FLAW-LIKE FEATURES WITH VISIBLE INDICATION ON C-SCAN	INDICATION ON C-SCAN WITH NO FLAW-LIKE FEATURES	QUESTIONABLE C-SCAN WITH NO FLAW-LIKE FEATURES	NO FLAW- LIKE FEATURES AND NO VISIBLE INDICATION ON C-SCAN
CORRELATION	PLUG	PLUG (NP)	PLUG (NP)	REVIEW/RETEST
NO CORRELATION	PLUG (NF)	PLUG (NP)	REVIEW/RETEST	CLEAR

(NP) - DENOTES TUBES NOT PLUGGED USING 1991 ANALYSIS CRITERIA

CONCLUSION

- * NEW GROWTH RATES WILL BE DETERMINED FROM CURRENT INSPECTION BASED ON
 - RPC OF INDICATIONS LEFT IN-SERVICE
 - 8x1 COMPARISONS FOR 1991 VS 1992 INSPECTION
- * 8x1 PROBE PERFORMANCE CONSIDERED ACCEPTABLE, PARTICULARLY WITH NEW RULE CHANGES
 - LABORATORY TESTS DEMONSTRATE COMPARABLE DETECTION CAPABILITY
 - RULE CHANGES PROVIDE CONSISTENCY BETWEEN METHODS USED TO CORRELATE 8x1 AND RPC CIRCUMFERENTIAL EXTENTS IN WCAP 13034
- * CYCLE GROWTH FOR THE REMAINING 10 MONTHS OF THE OPERATING CYCLE IS NOT EXPECTED TO EXCEED THAT EXPERIENCED DURING THE LAST 10 MONTHS AND IS CONSERVATIVELY BOUNDED BY THE SAFETY ANALYSIS WHICH MEETS REG. GUIDE 1.121 CRITERIA

VIRGINIA POWER



Licensing Actions to Support Unit Startup

M. L. Bowling
Manager - Nuclear Licensing and Programs

Licensing Actions to Support Unit Startup

- Steam Generator Licensing Basis
- NRC Approvals for Unit Startup
- Other Licensing Actions

Licensing Basis

- No detectable defects will be left in service.
- Compliance with TS 3.4.5 on steam generators is provided by:
 - Comprehensive steam generator inspection plan.
 - Tubes with defects as determined in accordance with the conservative inspection guidelines are plugged.
 - Tubes with possible degradation below the threshold of detection are bounded by the safety analysis (reference WCAP-13034).
- A specific safety evaluation for operation until January 1993 will be provided for steam generator tube integrity which will be in accordance with the recommendations of Reg. Guide 1.121.
- "State of the art" primary-to-secondary leakage monitoring capability and conservative primary-to-secondary leakage limits provide reasonable assurance of continued safe operation.

Licensing Actions Required to Support North Anna Unit 1 Startup

- NRC approval required for Unit 1 restart in accordance with Table 4.4-2 of TS 3/4.4.5 when more than one steam generator is classified Category C-3. Safety evaluation to support startup to be presented by February 17, 1992.
- Due to increased tube plugging, the current minimum allowed RCS flow rates specified in TS must be revised. The flow rate will be revised from 284,000 to 275,300 gpm until steam generator replacement outage in Table 2.2-1 of TS 2.2.1 and Table 3.2-1 of TS 3/4.2.5. TS change to be submitted by January 10, 1992.
- One-time extension of certain TS surveillance requirements to support continued operation until steam generator replacement outage. This change is not required to support unit restart but impacts subsequent operating cycle. TS change to be submitted by January 17, 1992.

Possible restriction to Unit 1 rated thermal power by ~5% until steam generator replacement due to impact of additional plugging on LOCA analyses. If needed, safety analysis will be submitted by January 27, 1992.