Duke Power
A Duke Energy Company

RON A. JONES
Vice President
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Seneca, SC 29672

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September 22, 2004

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Subject: Oconee Nuclear Station
Docket No. 50-270
Unit 2 EOC-21 Refueling Outage,
Steam Generator Inservice Inspection
Steam Generator Three Month Report

The Oconee Nuclear Station Technical Specification (TS) 5.5.10 establishes the Steam Generator (SG) tube surveillance program requirements for SGs. TS 5.6.8.b, requires the results of a Steam Generator Tube Inservice Inspection be reported to the NRC within 3 months following completion of the inspection.

Both of the original Oconee Unit 2 SGs were replaced with new SGs in End-Of-Cycle outage No. 20 which began March 20, 2004 and completed June 15, 2004. Therefore, SG tube Inservice Inspections were not performed.

The new SGs have been subjected to pre-service inspections in accordance with the requirements of EPRI PWR Steam Generator Examination Guidelines, Revision 6, to which Duke Energy Corporation committed through NEI 97-06, Steam Generator Program Guidelines and ASME Section XI.

Attachment A provides a copy of the steam generator tube pre-service inspection summary report for the NRC information per American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section XI, Article IWA-6230 for the subject refueling outage.

If there are any questions you may contact R. P. Todd at (864) 885-3418.

Very truly yours,

R. A. Jones

Attachment

A047

xc w/attachments:

Mr. W. D. Travers
Regional Administrator, Region II

xc w/o attachments:

Mr. M. C. Shannon
NRC Senior Resident Inspector

Mr. L. E. Olshan
ONRR, Senior Project Manager

Mr. Henry Porter
DHEC

Steam Generator
In-service Inspection Summary Report

Oconee Unit 2 2004
Outage EOC 20

Location: 7800 Rochester Highway, Seneca, South Carolina 29672

NRC Docket No. 50-269

National Board No. N/A

Commercial Service Date: July 15, 1973

Owner: Duke Energy Corporation
526 South Church St.
Charlotte, N.C. 28201-1006

Revision 0

Prepared By: James H Batton Date: September 12, 2004

Reviewed By: D B Mayes Date: Sept 13, 2004

Approved By: [signature] Date: September 13 2004

Copy No. 1 Assigned To: NRC

Controlled: ✓ Uncontrolled: _____

ONS Master File no. OS-208.20

Distribution
For
Steam Generator
In-service Inspection Summary Report
Oconee Unit 2 2004
Outage EOC 20

Controlled Distribution

Copy No.	Assigned To
Original	Oconee Nuclear Station Document Control Master File OS-208.20
1	NRC Document Control

Uncontrolled Distribution

2	Hartford Steam Boiler Inspection and Insurance Corporation (AIA)

FORM NIS-1 OWNER'S DATA REPORT FOR INSERVICE INSPECTIONS

As required by the Provisions of the ASME Code Rules

1. Owner: Duke Energy Corporation, 526 S. Church St. Charlotte, NC 28201-1006
   (Name and Address of Owner)

2. Plant: Oconee Nuclear Station, 7800 Rochester Highway, Seneca, SC 29672
   (Name and Address of Plant)

3. Plant Unit: 2

4. Owner Certificate of Authorization (if required) N/A

5. Commercial Service Date: September 9, 1974

6. National Board Number for Unit N/A

7. Components Inspected:

Component	Manufacturer	Manufacturer Serial No.	State or Province No.	National Board No.
Steam Generator A	Babcock & Wilcox- Canada	006K03	N/A	207
Steam Generator B	Babcock & Wilcox- Canada	006K04	N/A	208

Note: Supplemental sheets in form of lists, sketches, or drawings may be used provided (1) size is $8\frac{1}{2}$ in. x 11 in., (2) information in items 1 through 6 on this data report is included on each sheet, and (3) each sheet is numbered and the number of sheets is recorded at the top of this form.

FORM NIS-1 (Back)

8. Examination Dates: October 13, 2002 To June 12, 2004 *

9. Inspection Period Identification: Third Period

10. Inspection Interval Identification: Third Interval

11. Applicable Edition of Section XI: 1989 ** Addenda None

12. Date/Revision of Inspection Plan: Station Tech. Spec. 5.5.10 Steam Generator Tube Surveillance Program provides plan requirements for in-service inspections

13. Abstract of Examinations and Test. * No in-service inspection of the 2A and 2B original steam generators was performed during this period. Both the 2A and 2B steam generators were completely replaced during the ONS-2 EOC-20 refueling outage in spring 2004. This NIS-1 is to document the pre-service examination of 100% of the tubes in the replacement steam generators in October 2003. ** 1989 edition of Section XI is code of record for the original steam generators (OTSG's). The 1998 edition thru 2000 addendum of Section XI was used for the replacement steam generator's (ROTSG's) pre-service inspection.

14. Abstract of Results of Examination and Tests. Reference attached Replacement Steam Generator Pre-service Inspection Summary Report.

15. Abstract of Corrective Measures. No corrective measures. No repairs were made (tubes removed from service) based on the results of the pre-service examinations (eddy current testing).

We certify that a) the statements made in this report are correct b) the examinations and tests meet the Inspection Plan as required by the ASME Code, Section XI, and c) corrective measures taken conform to the rules of the ASME Code, Section XI.

Certificate of Authorization No. (if applicable) N/A Expiration Date N/A

Date Sept. 12, 20 04 Signed Duke Energy Corp. By James H Batton

Owner

CERTIFICATE OF INSERVICE INSPECTION

I, the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and the State of Province of North Carolina employed by *The HSBI&I Co., have inspected the components described in this Owner's Report during the period 10-13-02 to 6-12-04, and state that to the best of my knowledge and belief, the Owner has performed examinations and tests and taken corrective measures described in the Owner's Report in accordance with the Inspection Plan and as required by the ASME Code, Section XI.

By signing this certificate neither the Inspector nor his employer makes any warranty, expressed or implied, concerning the examinations, test, and corrective measures described in this Owner's Report. Furthermore, neither the Inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection

Commissions NC 1444 NIABC

Inspector's Signature National Board, State, Province, and Endorsements

Date SEPT 15 2004

* The Hartford Steam Boiler Inspection & Insurance Co.
200 Ashford Center North Suite 300 Atlanta, GA. 30338

Attachment 1 to Form NIS-1
Replacement Steam Generator Pre-service Inspection Summary Report

Oconee Nuclear Station Unit 2 – 2004
Outage EOC-20

Replacement Steam Generator Tubing - Pre-service Inspection

Eddy current examinations were performed on the 0.625" OD x 0.037" wall Inconel 690 tubing for the replacement Oconee Nuclear Station Unit 2 steam generators. The inspections were performed by Babcock & Wilcox Canada (B&W) and subcontracted personnel prior to delivery of the replacement steam generators to the ONS site. The steam generators were replaced during the spring 2004 refueling outage.

Attached are the B&W Pre-service Inspection Summary reports for the 2A (S/N 006K-03) and 2B (S/N 006K-04) replacement steam generators. The 2A steam generator report is number BWC-TR-2003-012. The 2B steam generator report is number BWC-TR-2003-013.

The reports are a summary of the eddy current testing results for each of the two replacement steam generators. The examination techniques performed during this inspection were bobbin coil and X-probe simultaneously. The inspections were performed on 100% of the tubes from tube end to tube end. The X-probe technique was used to characterize reportable and special interest indications.

There were no tubes identified in either steam generator that contained eddy current indications that required repairs. There were 4 tubes plugged in the 2A and 1 tube plugged in the 2B steam generator due to tubesheet mis-drilling or due to damage that occurred during manufacturing.

Attachments:

Attachment 1-A - BWC-TR-2003-012 Rev. 0 (Vessel 006K-03 – 2A Steam Generator)

Attachment 2-B - BWC-TR-2003-013 Rev. 1 (Vessel 006K-04 – 2B Steam Generator)

PRESERVICE EDDY CURRENT INSPECTION

B&W REPORT NUMBER: BWC-TR-2003-12 Rev. 1

LOCATION : Oconee Nuclear Station Units 1,2 and 3
P.O. Box 1439, Hwy 130 and Hwy 183
Seneca, SC, USA
29679

ISSUE DATE : August 31, 2004

OWNER : Duke Energy Corporation

B&W ORDER NUMBER: 006K STEAM GENERATOR SERIAL NO.: 006K-03
DUKE POWER PO NUMBER: SG82

Prepared by: M. Addario Date: Sept 3, 2004
Mary Addario ET LIII/QDA
Supervisor Inspection Services

Reviewed by: H. Myderwyk Date: 09.03.04.
Henry Myderwyk ET LII/QDA
Lead Analyst

Approved by: _____ Date:
Customer Signature

DUKE ENERGY
THIS DOCUMENT IS:
☑ Approved
☐ Approved As Noted
☐ Disapproved
This Approval does not relieve the supplier of his responsibility for correctness of dimensions, for the proper design of equipment, and for complying with the conditions of the order.
Signed 9/8/04 Date

B&W NUCLEAR SERVICES
55 Savage Drive
Cambridge, Ontario
N1T 1S5

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5.0 EXAMINATION RESULTS

6.0 PLUG LIST

7.0 DOCUMENTATION

INTRODUCTION

This report provides the results of the Eddy Current (ET) Examination performed by B&W Nuclear Services on the Alloy 690 tubing in the replacement, once-through steam generator, serial no. 006K03, for Oconee Nuclear Power Plant. These examinations were conducted as a pre-service inspection of this steam generator prior to shipment from the BWC facility in Cambridge, Ontario, Canada as per Shop Floor Routing 840325 Operation 0090 and Operation 0092. Operation 0092 was added, after the Baseline ECT examination of all tubes in this unit was complete, four tubes were found to have a deposit like signal. This signal was due to melted plugs in these tubes. The deposit was removed and the four tubes rescanned. This report includes data from full-length bobbin examination of all (100%) tubes including bobbin profilometry of each tube end and 100% X-probe acquired data. X-probe data was only analyzed for special interest areas and a sample of the MBM indications.

This technical summary reports the information as required by BWC Bobbin and X-probe Analysis Procedure No. 259088 and BWC Bobbin tubesheet expansion Profilometry Analysis Procedure No. 259089.

The inspection staff of BWC Nuclear Services provides this report to Oconee Nuclear Power Plant in compliance with the following guidelines.

BWC Written Practice	QCI-702-039
	BWC Technical Specification TS-2480
	Section XI ASME Boiler and Pressure Vessel Code 1998 Edition Appendix IV, with 2000 addenda
	Section V ASME Boiler and Pressure Vessel Code 1998 Article 8, Appendix 1 with 2000 addenda
	EPRI Steam Generator Examination Guidelines Rev 6

TECHNICAL SUMMARY

1.0 OVERVIEW

This document provides a technical summary of the pre-service examination and is the final report which includes all the reported entries for each tube examined, inspection tube sheet maps for the reportable tube indications identified in the eddy current analysis procedures and printouts of these reportable indications.

2.0 STEAM GENERATOR EXAMINATION INFORMATION

The steam generator referred to in this report is a Babcock & Wilcox Designed Once-through Type, containing 15631 straight Alloy 690 (BWC TS-2480) 0.625 inch outside diameter (OD) by 0.038 inch wall tubing.

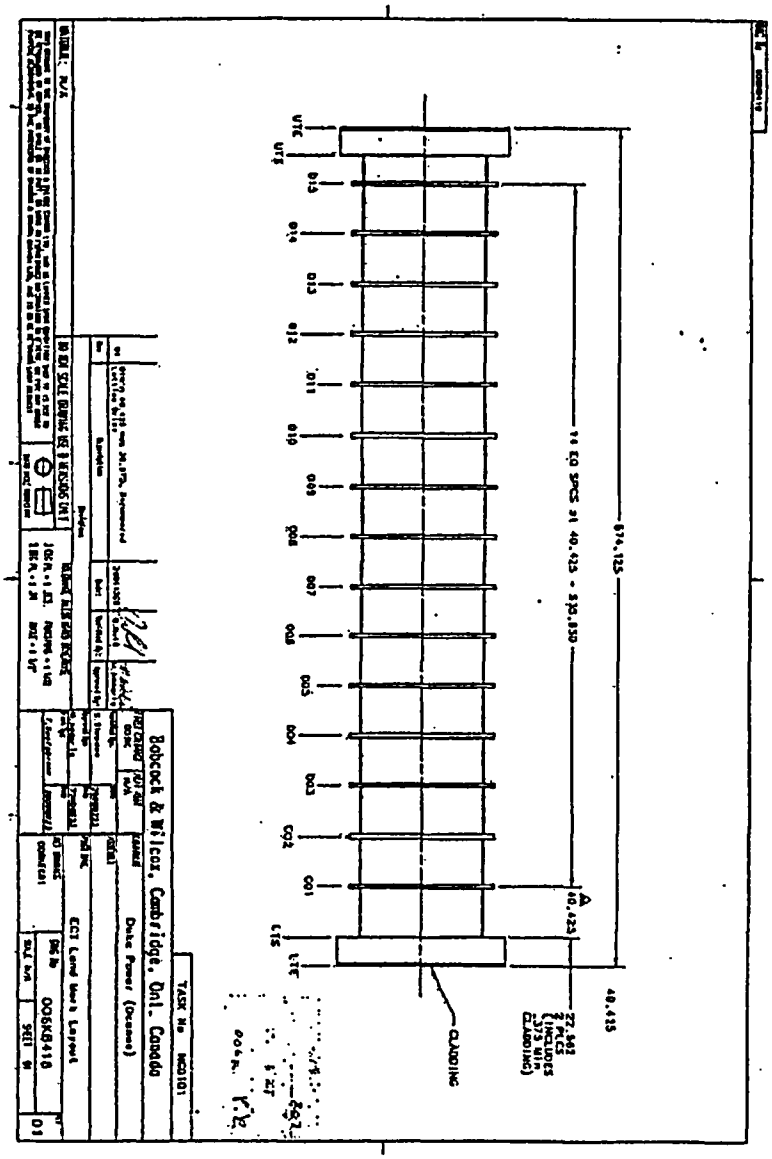
There are fifteen (15) broach support structures constructed from SA 240 410 Stainless steel material within the tube bundle of this vessel. The supports are identified as per the Tube Support Layout for this steam generator (Figure 1).

The examination techniques performed during this inspection were Bobbin Coil and X-probe simultaneously. The bobbin coil and X-probe technique were performed on 100% of the tubing in the tube bundle to provide general information of tube integrity from tube end to tube end. The X-probe technique was also used to characterize reportable and special interest indications discovered by the bobbin examination technique.

The tube examinations were performed from the inlet side of the steam generator. Tube numbering of this steam generator was identified as per BWC drawing 006KE121. As per this drawing, Row 1, Tube 1 is located on the Y2, X2 side of the vessel. All Rows and Tubes are numbered the same from both the inlet and outlet sides of the steam generator. To remain consistent with the utility's numbering scheme all tube holes were numbered as tube coordinates.

Replacement Steam Generator
For Oconee
Tube Support Layout

Figure #1



3.0 EXAMINATION METHODOLOGY

The examinations, personnel and equipment complied with BWC Quality Assurance Manual for Nuclear Products, the applicable Duke Power Corp specification and Section XI of the ASME Boiler and Pressure Vessel Code, 1998, with 2000 Addenda.

The examination data was acquired using the RD Tech TC7700-14D Multi frequency Acquisition System. The raw data was recorded onto hard drives and spooled from the acquisition server to the main server at Savage Drive in Cambridge. Following the completion of analysis, all evaluation results and calibration setups were copied to DVD for final storage. Any calibration groups which were considered unsatisfactory (bad data acquired), were removed from the DVDs.

3.1 Bobbin Examination

All bobbin data generated from these examinations underwent two (2) separate analysis reviews. They were independent of each other and were referred to as Primary and Secondary analysis. The evaluations performed by each analysis review were to determine data quality and completeness. If evidence of defect indications, loose parts detection and other undetermined condition of the installed tubing, appropriate calls were made in accordance with the referenced data analysis guidelines, BWC SIS 259088 Rev. 1 for the bobbin technique.

Primary and Secondary analysis were performed manually by different in house analysts. The results from these two analysts were compared through Zetec EddyNet98 compare software, by a Primary and Secondary Resolution analyst. The final discrepancies were resolved by the Resolution Analyst in accordance with the data analysis guidelines.

3.2 Bobbin Profilometry Examination

The Bobbin Profilometry analysis was performed utilizing BWC SIS 259089 Rev 0 and consisted of a single analyst reviewing the results of each tubesheet hole.

Bobbin Tubesheet Profilometry analysis consisted of evaluating the tube expansion profile to determine if the tube was expanded, where the closure gap location was with relation to the top of the tubesheet, diameter of the expansion, and any abnormal signals within the tubesheet expansion.

3.3 Data Management

Results of the evaluations (analysis) were loaded into the EIMS and STMax Data Management Systems. These systems were used to check that all the tubes were inspected and results reviewed through the analysis program. The EIMS system was used to perform data manipulation for data inquiry, tube sheet mapping and final reporting.

4.0 EXAMINATION TECHNIQUES

4.1 Bobbin

All acquisition examinations, were performed using RD Tech TC 7700-14D via Eddyview software and all analysis platforms were performed using Zetec EddyNet Analysis Systems, running HP UNIX based EddyNet 98 Software Version 2 Patch 2.42. Bobbin Profilometry was performed using Westinghouse Anser Auto Profilometry software version 8.3.

The bobbin coil examinations were performed with a RD Tech combination Bobbin-X probe (XP-510-214-083-41). The primary probe utilized for this inspection was a 0.510-inch/ 2 x 14 pancake array diameter probe.

During the inspection, this probe traversed the tube at a speed of 24 inches per second coupled with a sampling rate of 780 samples per second. This provides a digitization rate of greater than 30 samples per inch of the tubing examined.

The examination frequencies used and their purpose for the inspection are as follows:

750 kHz Differential	this is the primary inspection frequency and provides, in close proximity the phase separation between the 100% through hole and 4x20% OD flat bottom holes to meet ASME Code requirements. This frequency was also used as a mix component.
750 kHz Absolute	Used for defect confirmation, and an absolute mix component.
380 kHz Differential	Used for the screening of data and defect confirmation.
380 kHz Absolute	Used as absolute percent through wall calling channel, for defect confirmation.
190 kHz Differential	Used as a mix component and for defect confirmation.

190 kHz Absolute	Used as a reporting channel for non-commercial MBM's. Also as a mix component and for defect confirmation.
70 kHz Differential	Locator channel for support and tube sheet locations and loose parts detection.
70 kHz Absolute	Locator channel for support and tube sheet locations and loose parts detection.

In addition, mixing of frequencies were performed to produce process channels, which suppress the effects of tube support structures on eddy current signals, thus enhancing the evaluation of results at these locations.

The process channels and their purpose are as follows:

PROCESS CHANNEL 1 (P1) - 750/190 kHz. Differential (broach support suppression) used for detecting indications at broach support locations.

PROCESS CHANNEL 2 (P2) - 380/190 kHz. Absolute (broach support suppression) used for detecting indications at broach support locations.

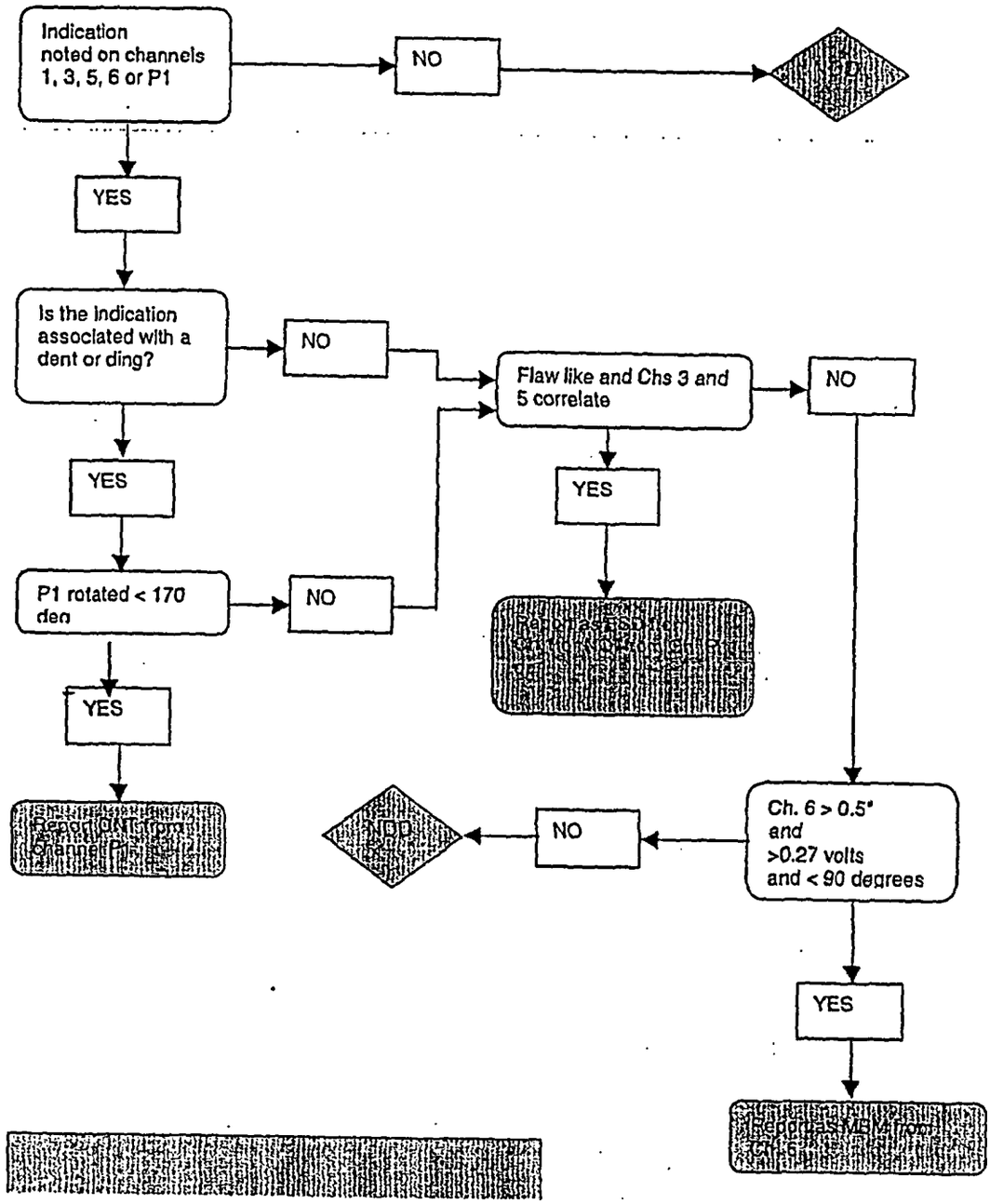
Evaluation of the results used the as-built dimensions from the ASME calibration standard to develop calibration curves of PHASE ANGLE versus PERCENT (%) DEPTH. DEPTH from signal responses produced by the 100% through wall .052" diameter hole, 60% O.D. flat bottom hole and the 4 - 20% O.D. flat bottom holes. Discontinuities which were produced through the tube manufacturing process were reported regardless of voltage.

- Analysis was performed as per BWC procedure 259088 and the analysis flow chart seen in Figure 2.

FIGURE #2
BOBBIN ANALYSIS FLOW CHART

Duke Power
Oconee Nuclear Power Plant

Bobbin Coil Indication Flow Chart



4.2 X-Probe

The X-probe examinations were performed using a 0.510 inch diameter RD Tech (XP-510-214-083-41) probe consisting of 2 x 14 pancake array arrangement.

The frequencies utilized for the X-probe acquisition and analysis are as follows:

750 kHz
380 kHz
190 kHz
70 kHz

Additional process channels were also used. Their identification is noted in ETSS #3 (BWC number ETS-023)

Specific calibration, data screening and indication reporting methodologies were used in accordance with the data analysis guidelines. The primary purpose of the X-probe technique was to have full-length array probe data on each tube for future reference. It was also used to characterize discontinuities identified from bobbin analysis to determine the relevance of these indications and to assist in the final reporting of tube condition.

A selection of MBM calls and some special interest tubes selected by the Resolution Analyst were analyzed using the X-probe inspection technique to characterize these areas of concern

5.0 EXAMINATION RESULTS

5.1 Bobbin Analysis

The majority of discontinuities exhibited in this steam generator were indicative of MBM (Manufacturing Burnish Mark) signals. The MBM's may be caused by tube conditioning at the tube manufacturer to remove localized tubing imperfections on the outside diameter (OD) or removal of imperfections caused by the installation of the tubes into the tube bundle. The process of tube conditioning was performed using approved process procedures. A total of one thousand one hundred and sixty-six (1166) non-commercial MBM indications were observed in this vessel.

Three, non-quantifiable indications (NQI) were reported using the bobbin technique.

One, free span differential indication (FSD) was reported using the bobbin technique.

Four, free-span absolute indications (FSA) were reported using the bobbin technique. These indications were dispositioned and the plug deposit removed.

One hundred and eighty-two (182) tubes were addressed with the code, NSY. Small voltage indications, less than the reporting criteria for MBM indications, were observed through out the tubes addressed in this vessel. This code will allow us to flag these tubes to Duke Power.

No Wall Loss indications were reported in this steam generator.

5.2 Bobbin Profilometry Analysis

Bobbin Profilometry Analysis was performed on all tube sheet holes of this steam generator. Analysis was performed using Westinghouse Anser Bobbin Profilometry Auto Analysis Software and the resultant reporting measurements performed were as follows:

AVG Average expansion diameter throughout the tubesheet

DEV Deviation in measurement of expansion from the average tube expansion (AVG) diameter.

OXP These are indications within the tubesheet with a deviation of 0.005 inches or greater from the nominal tube expansion diameter of each tube hole.

TMR Tube Expansion Transition (Closure Gap) This is a linear measurement from the end of the expansion with relation to the secondary face of the tubesheet.

Of the tubes inspected, tube holes did not exhibit any OXP signals, all tubes were expanded and no AVG were observed beyond the expansion parameters.

5.3 Special Interest X-probe Analysis

X-probe analysis was performed on 8 indications, 3 NQI, 1 FSD and 4 FSA. The tubes and the location of indications scanned are as follows:

Row	Tube	Location	Indication
037	063	001 + 33.99	FSA
037	064	001 + 33.98	FSA
024	090	002 + 37.23	FSA
008	004	002 + 16.49	FSA
079	046	002 + 37.46	FSD
095	014	015 + 18.87	NQI
095	014	011 + 04.70	NQI

095	014	004 + 38.84	NQI

Three NQI calls were NDD call, after X-probe characterization.

Four FSA call were NDD call, after the deposit removal.

One FSD call was NDD call, after X-probe characterization

Several MBM calls were characterized with the X-probe

The following Summary Report on the Oconee Baseline Inspection identifies the quantity of tubes inspected, the number of tubes resolved, the quantity of tubes which contain the indication and the quantity of reportable indications.

SUMMARY REPORT
OCONEE BASELINE

SERIAL 006K03

Tubes to Inspect : 15631

Tubes Through Resolution: 15631 100% COMPLETE

Tubes Remaining to Resolve : 0

BOBBIN RESULTS

INDICATION TYPE	QTY OF TUBES WITH INDICATION	# OF INDICATIONS
Wall loss > 7%	0 TUBES	0
Wall loss < 7%	0 TUBES	0
NQI	1 TUBE	3
FSD	1 TUBE	1
FSA	4 TUBES	4
MBM	1048 TUBES	1166

BOBBIN PROFILOMETRY RESULTS

INDICATION TYPE	QTY OF TUBES WITH INDICATION
OXP	0 TUBES
No Tube Expansion	0 TUBES

X-PROBE SPECIAL INTEREST RESULTS

INDICATION TYPE	QTY OF TUBES WITH INDICATION	# OF INDICATIONS
NQI	1 Tube with 3 possible indications	0 all became NDD
FSD	1 Tube with 1 possible indications	0 became NDD
FSA	4 Tubes with 4 possible indications	Rework became NDD
MBM	1048 Tubes with 1166 possible Indications	All MBM's over 1 volt were reviewed with X-probe

6.0 PLUGGING LIST

Four tubes were plugged in this steam generator:

Row	Tube	Reason for Plugging
104	1	miss drilled tube sheet
104	8	miss drilled tube sheet
104	15	miss drilled tube sheet
104	22	miss drilled tube sheet

Refer to NR 20857 for further details on the four holes drilled out of position on the tubesheet. Hole locations are as follows: X48 Y10 which equate to R104 T1, X48 Y 24 which equate to R104 T 8, X48 Y 38 which equate to R 104 T 15 and X 48 Y52 which equate to R104 T22, each stated tube is a blank, resembling a tie rod location.

NR24419 was raised to further document that the tube numbers reported in this preservice inspection report are incorrect. This NR provides the correspondence between the correct tube locations and the ECT baseline tube location identifiers as incorrectly coded in Cal Group 21H00036. These correct tube locations match the tube numbering scheme utilized in the above mentioned NR 20857 (based on the tubesheet gundrilling pattern). The plugged tube list above is also relative to the tubesheet gundrilling pattern numbering scheme, and the associated tube identifier reflects the tube numbering location, as it should have been. Initial ISI ECT activities will acknowledge and "re-align" the acquired baseline ECT data to the correct tube location, as identified and explained in the disposition-to-NR24419.

7.0 DOCUMENTATION

One copy of DVD containing the acquired and analyzed data plus two copies of the inspection report shall be provided to Duke Power for record purposes and archival storage.

One copy of the DVD containing the acquired and analyzed data shall be retained, by BWC Quality Records, for use as a working copy, for future evaluation.

Copies of the procedures used for these examinations have already been provided to Duke Power for their approval before commencing the eddy current inspection.

Record of Revision

Mary Addario – August 31, 2004

Page 1 reissued as Revision 1, with appropriate dates and signatures.
Page 5 corrected reference drawing number from 006KE621 to 006K E121
Page 14 Under the 6.0 Plugging List heading – revised to include all appropriate NR disposition information.

PRESERVICE EDDY CURRENT INSPECTION

B&W REPORT NUMBER: BWC-TR-2003-013 Rev. 0

LOCATION : Oconee Nuclear Station Units 1,2 and 3
P.O. Box 1439, Hwy 130 and Hwy 183
Seneca, SC, USA
29679

ISSUE DATE : November 07, 2003

OWNER : Duke Energy Corporation

B&W ORDER NUMBER: 006K STEAM GENERATOR SERIAL NO.: 006K-04
DUKE POWER PO NUMBER: SG82

Prepared by: M. Addario Date: Nov 4, 2003
Mary Addario ET LIII/QDA
Supervisor Inspection Services

Reviewed by: Dave Sheff Date: 11.04.03
Dave Sheff ET LII
Lead Acquisition

Approved by: (See separate page) Date: _____
Customer Signature

B&W NUCLEAR SERVICES
55 Savage Drive
Cambridge, Ontario
N1T 1S5

PRESERVICE EDDY CURRENT INSPECTION

B&W REPORT NUMBER: BWC-TR-2003-013 Rev. 0

LOCATION : Oconee Nuclear Station Units 1,2 and 3
P.O. Box 1439, Hwy 130 and Hwy 183
Seneca, SC, USA
29679

ISSUE DATE : November 07, 2003

OWNER : Duke Energy Corporation

B&W ORDER NUMBER: 006K STEAM GENERATOR SERIAL NO.: 006K-04
DUKE POWER PO NUMBER: SG82

Prepared by:_____ Date:
Mary Addario ET LIII/QDA
Supervisor Inspection Services

Reviewed by:_____ Date:
Dave Sheff ET LII
Lead Acquisition

Approved by: _____ Date: Nov 4 '03
Customer Signature
DPC. NS ECT LIII

B&W NUCLEAR SERVICES
55 Savage Drive
Cambridge, Ontario
N1T 1S5

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4.0 EXAMINATION TECHNIQUES

5.0 EXAMINATION RESULTS

6.0 PLUG LIST

7.0 DOCUMENTATION

INTRODUCTION

This report provides the results of the Eddy Current (ET) Examination performed by B&W Nuclear Services on the Alloy 690 tubing in the replacement, once-through steam generator, serial no. 006K04, for Oconee Nuclear Power Plant. These examinations were conducted as a pre-service inspection of this steam generator prior to shipment from the BWC facility in Cambridge, Ontario, Canada as per Shop Floor Routing 841009 Operation 0100. This report includes data from full-length bobbin examination of all (100%) tubes including bobbin profilometry of each tube end and 100% X-probe acquired data. X-probe data was only analyzed for special interest areas and a sample of the MBM indications.

This technical summary reports the information as required by BWC Bobbin and X-probe Analysis Procedure No. 259088 and BWC Bobbin tubesheet expansion Profilometry Analysis Procedure No. 259089.

The inspection staff of BWC Nuclear Services provides this report to Oconee Nuclear Power Plant in compliance with the following guidelines.

BWC Written Practice	QCI-702-039
	BWC Technical Specification TS-2480 Section XI ASME Boiler and Pressure Vessel Code 1998 Edition Appendix IV, with 2000 addenda Section V ASME Boiler and Pressure Vessel Code 1998 Article 8, Appendix 1 with 2000 addenda EPRI Steam Generator Examination Guidelines Rev 5

TECHNICAL SUMMARY

1.0 OVERVIEW

This document provides a technical summary of the pre-service examination and is the final report which includes all the reported entries for each tube examined, inspection tube sheet maps for the reportable tube indications identified in the eddy current analysis procedures and printouts of these reportable indications.

2.0 STEAM GENERATOR EXAMINATION INFORMATION

The steam generator referred to in this report is a Babcock & Wilcox Designed Once-through Type, containing 15631 straight Alloy 690 (BWC TS-2480) 0.625 inch outside diameter (OD) by 0.038 inch wall tubing.

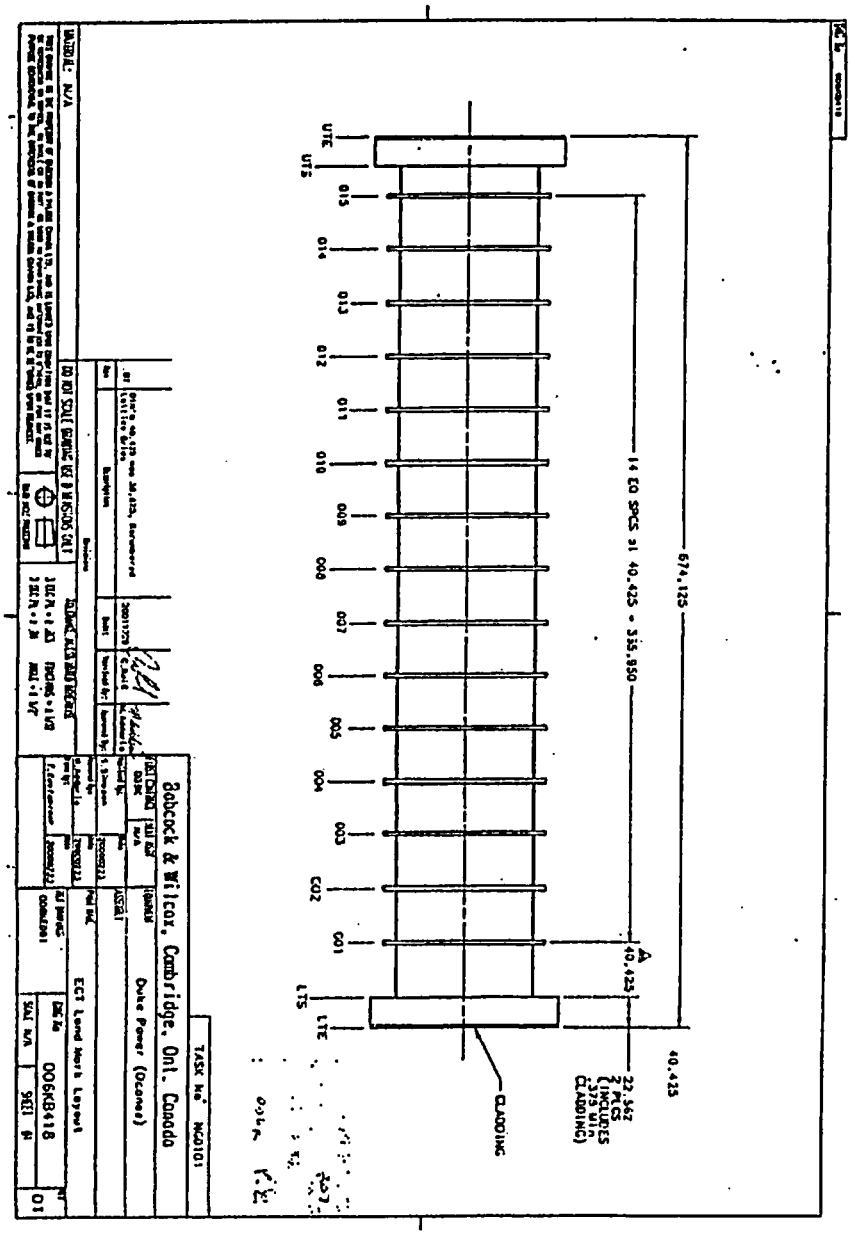
There are fifteen (15) broach support structures constructed from SA 240 410 Stainless steel material within the tube bundle of this vessel. The supports are identified as per the Tube Support Layout for this steam generator (Figure 1).

The examination techniques performed during this inspection were Bobbin Coil and X-probe simultaneously. The bobbin coil and X-probe technique were performed on 100% of the tubing in the tube bundle to provide general information of tube integrity from tube end to tube end. The X-probe technique was also used to characterize reportable and special interest indications discovered by the bobbin examination technique.

The tube examinations were performed from the inlet side of the steam generator. Tube numbering of this steam generator was identified as per BWC drawing 006KE121. As per this drawing, Row 1, Tube 1 is located on the Y2, X2 side of the vessel. All Rows and Tubes are numbered the same from both the inlet and outlet sides of the steam generator. To remain consistent with the utility's numbering scheme all tube holes were numbered as tube coordinates.

Replacement Steam Generator
For Oconee
Tube Support Layout

Figure #1



3.0 EXAMINATION METHODOLOGY

The examinations, personnel and equipment complied with BWC Quality Assurance Manual for Nuclear Products, the applicable Duke Power Corp specification and Section XI of the ASME Boiler and Pressure Vessel Code, 1998, with 2000 Addenda.

The examination data was acquired using the RD Tech TC7700-14D Multi frequency Acquisition System. The raw data was recorded onto hard drives and spooled from the acquisition server to the main server at Savage Drive in Cambridge. Following the completion of analysis, all evaluation results and calibration setups were copied to DVD for final storage. Any calibration groups which were considered unsatisfactory (bad data acquired), were removed from the DVDs.

3.1 Bobbin Examination

All bobbin data generated from these examinations underwent two (2) separate analysis reviews. They were independent of each other and were referred to as Primary and Secondary analysis. The evaluations performed by each analysis review were to determine data quality and completeness. If evidence of defect indications, loose parts detection and other undetermined condition of the installed tubing, appropriate calls were made in accordance with the referenced data analysis guidelines, BWC SIS 259088 Rev. 1 for the bobbin technique.

Primary and Secondary analysis were performed manually by different remote site analysts. The results from these two analysts were compared through Zetec EddyNet98 compare software, by a Primary Resolution analyst, both being independent from each other. The final discrepancies were resolved by the Resolution Analyst in accordance with the data analysis guidelines.

3.2 Bobbin Profilometry Examination

The Bobbin Profilometry analysis was performed utilizing BWC SIS 259089 Rev 0 and consisted of a single analyst reviewing the results of each tubesheet hole.

Bobbin Tubesheet Profilometry analysis consisted of evaluating the tube expansion profile to determine if the tube was expanded, where the closure gap location was with relation to the top of the tubesheet, diameter of the expansion, and any abnormal signals within the tubesheet expansion.

3.3 Data Management

Results of the evaluations (analysis) were loaded into EIMS Data Management System. This system was used to ensure all tubes were inspected and results reviewed through the analysis program. The EIMS system was used to perform data manipulation for data inquiry, tube sheet mapping and final reporting.

4.0 EXAMINATION TECHNIQUES

4.1 Bobbin

All acquisition examinations, were performed using RD Tech TC 7700-14D via Eddyview software and all analysis platforms were perform using Zetec EddyNet Analysis Systems, running HP UNIX based EddyNet 98 Software Version 2 Patch 2.42. Bobbin Profilometry was performed using Westinghouse Anser Auto Profilometry software version 8.3.

The bobbin coil examinations were performed with a RD Tech combination Bobbin-X probe (XP-510-214-083-41). The primary probe utilized for this inspection was a 0.510-inch/ 2 x 14 pancake array diameter probe.

During the inspection, this probe traversed the tube at a speed of 24 inches per second coupled with a sampling rate of 780 samples per second. This provides a digitization rate of greater than 30 samples per inch of the tubing examined.

The examination frequencies used and their purpose for the inspection are as follows:

750 kHz Differential	This is the primary inspection frequency and provides, in close proximity the phase separation between the 100% through hole and 4x20% OD flat bottom holes to meet ASME Code requirements. This frequency was also used as a mix component.
750 kHz Absolute	Used for defect confirmation, and an absolute mix component.
380 kHz Differential	Used for the screening of data and defect confirmation.
380 kHz Absolute	Used as absolute percent through wall calling channel, for defect confirmation.
190 kHz Differential	Used as a mix component and for defect confirmation.
190 kHz Absolute	Used as a reporting channel for non-commercial MBM's. Also as a mix component and for defect confirmation.

70 kHz Differential	Locator channel for support and tube sheet locations and loose parts detection.
70 kHz Absolute	Locator channel for support and tube sheet locations and loose parts detection.

In addition, mixing of frequencies were performed to produce process channels, which suppress the effects of tube support structures on eddy current signals, thus enhancing the evaluation of results at these locations.

The process channels and their purpose are as follows:

PROCESS CHANNEL 1 (P1) - 750/190 kHz. Differential (broach support suppression) used for detecting indications at broach support locations.

PROCESS CHANNEL 2 (P2) - 380/190 kHz. Absolute (broach support suppression) used for detecting indications at broach support locations.

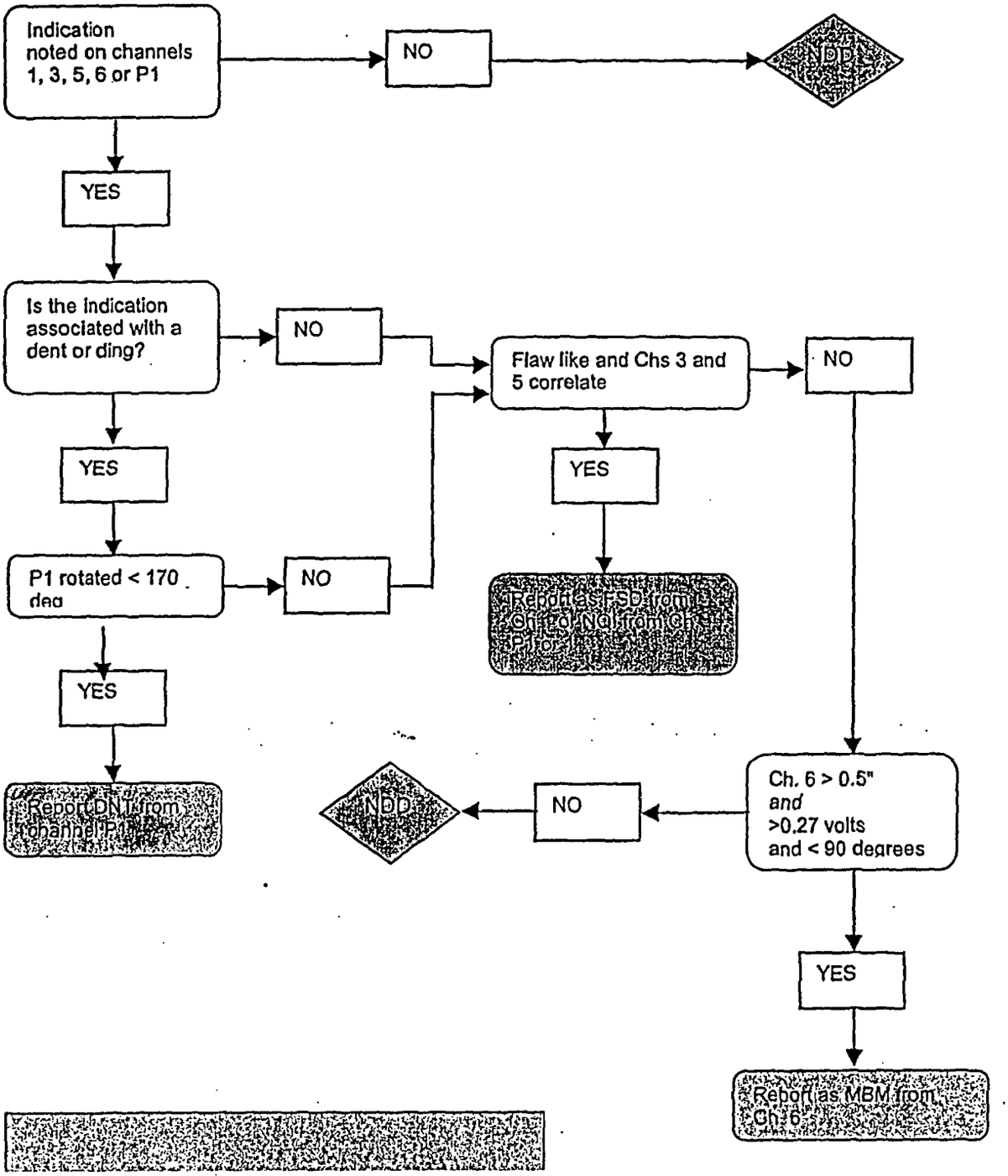
Evaluation of the results used the as-built dimensions from the ASME calibration standard to develop calibration curves of PHASE ANGLE versus PERCENT (%) DEPTH. DEPTH from signal responses produced by the 100% through wall .052" diameter hole, 60% O.D. flat bottom hole and the 4 - 20% O.D. flat bottom holes. Discontinuities which were produced through the tube manufacturing process were reported regardless of voltage.

Analysis was performed as per BWC procedure 259088 and the analysis flow chart seen in Figure 2.

FIGURE #2
BOBBIN ANALYSIS FLOW CHART

Duke Power
Oconee Nuclear Power Plant

Bobbin Coil Indication Flow Chart



4.2 X-Probe

The X-probe examinations were performed using a 0.510 inch diameter RD Tech (XP-510-214-083-41) probe consisting of 2 x 14 pancake array arrangement.

The frequencies utilized for the X-probe acquisition and analysis are as follows:

750 kHz
380 kHz
190 kHz
70 kHz

Additional process channels were also used. Their identification is noted in ETSS #3 (BWC number ETS-023)

Specific calibration, data screening and indication reporting methodologies were used in accordance with the data analysis guidelines. The primary purpose of the X-probe technique was to have full-length array probe data on each tube for future reference. It was also used to characterize discontinuities identified from bobbin analysis to determine the relevance of these indications and to assist in the final reporting of tube condition.

A selection of MBM calls and some special interest tubes selected by the Resolution Analyst were analyzed using the X-probe inspection technique to characterize these areas of concern

5.0 EXAMINATION RESULTS

5.1 Bobbin Analysis

The majority of discontinuities exhibited in this steam generator were indicative of MBM (Manufacturing Burnish Mark) signals. The MBM's may be caused by tube conditioning at the tube manufacturer to remove localized tubing imperfections on the outside diameter (OD) or removal of imperfections caused by the installation of the tubes into the tube bundle. The process of tube conditioning was performed using approved process procedures. A total of five hundred and eighty (580) non-commercial MBM indications were observed in this vessel.

Sixteen (16) tubes were addressed with the code, NSY. Small voltage indications, less than the reporting criteria for MBM indications, were observed through out the tubes addressed in this vessel. This code will allow us to flag these tubes to Duke Power.

No Wall Loss indications were reported in this steam generator.

5.2 Bobbin Profilometry Analysis

Bobbin Profilometry Analysis was performed on all tube sheet holes of this steam generator. Analysis was performed using Westinghouse Anser Bobbin Profilometry Auto Analysis Software and the resultant reporting measurements performed were as follows:

AVG	Average expansion diameter throughout the tubesheet
DEV	Deviation in measurement of expansion from the average tube expansion (AVG) diameter.
OXP	These are indications within the tubesheet with a deviation of 0.005 inches or greater from the nominal tube expansion diameter of each tube hole.
TMR	Tube Expansion Transition (Closure Gap) This is a linear measurement from the end of the expansion with relation to the secondary face of the tubesheet.

Of the tubes inspected, tube holes did not exhibit any OXP signals, all tubes were expanded and no AVG were observed beyond the expansion parameters.

5.3 Special Interest X-probe Analysis

X-probe analysis was performed on twenty-four (24) MBM calls greater than one volt (Vmx).

The following Summary Report on the Oconee Baseline Inspection identifies the quantity of tubes inspected, the number of tubes resolved, the quantity of tubes which contain the indication and the quantity reportable of indications.

SUMMARY REPORT
OCONEE BASELINE

SERIAL 006K04

Tubes to Inspect : 15631

Tubes Through Resolution: 15631 100% COMPLETE

Tubes Remaining to Resolve : 0

BOBBIN RESULTS

INDICATION TYPE	QTY OF TUBES WITH INDICATION	# OF INDICATIONS
Wall loss > 7%	0 TUBES	0
Wall loss < 7%	0 TUBES	0
NQI	0 TUBES	0
MBM	475 TUBES	580
DNT/DNG	0/0 TUBES	0/0

BOBBIN PROFILOMETRY RESULTS

INDICATION TYPE	QTY OF TUBES WITH INDICATION
OXP	0 TUBES
No Tube Expansion	0 TUBES

X-PROBE SPECIAL INTEREST RESULTS

INDICATION TYPE	QTY OF TUBES WITH INDICATION	# OF INDICATIONS
MBM	475 Tubes with 580 possible indications	All MBM's over 1 volt were reviewed with X-probe

6.0 PLUGGING LIST

One tube was plugged in this steam generator:

Row	Tube	Reason for Plugging
147	39	Damaged during manufacturing

7.0 DOCUMENTATION

One copy of DVD containing the acquired and analyzed data plus two copies of the inspection report shall be provided to Duke Power for record purposes and archival storage.

One copy of the DVD containing the acquired and analyzed data shall be retained, by BWC Quality Records, for use as a working copy, for future evaluation.

Copies of the procedures used for these examinations have already been provided to Duke Power for their approval before commencing the eddy current inspection.