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Byron Station, Unit 1
Facility Operating License NPF-37
NRC Docket No. STN 50-454

Subject: Byron Station Unit 1 Cycle 10 Steam Generator Eddy Current Examination, 90-Day Summary Report

Pursuant to Item b. of Technical Specification 5.6.9, "Steam Generator (SG) Tube Inspection Reports," we are submitting the steam generator inspection results which were completed during the Byron Station Unit 1, Cycle 10 Refueling Outage (B1R10). This report is also being submitted in accordance with the requirements of IWA-6000, "Records and Reports," and Mandatory Appendix IV, "Eddy Current Examination of Nonferromagnetic Steam Generator Heat Exchanger Tubing," Article IV-7000, "Report of Examination," of Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, 1989 Edition. This report is also being submitted in accordance with the steam generator reporting requirements contained in Nuclear Energy Institute (NEI) 97-06, "Steam Generator Program Guidelines," Section 4.

Attached is the report containing the results of the Byron Station Unit 1 Steam Generator examination performed during the B1R10 refueling outage.

If there are any questions regarding this matter, please contact Ms. P. Reister, Regulatory Assurance Manager, at (815) 234-5441, extension 2280.

Respectfully,

William Levis
Site Vice President
Byron Station

WL/JS/GS/dpk

Attachment: Steam Generator Eddy Current Inspection Report (B1R10)

A047

cc: Regional Administrator – NRC Region III
NRC Senior Resident Inspector – Byron Station

Commonwealth Edison Company
BYRON STATION UNIT 1
4450 N. German Church Road
Byron, IL 61010

COMMERCIAL OPERATION: 09/16/85

STEAM GENERATOR EDDY CURRENT INSPECTION REPORT

CYCLE 10 REFUELING OUTAGE (B1R10)

September 2000

Commonwealth Edison
P.O. Box 805379
Chicago, IL 60680-5379

Documentation Completed Date: 12/19/00

Table of Contents

1.0 INTRODUCTION

Byron Station Unit 1 operates with four Babcock & Wilcox Replacement Steam Generators (SGs) in the four loop pressurized water reactor system. The SGs each contain 6633 thermally treated Inconel-690 U-tubes that have a nominal diameter of 0.6875 inches and a nominal thickness of 0.040 inches. The tubes are supported by stainless steel lattice grid structures and fan bars. The tubes are hydraulically expanded into the full depth of the tubesheet. Main Feedwater enters the SGs above the tube bundle through a feedring and J-tubes. The SG configuration is shown in Figures A.1 and A.2. The replacement SGs were installed at the end of Cycle 8.

In compliance with Byron Station Technical Specification 5.5.9, "Steam Generator Tube Surveillance Program," and American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code Section XI 1989 Edition, IWB 2500-1, Examination Category B-Q, Item B16.20, SG eddy current examinations were performed during the Byron Station Unit 1 Cycle 10 refueling outage (B1R10). In addition, the inspections were performed consistent with the Electric Power Research Institute (EPRI) "PWR Steam Generator Examination Guidelines: Revision 5" and Nuclear Energy Institute (NEI) 97-06, "Steam Generator Program Guidelines." The field inspection activities were conducted from September 26, 2000, through October 1, 2000, by Westinghouse Electric Co. Ltd. The following inspections were performed during this outage.

- 100% Full Length Bobbin Coil in SG A.
- Diagnostic Plus-Point Inspections based on Bobbin Coil Results.

2.0 SUMMARY

The guidance in Revision 5 of the EPRI PWR Steam Generator Examination Guidelines (i.e., EPRI Guidelines) was used during this inspection. A degradation assessment was performed prior to the inspection to ensure the proper EPRI Appendix H, "Performance Demonstration for Eddy Current Examination," qualified inspection techniques were used to detect any existing (currently none) and potential modes of degradation. Each technique was evaluated to ensure that the detection and sizing capabilities are applicable to the Byron Station Unit 1 site specific condition in accordance with Section 6.2.4 of the EPRI Guidelines. All data analysts were qualified to Appendix G, "Qualification of Nondestructive Examination Personnel for Analysis of NDE Data," of the EPRI Guidelines (i.e., Qualified Data Analyst (QDA)). All data analyst and acquisition personnel satisfactorily completed site specific training and testing. An independent QDA process control review was employed to randomly sample the data to ensure that the analysis resolution process was properly performed and that the field calls were properly reported. An analysis feedback process was implemented that required the data analysts to review their missed calls and overcalls on a daily basis.

As a result of the eddy current inspection of the SG, no degradation was found in the tubing. The results of this inspection were classified as inspection category C-1 pursuant to Technical Specification 5.5.9.c, "Inspection Results Classification." There were no scanning limitations during the eddy current examinations. No tubes were repaired. Table 2.1 provides the total tube plugging history and equivalent plugging levels to-date for the Byron Station Unit 1 SGs:

Table 2.1
Equivalent Tube Plugging Level

	SG A	SG B	SG C	SG D	Total
Tubes Previously Plugged	0	0	1*	0	1
Tubes Plugged in B1R10	0	0	0	0	0
Total Tubes Plugged	0	0	1	0	1
Total Tubes Plugged (%)	0%	0%	0.015%	0%	0.004%

* Tubes plugged at factory during vessel fabrication.

3.0 CERTIFICATIONS

3.1 Procedures/Examinations/Equipment

3.1.1 The examination and evaluation procedures used during the SG eddy current inspection were approved by personnel qualified to Level III in accordance with the 1984 Edition of SNT-TC-1A, "Personnel Qualification and Certification in Nondestructive Testing." Commonwealth Edison (ComEd) Company procedures Special Process Procedures Manual (SPPM) NDT-E-2, "Multifrequency Eddy Current Data Acquisition of Steam generator Tubing at Braidwood and Byron Nuclear Stations," Revision 4 and SPPM NDT-E-3, "Evaluation of Eddy current Data for Steam generator tubing at Braidwood and Byron Nuclear Stations," Revision 2 were used for the data acquisition and analysis.

3.1.2 The examinations, equipment and personnel were in compliance with the requirements of ComEd and Westinghouse Quality Assurance Programs for Inservice Inspection, Byron Station Technical Specification 5.5.9, 1989 Edition of ASME B&PV Code Sections XI, "Rules for Inservice Inspection of Nuclear power Plant Components," and V, "Nondestructive Examination," Revision 5 of the EPRI PWR SG Examination Guidelines and NEI 97-06, Steam Generator Program Guidelines, Revision 0.

3.1.3 Certification packages for examiners, data analysts and equipment are available at Byron Station. Tables A.1 and A.2 list all personnel who performed, supervised or evaluated the data during this SG inservice inspection.

3.1.4 R/D Tech Inc. TC6700 Remote Data Acquisition Units (RDAUs) with Westinghouse ANSER computer software was used to acquire the eddy current data. Analysis was performed with Westinghouse ANSER Version 00.2 computer software. Secondary analysis was performed with CoreStar Eddyvision 32 computer software.

3.1.5 The bobbin coil examinations of SG A were performed with Westinghouse 0.560 inch diameter long life and replaceable head probes.

3.1.6 The rotating coil examinations were performed with Zetec 0.560 inch diameter three coil plus-point probe. The coils within this probe were a 0.115 inch diameter pancake coil, a shielded 0.080 inch diameter mid-range pancake coil and a standard mid-range plus-point coil.

3.2 Personnel

3.2.1 The personnel who performed the SG eddy current inspections were qualified to Level I and Level II certification in accordance with the 1984 Edition of SNT-TC-1A. The Level I personnel performed the inspections under the direct supervision of Level II personnel.

3.2.2 The personnel who performed the SG eddy current data analysis were qualified to a minimum of Level II, with special analysis training (i.e., Level IIA) in accordance with the 1984 Edition of SNT-TC-1A and Article IV-2000 of ASME Section XI, 1989 Edition.

3.2.3 All eddy current data analysts were qualified in accordance with EPRI Appendix G for Qualified Data Analysts (QDAs). In addition, all data analysts were trained and tested in accordance with a site specific performance demonstration program in both the bobbin coil and plus-point inspection data analysis. Resolution analysts were also trained and tested specifically for the performance of data resolution. All analysts were required to achieve a score of 80% or greater on both the written and practical examinations prior to analyzing data.

3.2.4 All SG eddy current data acquisition personnel were trained and tested in accordance with a site specific performance demonstration program. The data acquisition operators were required to achieve a written test score of 80% or greater prior to acquiring data.

3.2.5 The SG eddy current analysis was subject to two independent analyses. Primary analysis of all data was performed by NDE Technologies and Westinghouse. An independent company, CoreStar International, performed the secondary analysis. Primary and Secondary analysis was performed by an automated data screening analysis system as described in Section 6.3 of the EPRI PWR Steam Generator Examination Guidelines, Revision 5. Each system was required to successfully pass the site specific performance demonstration practical examination prior to analyzing field data.

3.2.6 An independent SG eddy current Level III QDA was employed to serve as a process control reviewer, in accordance with EPRI Guidelines, Section 6.3.3.4, to randomly sample the data to ensure the resolution process was properly performed and that the field calls were properly reported. The Independent Level III QDA also provided data acquisition oversight to ensure that the data collection process was in compliance with appropriate procedures, that all essential variables were set in accordance with the applicable Examination Technique Specification Sheet (ETSS) and to provide a data quality check of acquired data. The Independent Level III QDA was employed by a third inspection company, Anatec, and reported directly to the ComEd Level III inspector.

4.0 EXAMINATION TECHNIQUES AND EXAMINATION SCOPE

All SG eddy current examination techniques used were qualified in accordance with Appendix H of the EPRI PWR SG Examination Guidelines. Each examination technique was evaluated to be applicable to the tubing and conditions of the Byron Station Unit 1 SGs.

4.1 Examination Techniques

4.1.1 All inservice tubes in SG A were inspected full length utilizing a bobbin coil probe described in Section 3.1.5 of this report. Nominal probe inspection speed was 40 inches per second for tubes in rows 10 and higher and 24 inches per second in rows 1 through 9. Sufficient sampling rates were used to maintain a minimum digitizing rate of 30 samples per inch. The bobbin probes were operated in both the differential and absolute modes at frequencies of 650 kHz, 320 kHz, 160 kHz, and 35 kHz. The following suppression mixes were used to enhance the inspection: 650/160 kHz differential mix, 320/160 kHz absolute mix, and a 650/320 kHz differential mix.

4.1.2 Diagnostic examinations were planned for non-quantifiable indications and hot leg dents/dings greater than 5.0 volts that may be detected by the bobbin coil examination. The diagnostic examinations utilized a plus-point probe as described in Section 3.1.6. Axial probe inspection speed was 0.5 inches per second for straight tubing and 0.15 inches per second for U-bend region of the tubing and dents/dings region of the tubing. Sample rates and rotation speeds were used to maintain a minimum digitizing rate of 30 samples per inch (i.e., 25 samples per inch for the axial direction and 30 samples per inch for the circumferential direction). The rotating probes were operated in the absolute test mode at frequencies of 300 kHz, 200 kHz, 100 kHz and 20 kHz. In addition to the four base frequencies, three process channels were used to display axial indications in the positive trace.

4.1.3 The eddy current calibration standards used for the bobbin coil and plus-point inspections met the requirements of Section 6.2.7 of the EPRI PWR Steam Generator Examination Guidelines, Revision 5 and Sections V and XI of the ASME B&PV Code, 1989 Edition.

4.1.4 The SG eddy current examination techniques used during this inspection were equivalent to the EPRI Appendix H techniques listed in Table 4.1. Each technique was evaluated and determined to be applicable to the site conditions.

Table 4.1
EPRI Appendix H Techniques

EPRI Technique	Probe	Description
96004.2	Bobbin	Fan Bar/Lattice Grid/Foreign Object Wear and Free Span Flaws
96910.1	Plus-Point	Foreign Object Wear/Free Span Flaws
96509	Plus-Point	Dents/Dings – Primary Water Stress Corrosion Cracking (PWSCC)
96703.1	Plus-Point	Dents/Dings – PWSCC sizing
96402	Plus-Point	Dents/Dings – Outer Diameter Stress Corrosion Cracking (ODSCC)
96010	Bobbin	Manufacturing Burnish Marks

4.2 Steam Generator Inspection Scope

4.2.1 100% of the tubes in SG A were inspected full length (tube end to tube end) with a bobbin coil probe as described in Section 4.1.1 above.

4.2.2 Diagnostic examinations were planned for non-quantifiable indications and hot leg dents/dings greater than 5.0 volts that were detected by the bobbin coil examination. These special examinations are performed with the three coil plus-point probe described in Section 4.1.2 above. A total of 4 indications were inspected due to non-quantifiable signals detected during the bobbin coil inspection. See Section 5.1 for further detail. No hot leg dents or dings greater than 5.0 volts by the bobbin coil technique were detected.

4.3 Recording of Examination Data

Results of the SG eddy current data analysis were recorded on optical disks. The data was then loaded into a Westinghouse SG eddy current data management system. The system was used to track the completion of the examinations and was used to generate the final SG eddy current report summaries.

4.4 Witness and Verification of Examination

SG eddy current inspections were witnessed and/or verified by the Authorized Nuclear Inservice Inspectors, Mr. Jeff Hendricks and Mr. Robert Ward of the Hartford Steam Boiler Inspection and Insurance Company of Hartford Connecticut, Chicago Branch, 2443 Warrenville Road, Suite 500, Lisle, Illinois 60532-9871.

ASME Form NIS-1, "Owners Report for Inservice Inspections," is contained in Figure B.1.

5.0 EXAMINATION RESULTS

5.1 Eddy Current Inspection

Full length bobbin coil examination was performed on 100% of the tubes in SG A. No indication of tube degradation was found in any SG tube. Diagnostic plus-point examination was performed on SG tubes that contained non-quantifiable bobbin coil signals located in three tubes and one tube that contained a large expansion signal (see Table 5.1). The plus-point examination confirmed that the tubes did not contain any tube degradation.

Table 5.1
Diagnostic Plus Point Inspection

SG	Row	Column	Bobbin Result	Plus-Point Result	Location
A	74	37	BLG	NDF	TEC + 3.19"
A	108	43	ADI	NDF	2H + 15.98"
A	81	88	ADI	NDF	5H + 27.79"
A	52	131	ADI	NDF	2H + 25.56"

BLG – Bulge
ADI – Absolute Drift Indication
NDF – No Degradation Found
TEC – Tube End Cold Leg
2H, 5H – Hot Leg Lattice Grid

6.0 REPAIR SUMMARY

Since the SG eddy current and visual examinations resulted in no tube or component degradation, no tubes were plugged or repaired.

7.0 TUBE INTEGRITY ASSESSMENT SUMMARY

SG tube integrity assessments were performed to demonstrate that SG performance met the required structural integrity and leakage requirements for the previous operating period (i.e., condition monitoring) and for the next operating period (i.e., operational assessment).

There was no primary to secondary leakage detected during Cycle 10 or during plant shutdown for refueling outage B1R10.

7.1 Condition Monitoring/Operational Assessment

Since no degradation was found in the SG tubes during the SG inspections, there is no impact to any structural or leakage performance criteria. Therefore, SG structural and leakage performance criteria were maintained within the original design limits for the previous operational period. The only mode of degradation found in the industry with similarly designed replacement SGs has been mechanical wear associated with fan bars and lattice grids. The industry experience with this damage mechanism demonstrates that there is a high probability of detection for small wear flaws (i.e., <=10% Through Wall) and that the growths rates are also small (i.e., <5% Through Wall/cycle).

Based upon the absence of any degradation in the Byron Station Unit 1 SGs after 2 cycles of operation and the industry experience of detecting small indications with low growth rates, no indications are expected to be found during the next inspection that would challenge structural integrity, if degradation were to initiate. Therefore, this results in an acceptable operational assessment.

8.0 DOCUMENTATION

All original SG eddy current optical disks have been provided to ComEd and are maintained at Byron Station. The final data sheets and pertinent SG tube sheet plots are contained in the Westinghouse Final Outage Report for Byron Station Unit 1, B1R10, and are also maintained at Byron Station.

9.0 TABLES/FIGURES/ATTACHMENTS

Table A.1 Data Analysis Personnel Certifications
Table A.2 Data Acquisition Personnel Certifications

Figure A.1 Babcock & Wilcox Replacement Steam Generator Byron Unit 1 Configuration

Figure A.2 Byron Station Unit 1 Steam Generator Tubesheet Configuration

Figure B.1 ASME Form NIS-1, "Owners Report for Inservice Inspections

TABLE A.1
DATA ANALYSIS PERSONNEL CERTIFICATIONS

Name	Company	Level	QDA (Y/N)
Anderson, DA	NDE Technologies	IIA	Y
*Barnes, RM	Anatec	III	Y
Beiers, TS	NDE Technologies	III	Y
Case, JM	NDE Technologies	III	Y
Ives, DH	CoreStar	III	Y
McChesney, WD	CoreStar	III	Y
Nelson, DL	NDE Technologies	IIIA	Y
Popovich, RA	Westinghouse	III	Y
Robertson, RR	CoreStar	IIA	Y
Ruscitti, SF	NDE Technologies	IIA	Y
Skirpan, JR	CoreStar	IIA	Y
Stokke, TF	NDE Technologies	III	Y
Thulien, TA	CoreStar	IIA	Y
Visconti, CG	CoreStar	IIA	Y

* Independent Level III Qualified Data Analyst

Table A.2
DATA ACQUISITION PERSONNEL CERTIFICATIONS

Name	Company	Level	QDA (Y/N)
Evering, DP	Westinghouse	II	N
Hill, WW	Westinghouse	I	N
Kukic, FC	Westinghouse	I	N
Lorenzi, JP	Anatec	IIA	Y
Majoros, TP	Anatec	IIA	Y
Mardell, DM	Westinghouse	II	N
Parris, JR	Westinghouse	II	N
Traves, DJ	CoreStar	IIA	Y

FIGURE A.1

Babcock & Wilcox Replacement Steam Generator
Byron Unit 1 Configuration

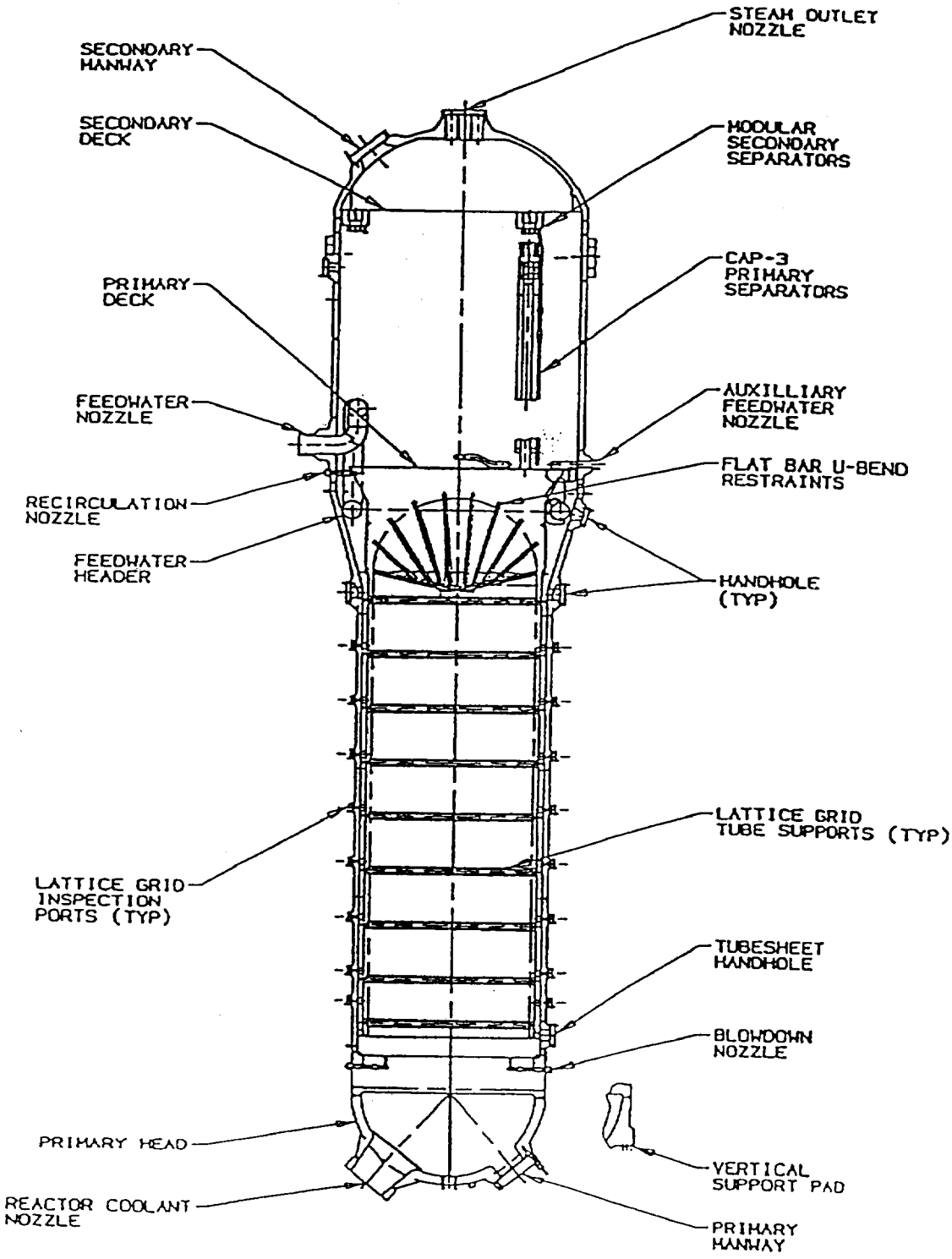

FIGURE A.2
Byron Unit 1 Steam Generator
Tubesheet Configuration (Typical)

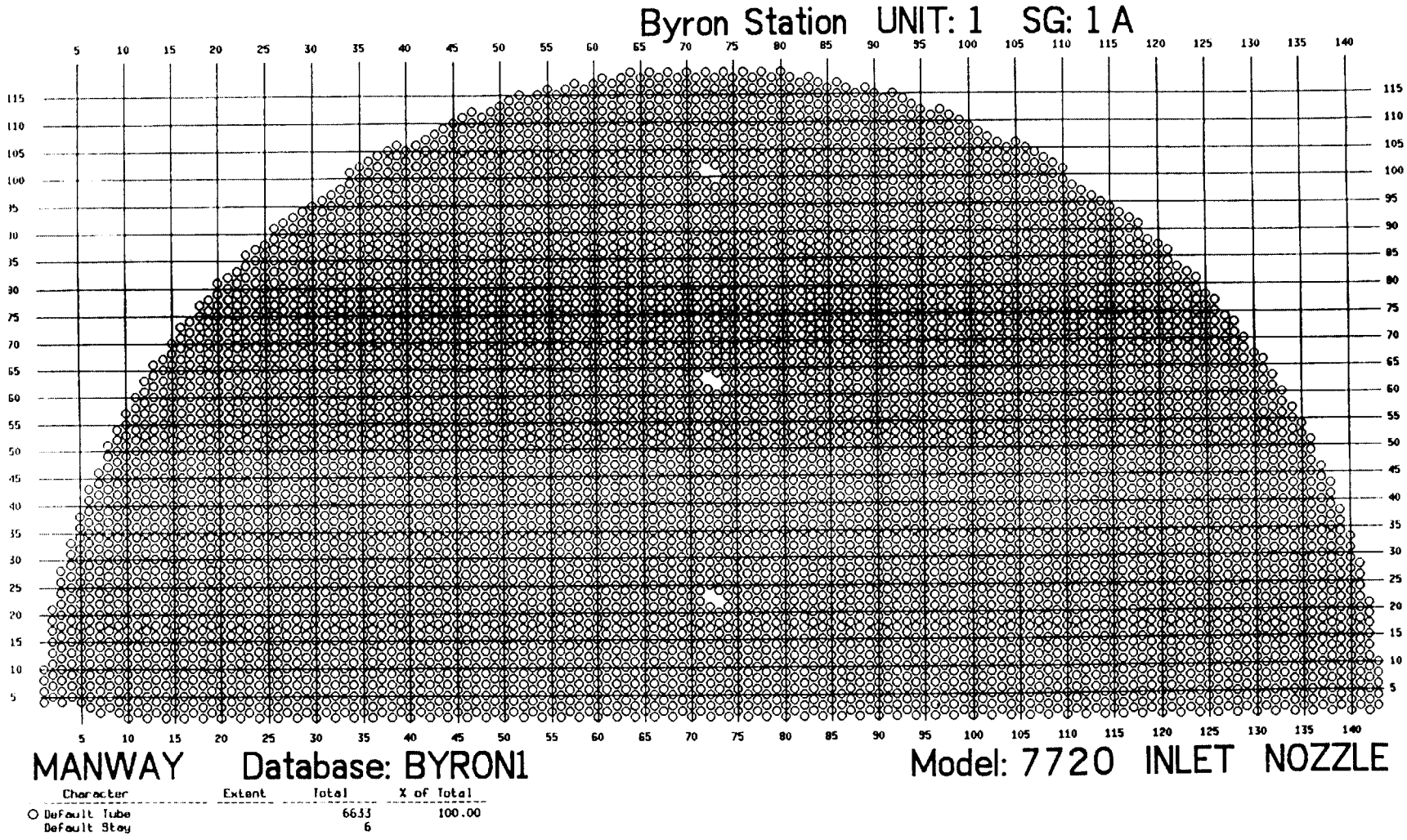

FIGURE B.1
FORM NIS-1 OWNER'S REPORT FOR INSERVICE INSPECTIONS
As Required by the Provisions of the ASME Code Rules

1. Owner: Commonwealth Edison P.O. Box 805379 Chicago, Illinois 60680-5379
(Name and Address of Owner)

2. Plant: Byron Station 4450 N. German Church Rd . Byron, Illinois 61010
(Name and Address of Plant)

3. Plant Unit: One (1)

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

5. Commercial Service Date: 09/16/85

6. National Board Number for Unit: N-198

7. Components Inspected: Steam Generator Eddy Current Inspection

Component or Appurtenance	Manufacturer or Installer	Manufacturer or Installer Serial No.	State or Province No.	National Board No.
1RC01BA	Babcock & Wilcox	7720-02	ILU-242904	165

FORM NIS-1 (Back)

8. Examination Dates 09/26/00 to 10/01/00 9. Inspection Interval from 6/30/96 to 9/16/05

10. Abstract of Examinations. Include a list of examinations and a statement concerning status of work required for current interval.

Refer to the Attached Steam Generator Eddy Current Report

11. Abstract of Conditions Noted

Refer to the Attached Steam Generator Eddy Current Report

12. Abstract of Corrective Measures Recommended and Taken

Refer to the Attached Steam Generator Eddy Current Report

We certify that the statements made in this report are correct and the examinations and corrective measures taken conform to the rules of the ASME Code, Section XI.

Certificate of Authorization No. (if applicable) Not Applicable Expiration Date Not Applicable

Date 12/19 20 00 Signed For Commonwealth Edison By

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 or Province of Illinois and employed by H.S.B.I & I Co. of Hartford, CT have inspected the components described in this Owner's Report during the period 9/26/00 to 10/1/00, and state that to the best of my knowledge and belief, the Owner has performed examinations and taken corrective measures described in this Owner's Report in accordance with the requirements of the ASME Code, Section XI.

By signing this certificate neither the Inspector nor his employer makes any warranty, expressed or implied, concerning the examinations 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 loss of any kind arising from or connected with this inspection.

J. X. [illegible] Commissions 166-1254

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

Date Dec. 19 20 00