August 31, 1984

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
CAROLINA POWER & LIGHT COMPANY	)	Docket No. 50-400 OL
and NORTH CAROLINA EASTERN	)	
MUNICIPAL POWER AGENCY	)	
	)	
(Shearon Harris Nuclear Power	)	
Plant)	)	

APPLICANTS' TESTIMONY OF ROBERT W. PRUNTY, PETER M. YANDOW AND RICHARD B. MILLER IN RESPONSE TO EDDLEMAN CONTENTION 9A (ITT-BARTON TRANSMITTERS)

Q.1 Please state your names.

A.1 Robert W. Prunty, Peter M. Yandow and Richard B. Miller.

Q.2 Mr. Prunty and Mr. Yandow, are your addresses, occupations, employers, educational backgrounds and professional work experiences described elsewhere in the record of this proceeding?

A.2 (RWP, PMY) Yes, the relevant information is provided in "Applicants' Testimony of Robert W. Prunty and Peter M. Yandow in Response to Eddleman Contention 9 (Environmental Qualification of Electrical Equipment)."

Q.3 Mr. Miller, please state your address, present occupation and employer.

A.3 (RBM) I am a Principal Engineer with the Nuclear Safety Department of Westinghouse Electric Corporation, P.O. Box 355, Pittsburgh, PA 15230.

Q.4 State your educational background and professional work experience.

A.4 (RBM) I was graduated from the University of Delaware in 1967 with a Bachelor of Electrical Engineering degree and joined Westinghouse that year in the Field Service Department. After participating in resolving start-up problems at several plants, I transferred to the Engineering Department in 1970. While there, I had lead responsibility for the design and procurement of instrumentation systems and sensors, as well as being the interface between Nuclear Safety and Engineering

for licensing issues. I am the co-author of WCAP-8587, "Methodology for Qualifying Westinghouse WRD Supplied NSSS Safety Related Electrical Equipment," and several IEEE papers on the qualification of electrical equipment. I am the Secretary of the IEEE sub-committee on electrical equipment qualification (NPEC/SC-2) and am a registered Professional Engineer in the State of Pennsylvania. I have also been very active in establishing instrumentation setpoints consistent with safety analysis limits and plant and instrument characteristics and have co-authored a report detailing the methodology that is used for determining plant specific setpoints. I am presently the lead engineer in the Nuclear Safety Department responsible for electrical equipment qualification and am the primary interface on this subject with the NRC and Westinghouse customers.

Q.5 Please elaborate on your professional experience that is directly relevant to the testimony which you are presenting regarding ITT-Barton transmitters used at SHNPP.

A.5 (RBM) The primary emphasis of my job is to perform safety evaluations regarding identified electrical equipment deficiencies. I was very active in this effort regarding the ITT-Barton transmitter problems.

Q.6 What is the purpose of this testimony?

A.6 (RWP, PMY, RBM) The purpose of this testimony is to respond to Eddleman Contention 9A, which states:

> The proposed resolution and vendor's modification for ITT-Barton transmitters has not been shown to be adequate. (Ref. IE Information Notices 81-29, 82-52 and 83-72).

Q.7 How is your testimony organized?

A.7 (RWP, PMY, RBM) First, we provide background information on the ITT-Barton transmitters, including descriptions of the two types of transmitters of concern and their functions. Second, we discuss the concerns about ITT-Barton transmitters addressed in IE Information Notices 81-29, 82-52 and 83-72. We discuss the applicability of the Information Notices to SHNPP, the causes of the testing failures reported in the Information Notices, the safety significance of those failures, and the corrective actions taken by CP&L and Westinghouse.

Q.8 Mr. Yandow, please describe the ITT-Barton transmitters which are addressed in the IE Information Notices referenced in Eddleman Contention 9A.

A.8 (PMY) The transmitters addressed in the IE Information Notices are pressure-type transmitters. ITT-Barton pressure-type transmitters use either a Bourdon tube to measure pressure (see Figure 1, attached hereto), or a bellows assembly to measure differential pressure (see Figure 2, attached hereto), depending on the type of transmitter. In both types of transmitters, pressure changes cause mechanical movement of internal strain gauges, thereby varying the tension. The variation in tension causes changes in electrical resistance of the strain gauges, which is converted into an electrical output by the electronic circuitry of the transmitters.

Q.9 Please discuss IE Information Notice 81-29 as it relates to ITT-Barton transmitters.

A.9 (RBM) Equipment Qualification Notice No. 2, Test Summary Report No. 1 of IE Information Notice 81-29 (September 24, 1981) reported test failures which occurred during the initial qualification testing of ITT-Barton transmitters performed by Westinghouse. Two Model 764 differential pressure transmitters and one Model 763 pressure transmitter exhibited erratic behavior (fluctuating signal or step change in the output) during portions of the test sequence.

Q.10 What was the significance of these test failures?

A.10 (RBM) Significant unpredictable errors in the output of the transmitters were noted which could have resulted in safety analysis limits being exceeded. Subsequent testing and evaluation led to the conclusion that the erratic behavior would not occur until the product had been in use for at least five years.

Q.11 What was the cause of the test failures?

A.11 (RBM) As documented in Equipment Environmental Qualification Notice No. 2, Test Summary Report No. 2 of IE Information Notice 82-52 (December 21, 1982), all the failures resulted from degradation of contacts in the internal circuit connector assemblies of the transmitters.

Q.12 What did Westinghouse do to correct the problem?

A.12 (RBM) As a result of the investigation of the problem, Westinghouse and ITT-Barton determined that it could be corrected by soldering the connector assemblies. The modification was then successfully retested by both Westinghouse and ITT-Barton.

Q.13 Were the modification and the results of the retesting program reported to the NRC Staff?

A.13 (RBM) As indicated in IE Information Notice 82-52, Westinghouse submitted to the Staff a report which described the modification as well as the successful retesting. The Staff approved that test report. "Safety Evaluation Report of Westinghouse Equipment Qualification Documentation WCAP-8587, WCAP-8587 Supplement 1, WCAP-8687 Supplement 2, and WCAP-9714: Seismic and Environmental Qualification of Safety Related Electrical Equipment," (November 10, 1983).

Q.14 Are ITT-Barton Model 763 or 764 transmitters used at SHNPP?

A.14 (PMY) Yes, both Model 763 and 764 ITT-Barton transmitters are used at SHNPP. These transmitters are supplied by Westinghouse and ITT-Barton. As illustrated below, the transmitters are used to perform various safety functions at SHNPP.

Model	Function	Quantity
763	Reactor Coolant Pressure	1
763	Pressurizer Pressure	5
763	Steam Pressure	9
764	Pressurizer Level	3
764	Steam Generator Level	15
764	Steam Flow	6

These transmitters are located throughout the containment building.

Q.15 How did CP&L become aware of the problem with ITT-Barton Model 763 and Model 764 transmitters reported in IE Information Notice 81-29?

A.15 (RWP) CP&L, as the holder of a construction permit for SHNPP, receives IE Information Notices issued by the NRC. IE Information Notice 81-29 was received by CP&L's Nuclear Licensing Department and was distributed to the Harris Plant Engineering Section ("HPES") for evaluation. It was determined by HPES that the Information Notice was applicable to SHNPP.

Q.16 What was CP&L's response to the problem?

A.16 (RWP) Since Westinghouse and ITT-Barton still were investigating the problem, no corrective actions were taken at that time.

Subsequently, IE Information Notice 82-52 was issued, describing the failure mode and noting the modification and successful retesting. Upon receipt of a change notice from Westinghouse, CP&L sent the safety-related ITT-Barton Model 763 and Model 764 transmitters back to ITT-Barton to perform the modification discussed above. In addition, CP&L has reviewed the Westinghouse test report in order to confirm that the modification was adequate.

Q.17 Please discuss IE Information Notice 83-72 as it relates to ITT-Barton transmitters.

A.17 (RBM) IE Information Notice 83-72 (October 28, 1983) reported two additional problems with ITT-Barton transmitters. Equipment Environmental Qualification Notice No. 20, Test

Summary Report No. 1 of IE Information Notice 83-72 reported a negative shift (decrease) in output during initial exposure to a constant operating pressure. This defect occurred during testing by ITT-Barton of a suppressed zero (minimum measurement greater than zero) Model 763 pressure transmitter.

Equipment Environmental Qualification Notice No. 23, Test Summary Report No. 1 of IE Information Notice 83-72 addressed thermal nonrepeatability failures at 320HF of Model 763 and Model 764 transmitters during testing by ITT-Barton. Thermal nonrepeatability failure is the inability of an instrument to repeat a specified output, within allowable limits, when exposed to the same temperature and pressure to which it was initially calibrated.

Q.18 What was the cause of the negative shift in output of the Model 763 pressure transmitter?

A.18 (RBM) On the basis of further testing, ITT-Barton identified the cause to be combined creep in the link wire (between the pressure Bourdon tube and the strain-sensing beam) and in the material used to attach the link wire.

Q.19 Does this negative shift have any safety significance?

A.19 (RBM) No. The only Model 763 suppressed zero pressure transmitters used in safety-related applications at SHNPP are those used to measure pressurizer pressure. Pressurizer pressure provides an input to the overtemperature delta T set point calculation. It also provides reactor trip on high

pressure, and reactor trip and safety injection on low pressure. The effect of this negative shift on overtemperature delta T is minimal, and is also in the conservative direction. Similarly, the effect on low pressure trips is conservative. Credit in the safety analysis is taken for the high pressure trip on loss of load only, and this function would occur less than 0.5 seconds later than analyzed. Since this transient is not limiting, the acceptance criterion for overpressure protection is still met.

Q.20 What, if any, action has CP&L taken with respect to the negative shift problem?

A.20 (RWP) CP&L agrees that this is not a safety problem. However, CP&L will evaluate any modifications recommended when ITT-Barton's testing and evaluation are completed.

Q.21 What was the cause of the thermal nonrepeatability problem in Model 763 and Model 764 transmitters addressed in IE Information Notice 83-72?

A.21 (RBM) Based on a report of excessive errors at abnormal temperature conditions by one of their customers, ITT-Barton performed static temperature calibration checks on several transmitters. As a result of this investigation, ITT-Barton discovered excessive errors at both abnormal and accident temperature conditions and determined two separate causes.

One cause of the errors was ITT-Barton's calibration technique for temperature compensation, which was found to

result in previously unaccounted for errors at both abnormal and accident temperatures. This compensation technique resulted in an overall change in the specified accuracy that was assumed for these transmitters. As part of this calibration technique, the zero output (start point) of the transmitter was elevated in order to be able to observe negative errors. This procedure introduced false (previously unaccounted for) temperature errors which were then incorporated into the transmitter compensation. The transmitters were not checked at the elevated temperatures after the original zero was restored, and were therefore shipped with excessive temperature compensation. The evaluation conducted by ITT-Barton showed that the resultant error would always be in the positive direction.

During the investigation process, ITT-Barton also discovered an electrical leakage path through the wiper arm and shaft of the zero and span calibration potentiometers to the instrument case. The zero and span potentiometers are electrical resistors used to adjust the start point (zero) and total electrical output range (span) of the transmitter. This path only creates significant positive errors at high temperatures and is only of concern during accident conditions.

Q.22 What was the safety significance of the thermal nonrepeatability problem for the SHNPP?

A.22 (RBM) Based on static calibration data received from ITT-Barton on a sample of approximately eighty transmitters, Westinghouse has calculated expected error deviations and

evaluated the effect of any additional deviation on functions performed by these transmitters. Westinghouse notified those plants, including the SHNPP, where adequate margin did not exist for trip or actuation functions and changed the set points to provide adequate margin between the safety analysis limit and the set point. Therefore, there is no safety concern.

Q.23 What can be done to correct the nonrepeatability problem?

A.23 (RBM) The calibration technique problem can be corrected by checking the transmitters at the elevated temperature after restoration of the zero point. This problem can be corrected at the factory. ITT-Barton has also developed a hardware modification consisting of installation of a fiberglass insulator (washer) between the potentiometer shafts and the mounting brackets to interrupt the electrical leakage path through the potentiometers. Westinghouse and ITT-Barton have agreed that any transmitter returned to the factory for other repairs will also have the temperature compensation checked by the new procedure and the insulating washer installed.

Q.24 Has CP&L accepted this resolution?

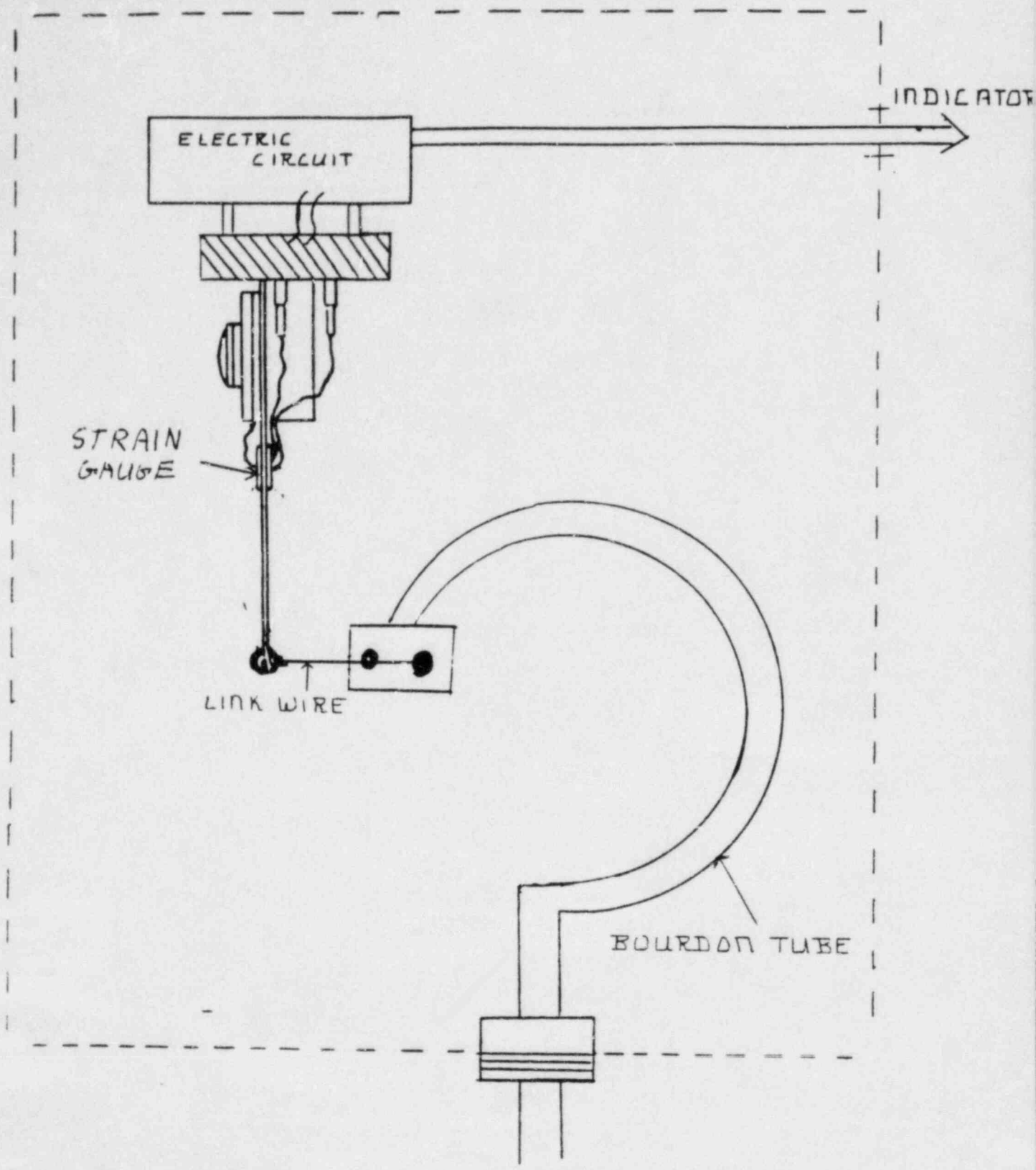
A.24 (RWP) Yes. CP&L has instructed ITT-Barton to perform the modifications on all transmitters returned to the factory for rework pursuant to IE Information Notices 81-29 and 82-52, as described above. The modifications provide additional margin for trip and actuation functions.

Q.25 In conclusion, do the resolutions recommended by Westinghouse and ITT-Barton for the Model 763 and Model 764 transmitters as accepted by CP&L adequately address for SHNPP the potential safety problems with those transmitters identified in IE Information Notices 81-29, 82-52 and 83-72?

A.25 (RWP, PMY, RBM) Yes.

PRESSURE TRANSMITTER

Figure 1



DIFFERENTIAL PRESSURE TRANSMITTER

Figure 2