UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
COMMONWEALTH EDISON COMPANY	)	Docket No. 50-454-OLA
	)	50-455-OLA
(Byron Station, Units 1 and 2)	)	

SUMMARY

The testimony of Mr. Nilratan Paul addresses the pre-service inspection performed by Ebasco Services, Inc. on the steam generator tubes for Unit 1 at Byron Station. It also indicates that a similar pre-service inspection will be performed at Unit 2 prior to operation. After detailing his qualifications as an expert, Mr. Paul describes the results of the 100% pre-service inspection for Unit 1. Two tubes were plugged. All other reportable indications, as required by Article IV-6000 of ASME Section XI, were considered insignificant.

Mr. Paul concludes that an eddy current testing baseline for Unit 1 was established successfully against which subsequent in-service eddy current testing inspections can be compared.

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TESTIMONY OF NILRATAN PAUL CONCERNING STEAM GENERATOR TUBE INTEGRITY (PRE-SERVICE INSPECTION)

Q.1. State your name, address and present occupation.

A.2. My name is Nilratan Paul. My business mailing address is c/o Ebasco Overseas Corporation, P.O. Box 1026 MCC, Makati, Metro Manila, Philippines. I am employed by Ebasco Services, Inc. as a Quality Assurance Engineer.

Q.2. State your educational background and professional work experience.

A.2. I passed Section A and Section B in Metallurgical Engineering from the Institution of Engineers (India) in 1964 and 1967, respectively. (This qualification is equivalent to a B.S. degree in metallurgical engineering.) I was also graduated from the University of Calcutta in 1957 with a B.S.

Degree in Science. I received six months advanced special training in non-destructive testing and other metallurgical quality controls at English Electric - AEI Turbine Generators, Ltd., Northern Ireland, U.K. I also received two weeks of training in eddy current testing by Zetec, including one week in data analysis (one week in Issaquah and one week in New York City).

I hold NDT certifications at a Level III in radiographic testing, ultrasonic testing, magnetic particle testing, liquid penetrant testing and eddy current testing.

I joined Ebasco Services, Inc. in 1974 and I have been promoted to progressively more responsible assignments: senior technician, 1974-78; associate engineer, 1979-80; senior associate engineer, 1980-81; engineer, 1981-1982; and senior engineer, 1983 to the present. I have about 24 years of experience in non-destructive testing and metallurgical quality control of components and materials used in nuclear fueled, fossil fueled and hydro electric power plants, as well as boilers and other heavy engineering industry. My responsibilities have included establishing a testing laboratory,

developing testing techniques, writing procedures, reviewing vendor testing procedures, and developing a training and certification program for nondestructive testing personnel.

I have worked on 8 projects in the U.S.A. involving the implementation of non-destructive testing programs.

Q.3. Was a pre-service inspection performed by Ebasco on the steam generator tubes for the Byron Station?

A.3. Yes, a pre-service inspection was performed on the tubes in the four steam generators in Unit 1 of the Byron Station. I understand that a similar pre-service inspection of Unit 2 will be performed prior to operation.

Q.4. What was the purpose for performing this pre-service inspection?

A.4. The purpose of performing the pre-service inspection was to establish a baseline against which subsequent in-service inspections can be compared.

Reg. Guide 1.83 allows use of fabrication shop examinations as an adequate baseline examination. Commonwealth Edison, however, elected to perform a

baseline examination in the field conducted under conditions and with equipment and techniques equivalent to those that are expected to be employed for subsequent in-service examinations.

Q.5. Were you involved in the pre-service inspection for Unit 1?

A.5. Yes, I was responsible for writing the testing procedures and interpretating the recorded eddy current test data.

Q.6. What written procedures did you establish for the pre-service inspection?

A.6. I prepared a written procedure entitled "Multi-frequency Eddy Current Examination of Westinghouse Steam Generator Tubing," which provided technique and equipment details for the inspection. In addition, the procedure included the following:

(a) personnel certification requirements;

(b) equipment calibration standards;

(c) examination preparation;

(d) set-up and step-by-step procedure for calibration of each of the four channels and the mix;

(e) examination procedure;

(f) analysis of data; and

(g) Reporting criteria.

This procedure meets the requirements set forth in the following documents:

(a) Appendix IV to ASME Section XI, 1977 up to and including Summer 1978 Addenda;

(b) ASME Section V, 1977, Winter 1979;

(c) Ebasco Services Incorporated procedure NDE-1, "Training, Examination and Certification of Nondestructive Examination Personnel"; and

(d) American Society for Nondestructive Testing document SNT-TC-1A, 1975 Edition.

In particular, this procedure incorporates the criteria for recording, evaluation and reporting of data in accordance with Article IV-6000 of ASME Section XI. This requires the reporting of tube wall penetrations in excess of 20% of the tube wall thickness and tube wall dents.

Q.7. Please describe the equipment used in the inspection.

A.7. The data was collected using a Zetec MIZ-12 system. This is a multi-frequency system of the time-sharing type. The eddy current signal is presented in two quadrature components for visualization and recording. The visual presentation of the indication is made on an oscilloscope and strip chart paper.

Permanent recording of indications is made on magnetic tape and strip chart paper. The 550 KHz differential mode was employed as the standard frequency complying with the requirements of the Code for the eddy current testing. Because flaw signals respond differently to different modes and frequencies, however, the following frequencies and the absolute mode were employed in addition to the Code-required frequency. The 140 KHz differential mode was used mainly for mixing with the 550 KHz differential mode to mix out interference from tube support plate signals in order to detect possible flaws under the tube support plates. The 10 KHz differential mode was employed mainly as a reference for future detection and measurement of possible sludge formation on the tube sheet.

The 100 KHz absolute mode was employed for easy recognition and better interpretation of certain types of indications.

Analysis of data recorded on magnetic tape was performed using a vector analyzing system. This system is employed to determine phase angles and to display lissajous patterns of flaw signals.

Q.8. What were the results of the inspection?

A.8. Based on performance of the Eddy Current Test in accordance with the written procedure and my analysis of the test data, an inspection baseline was established for Unit 1. The following items were noted and the information was furnished to Commonwealth Edison Company.

(a) Blocked Tubes.

Two tubes were found that would not allow the passage of the eddy current probe. They are as follows:

Steam Generator #1, Row 12 Column 2

The tube is blocked between #6 support on the hot leg side and #8 support on the cold leg side.

Steam Generator #2, Row 12 Column 113

The tube is blocked at the middle of the 'U' bend and at the #10 support on the cold leg side.

It is my understanding that Westinghouse has recommended that these two tubes be plugged.

(b) Dented Tubes.

A dent was found at support #1 of Row 25 Column 7, steam generator #4, which did not allow the passage of probes A610SF and A590SF; probe A540BF, however, went through. The diameter of this probe is 0.540" and the nominal inside diameter of the steam generator tubing is 0.664". It is my understanding that Westinghouse has concluded there is no need to plug the tube if a 0.540" probe will pass through the tube.

A number of tubes, especially in Row 1 of Steam Generator 1, were found to have processing-induced dents. These dents were considered less significant than the dent mentioned above because they allowed passage of a standard probe. Nonetheless, tube numbers with dent locations for each tube were noted in the final report. It is my understanding that Westinghouse has independently evaluated the data and determined that tubes with such dents are acceptable for plant operation. I would like to clarify that these processing-induced dents are not the same as corrosion-induced dents found during an in-service inspection.

(c) Uneven ID Wall.

Slight dimensional variations were detected in a number of tubes. This condition, sometimes known as ID chatter or ridging, is caused by the manufacturing process and appears as waviness on the tube surface. The waves are regularly spaced and the dimensional variations are generally well within the allowable dimensional tolerance of the tubing. Although the ASME Code considers such conditions as non-relevant and does not require them to be reported, this information was recorded in the final report.

(d) Permeability.

The Inconel tubing in the steam generator is nonmagnetic. However, in some cases magnetic particles occur on or in the tubing. Although these localized areas of magnetic material do not impair tube integrity, they are detected by the eddy current test as differences in magnetic permeability and result in indications. In general, the behavior of these signals at various frequencies differs from signals caused by other conditions and thus can be recognized by the data analyzer as permeability variations. Sometimes the condition is so

prevalent that the permeability signals can mask true defect signals. In such instances a special eddy current test probe is used. The special probe introduces a saturated magnetic field in the tube, thereby eliminating the local variation in permeability. In this inspection, especially in steam generator #4, a number of tubes were found to have indications of permeability. All the tubes with significant permeability were retested with the saturation probe. These re-testings revealed no indications other than those already discussed above.

(e) Tube Wall Penetration.

The ASME Code requires a tube with 20% or greater wall loss to be reported. No tube location was found with 20% or more wall loss. A few tubes were found with less than 20% OD wall loss; these were noted in the final report.

Q.9. Other than the items discussed in your testimony, did your inspection detect any other reportable indications?

A.9. No.