EPRI

19th Annual Steam Generator NDE Workshop

AGENDA

July 10-12, 2000
Monterey, California

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19th Annual EPRI Steam Generator NDE Workshop

Monterey, California
July 9-12, 2000

SUNDAY JULY 9, 2000

7:00 PM-9:00 PM **Registration**

MONDAY JULY 10, 2000

7:00 AM	**Registration and Continental Breakfast**
8:00 AM	**Welcome and Introduction,** Mohamad Behravesh, *EPRI*
	General Session I, Chair: Al Matheny
8:10 AM	**Status Report on NEI Initiative 97-06,** Jim Riley, *Nuclear Energy Institute.*
8:30 AM	**Progress Review for the Argonne Steam Generator Mock-Up NDE Round Robin,** David Kupperman and Sasan Bakhtiari, *Argonne National Laboratory;* Joe Muscara, *Nuclear Regulatory Commission.*
8:50 AM	**Revision 6 of the Steam Generator Examination Guidelines,** Dan Mayes, *Duke Power Co.*
9:10 AM	**On-Line Data Quality Control,** W. Boudreaux, *Framatome Technologies* and R. Vojvodic, *Intercontrole, France.*
9:30 AM	**Formal QA of ETSS,** Gary Henry, *EPRI NDE Center.*
9:50 AM	**Break**
	General Session II, Chair: David Ayres
10:10 AM	**Visual Inspection and Eddy Current Testing: A Long Term Relationship,** John Gay and Randy Lewis, *R. Brooks Associates, Inc.*
10:30 AM	**Inspection Successes,** Bob Vollmer and Neal Farenbaugh, *Zetec, Inc.*
10:50 AM	**Tube Samples with Cracks,** Pedro Veron, *ENSA, Spain*
11:10 AM	**Study of Anomalous Signals at SG Tubing Mill,** J.L. Buret, Grady Harrison and Serge Montrichard, *Valinox Nucleaire, France.*
11:30 AM	**Helium Leak Testing on the French PWR Steam Generators, Improvements of the Method,** Denis Delorme and Francis Casado, *ALSTOM, France.*
11:50 AM	**Eddy Current Services of the Future,** Mark Briers, *Framatome Technologies*
12:10 Noon	**Lunch**

Utility Session, Chair: Russ Lieder

1:20 PM **Beaver Valley U1R13 – ST2000 Data Management Usage,** R.A. Cassa and R.W. Shaffer, *Westinghouse.*

1:40 PM **Diablo Canyon – Deplugging and Returning Tubes to Service Under Alternate Repair Criteria,** John Arhar, *PG&E,* and Jeff Fleck, *Framatome.*

2:00 PM **Installation of Alloy 800 Mechanical Sleeves at Calvert Cliffs,** Edward P. Kurdziel and Darrel D. Weber, *Westinghouse*

2:20 PM **Farley Nuclear Plant utility Status Report,** David Pugh, *Southern Nuclear Operating Co.*

2:40 PM **Experience With Appendix K of the EPRI PWR Steam Generator Examinations Guidelines at Indian Point unit 2,** Ken Krieger, Jack Parry and Jimmy Mark, *Consolidated Edison;* A. Neff, *Verner & James;* G.P. Pierini, A. Vaia and Don Adamonis, *Westinghouse.*

3:00 PM **Break**

Special Session on U-Bend Cracking, Chair: Gary Henry

3:30 PM **Palo Verde,** Doug Hansen, *Arizona Public Service.*

3:50 PM **Indian Point Unit 2,** Jack Parry, *Consolidated Edison.*

4:10 PM **Prairie Island,** Scott Redner, *Northern States Power.*

4:30 PM **Kewaunee,** Tim Olson, *Wisconsin Public Service Corp.*

4:50 PM **End of Today's Sessions**

6:30 PM **EPRI Workshop Dinner**

TUESDAY JULY 11, 2000

7:30 AM	**Continental Breakfast**
	Automated Eddy Current Acquisition and Analysis Session, Chair: Steve Brown
8:00 AM	**Automated Analysis of Eddy Current Data: Terminology and Realistic Principles,** Robert Levy and C. Ferre, *Intercontrole, France.*
8:20 AM	**Evaluation of an Algorithm for Automated Analysis of RPC Data,** Sasan Bakhtiari and David Kupperman, *Argonne National Laboratory.*
8:40 AM	**Automated Analysis of Eddy Current Data from Rotating Probes,** M. Afzal, X. Ping, Lalita Udpa and S.S. Udpa, *Iowa State University;* Steve Brown, *Aptech Engineering Inc.* and Jim Benson, *EPRI.*
9:00 AM	**Automated Eddy Current Acquisition,** L.J. Petrosky, *Westinghouse;* Sam Casey, *Southern Nuclear Operating Co.;* Harry Smith, *Commonwealth Edison.*
9:20 AM	**Experience With TEDDY Automatic Analysis,** Javier Guerra, *Tecnatom s.a., Spain.*
9:40 AM	**Probabilistic Neural Networks for the Analysis of Bobbin Coil Eddy Current Data,** Steve Brown, *Aptech Engineering Services, Inc.*
10:00 AM	**Break**
	Technology Applications Session, Chair: Robert Levy
10:20 AM	**Elimination of NDE Uncertainty From Indication Growth Measurements,** David Ayres and Don Streinz, *Westinghouse Electric Nuclear Services.*
10:40 AM	**Optimization of Eddy Current Inspection Techniques for Inner Diameter-Initiated Stress Corrosion Cracking,** Caius V. Dodd, Stephanie M. Coffin and Emmett L. Murphy, *U.S. Nuclear Regulatory Commission.*
11:00 AM	**Progress on +Point Sizing of Freespan and TSP Intersection Axial ODSCC,** Tom Pitterle and A. Sagar, *Westinghouse.*
11:20 AM	**Eddy Current Evaluation Techniques at Sleeve and Support Plate Edges in Steam Generators,** Bill Stock, *Westinghouse* and Tom Smith, *Southern Nuclear Operating Co.*
11:40 AM	**SPNR (Spinner) Probe: Long-Life ECT Rotating Probe,** Guy Lafontaine, Joe Renaud, Paul Malette and Curtis Fogal, *R/D Tech, Canada.*
12:00 Noon	**End of today's sessions and start of technology fair at vendors' displays in the hotel for the remainder of the afternoon**

WEDNESDAY, JULY 12, 2000

7:30 AM **Continental Breakfast**

Ultrasonic Session, Chair: Jim Quinn

8:00 AM **Development of an Ultrasonic Probe for Accurate Detection and Sizing of SCC in SG Tubes,** Rene Krutzen, Chris Broere and Frans de Boer, *Nuson Inspection Services BV, The Netherlands.*

8:20 AM **Field Implementation of a Qualified Ultrasonic Technique for S/G Tube Inspection,** Steve Swilley, *Texas Utilities; Steve* Kenefick, *EPRI NDE Center;* Pat Minogue, *WesDyne International* and Gilles Rousseau, *R/D Tech, Canada.*

8:40 AM **40 MHz High Frequency Ultrasonic Examination Technique for Steam Generator Tube,** Y. Iwahashi, M. Ideo, Yoshihiro Asada, T. Kinoshita, M. Kurokawa, K. Kawata, K. Enami, and S. Wakayama, *MHI, Japan.*

9:00 AM **Ultrasonic Inspection Experience of Steam Generator Tubes at Ontario Power Generation and Plans to Improve the Capability,** John W. Huggins *Ontario Power Generation, Canada,* and W.K. Chan, *Ontario Power Technologies, Canada.*

9:20 AM **High Speed UT Data Acquisition With 500 MHz Sampling Rate,** Chris Broere and Rene Krutzen, *Nuson Inspection Services BV, The Netherlands.*

9:40 AM **Ultrasonic Examination of Axial ODSCC,** Steve Kenefick, *EPRI NDE Center.*

10:00 AM **Break**

Development and Application of Eddy Current Array Probes, Chair: Jim Benson

10:20 AM **X-Probe: An ECT Array As an Effective High-Speed Replacement for Rotating Probes,** Guy Lafontaine, Florian Hardy and Joe Renaud, *R/D Tech, Canada.*

10:40 AM **Defect Sizing for Intelligent ECT,** M. Kurokawa, K. Kawata, E, Enami, Y. Iwahashi, M. Ideo, Y. Asada, and T. Kinoshita, *MHI, Japan*

11:00 AM **Palo Verde Experience with X-Probe,** Douglas Hansen, *Arizona Public Service.*

11:20 AM **Field Experience and Detectability Test of High Performance ECT Array X-Probe in Japan,** Yutaka Harada, Kotaro Maeda, Junri Shimone and Yasutada Kishi, *Nuclear Engineering Ltd., Japan.*

11:40 AM **Field Experience With X-Probe at Doel 2,** Raymond De Graeve and Olivier Scauflaire, *Laborelec, Belgium;* Joe Renaud, *R/D Tech, Canada.*

12:00 Noon **Closing Remarks,** Mohamad Behravesh, *EPRI*

12:05 PM **End of 2000 Steam Generator NDE Workshop**

PALO VERDE

U-BEND EXAMINATIONS

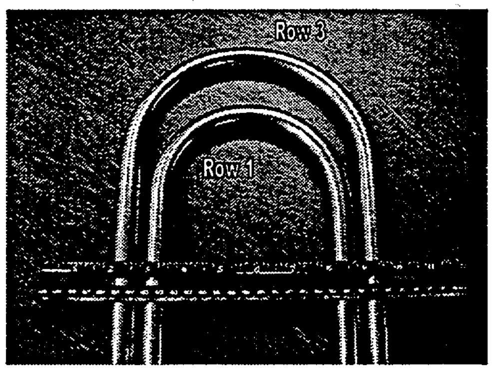
ARIZONA PUBLIC SERVICE
PALO VERDE NUCLEAR
GENERATING STATION

EPRI SG NDE WORKSHOP
2000

Presented by:
Douglas Hansen
Sr Consulting Engineer

U-BENDs

I600 HTMA
.750 OD x .043" wall
cold bent External dies
stress relieved
Row 1 is 2.5" radius
Row 2 is 3.0" radius
Row 3 is 3.5" and etc



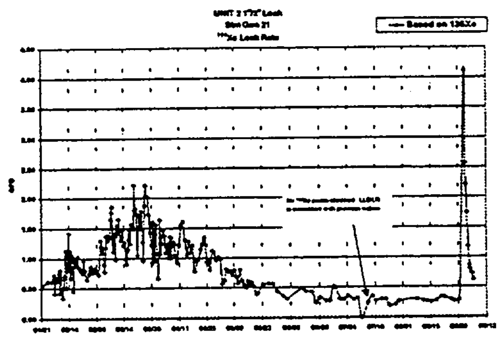
U-BENDs

- Examination History
  - 1994 RPC of rows 1 & 2
  - 1997 added rows 3 & 4
  - 1999 added row 5
- Probe Use History
  - + Point since 1995
- Indication (Plug) History

– SG 11	1
– SG 12	7
– SG 21	7
– SG 22	2
– SG 31	6
– SG 32	11

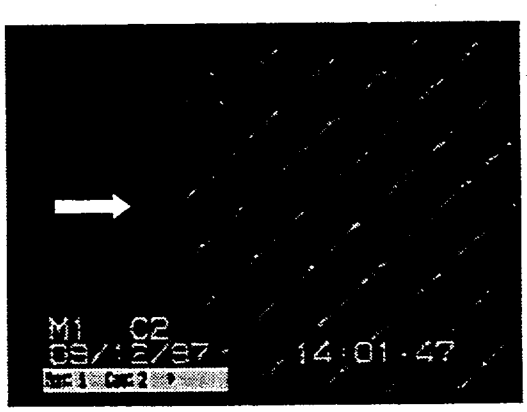
U-BENDs

Unit 2 Cycle 7
Primary-to-Secondary Leak Trend



U-BENDs

UNIT 2 "LEAK"

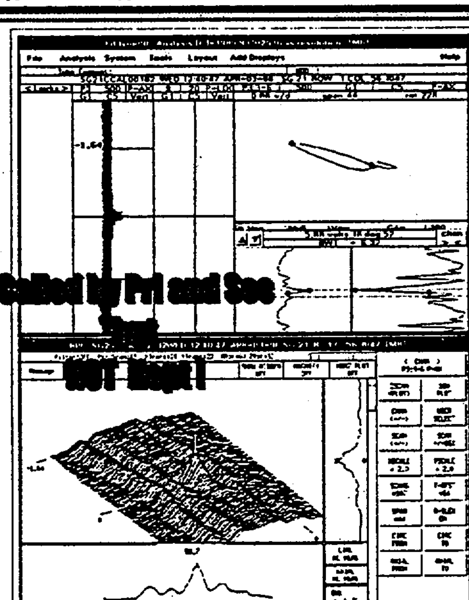


U-BENDs

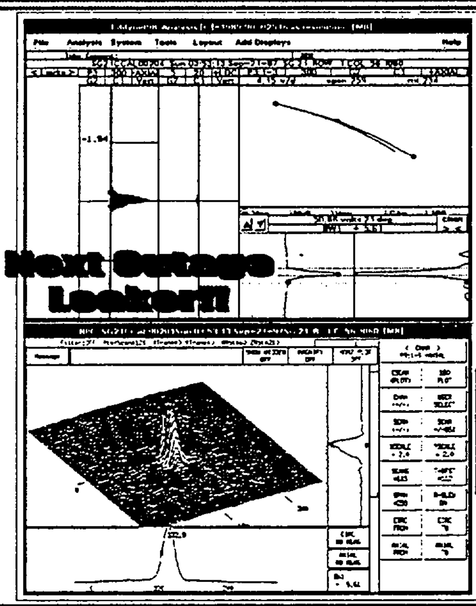
History
for
Row 1 Line 56

- Pancake examination
  - 1994 called; but not kept
- + Point examinations
  - 1995 encoded wrong
  - 1996 called; but not kept
  - 1997 leaked

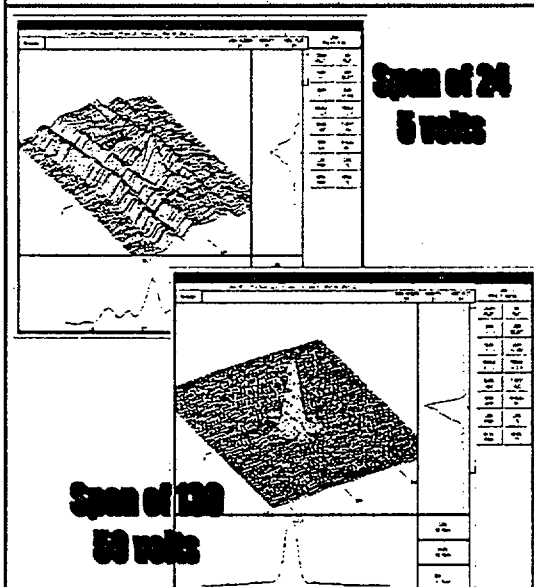
U-BENDs



U-BENDs



U-BENDs



U-BENDs

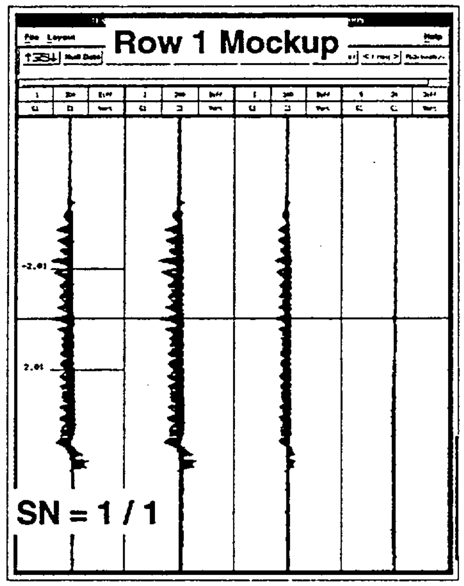
Row 1 Line 56

- 1997 Evaluation
  - "sized" and evaluated with multiple probe designs
  - +Point "sizing" appeared most conservative
- Structural and Leakage Integrity
  - integrity analyzed
  - acceptable insitu

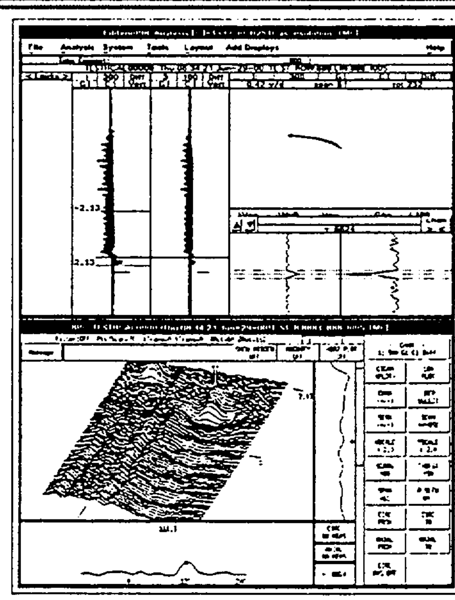
U-BENDs

- **"Site Specific" Changes**
  - separate SSPD exam
  - limited to **on site** pri and sec
  - "heavy" emphasize in training
  - speed test qualification
  - "heavy" emphasize on data quality
- **Added Analysis Step:**
  - re-review of all short radius U-Bends
  - performed by Independent QDA
  - 100% of all short radius examinations
- **Procedural Changes**
  - added **GEO**metry code
  - technique 30 / 30 samples per inch

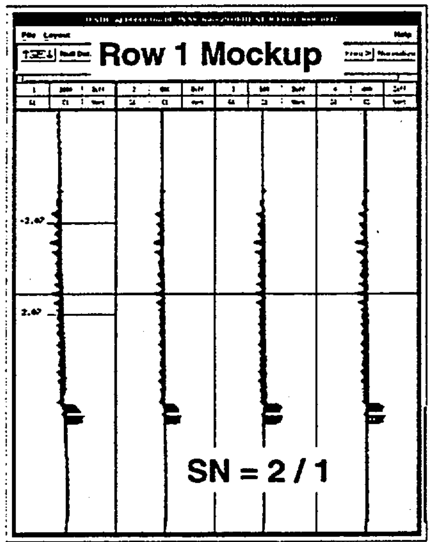
Mid-Freq "PP36"



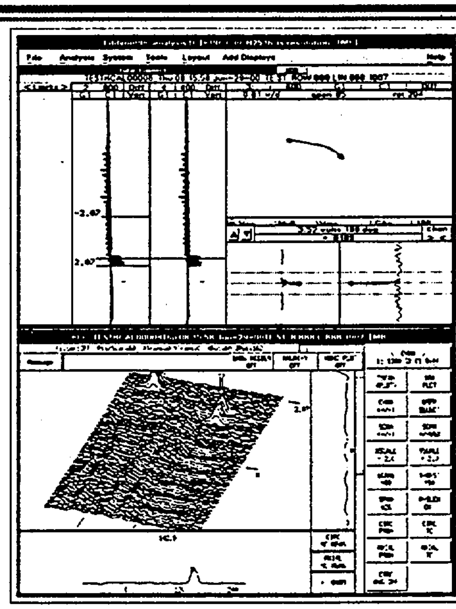
Mid-Freq



Hi-Freq "PP9"



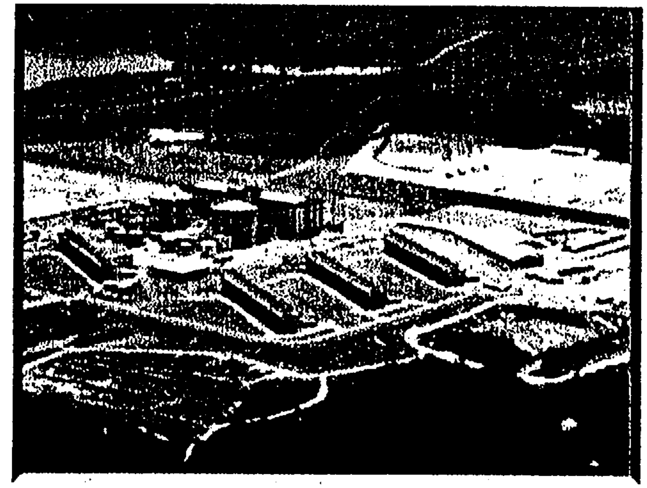
Hi-Freq



Conclusion/Plans

- **"Site Specific" Changes**
  - update SSPD with "DQ" issues
  - update SSPD with more indications
  - more **"heavy"** emphasize in training
  - more **"heavy"** emphasize on "DQ"
- **Added Analysis Step:**
  - continue with "Independent" review
- **Plans**
  - combination mid & high Freq + Point
  - spaced at 10"
  - site validate the hi-freq (PP9)

Farley Nuclear Plant Utility Status Report



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Farley Unit 1 Steam Generator Experience

	Pre-Service	Mar 79	Jun 80	Dec 80	Sep 81	Mar 84	May 85	Oct 86	Apr 88	Oct 89	Mar 91	Sep 92	Mar 94	Sep 95	Mar 97	Aug 98	Oct 98	Total
ODSCC TSP	0	0	0	0	0	0	0	3	0	2	95	114	3	36	82	0	104	439
ODSCC TS	0	0	0	0	0	0	1	3	16	22	42	36	72	210	576	1	224	1,203
ODSCC/IGA Freespan	0	0	0	0	0	0	0	0	0	0	0	0	0	15	47	13	96	171
PWSCC TS	0	0	0	0	0	0	0	0	1	0	75	19	11	51	51	0	41	249
PWSCC U-bend	0	1	3	1	277	0	0	0	0	0	-228	0	2	1	2	0	1	60
Cold Leg Pitting	0	0	0	0	0	0	0	0	0	0	0	0	0	15	0	0	1	16
AVB Wear	0	0	0	0	0	9	0	0	0	0	0	0	0	0	1	0	0	10
Other	0	0	0	0	0	0	0	0	0	0	2	0	0	1	2	0	91	96
Total	0	1	3	1	277	9	1	6	17	24	-14	169	88	329	761	14	558	2,244
Sleeves	0	0	0	0	0	0	0	0	0	0	0	186	83	-11	1040 (66)	-6	318 (94)	1,450
Sleeved Tubes	0	0	0	0	0	0	0	0	0	0	0	136	80	-8	815 (40)	-3	309 (70)	1,216
Plugs	0	1	3	1	277	9	1	6	17	24	-14	33	7	329	102 (149)	14	260	921

Plug Equivalent - 997.24 (9.8%)

Farley Unit 2 Steam Generator Experience

	Pre-Service	Jun-81	Oct-82	Sep-84	Jan-85	Apr-86	Nov-87	Apr-89	Oct-90	Apr-92	Oct-93	Apr-95	Sep-96	Apr-98	Nov-99	Total
ODSCC TSP	0	0	0	0	1	28	72	10	238	19	25 (4)	1 (90)	35	3	14	352
ODSCC TS	0	0	0	0	1	0	1	0	0	0	1	2	11(1)	71	207	293
ODSCC Freespan	0	0	0	0	1	0	3	0	0	0	1	0	2	0	13	20
PWSCC TS	0	0	0	0	0	16	29	16	334	51	102 (7)	85	718(130)	66	90	1370
PWSCC U-bend	0	0	280	0	0	0	0	0	(279)	0	0	0	0	0	0	1
AVB Wear	0	0	0	0	6	2	2	0	1	1	(5)	1	0	0	0	8
Other	4	1	3	3	5	0	2	0	(1)	0	12	2	4 (3)	2	1	35
Total Degradation	4	1	283	3	14	46	109	26	293	71	125	1	636	142	325	2079
Sleeves	0	0	0	0	0	0	0	0	0	85	259	(4)	863 (14)	108 (7)	(7)	1283
Sleeved Tubes	0	0	0	0	0	0	0	0	0	29	246	(2)	847 (12)	108 (5)	(7)	1204
Plugs	4	1	283	3	14	46	109	26	293	42	34 (145)	91 (90)	59 (134)	35	325	996

Plug Equivalent - 1067.68 (10.5%)

Unit 2 RF13 Major Issues

- Plug Only Strategy Estimate
  - Sleeve 8.1%
  - Plug 9.8%
- Degradation in Freespan
  - Degradation masked by residual indications
- Permeability Indications (PVN)

Number of Repairable Tubes by Degradation Mechanism
Farley-2 10/99 U2RF13

Tubesheet Region (Tubes)

Degradation Mechanism	Detection Technique	SG A		SG B		SG C		Total	Est.
		Axial	Circ	Axial	Circ	Axial	Circ		
PWSCC In Sludge Pile	Plus Point	0	0	0	0	0	0	0	0
PWSCC @ Transition (+/- .5")	Plus Point	38	2	13	4	30	2	89	102
PWSCC In F* Region of Tubesheet	Plus Point	1	2	4	0	13	2	22	
ODSCC In Sludge Pile (+.5" to 3")	Plus Point	0	0	1	0	6	0	7	4
ODSCC @ Transition	Plus Point	2	54	4	70	5	52	187	81
ODSCC In F* Region of Tubesheet	Plus Point	0	0	0	0	0	0	0	0
OD Volumetric In Tubesheet Region	Plus Point	0		1		0		1	0
	Total	99		97		110		306	
	U2RF13 Estimate	89		38		60			187

Tube Support Plates (Tubes)

Degradation Mechanism	Detection Technique	SG A		SG B		SG C		Total
		Axial	Circ	Axial	Circ	Axial	Circ	
ODSCC @ TSP's	Bob/Plus Pt	2	0	0	0	15	0	17
	Total	2		0		15		17
	U2RF13 Estimate	1		3		6		10

Other Tubes To Be Plugged

Degradation Mechanism	Detection Technique	SG A		SG B		SG C		Total
		Axial	Circ	Axial	Circ	Axial	Circ	
SCC In Row 1&2 U-bends	Plus Point	0	0	0	0	0	0	0
Pitting	Plus Point	0		0		0		0
Sleeve Degradation	Plus Point	0		1		0		1
Freespan OD Degradation	Bob/Plus Pt	0		4		10		14
	Total	0		5		10		15
	U2RF13 Estimate	1		0		1		2

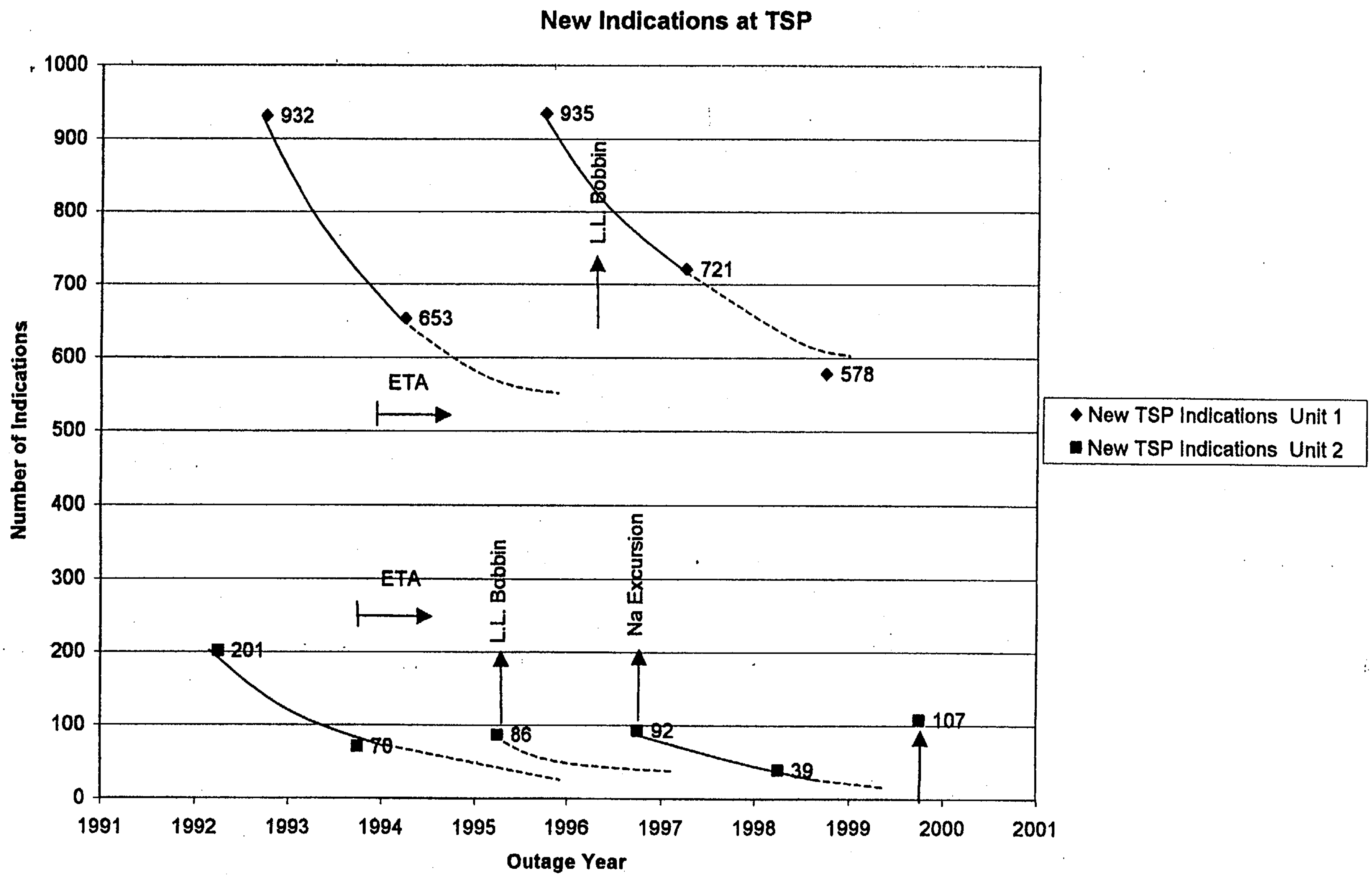
Total Tubes To Be Plugged

	SG A	SG B	SG C	Total
Total Tubes	100	99	126	325
U2RF13 Estimate	91	41	67	199

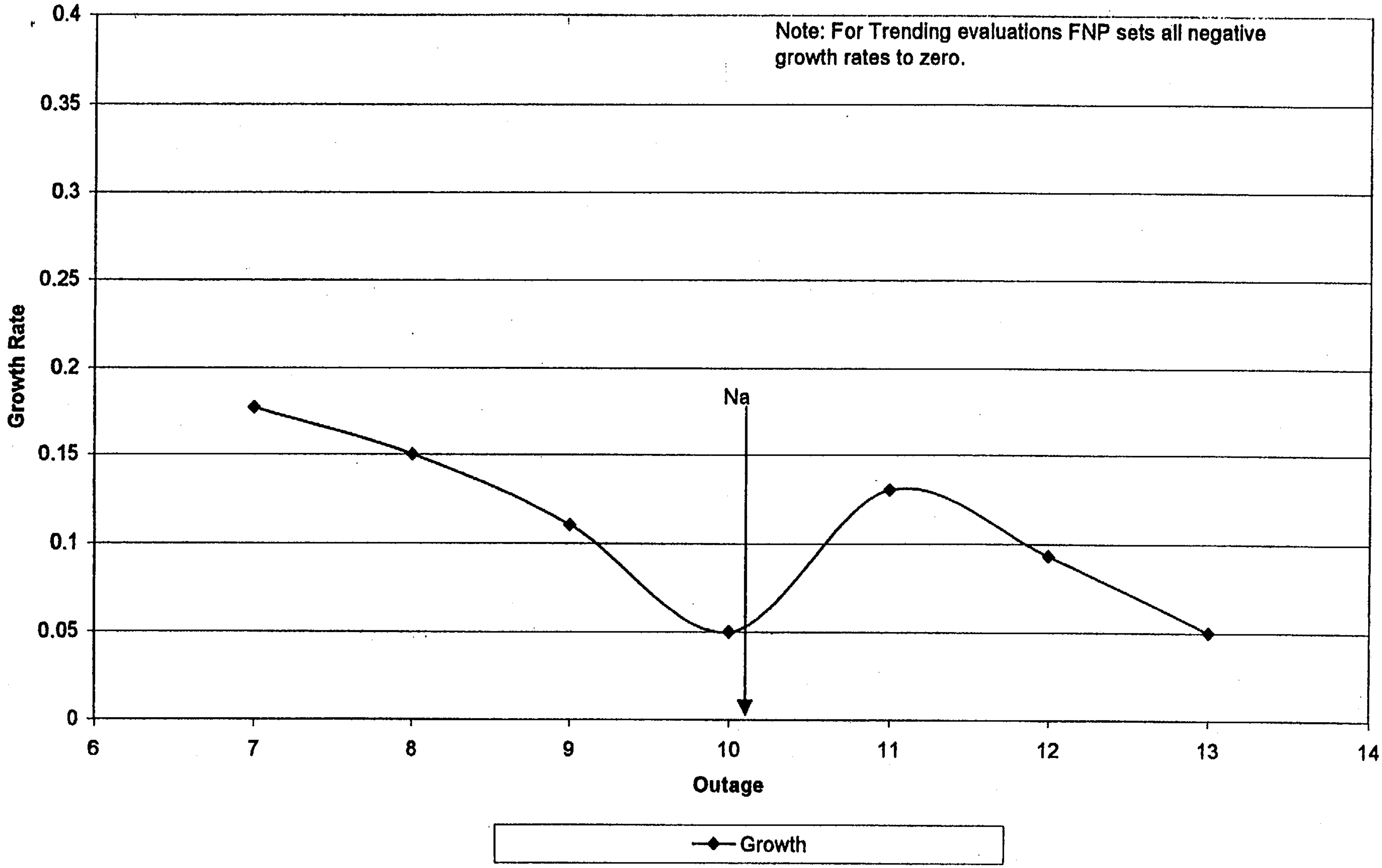
Estimate Summary

		SG A	SG B	SG C	Total
U2RF12	Plug Equivalent	302.2	208.5	232.4	743
	% Plugged	8.9%	6.2%	6.9%	7.3%
Original U2RF13 (Estimate)	Plug Equivalent	393.2	249.5	299.5	942.1
	% Plugged	11.6%	7.4%	8.8%	9.3%
11/10 Estimate	Plug Equivalent	402.2	307.5	358.4	1068.1
	% Plugged	11.9%	9.1%	10.6%	10.5%

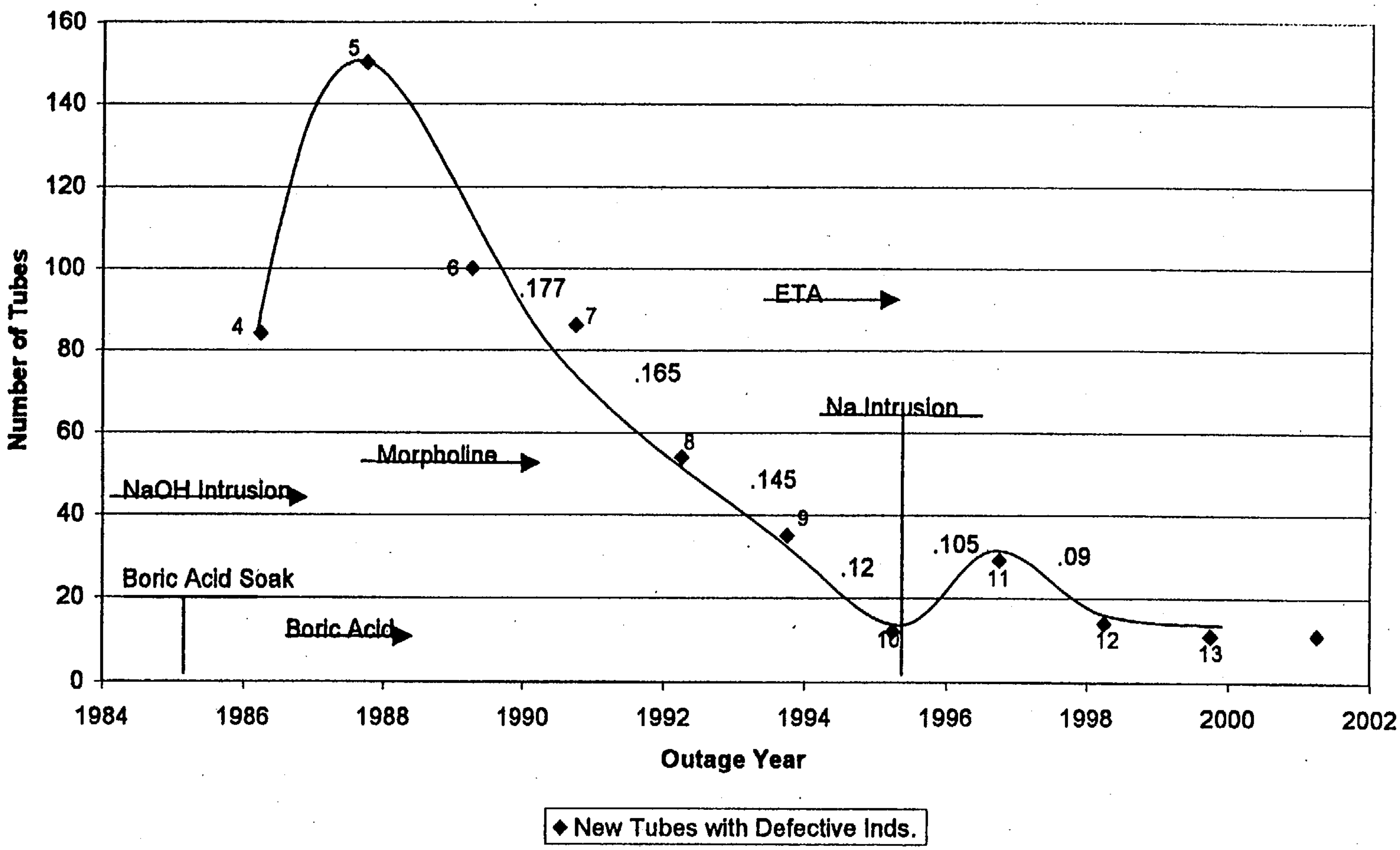
Status As Of: 11/11/99 0300


New Indications at TSP
Number of Indications
1000
900
800
700
600
500
400
300
200
100
0
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
Outage Year
932
653
935
721
578
L.L. Bobbin
ETA
ETA
L.L. Bobbin
Na Excursion
201
70
86
92
39
107
New TSP Indications Unit 1
New TSP Indications Unit 2

Unit 2 TSP Average Voltage Growth Rates



Farley Unit 2
New Tubes with Defective TSP Indications



Farley-2 R13: Summary of Limiting Circumferential Indications and +Point Sizing Results												
				+Point Analysis Results								
Tube Identification				Reference Sizing Method					Circ. Lissajous			
SG	Tube	Elevation	Bobbin Volts	Max. Volts	Avg. Volts	Max. Depth	PDA (Avg. Depth)	Length	Max. Length	PDA (Avg. Depth)	Length	In situ test: P/L?
C	4/31	TSH-0.04	NA	0.36	0.13	95%	40.7%	228°	98%	54.4%	261°	L
	16/80	TSH-0.17	NA	0.22	0.06	57%	9.6%	143° MCI	80%	20.8%	155°	None
	2/78	TSH-0.05	NA	0.31	0.12	82%	32.8%	271°	90%	33.1%	174°	None
A	24/35	TSH-0.19	NA	0.31	0.14	59%	28.1%	325° MCI	94%	34.2%	282°	None
	27/59	TSH+0.01	NA	0.44	0.27	66%	22.4%	218° MCI	98%	37.8%	282°	None
	25/55	TSH-0.14	NA	0.18	0.07	100%	34.1%	207° MCI	80%	15.0%	116°	None
	25/52	TSH-0.10	NA	0.14	0.07	94%	19.9%	183° MCI	96%	41.1%	215°	None
	29/43	TSH-0.03	NA	0.13	0.02	83%	13.7%	145° MCI				None
	28/64	TSH+0.03	NA	0.57	0.16	91%	30.9%	201°	98%	32.2%	167°	None
	9/66	TSH+0.02	NA	0.22	0.09	98%	33.2%	193°	90%	20.1%	156°	None
B	22/31	TSH-0.08	NA	0.32	0.17	93%	33.1%	217°	87%	37.4%	229°	P,L
	5/40	TSH-0.04	NA	0.24	0.07	92%	41.8%	281° MCI	85%	46.8%	262°	P,L
	26/58	TSH+0.03	NA	0.25	0.05	97%	28.9%	245° MCI	85%	26.5%	264°	L
	8/69	TSH-0.04	NA	0.21	0.08	98%	21.4%	231° MCI	87%	27.3%	238°	L

FNP Degradation Model
Unit 2

*	Plug EQ----------------------------------	(+)	1067	or	10.50%
*	Defective Tubes (40% TW)				
	In-service per 2 volt ARC----------	(+)	258		
*	Sleeved Tubes-----------------------	(+)	1200		
*	Plug EQ. For Sleeved Tubes-----	(-)	71.97		
	Total--------		2453.03	or	24.10%

FNP Degradation Model
Unit 1

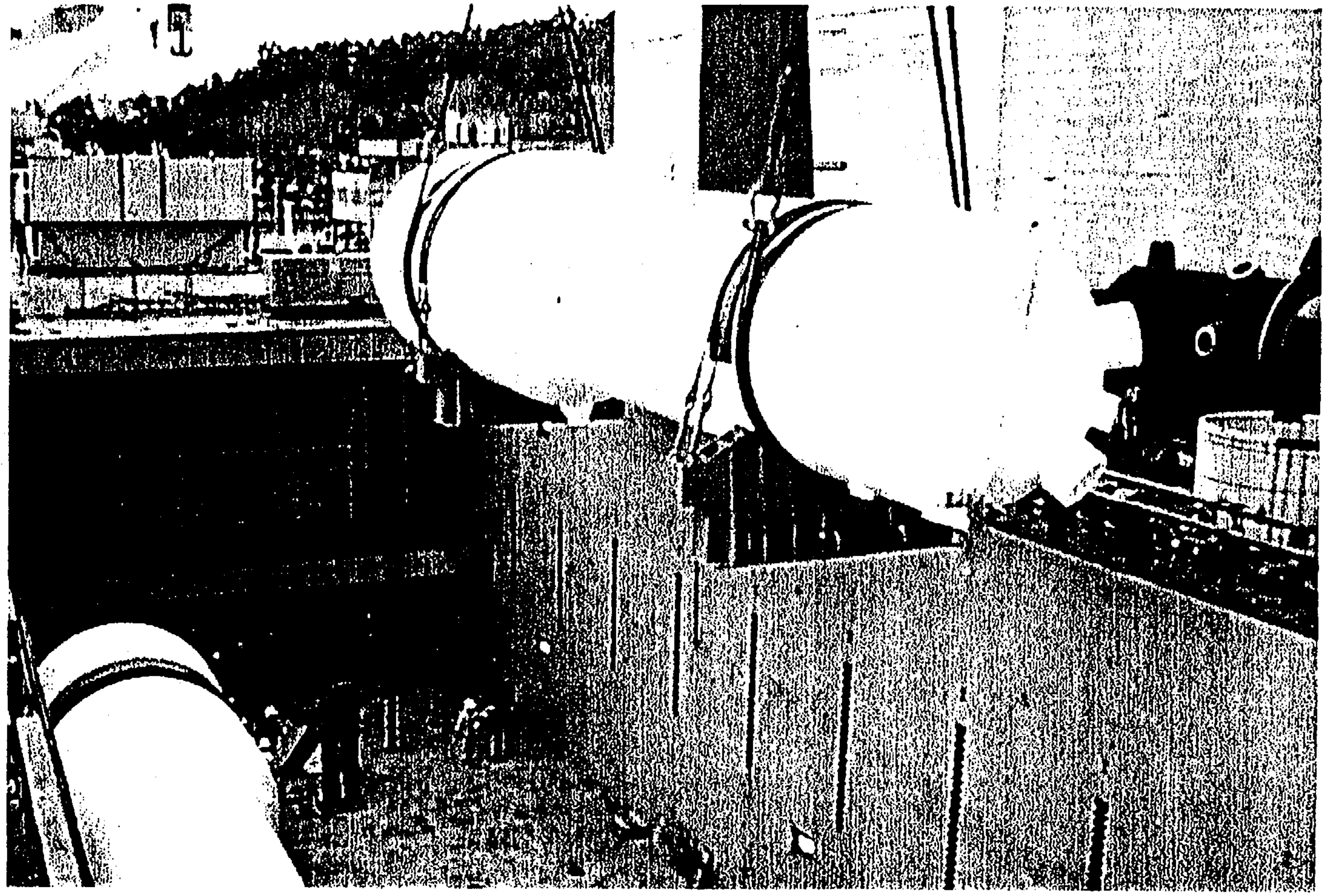
* Plug EQ----------------------------------	(+)	996	or	9.80%
* Defective Tubes (40% TW) in-service per 2 volt ARC----------	(+)	1300		
* Sleeved Tubes------------------------	(+)	1216		
* Plug EQ. For Sleeved Tubes-----	(-)	76		
Total--------		3436	or	33.80%

Unit 1 SG Replacement

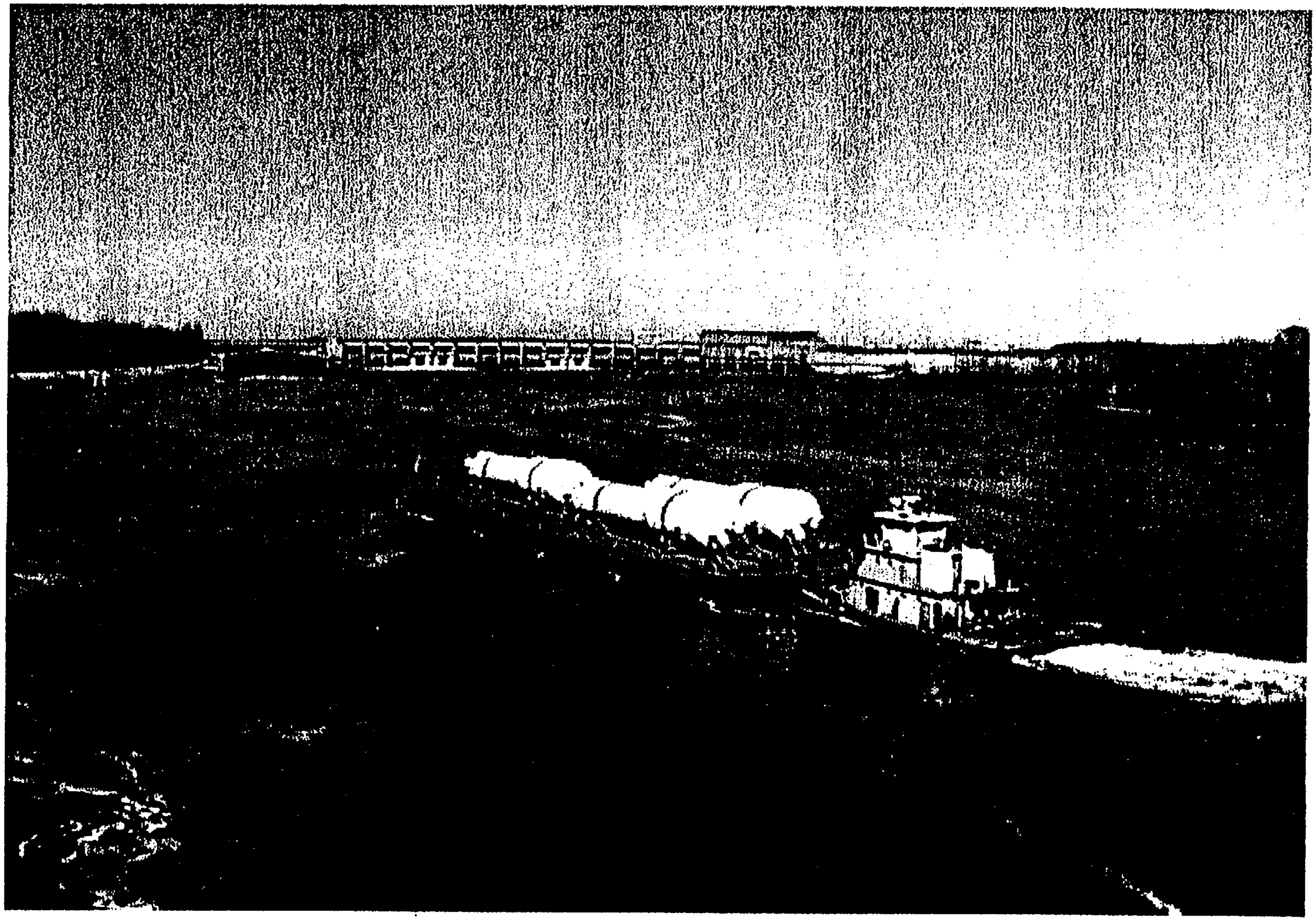
- Westinghouse Model 54F
- Inconel 690 Tubing
- SG Fabricator - ENSA
- SG Tubing - Sandvick
- General Contrator - Bechtel

Unit 1 Replacement SGs
Pre-Service Inspection Results

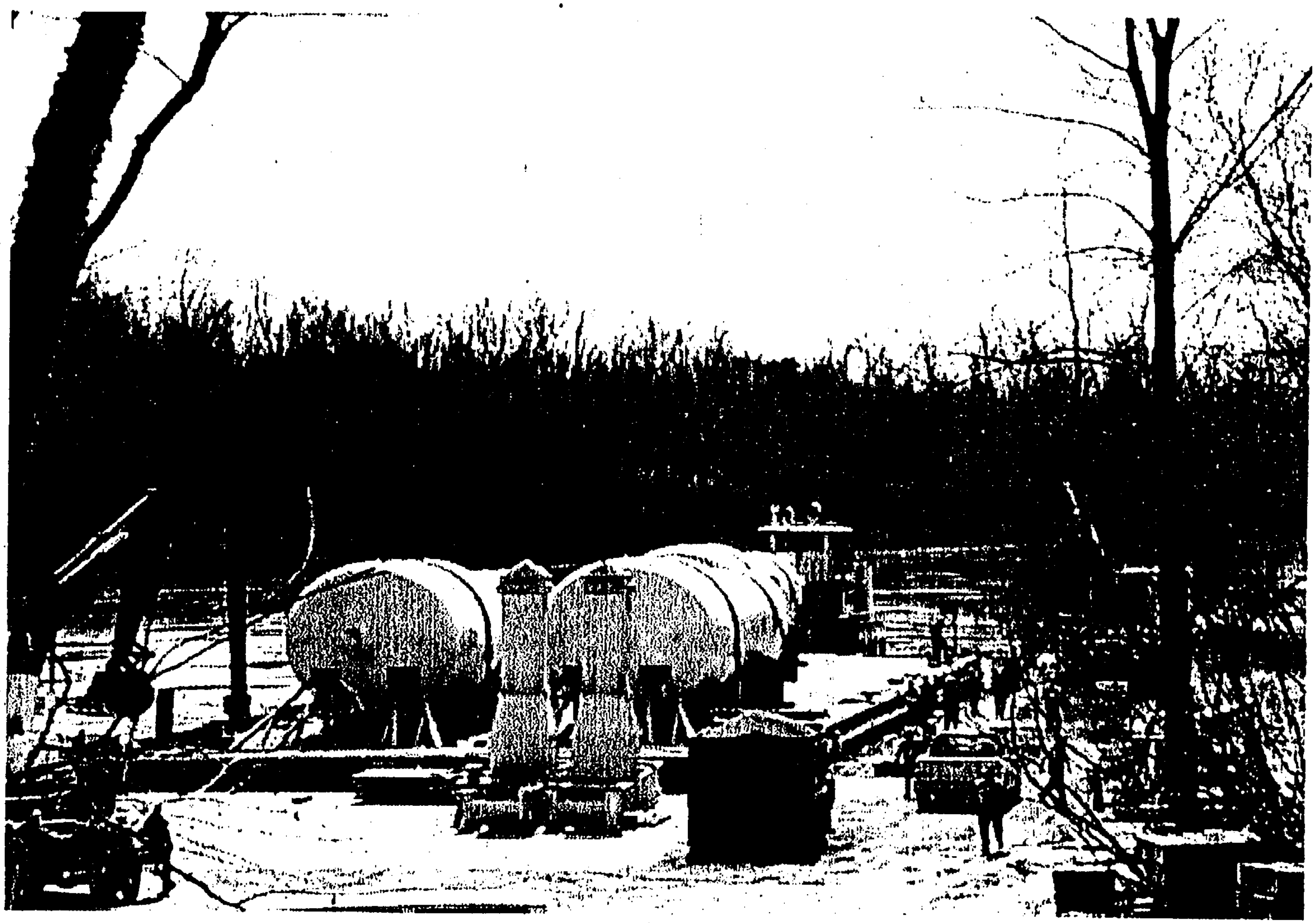
Indication	SG A	SG B	SG C	Total
MBM	6	3	6	15
PVN	4	0	10	14
DNG	5	3	10	18
BLG	0	0	3	3
NQI	3	3	4	10
NQS	3	0	0	3
Total	21	9	33	63



1/23/2000 Santandier, Spain
Jumbo loads second of three SG's on heavy lift ship Stellanova in preparation for 15 day transatlantic journey.

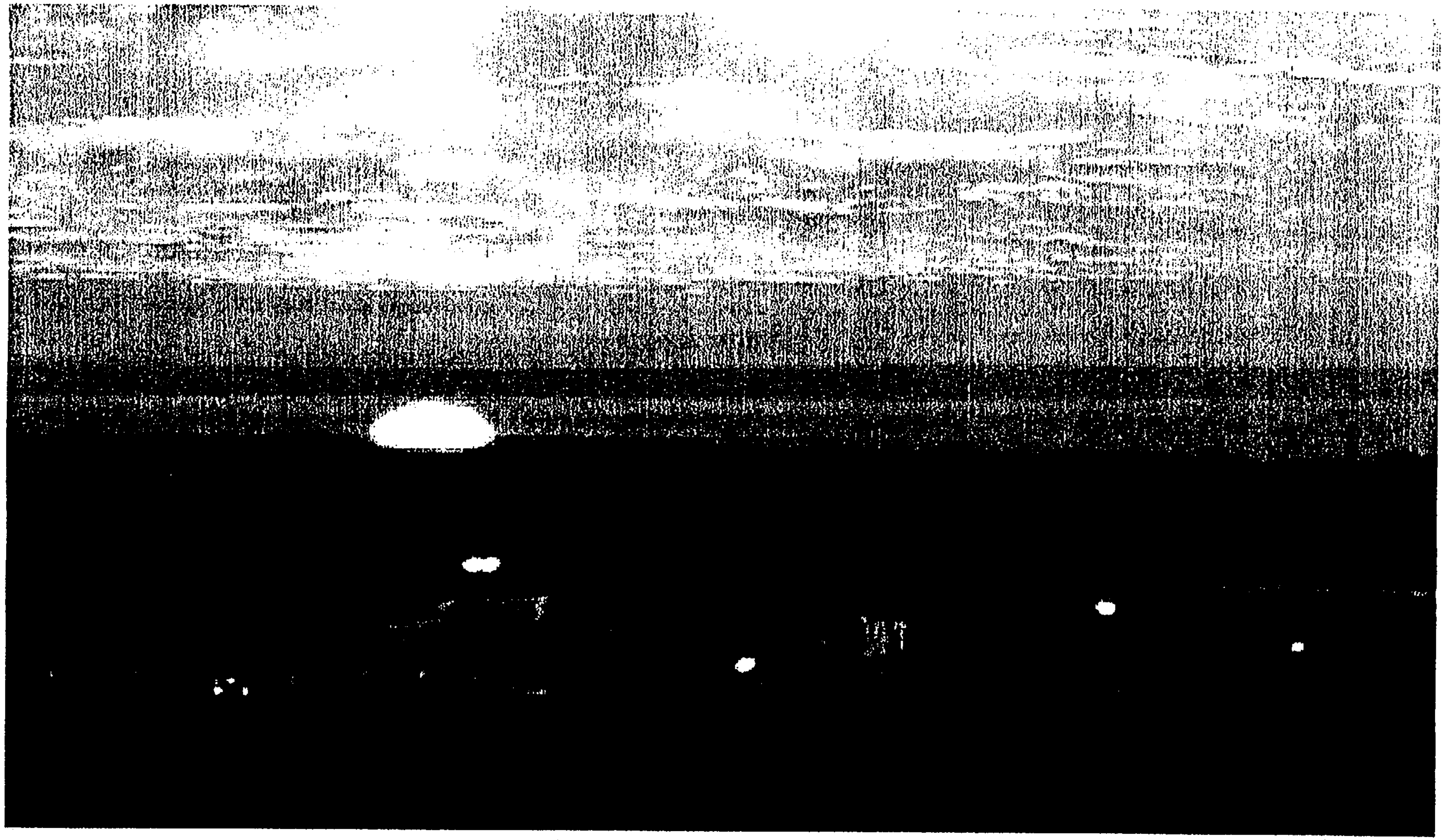


2/15/2000 On the Chattahoochee
Barge approaches Woodruff Lock and Dam



2/16/2000 FNP Barge Slip
Preparing to ground the barge for offloading SG's

3/30/2000 FNP
Down-ending of second "old" SG



FNP
A new day --- a new SG. In final preparation

Unit 1 SG Replacement

- FNP SGR Window - 60 days

  FNP Breaker - Breaker - 82 days

Future Challenges

- Develop inspection programs commensurate with degradation
- Chemistry surveillance for Pb and Na
- Cleanliness Control
- Thermal Performance
  - Modeling for SGs and all plant components

PRAIRIE ISLAND U-BEND EXPERIENCE - POST IP#2

19 TH Annual EPRI Steam Generator NDE Workshop
July 9-12, 2000
Monterey, CA
Scott A. Redner
Northern States Power Co.

NSP

OUTLINE

- BACK GROUND
- DATA QUALITY
- NOISE STUDY
- CRACK INDICATION
- RECOMMENDATIONS

NSP

BACK GROUND

- Pre IP#2 P.I. Used a Mid Range +Pt. (PP11) from 5/95 through 4/2000
- Prairie Island decided to use the IP#2 High Frequency +Pt. (aka HFPP9 or the Caius V. Dodd probe)
- PI also decided to perform Row 1 and 2 U-Bend Heat Treatment
- PI decided to use a dual coil +Pt. probe (HFPP9 & PP11) pre and post U-Bend heat treatment

NSP

BACK GROUND

- Prior to the inspection no Site Validation was performed for the HF +Pt.
  - not possible due to no site data
- A general noise comparison of IP#2 and PI#2 was completed for the MR +Pt.
- A general review of the EPRI non peer reviewed HF +Pt. Qualification and IP#2 HF +Pt. data was completed
- IP#2 MR +Pt. and HF +Pt. data was included in the SSPD

NSP

DATA QUALITY

- Zero tolerance for poor quality data
  - no spikes, no stalls, no noise
- Resulted in using 43 additional probe heads and 6 additional motor units
- Resulted in plugging 11 row 1 and 2 tubes for poor data quality
- A review of 11/98 data with 4/00 quality parameters resulted in 58 questionable tubes verses 98 in 2000

5

NSP

NOISE STUDY

- Review of the high frequency and mid range EPRI Appendix H data sets to determine the tubing noise values

VERSES

- Review of a sample of row 2 tubes in 3 of the 4 most at risk plants to determine the tubing noise values (Plants I, K & P)

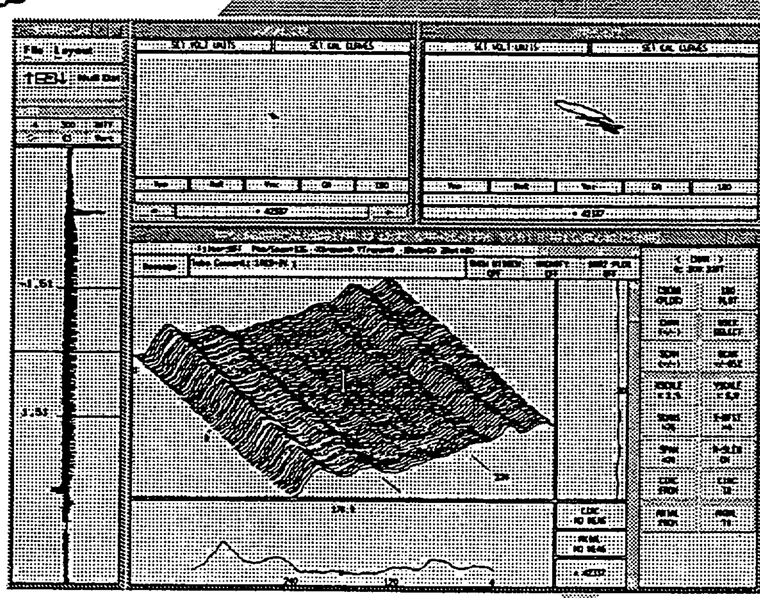
6

NSP

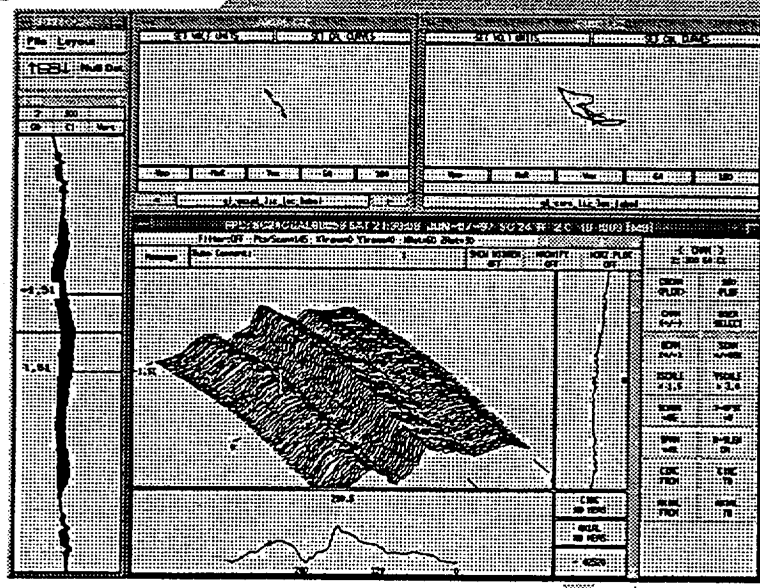
NOISE STUDY

- Procedure
  - Normalize voltage per Revision 5 of the GL's
  - Use qualification frequency of both +Pt. Coils
    - 300 kHz for MR and 800 kHz for HF
  - record both the Vpp and Vmx at the apex of the u-bend on the qualification data set and a sample of approximately 20 row 2 tubes from each plant
- The following are the noisiest results from the 2 qualifications and 3 plants with normalized spans and rotations

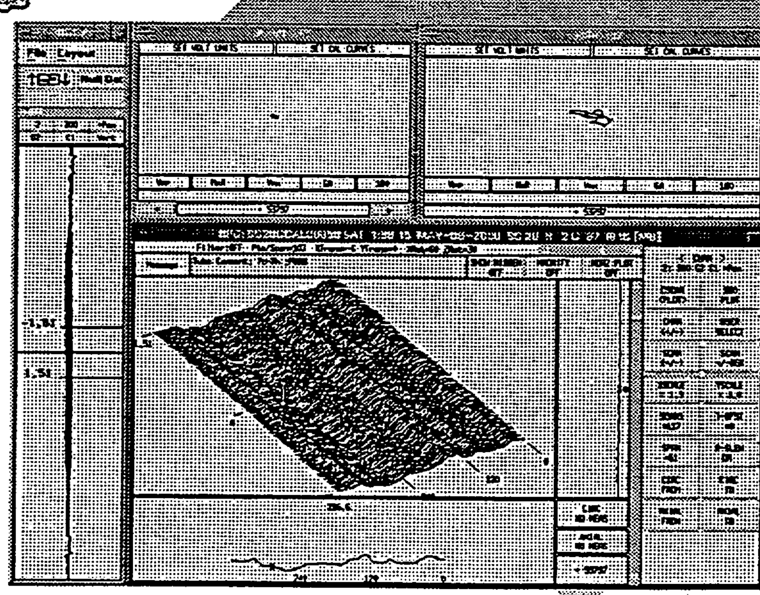
300 kHz MR +Pt. QUAL.



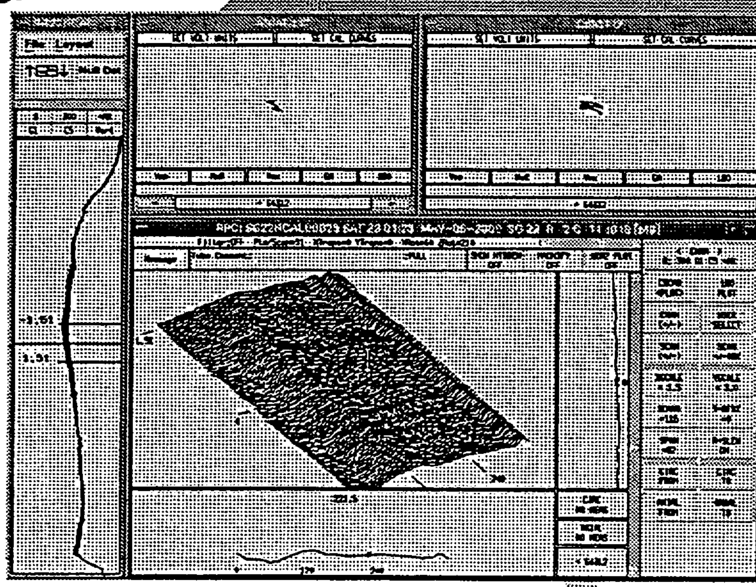
300 kHz MR +Pt. PLANT I



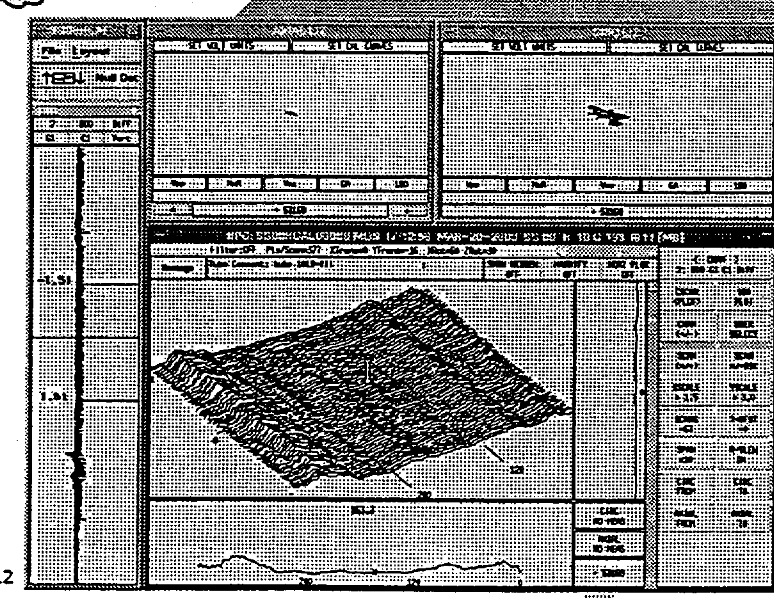
300 kHz MR +Pt. PLANT K



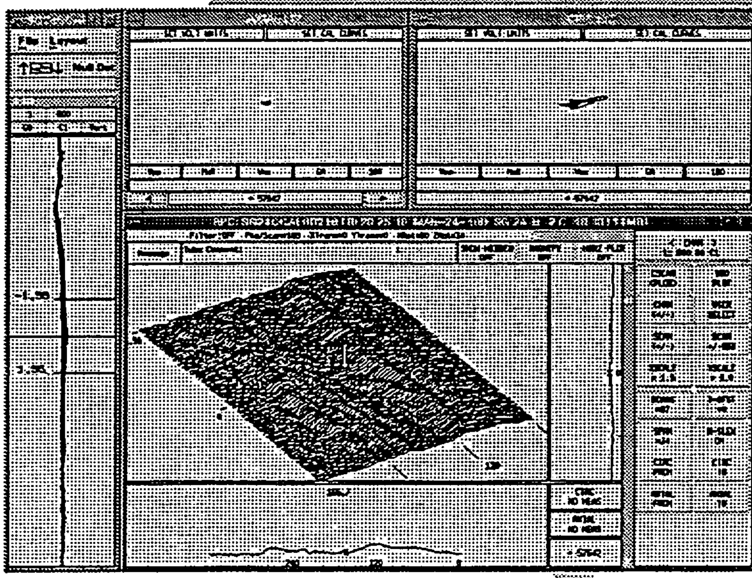
300 kHz MR +Pt. PLANT P



800 kHz HF +Pt. QUAL.

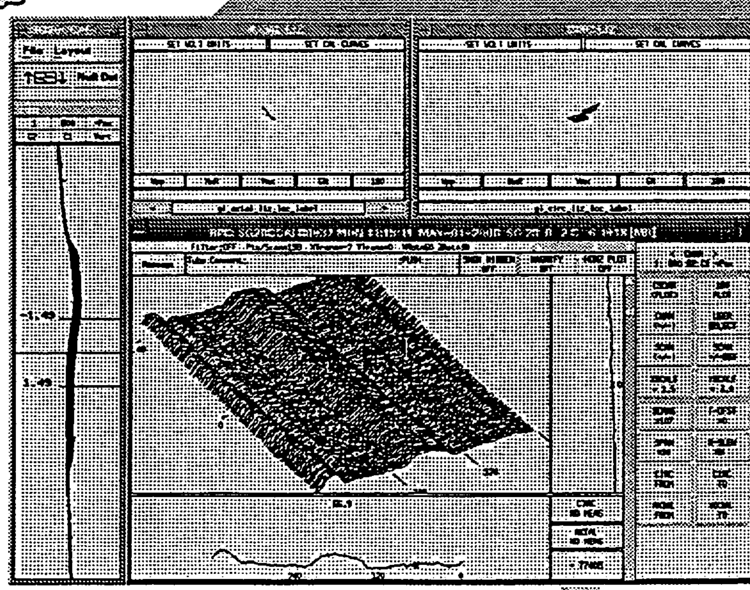


800 kHz HF +Pt. PLANT I



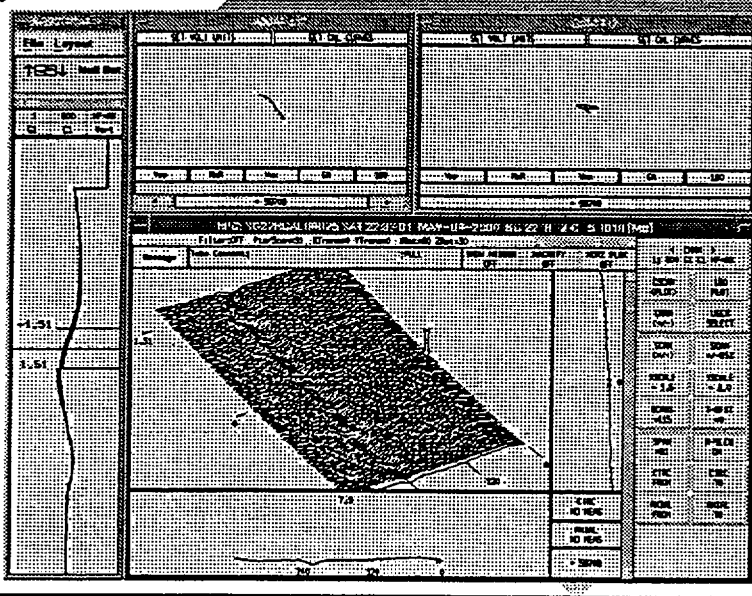
13

800 kHz HF +Pt. PLANT K



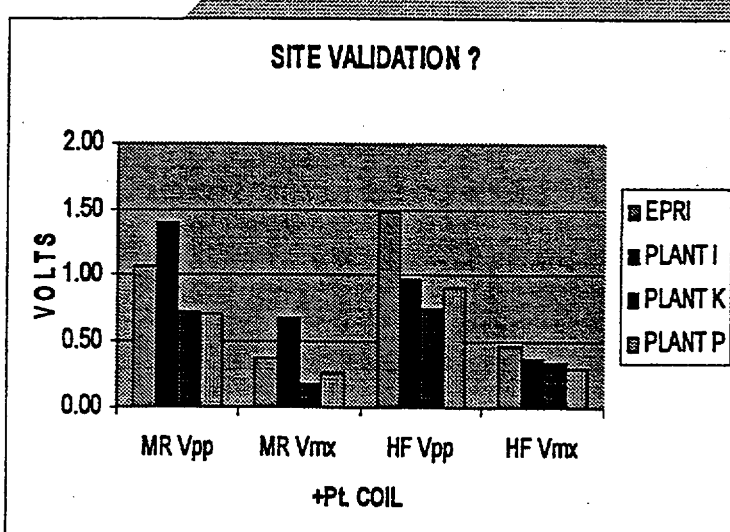
14

800 kHz HF +Pt. PLANT P



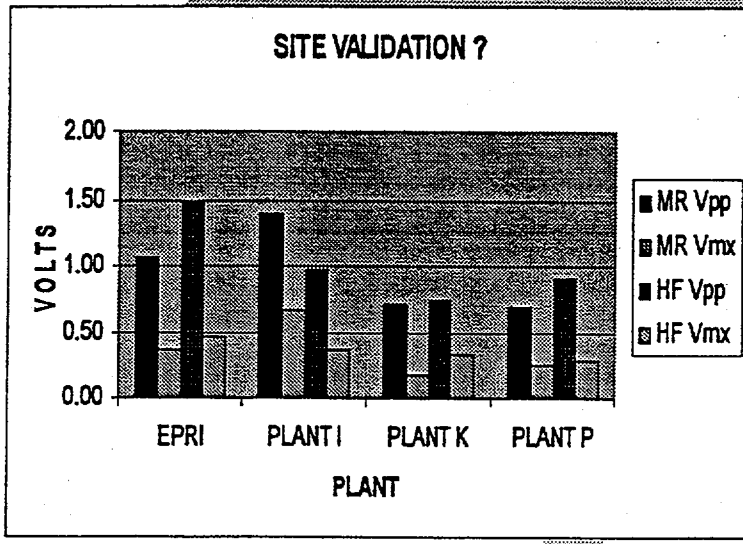
15

NOISE STUDY



16

NOISE STUDY



NSP

CRACK INDICATION

- SCI - LIFT OFF - TBP - SCI ?
- SCI called by SEC 5/95 - Tossed by RES
- SCI called by PRI 1/97 - Tossed by RES
- SCI called by SEC 11/98 - Tosses by RES
- SCI called by PRI & SEC 4/00 - Kept by night shift RES - Changed to TBP by day shift IQDA and RES
  - looks like a lift off signal
  - no change from 5/95 (first +Pt.)
  - scary looking none the less - TBP

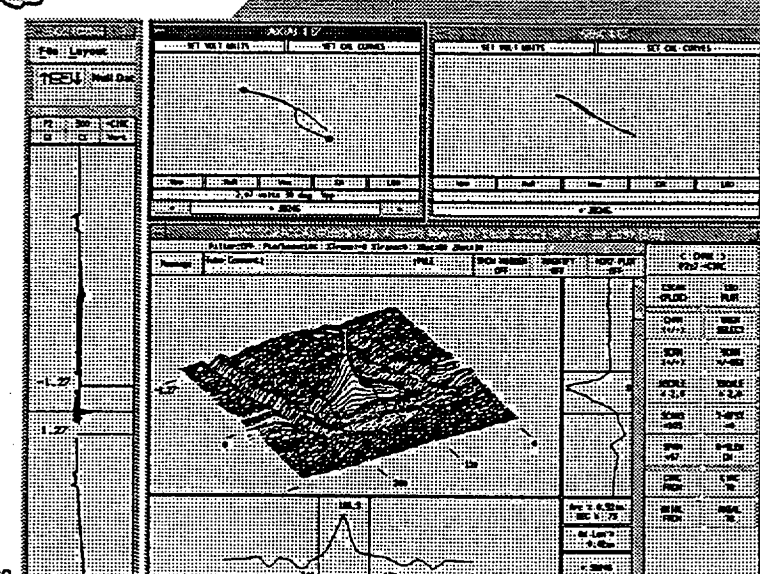
NSP

CRACK INDICATION

- In-situ Pressure Tested
  - no leakage NOP
  - no leakage MSLB
  - leaked 0.0048 GPM at 3ΔP
- Did not exceed the performance criteria
- Changed back to a SCI
- The following are MR & HF pre and post in-situ and MR from 5/95

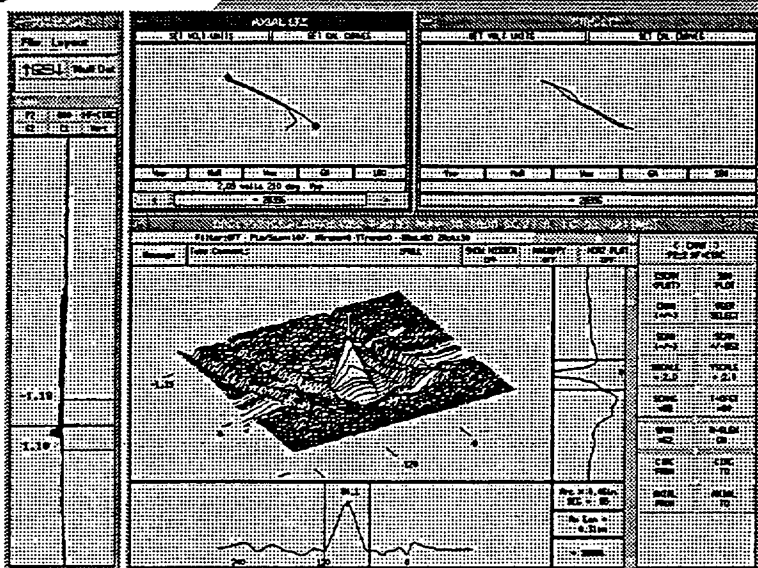
NSP

MR +Pt. PRE IN-SITU



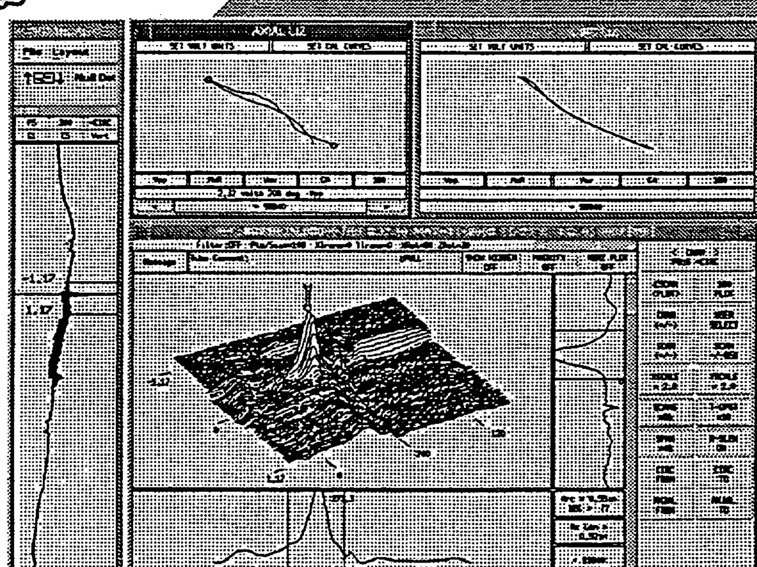
NSP

HF +Pt. PRE IN-SITU

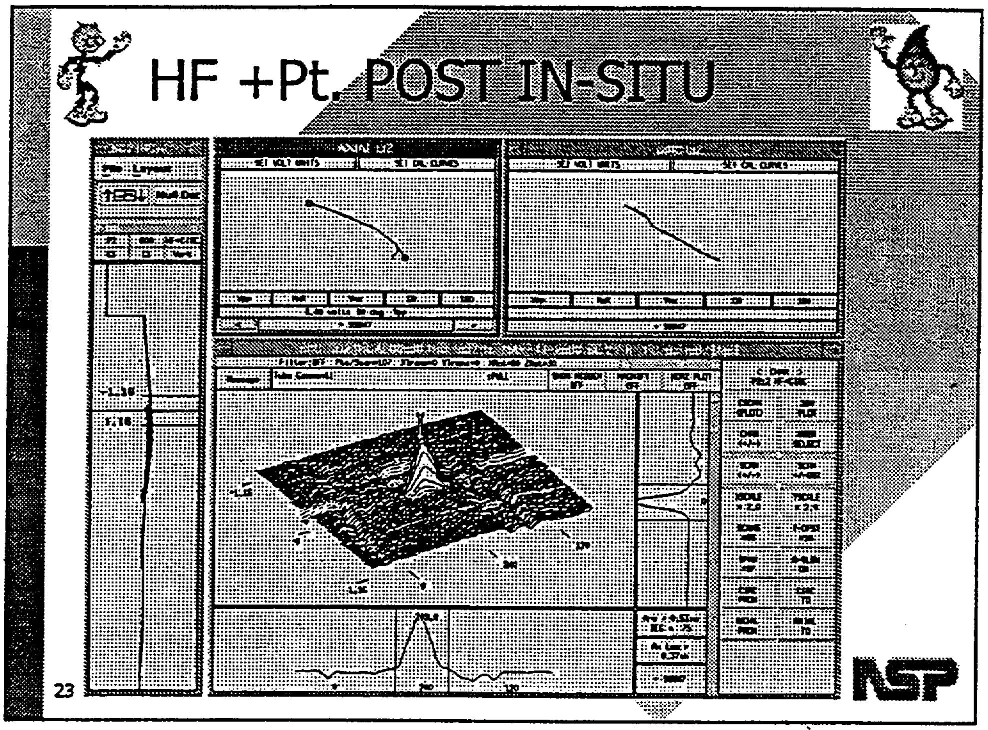


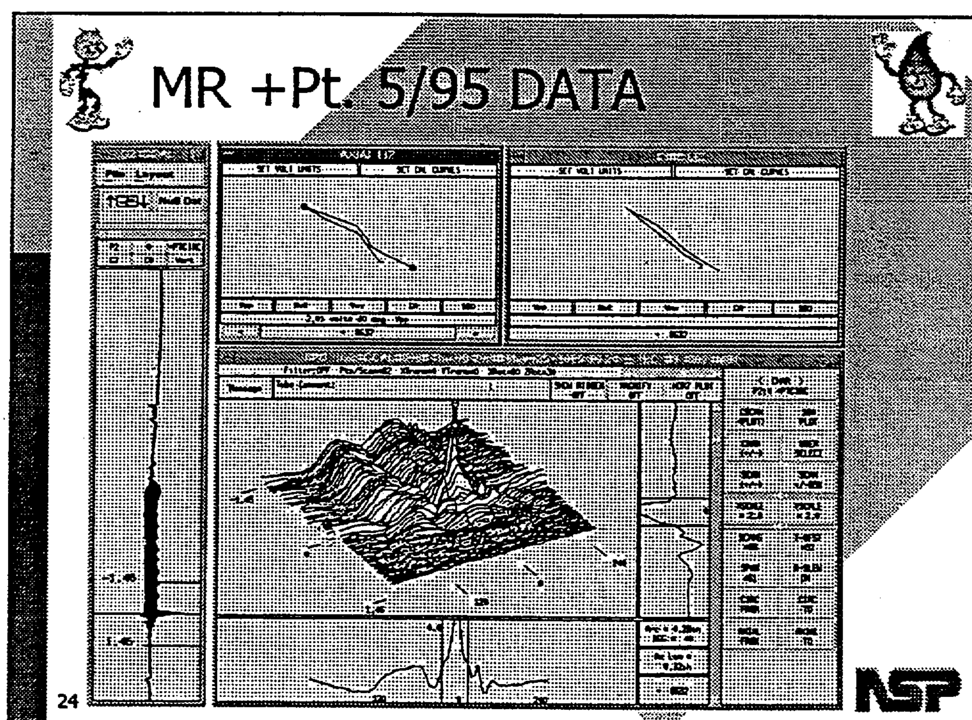
21

MR +Pt. POST IN-SITU



22


HF +Pt. POST IN-SITU
NSP
23


MR +Pt. 5/95 DATA
NSP
24

RECOMMENDATIONS

- DATA QUALITY
  - 1 skewed scan line should be OK
  - <3 spikes / inch lined up axial or circumferential should be OK
  - 1 stall per exam if encoders are used and the probe does not translate more than 0.033" should be OK
- CRACK INDICATIONS
  - Don't always believe historical reviews
  - Some cracks don't grow

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RECOMMENDATIONS

- HIGH FREQUENCY +Pt.
- SHOULD EVERY PLANT USE IT? NO, BUT
  - If the noise in your site data exceeds the noise in the qualification - YES
- IF YOU CHOOSE TO USE IT OR NEED TO USE IT - CAN IT REPLACE THE MR +Pt.? NO
  - The HF +Pt. Does not detect OD EDM notches below approximately 60% TW

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.9

Automated Data Analysis Experience at Oconee 3

CoreStar

Presented by:

Greg Turley
CoreStar International Corporation

Presented at:

19th Annual EPRI Steam Generator NDE Workshop
Monterey, California
July 10-12, 2000

Acknowledgements

CoreStar

- Kevin Newell (co-author)
  Duke Engineering and Services
- Craig Bowser (co-author)
  CoreStar International Corporation
- Keith Davis (utility sponsor)
  Duke Power Company

Overview

CoreStar

- AutoVISION Concept
- Description of Oconee 3 SGs
- SSPD Qualification
- System Interface Issues
- Scope & Schedule
- Discussion of Results
- Lessons Learned
- Future Developments
- Summary

AutoVISION Concept

CoreStar

- PC-based / Windows® NT 4.0
- Uses sophisticated signal extraction algorithms vs. simple phase and/or amplitude thresholds to isolate signals of interest
  - "interprets" data much in the same way as a human analyst does
- Automated data analysis can be "trained" to:
  - recognize and extract signals of interest from non-relevant signals
  - characterize & report relevant (extracted) signals based on a predetermined rule-set
- Advantages
  - Demonstrates that an automated analysis system can perform ET data analysis with minimal human intervention
  - Provides consistent, accurate, & repeatable analysis results
  - Reduced labor requirements = cost savings
  - Low overcall rate resulting in less time editing results = cost savings
  - High productivity rates = cost savings

Description of Oconee 3 SGs

CoreStar

- SGs are OTSG design
- Degradation morphology common to Oconee 3
  - Groove IGA
  - Impingement
  - ODSCC at TSP
  - Wear at TSP
  - Crevice IGA

SSPD Qualification

CoreStar

- General statements
  - Exam provided to AutoVISION
    - contained 3 times the number of tubes compared to the typical human analyst exam
    - contained 4 times the number of truth flaws compared to the typical human analyst exam
  - Average human analyst completion time was 24 hours (2 shifts)
    - Creation of calibration setups not required since analyst utilized UNIX-based workstation
    - No file manipulation required since analyst utilized UNIX-based workstation
  - AutoVISION completed & passed exam in < 8 hours
    - Majority of time spent:
      - creating calibration setups
      - manipulating files between UNIX-based & PC-based workstations
        - *NOTE: File manipulation between different operating systems is only required during SSPDs and not during the actual inspection.*

SSPD Qualification (continued)

CoreStar

- SSPD exam not "auto friendly"
  - Common situation at most if not all sites
  - Data sets built from more than one plant
  - Data sets contained a mix of probe & tester types
    - Configuration changes require extraction & reporting parameter changes
      - Wider tolerances or thresholds contribute to unnecessary overcalls since same parameters are applied to all data
  - Not the case at Oconee, but some data sets are built from different SG types to "capture" flaw morphologies seen elsewhere
  - Potential solutions
    - Apply best practices for flaw types not yet observed
    - Build data sets from last outage data

SSPD Qualification (continued)

CoreStar

- Exam statistics

Damage Mechanism	Impingement	Wear bobbin	OD/IGA 1st span	OD/IGA UTS crevice	OD/IGA LTS crevice	Groove IGA	SCC sludge pile	SCC dent bobbin	ODI TSP	
POD	87.0	91.0	95.0	80.0	x	91.0	x	x	91.0	**93.0**
CL	92.0	92.2	95.0	91.9	x	91.4	x	x	91.4	**96.4**
Overcalls										**2845**

<u>Notes:</u>

Missed calls: 3 in impingement module & 2 in groove IGA module are the result of tube index issues

Overcalls: ~1500 are the result of excessive OD deposits in 3 tubes

System Interface Issues

CoreStar

- Description of data flow logistics
  - Data was acquired with Eddynet 98/MIZ30 systems
  - Primary (PRI) data analysis performed manually with Eddynet 98
  - Secondary (SEC) data analysis performed with AutoVISION
- Statement of issue:
  - How will we import AutoVISION results to Eddynet for analyst performance tracking, compare, & discrepancy resolution (RES) handling?
    - Existing AutoVISION capabilities included the export of data analysis reports in several formats:
      - CoreStar native
      - Westinghouse ANSER
      - SSPD
      - ASCII text
    - No Eddynet report export function was available

System Interface Issues (continued)

CoreStar

- What did we do?
  - CoreStar developed an Eddynet compatible data analysis report export function in AutoVISION
  - Duke Engineering & Inspections tested the output and deemed it qualified for use at Oconee 3
- Were there limitations to this solution?
  - Compare - NO
  - Analyst performance tracking - YES
    - APTS used ACQ setup to display analysts' overcalls
      - No problem for free span calls
      - Process channels not available for review of TSP calls
  - Resolution handling - YES
    - SEC data analysis setups could not be restored on Eddynet, where the RES process occurred
      - RES analysts had to restore the PRI setup to add SEC calls
      - This is a common problem between any 2 data analysis systems
      - This can be fixed by the software system vendors

Scope & Schedule

CoreStar

- Bobbin coil program description
  - 100% full length program
  - 8 guide tubes in parallel
  - 1-2 days allotted for open tubes in the exclusion zone
  - 6 days allotted for remainder of open tubes
  - 14 QDA assigned to SEC analysis to meet 72 hour rule
    - Team made up of CoreStar & Duke Engineering personnel
    - 2 QDA per shift processed data through SSPD qualified algorithms
    - 4 QDA per shift reviewed the results
  - 24 QDA assigned to PRI analysis

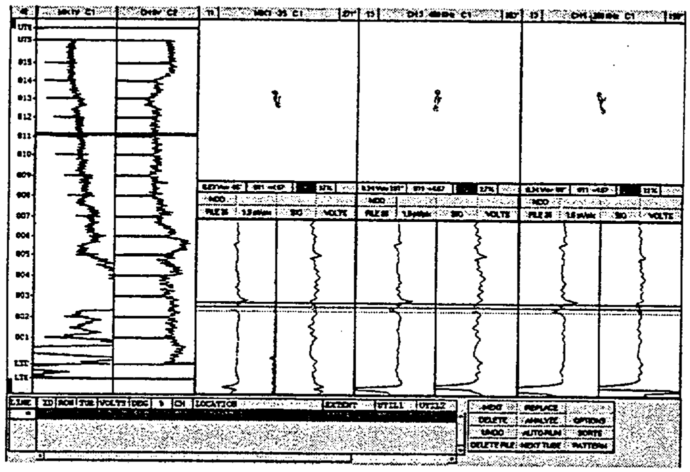
Discussion of AutoVISION Results

CoreStar

- Same signal extraction & reporting logic applied to all tubes
  - Voltage threshold for reporting set at 0.12
- Voltage normalized to 10 volts on 20% FBH
  - Industry standard is 4 volts on 20% FBH
  - 0.12 volt signal at Oconee is equivalent to 0.05 volt signal elsewhere
- OD deposits varied from tube to tube
- Tubes with nominal OD deposits behaved fairly well
- Tubes with excessive OD deposits produced hundreds of overcalls when compared to human results
  - Some believe the overcalls are the result of holes in or spalling of the OD deposits
  - Plus point typically did not confirm bobbin coil signals with amplitudes < 0.3 volts

Typical Groove IGA Signal

CoreStar



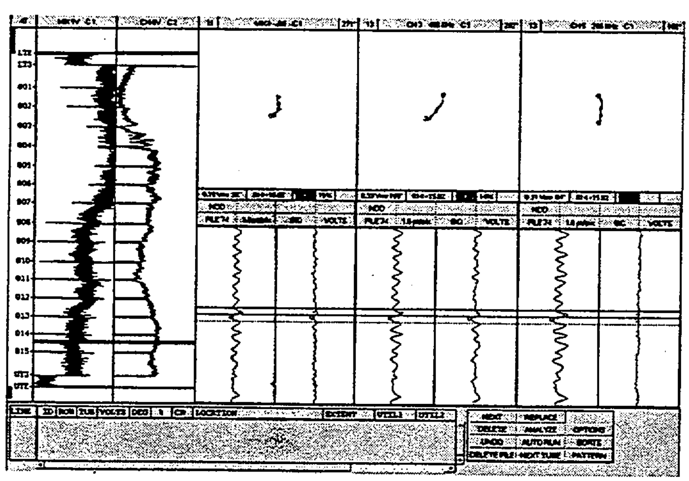
1,556 signals extracted

3 signals reported

<1 second to analyze

Tube With Excessive OD Deposits

CoreStar



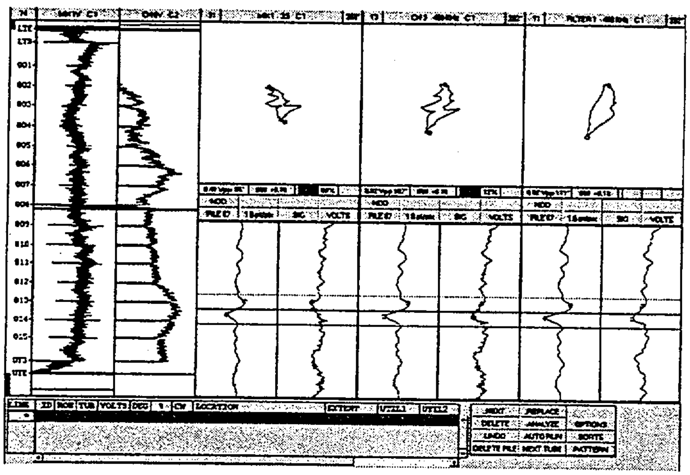
3,030 signals extracted

231 signals reported

6 seconds to analyze

Sample of Data Filtering Capabilities

CoreStar



Smoothing filter applied to the primary frequency data.

Lessons Learned

CoreStar

- Need feature to assess data around signal of interest
  - Had capability to assess previous & next signals only
  - Dynamic threshold adjustments need to be considered in tubes with excessive OD deposits
    - i.e. View the signal in the context of its surroundings
- Comparing auto results to RES results does not provide a fair assessment of system performance
  - History indications are treated differently than non-history indications in the RES process
  - Provides an imperfect measure of unedited results
- Software vendors need to share information necessary to transparently exchange ...
  - raw data
  - reports
  - setups

Future Developments

CoreStar

- Data processing enhancements
  - Improved mix algorithms
    - Less mix residual
  - Improved filtering
- Scripting
  - Adds capability to assess signals in a comparative sense
    - Amplitude, phase, and/or % TW of extracted signals can be correlated with other channels
      - i.e. Within 10% TW
    - History disposition logic can be applied
      - i.e. Does current signal have phase "x" degrees and amplitude "y" volts different than corresponding history signal?
    - Pattern libraries can be utilized to further characterize signals
      - i.e. A signal of interest may need to "resemble" or "not resemble" a signal in the library prior to making the call

Summary

CoreStar

- POD for automated data analysis systems is consistently higher than what can be expected of a single human analyst
  - Confidence level & RMSE statistics are also greatly enhanced
  - Signal extraction does not seem to be an issue
- Overcalls can be excessive when
  - reporting thresholds are extremely low
  - tube noise is excessive
- Can overcalls be minimized? YES
  - How? By applying the future development items
- Do automated data analysis systems provide more consistent & reliable results than a human analyst? YES
- Will automated data analysis systems get better? YES

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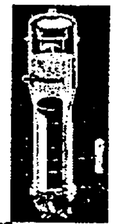
EPRI STEAM GENERATOR NDE CONFERENCE



Field Implementation of a Qualified Ultrasonic Technique for S/G Tube Inspection at Comanche Peak

Steve Swilley TXU Electric

Steve Kenefick EPRI

Pat Minogue WesDyne International

Gilles Rousseau R/D Tech

July 10 - 12, 2000

Background

- By early 1999, ETSS 98300 was qualified by EPRI for Detection and Sizing of Circumferentially Oriented ODSCC in roll transitions.
- TXU Electric expressed an interest in utilizing this technique during the Fall 1999 outage at Comanche Peak Unit 1
  - Utility also implementing G/L 95-05 and pulling tubes for TSP
  - Pulling tubes for TTS Circumferential cracking

EPRI TXU BNFL R/D TECH

Tasks For Implementation

- Schedule
- Cable Length Issue
- Interface to scanner/delivery system
- Extension of qualified technique

EPRI TXU BNFL R/D TECH

Cable Length Issue

- Technique initially qualified with 10' cable length between the Pulser/Receiver and Transducer. Increasing cable length resulted in unacceptable loss of frequency content essential for tip diffraction sizing
- Discussions with R/D tech on Possible Solutions
- Decision to reduce the size of the pulser/receiver and multiplexer such that it would fit inside a 0.500" diameter case- "Pencil Pulser Receiver" (June 1999)
- This would increase the length of the probe but would solve all issues and enhance the frequency as well

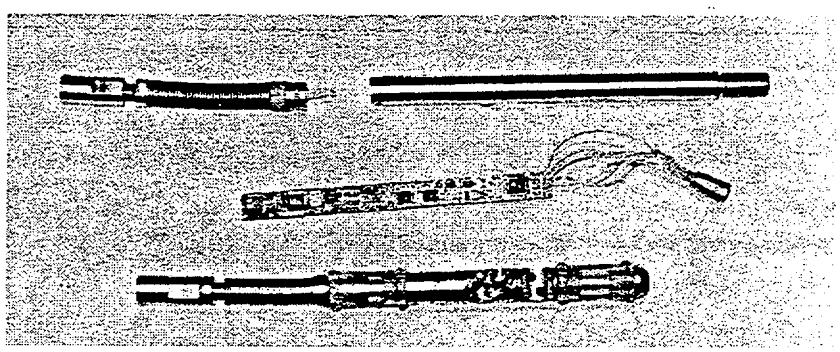
EPRI TXU BNFL R/D TECH

Pencil Pulser/Receiver

- Summer 1999 - Testing the new probe and electronics package
  - Initial noise level too high
  - Several design iterations required to reduce noise
  - Finally an acceptable signal. Second probe completed October 2.

EPRI TXU BNFL RD TECH

5 Element Search Unit with Pencil Pulser Receiver



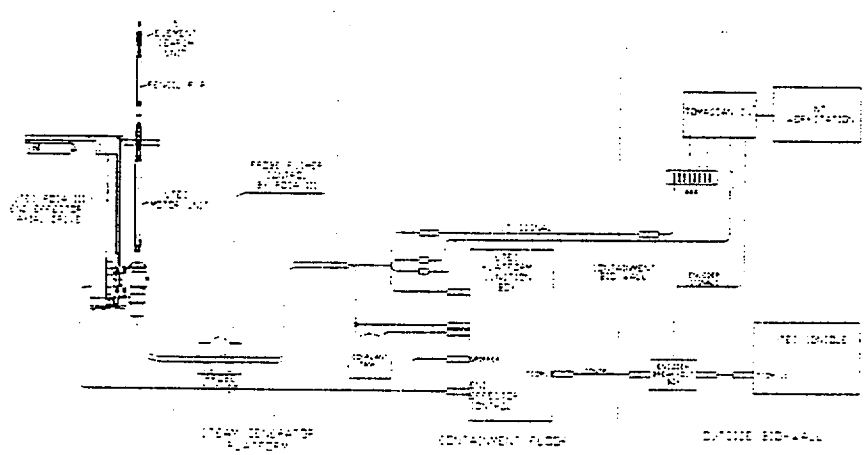
EPRI TXU BNFL RD TECH

Integration With Scanner

- Westinghouse teamed with R/D tech and EPRI to develop a strategy to deliver the new probe in the field.
- The new probe was adapted to a W UTEC motor unit. This motor was driven by the UTEC control system, and encoder signals were sent to the Tomoscan SV for triggering data acquisition.
- The axial drive was provided by a W UTEC end effector which interfaces with the ROSA III robot. This end effector was able to provide the drive speed necessary to produce the .004" scan pitch.

EPRI TXU BNFL R/D TECH

Field Configuration



EPRI TXU BNFL R/D TECH

Integration Testing

- October 4-5 collected first data at Westinghouse
- Calibration data collected on both probes
- Flawed tube sample 2596 data collected for comparison to 98300 technique
- Data supported justification that what was qualified in ETSS 98300 is equivalent to the RD Tech\ EPRI pencil pulser/receiver.
- System all checked out and working

EPRI TXU BNFL RD TECH

Field Implementation

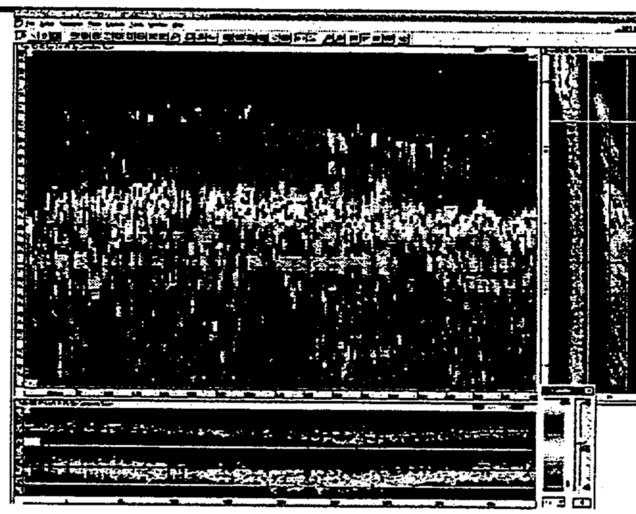
- On site 7th of October
- In containment 9th of October for setup
- Scheduled for testing on the 10th of October
- 15 tubes were selected and tested in just over 5 hours
- A single probe was used for the inspection

EPRI TXU BNFL RD TECH

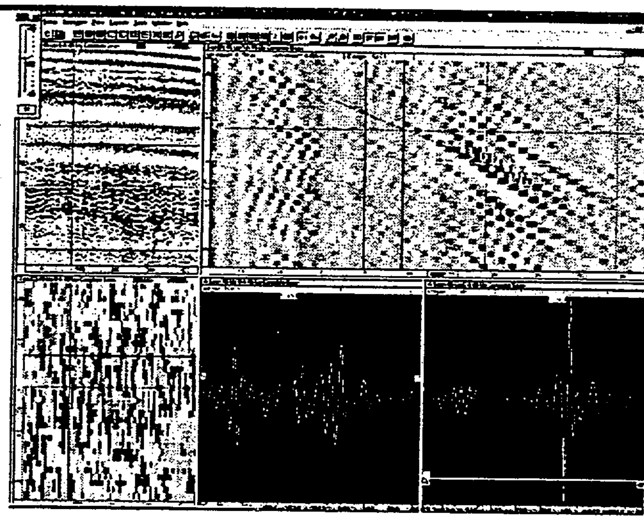
UT Results

- Indications for most part encompassed 360°
- Initial assessment of UT data indicated few resolvable tip diffraction signals suggestive of shallow depths.
- Small localized regions exhibited depths in the 30-50% range

UT Results R22- C89

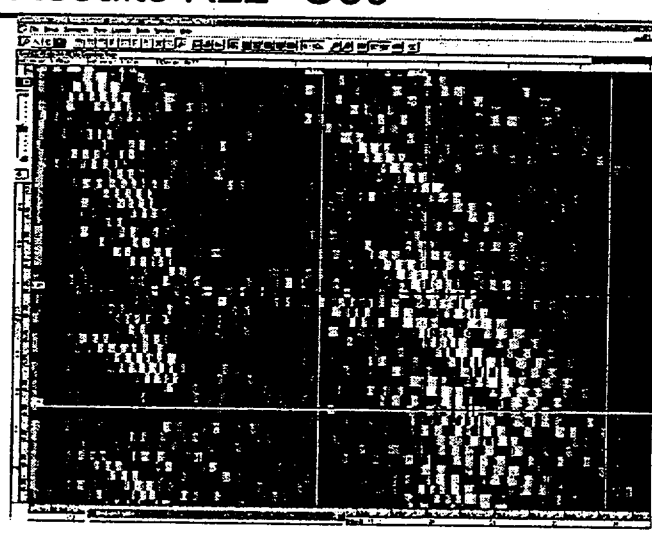


UT Results R22- C89



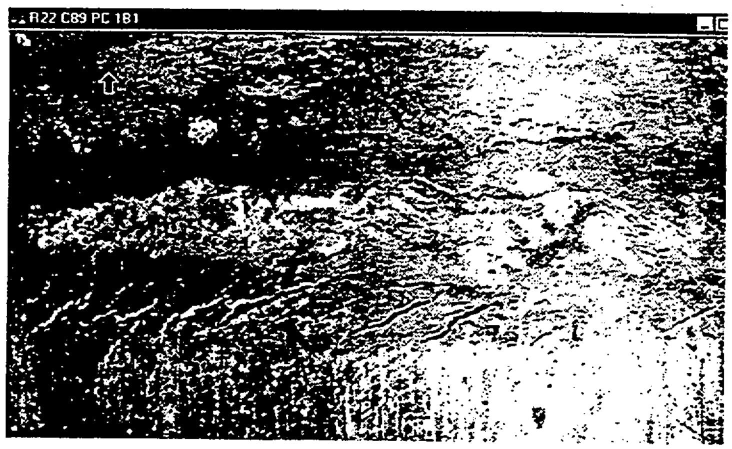
EPRI TXU BNFL RD TECH

UT Results R22- C89



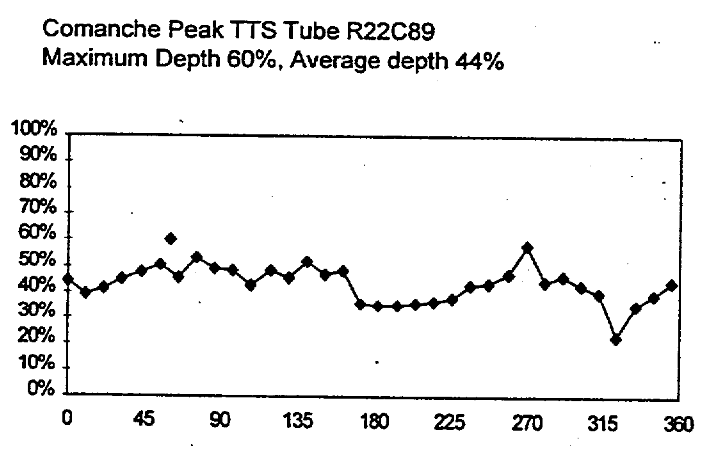
EPRI TXU BNFL RD TECH

Macrophoto R22- C89



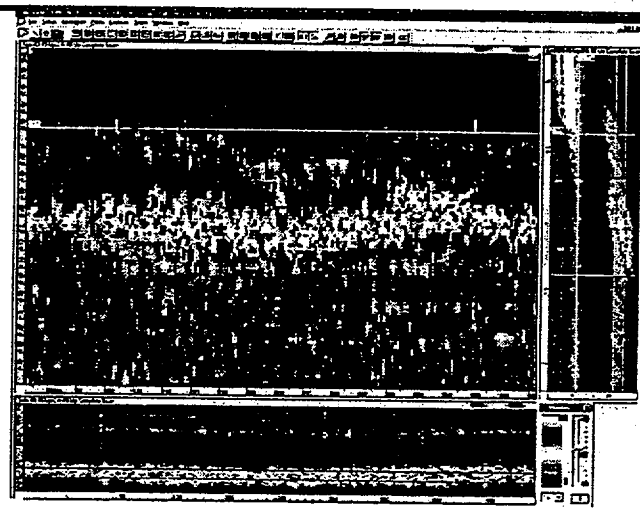
EPRI TXU BNFL RAD TECH

Depth Profile R22- C89



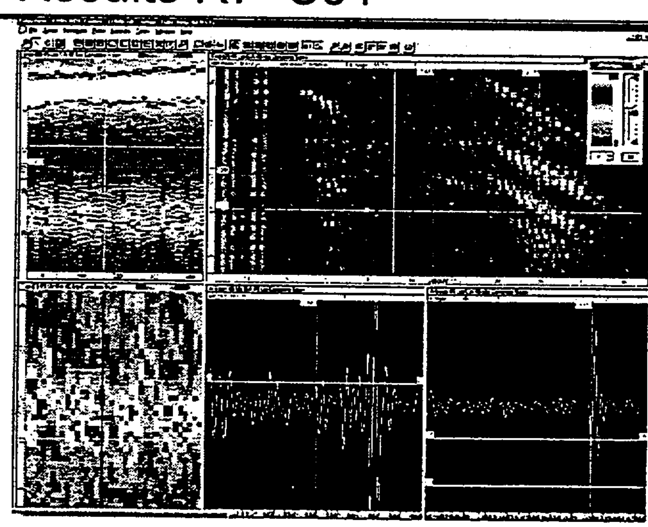
EPRI TXU BNFL RAD TECH

UT Results R7- C84



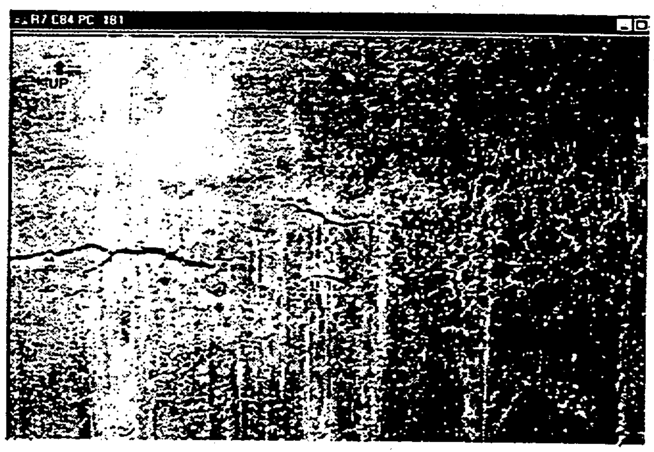
EPRI TXU BNFL RD TECH

UT Results R7- C84



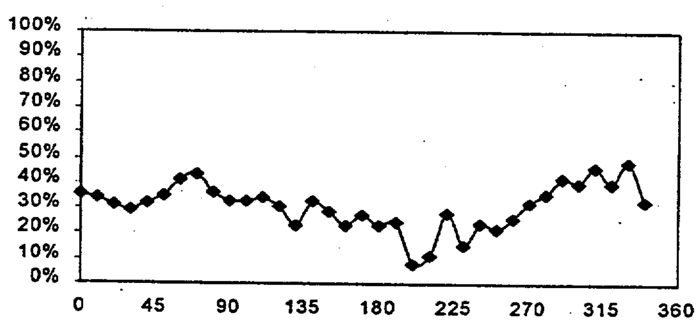
EPRI TXU BNFL RD TECH

Macrophoto R7- C84



EPRI TXU BNFL R/D TECH

Depth Profile R07- C84



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Metallurgical Results

- The crack networks on all of the specimens appeared to be 360°.
- The crack networks were composed of a thin band of multi-planar microcracks.

EPRI TXU BNFL R/D TECH

Met vs. UT

Tube		Max Depth	360° PDA	RMSE	Coef
R22C89	Ultrasonic	58	37.85%	9.86	0.40
	Metallurgical	60	43.61%		
R7C84	Ultrasonic	62%	38.23%	8.43	0.64
	Metallurgical	48%	31.14%		

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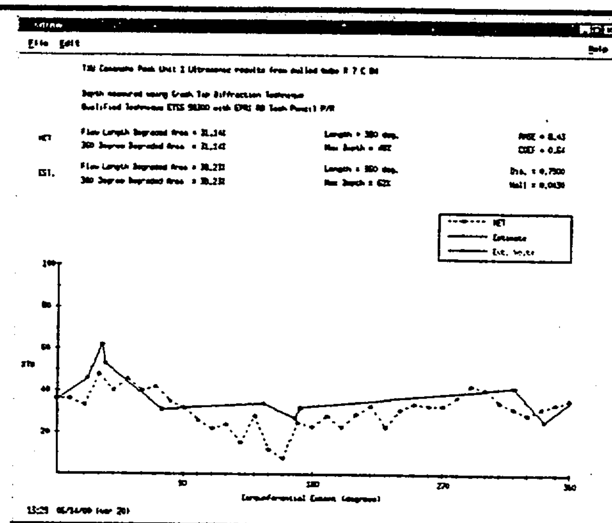
Met vs. UT R7 C84



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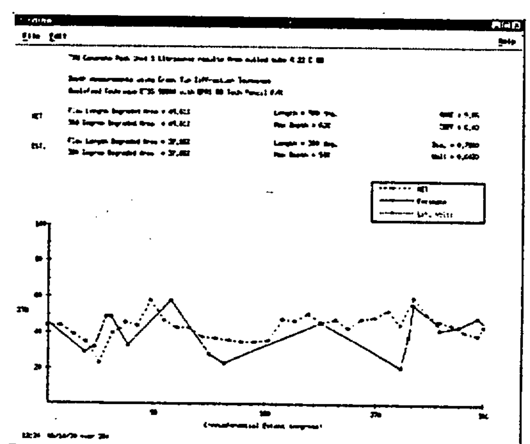
Met vs. UT R22 C89



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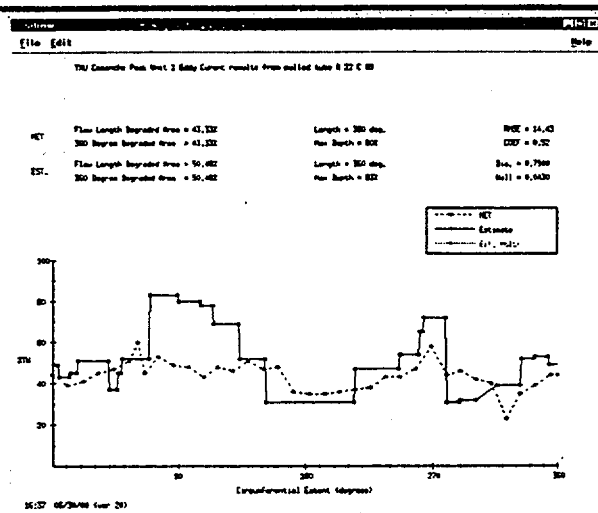
Met vs. ECT R22 C89



Conclusions

- The implementation was a success!
  - Meaningful results
  - No impact to the plant schedule
  - No equipment problems
- UT proved to be more accurate than eddy current in sizing circumferential ODSCC in hard rolled tubing
- This technique offers promise in providing more accurate numbers for structural integrity assessments and insitu pressure test screening

Conclusions

- This technique offers the first real tool for leaving small ODSCC circumferential indications in service (i.e. < 40% thru-wall)

EPRI TXU BNFL R/D TECH

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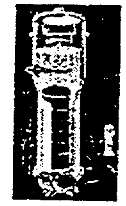
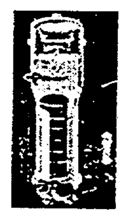


SG Examination Guidelines Revision 6

19th. Annual EPRI Steam Generator NDE Workshop
July 10-12, 2000, Monterey, CA

Dan Mayes
Duke Power Co.

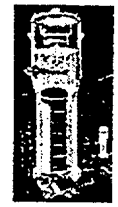
EPRI



Background

- Rev. 5 of the ISI G/L requires that the need for G/L revision be assessed at least once every two years
- Rev. 5 was issued in Nov. 1997. A utility group met in April 1999 and decided that no revision was needed as of that date
- With NEI 97-06 initiative and increasing number of 2nd generation steam generators, there was a need to address G/L revision again

EPRI

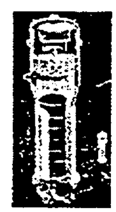


Background, Cont..

ISI Guidelines Workshop

- A workshop was conducted on February 3-4, 2000 in Orlando, FL.
- 45 participants representing utilities and all of the major ISI vendors
- Background presentation on:
  - Risk-based ISI
  - Data quality standards
- Utility and vendor presentations on:
  - Implementation Experience
  - Strengths and weaknesses of the Guidelines
  - Suggested revisions

EPRI

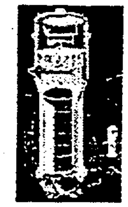


Background, Cont..

Summary of suggested changes

- Clarifications and editorials
- Allow dual automated analysis
- Update and refine Appendices G&H
- Relaxation of requirements for replacement S/G
  - 100% ISI within 60EFPM
  - No S/G can go longer than 2 cycles without ISI
- Inclusion of new topics in new revision:
  - Risk-based considerations
  - Data quality standards

EPRI



Background, Cont.

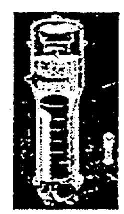
Workshop Conclusions

- The ISI Guidelines has served the industry well
- Unanimous recommendation to produce Rev. 6 to incorporate the suggested changes

Actions

- Take workshop recommendations to the NDE IRG and SGMP IIG for approval to proceed
- Form a utility group to produce Rev. 6

EPRI



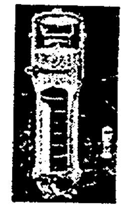
Development of Rev. 6

- EPRI solicited utility participation and the following have responded by participating in one or more working meetings:

Ed Addison / EOI	Tom Bipes / CP&L
Al Matheney / SCE	Ian Mew / NYPA
Scott Redner / NSP	Steve Swilley / TXU
Clayton Webber / TVA	Dan Mayes / Duke
CJ Conner / PSE&G	Doug Hansen / APS
John Smith / RG&E	

Mohamad Behravesh and Gary Henry / EPRI Support Staff

EPRI

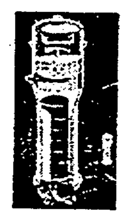


Approach to Rev. 6

General and Upfront Resolutions

- Use comments on Rev. 5 as general guidance in developing Rev. 6
- Produce Rev. 6 in a single volume and include justifications where needed
- Maintain Rev. 5 organization in Rev. 6. -- Seven sections with similar headings and retain appendices
- Address NRC's and E&R IRG's concerns about system performance vs.. performance of separate elements (techniques and analysts)

EPRI

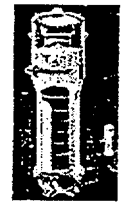


Approach to Rev.6

General and Uptfront Resolutions

- Include new and updated material on data quality, risk-informed considerations, and visual inspections
- Modify existing guidance and provide new guidance to better accommodate the needs of improved-material and replacement SGs
- Modify guidance on auto analysis to better reflect current technology and experience
- Track and respond to all comments on Rev. 6

EPRI

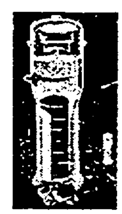


Migration From Rev. 5 to Rev. 6 and Ownership of Various Sections

The following have assumed the lead role and primary responsibility for development of each of the following sections:

- Al Matheney -- Sec. 1, Introduction and Background
- Steve Swilley -- Sec.2, Compliance Responsibilities
- Scott Redner -- Sec.3, Sampling for Tech. Spec. Exams
- Dan Mayes -- Sec. 4, Sampling for Perfor.-Based Exams
- Dan Mayes -- Sec. 5, SG Assessments
- Scott Redner -- Sec. 6, System performance
- Matheney / Henry -- Appendices G & H
- Sears / Exner -- Appendix K

EPRI



Important Changes Underway

Separate sampling requirements in Section 3 for 600 MA, 600TT, and 690 materials

<u>600 MA:</u>

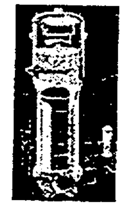
Inspect 100% of tubes in each SG every outage

<u>600 TT:</u>

Inspect 100% of tubes in each SG in 120, 90, and 60 EFPMs and with the following conditions:

- Inspect at least 50% of tubes in each SG by 1/2 way in each period and the remaining 50% by the end of the period
- Inspections are to be performed at the nearest refueling cycle provided that no more than 12 months will be added to the inspection cycle

EPRI



Important Changes Underway

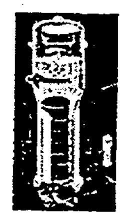
690 Alloy:

inspect 100% of tubes in each SG in 144, 108, 72, and 60 EFPMs with the following conditions:

- Inspect at least 50% of tubes in each SG by 1/2 way in each period and the remaining 50% by the end of the period
- Inspections are to be performed at the nearest refueling cycle provided that no more than 12 months will be added to the inspection cycle

- Ian Mew, with the help of the group, has worked out several examples for refueling cycles of 22, 18, and 15 months

EPRI



Inspection Scenarios for Alloy 600TT Steam Generators on 15 EFPM Operating Cycles

	CY1	CY2	CY3	CY4	CY5	CY6	CY7	CY8	CY9	CY10	CY11	CY12	CY13	CY14	CY15	CY16	CY17	CY18	CY19	CY20	CY21
Cycle	0			60				120			165			210		240		270		300	
G/L Required Inspections				R				R			R			R		R		R		[illegible]	
Inspection Interval	120 EFPM								90 EFPM						60 EFPM				[illegible]		
Cum EFPM	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240	255	270	285	300	315
Inspect all 4 SGs (50%)	100%	S	S	50%	S	S	S	50%	S	S	50%	S	S	50%	S	50%	S	50%	S	[illegible]	
Inspect All 4 SGs; mix % to maximize skip (There is no benefit)	100%	S	S	50%	S	S	S	50%	S	S	50%	S	S	50%	S	50%	S	50%	S	50%	
Inspect All 4 SGs 100%	100%	S	S	100%	S	S	S	100%	S	S	100%	S	S	100%	S	100%	S	100%	S	100%	

60 120 165 210 240 270 300

Note:

Inspection to be performed at the nearest refueling cycle.

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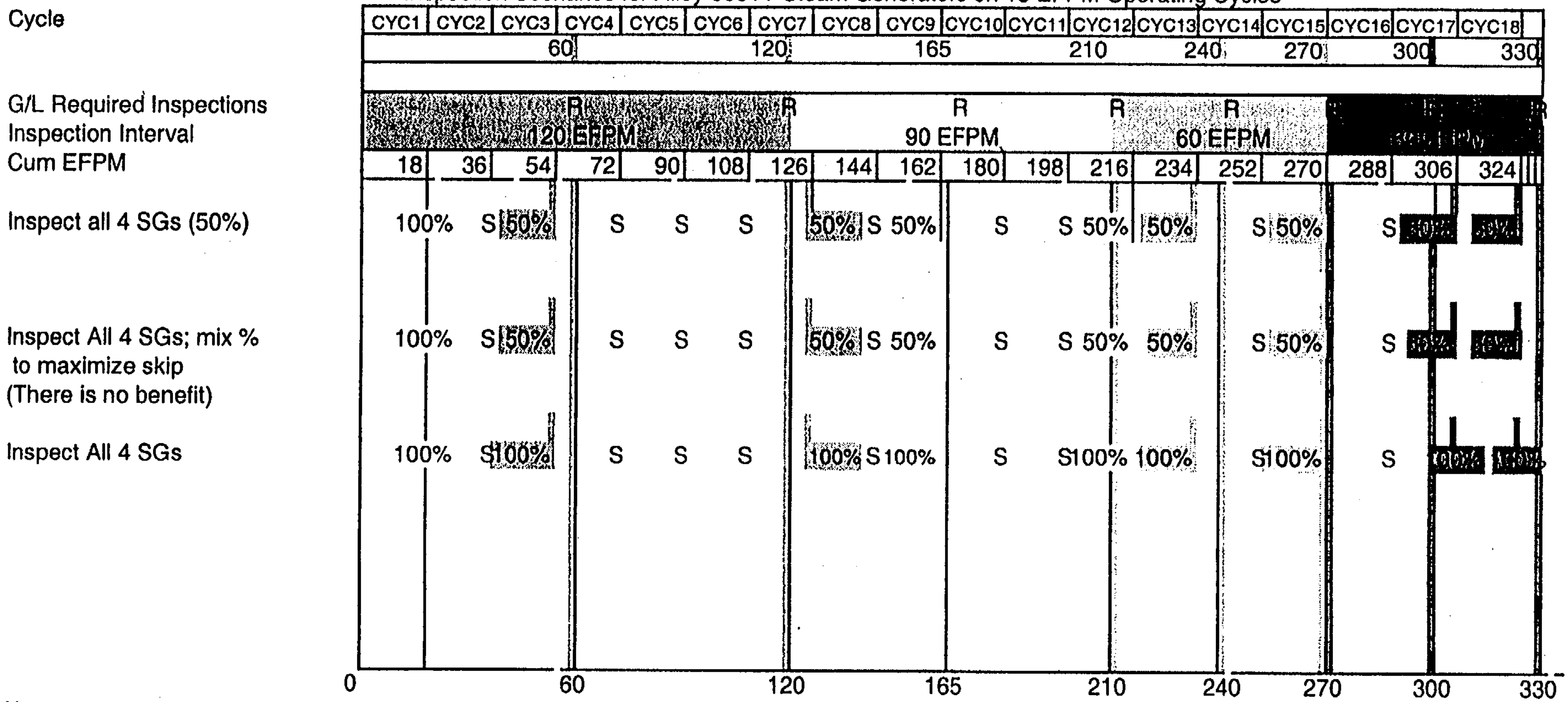
5-18-00

Inspection Scenarios for Alloy 600TT Steam Generators on 18 EFPM Operating Cycles



Note:

Inspection to be performed at the nearest refueling cycle.

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5-18-00

Inspection Scenarios for Alloy 600TT Steam Generators on 22 EFPM Operating Cycles

Cycle	Cyc 1	Cyc 2	Cyc 3	Cyc 4	Cyc 5	Cyc 6	Cyc 7	Cyc 8	Cyc 9	Cyc 10	Cyc 11	Cyc 12	Cyc 13	Cyc 14	Cyc 15
Cum EFPM	22	44	66	88	110	132	154	176	198	220	242	264	286	308	330
Inspect all 4 SGs (50%)	100%	S	50%	S	S	50%	S	50%	S	50%	50%	50%	S	[illegible]	[illegible]
Inspect All 4 SGs; mix % to maximize Skips (There is no benefit)	100%	S	50%	S	S	50%	S	50%	S	50%	50%	50%	S	[illegible]	[illegible]%
Inspect All 4 SGs	100%	S	100%	S	S	100%	S	100%	S	100%	100%	100%	S	[illegible]	[illegible]%

G/L Required Inspections (EFPM): 0, 60 R, 120 R, 165 R, 210 R, 240 R, 270, 300, 330

Inspection Interval: 120 EFPM (0–120); 90 EFPM (120–210); 60 EFPM (210–270); [illegible] (270–330)

Axis: 60, 120, 165, 210, 240, 270, 300, 330

Note:

Inspection to be performed at the nearest refueling cycle.

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5-18-00

Inspection Scenarios for Alloy 690TT Steam Generators on 15 EFPM Operating Cycles

Cycle	CY 1	CY 2	CY 3	CY 4	CY 5	CY 6	CY 7	CY 8	CY 9	CY 10	CY 11	CY 12	CY 13	CY 14	CY 15	CY 16	CY 17	CY 18	CY 19	CY 20	CY 21	CY 22	CY 23	CY 24	CY 25	CY 26
G/L Reqd Inspections					72 R					144 R			198 R				252 R		288 R			324 R		354		384 R
Inspection Interval					144 EFPM								108 EFPMR						72 EFPM				[redacted]			
Cum EFPM	15	30	45	60	75	90	105	120	135	150	165	180	195	210	225	240	255	270	285	300	315	330	345	360	375	390
Inspect all 4 S/Gs (50%)	100%	S	S	S		50% S	S	S	S		50% S	S	50%	S	S	S		50% S	50%	S	S		50% S		[redacted] S	[redacted]%
Inspect All 4 SGs; mix % to maximize skip	100%	S	S	S		50% S	S	S	S		50% S	S	50%	S	S	S		50% S	50%	S	S		50% S		[redacted] S	[redacted]%
Inspect All 4 SGs	100%	S	S	S		100% S	S	S	S		100% S	S	100%	S	S	S		100% S	100%	S	S		100% S		[redacted]% S	[redacted]%

72 144 198 252 288 324 354 384

Note:

Inspection to be performed at the nearest refueling cycle
No more than 12 EFPM can be added to the inspection cycle

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5-18-00

Inspection Scenarios for Alloy 690TT Steam Generators on 18 EFPM Operating Cycles

Cycle	CYC1	CYC2	CYC3	CYC4	CYC5	CYC6	CYC7	CYC8	CYC9	CYC10	CYC11	CYC12	CYC13	CYC14	CYC15	CYC16	CYC17	CYC18	CYC19	CYC20	CYC21	CYC22
G/L Req'd Inspections				R				R			R			R		R		R	[redacted]			
Inspection Interval	144 EFPM								108 EFPM						72 EFPM				[redacted]			
Cum EFPM	18	36	54	72	90	108	126	144	162	180	198	216	234	252	270	288	306	324	342	360	378	396
Inspect all 4 S/Gs (50%) Baseline after cyc. 1	100%	S	S	50%	S	S	S	50%	S	S	50%	S	S	50%	S	50%	S	50%	S	[redacted]	[redacted]	
Inspect All 4 SGs; mix % to maximize skip Baseline after cyc. 1	100%	S	S	50%	S	S	S	50%	S	S	50%	S	S	50%	S	50%	S	50%	S	[redacted]	[redacted]	
Inspect All 4 SGs Baseline after cyc. 1	100%	S	S	100%	S	S	S	100%	S	S	100%	S	S	100%	S	100%	S	100%	S	[redacted]	[redacted]	
				72				144			198			252		288		324	354		384	

Note:

Inspection to be performed at the nearest refueling cycle
No more than 12 EFPM can be added to the inspection cycle

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5-18-00

Inspection Scenarios for Alloy 690TT Steam Generators on 22 EFPM Operating Cycles

Cycle	Cyc 1	Cyc 2	Cyc 3	Cyc 4	Cyc 5	Cyc 6	Cyc 7	Cyc 8	Cyc 9	Cyc 10	Cyc 11	Cyc 12	Cyc 13	Cyc 14	Cyc 15	Cyc 16	Cyc 17	Cyc 18
G/L Reqd Inspections	0		72 R				144 R		198 R			252 R	288 R		324	354		384
Inspection Interval			144 EFPM						108 EFPM				72 EFPM		[redacted]			
Cum EFPM	22	44	66	88	110	132	154	176	198	220	242	264	286	308	330	352	374	396
Inspect all 4 S/Gs (50%)	100%	S	50%	S	S	50%	S	S	50%	S	50%	S	50%	S	50%	[redacted]	[redacted]	
		S	50%	S	S	S	50%	S	50%	S	S	50%	50%	S	50%	[redacted]	S	[redacted]
Inspect All 4 SGs; mix % to maximize skip	100%	S	50%	S	S	50%	S	S	100%	S	100%	S	100%	S	10[redacted]	[redacted]	S	
		S	50%	S	S	S	50%	S	100%	S	S	100%	S	S	10[redacted]	S	[redacted]	S
Inspect All 4 SGs	100%	S	100%	S	S	100%	S	S	100%	S	100%	S	100%	S	100%	[redacted]	S	[redacted]
		S	100%	S	S	S	100%	S	100%	S	S	100%	100%	S	100%	[redacted]	S	

0 72 144 198 252 288 324 354 384

Note:

Inspection to be performed at the nearest refueling cycle
No more than 12 EFPM can be added to the inspection cycle
Option 2 is as a result of inspection being within 12 months of requirement

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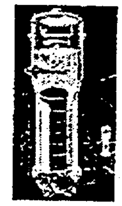
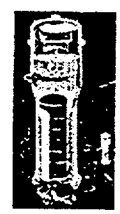


Interface with Structural Integrity

- Interface with and participation from utility structural integrity engineers have been sought to ensure that the Guidelines approach and resulting information are directly applicable to condition monitoring and operational assessment
- Approach to and progress on Rev. 6 was presented at the recent June 6-7, 2000 Structural Integrity Workshop

EPRI



Progress to Date

- Working meetings have been held in March, April, May and June 2000.
- Drafts of Sections 1, 2,4, and Appendices G&H have been completed and reviewed by the group
- Draft material on data quality has been developed and sent to ISI vendors for their review

<u>Schedule</u>

- Draft Rev. 6 is expected to be completed this year and go through review cycle early next year