UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In The Matter of	)	
	)	
	)	
COMMONWEALTH EDISON COMPANY	)	Docket Nos. 50-454 OL
	)	50-455 OL
	)	
(Byron Nuclear Power Station,	)	
Units 1 & 2)	)	

AFFIDAVIT OF LESLIE A. BOWEN

The attached questions and answers constitute my testimony in the above-captioned proceeding. The testimony is true and accurate to the best of my knowledge, information and belief.

Leslie A. Bowen

Leslie A. Bowen

Subscribed and sworn to
before me this 6th day
of June, 1982.

Notary Public

TESTIMONY OF LESLIE A. BOWEN

ON DAARE/SAFE CONTENTION 9a

Q. Please state your name, present position and present occupation.

A. My name is Leslie A. Bowen. I am employed by Commonwealth Edison Company as Lead Licensing Engineer in the Byron/Braidwood Project Engineering Department.

Q. Could you please describe your educational and professional background?

A. I received a Bachelor's Degree in Physics from Mount Holyoke College. I joined Commonwealth Edison in July 1974 as a training instructor in the Zion Station Training Department. After receiving a Senior Reactor Operator's License for Zion Units 1 and 2 in July 1976, I was appointed to the position of Shift Foreman. In July 1978, I was transferred to the position of Staff Assistant to Byron Lee, Jr., then Vice President. In February 1979, I was transferred to my present position.

Q. Describe your duties and responsibilities as Lead Licensing Engineer.

A. As Lead Licensing Engineer, my basic function is to ensure that issues that are raised during any portion of the licensing process by the NRC, by events that

occur at operating nuclear power plants or by contractors to Commonwealth Edison for the Byron Project that may impact the safety aspects of the design of the Byron Station are reviewed and evaluated. If safety significance is determined, I also ensure that responses to these issues are forwarded to the Nuclear Licensing Administrator for Byron for review and transmittal to the NRC or to other licensing bodies or for incorporation into the FSAR. In this capacity, I also ensure that any design changes necessitated by the evaluation of these issues are incorporated into the plant design.

Q. To which contention is this testimony addressed?

A. DAARE/SAFE Contention 9a.

Q. Have you reviewed the testimony of Robert Carlson pertaining to Contention 9a?

A. Yes, I have.

Q. Are you familiar with the water hammer event that occurred at the KRSKO plant?

A. Yes, I am. Westinghouse has informed us of this event by the attached letter.

Q. What actions has Commonwealth Edison Company taken with respect to the information and Westinghouse recommendations provided in the letter?

A. We performed an initial evaluation to determine the reportability, under 10 CFR 50.55(e), of the letter. We determined the information was not reportable for two reasons. The first reason pertains to differences between the KRSKO and Byron bypass system designs. The Byron design has a check valve upstream of the auxiliary nozzle which is not present in the KRSKO design in addition to check valves in the auxiliary feedwater and bypass system piping. Thus, backleakage would have to occur through two check valves for steam to enter the bypass system piping. Secondly, we determined that, contrary to the statement in the Westinghouse letter, Byron FSAR criteria allow for blowdown of two steam generators without adverse nuclear consequences. Thus, even if one postulates a bubble collapse water hammer in the main feedwater bypass line of damaging proportion with a main steam line break in another steam generator, Byron FSAR criteria would not be violated.

A. Are you aware of the recommendations proposed by Westinghouse in response to the KRSKO incident?

Q. Yes. Commonwealth Edison has evaluated these recommendations and believes that, for plant reliability purposes, the feedwater bypass system design should be modified so that the plant operator is made aware of

the potential existence of steam in the bypass system piping. This would permit action which would very significantly reduce the likelihood of bubble collapse water hammer events in the bypass system. Edison will install temperature sensors on the bypass system piping to detect backleakage of hot water or steam and the temperature measurements will be indicated and alarmed in the control room.

Q. Are the modifications you just described the same modifications recommended by Westinghouse?

A. In essence, yes. However, we are currently evaluating the possibility of placing the temperature sensors in a location other then the one recommended by Westinghouse. Nonetheless, any plant modifications to reduce the likelihood of a bubble collapse water hammer in the bypass system piping will be made only with the assurance from Westinghouse that the concerns raised by the KRSKO incident have been fully addressed.

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CBW-3193

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Electric Corporation

Water Reactor
Divisions

Nuclear Commercial
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Pittsburgh Pennsylvania 15230

November 4, 1981

S.O. NO: CAE/CCE- 4705

Mr. J. D. Deress
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COMMONWEALTH EDISON COMPANY
BYRON AND BRAIDWOOD STATION - UNITS 1 AND 2
AUXILIARY FEEDWATER/MAIN FEEDWATER BYPASS SYSTEM
STEAM BACKLEAKAGE

A recent incident during hot functional testing at a Westinghouse plant which damaged the auxiliary feedwater piping has raised a concern over backleakage of steam from the steam generator through the auxiliary feedwater nozzle on the preheat type steam generator into the main feedwater bypass line. This backleakage could occur if check valves in the auxiliary feedwater or main feedwater bypass system leak and the steam generator water level is below the point of discharge from the auxiliary nozzle in the steam generator. Should steam enter a horizontal portion of the line, restoring flow of cold feedwater could create a bubble collapse water hammer of damaging magnitude. The resulting damage could compromise the safety-related functions of the auxiliary feedwater system. Additionally, a water hammer in the auxiliary feedwater/main feedwater bypass system could allow more than one steam generator to blow down following an accident, in violation of SAR criteria.

Westinghouse has reviewed this issue for the Byron/Braidwood Plants, and concluded that it is potentially reportable under title 10CFR50.55(e). The licensee should determine reportability based on his own evaluation of the auxiliary feedwater/feedwater bypass system in his plant. Westinghouse will not notify the NRC of this issue.

Based on an evaluation of the aforementioned incident, Westinghouse has identified plant modifications which could be implemented to minimize the potential for this mechanism for bubble collapse water hammer in the auxiliary feedwater/main feedwater bypass system. Other approaches for minimizing the potential for this water hammer mechanism could be developed. Any approach should include a review of leak tightness/ inservice testing requirements for check valves in the auxiliary feedwater/

feedwater bypass systems. The Westinghouse proposed modifications, which consist of adding instrumentation and modifying operating procedures, are described in Attachment 1 to this letter.

If Westinghouse can be of further assistance in this matter, please contact the undersigned.

Very truly yours,

WESTINGHOUSE ELECTRIC CORPORATION

F.C. DiAgostino for

W. E. Kortier, Manager
Commonwealth Edison Projects

FCDiAgostino/dh

J. D. Deress, 2L

cc: W. C. Cleff, 2L

ATTACHMENT 1

WESTINGHOUSE RECOMMENDED MODIFICATIONS AUXILIARY FEEDWATER SYSTEM STEAM BACKLEAKAGE WATER HAMMER

To minimize the potential for the interaction of steam and cold water in the bypass/auxiliary feedwater piping as a result of steam backleakage into the piping from the steam generator due to leaking check valves, Westinghouse recommends temperature measurements upstream of the auxiliary feedwater nozzle, in the adjacent vertical section of piping connected to this upper nozzle, to detect any backleakage of steam. (1) These temperature measurements can be obtained from surfacemounted thermocouples or RTD's on the exterior pipe wall. A series of such temperature sensors mounted along the pipe can indicate the extent of any steam migration. The formation or backleakage of steam in this section of main feedwater bypass piping will be indicated by an increase in indicated temperature or by differences in temperatures from the sensors mounted along the same pipe. The temperature measurements should be indicated and alarmed in the Control Room.

Following are recommended procedures for monitoring the main feedwater bypass line temperature signals during plant heatup and cooldown, and power operation.

Plant Heatup and Cooldown

The temperature recorded by the bypass feedline mounted sensors should be no more than slightly above the ambient temperature while the plant is at hot zero power. Temperatures should be observed to drop when auxiliary feedwater is flowing through the line. The normal temperatures indicated by these sensors should be recorded during the first heatup after the sensors are installed. These temperature values can be used as a reference during future heatups.

The minimum steam temperature of concern will be 212°F (100°C) corresponding to steam at atmospheric pressure in the generator. During heatup, the bypass feedline mounted sensors should be monitored every 15 minutes. If the temperatures are observed to increase 20°F (11°C), or more, above the previously-determined reference (normal) value, this may be an indication of minor backleakage. In this case, continue with the heatup, but start one auxiliary feed pump and supply a minimum flow to the steam generator as required to maintain the surfacemounted sensor temperatures at approximately the reference normal values and at least below 180°F (82°C).

(1) Previously, theory and experiences had indicated a dependence of water hammer intensity on the length of horizontal piping adjacent to the nozzle. Therefore, Westinghouse had recommended the installation of a 90° elbow directed vertically downward as close to the steam generator as possible to limit the length of feedline which could drain when the steam generator water level could be below the nozzle.

If the temperature indicated by the bypass line sensors suddenly increases above 212°F (100°C) and approaches the saturation temperature of the steam in the generator, this may be an indication of significant backleakage. In this case, determine whether the steam generator water level has dropped below the top of the auxiliary feedwater discharge pipe in the generator.

If the water level has not dropped below this elevation, then initiate auxiliary feed at a minimum value as indicated above to restore normal auxiliary feedline temperature, and proceed to cold shutdown to investigate and correct the source of the backleakage. If the water level has dropped below the top of the discharge pipe, then it must be assumed that the main feedwater bypass line and the auxiliary feedline for the affected steam generator are steam filled and should be isolated. Proceed to cold shutdown using the unaffected steam generators for the cooldown. Start the auxiliary feed pump for the unaffected steam generators as a precaution against backleakage in these loops and verify that the water level in these generators is maintained above the top of the auxiliary feed discharge pipe. When cold shutdown conditions have been established, allow nitrogen or air into the steam-filled auxiliary feedline to prevent water hammer in the line, and correct the source of the backleakage.

The temperature alarm set up for heatup and cooldown and for operation at hot zero power should have a setpoint of 20°F (11°C) above the maximum normal temperature determined for the bypass feedline surface mounted sensors at these operating conditions.

Power Operation

During power operation, either main feedwater flow or tempering flow should always be passing through the auxiliary nozzle into the generator, and backleakage of steam from the generator into feedwater bypass line and auxiliary feedline is, therefore, very unlikely. The bypass feedline surface mounted sensors can be used to detect backleakage if flow to the auxiliary nozzle is interrupted by a lack of flow in the feedwater system. If the temperature recorded by the surface mounted sensors is observed to increase by 20°F (11°C), or more, above the maximum feedwater temperature, this may be an indication of backleakage. Slowly restore flow to the affected feedline to reduce the temperature of the line. If the feedwater temperature is below 250°F (121°C), and the steam generator level is observed to have dropped below the top of the auxiliary feedwater discharge pipe, do not restore flow to the affected auxiliary line, but, rather, proceed to cold shutdown, following the same precautions as are outlined above in the procedure for dealing with backleakage during heatup and cooldown or hot-zero-power operation.