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JOSEPH A. TIERNAN
VICE PRESIDENT
NUCLEAR ENERGY

July 5, 1988

U. S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318
Response to NRC Bulletin 88-04; Potential Safety-Related Pump Loss

REFERENCE: (a) NRC Bulletin No. 88-04; Potential Safety-Related Pump Loss

Gentlemen:

The attachment to this letter provides the information you requested in Reference (a).

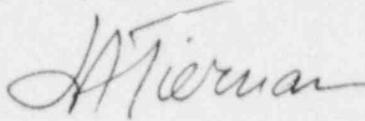
Based on our investigation into your concerns regarding miniflow design, we have determined that the current Calvert Cliffs design and operation (upon completion of noted action items) provide adequate flow.

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Should you have any further questions regarding this matter, we will be pleased to discuss them with you.

Very truly yours,



STATE OF MARYLAND :
City of Baltimore : TO WIT:

I hereby certify that on the 5th day of July, 1988, before me, the subscriber, a Notary Public of the State of Maryland in and for Baltimore City, personally appeared Joseph A. Tiernan, being duly sworn, and states that he is Vice President of the Baltimore Gas and Electric Company, a corporation of the State of Maryland; that he provides the foregoing response for the purposes therein set forth; that the statements made are true and correct to the best of his knowledge, information, and belief; and that he was authorized to provide the response on behalf of said Corporation.

WITNESS my Hand and Notarial Seal:


Notary Public

My Commission Expires:

July 4, 1990
Date

JAT/GLB/WCH/dlm

Attachment

- cc: D. A. Brune, Esquire
J. E. Silberg, Esquire
R. A. Capra, NRC
S. A. McNeil, NRC
W. T. Russell, NRC
D. C. Trimble, NRC
T. Magette, DNR

ATTACHMENT (1)

RESPONSE to NRC BULLETIN 88-04 POTENTIAL SAFETY-RELATED PUMP LOSS

Response to Bulletin Action Items

ITEM 1

NRC Request

Determine the existence of any safety-related system with a configuration which could allow for dead-heading or inadequate miniflow for pumps.

BG&E Response

Calvert Cliffs Nuclear Power Plant has two systems with pump recirculation lines sharing common return headers. These systems are the Auxiliary Feedwater (AFW) and Emergency Core Cooling (ECCS) Systems. Both of these systems were designed to operate with this configuration and therefore, there are no adverse consequences when all pumps are simultaneously operating during miniflow conditions. Specific discussion is as follows:

A. Auxiliary Feedwater System

Each of the units has two Steam-Driven Auxiliary Feedwater Pumps (SDAFWP) and one Motor-Driven Auxiliary Feedwater Pump (MDAFWP). One SDAFWP is placed in stand-by by manually isolating its turbine steam supply, thus only two pumps automatically start when an Auxiliary Feedwater Actuation Signal is received. Both pumps deliver flow to two discharge legs where all flow control valves fail open. The pumps are sized to allow flow delivery to the steam generators at any pressure. Thus, the probability of these pumps being in a condition of having only miniflow during automatic operation is very low. Nevertheless, in order to allow for operational flexibility and provide a prudent design, each pump was supplied with a miniflow recirculation line.

The SDAFWP recirculation for each pump is controlled by flow restriction orifices located between the pump and the common return header. The MDAFWP recirculation is controlled by a combination of an orificed recirculation valve and an orifice. The MDAFWPs were added as part of our response to the Bulletins and Orders Task Force Recommendations. The MDAFWP recirculation lines were tied into their respective unit's SDAFWP recirculation lines, with restriction orifice sizing design being based on simultaneous pump operation. Both units' recirculation lines tie together with a common run prior to entering the Condensate Storage Tank.

In response to this Bulletin, a confirmatory analysis was performed to re-verify the original design. This analysis factored in actual pump performance, ASME Section XI tolerances, gauge accuracy and running all four pumps (two from each unit) simultaneously. This analysis demonstrated that the original design was correct; i.e., there is adequate miniflow to protect the pumps under all operating conditions.

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During a recent disassembly of a SDAFWP, no damage due to internal flow recirculation was detected.

B. Emergency Core Cooling System

Each of the units has three High Pressure Safety Injection (HPSI) pumps (a maximum of two will automatically start), two Low Pressure Safety Injection (LPSI) pumps and two Containment Spray (CS) pumps. All of the individual pumps' miniflow recirculation lines tie together into a common header back to the Refueling Water Tank (RWT). During initial design, the Nuclear Steam Supply System vendor sized an individual restriction orifice for each pump according to its miniflow requirements. They provided the architect engineer with a maximum miniflow recirculation line pressure loss. A confirmatory analysis was performed to demonstrate that with all pumps running simultaneously, the flow orifices would be the determining factor for individual pump flow rather than the piping pressure losses.

C. Conclusions

Based upon our research and confirmatory analyses, we have determined that the original Calvert Cliffs design properly factored in the effects of simultaneous pump operation. During miniflow operation all AFW and ECCS Pumps will have adequate flow.

ITEM 2

NRC Request

Evaluate system flow if the condition described in Item 1 exists.

BG&E Response

Not applicable.

ITEM 3

NRC Request

Evaluate the adequacy of the minimum flow bypass lines for safety-related centrifugal pumps with respect to damage resulting from operation and testing in the minimum flow mode.

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RESPONSE to NRC BULLETIN 88-04 POTENTIAL SAFETY-RELATED PUMP LOSS

BG&E Response

The following is a list of all safety-related pumps with a discussion of the adequacy of their miniflow bypass lines.

A. High Pressure Safety Injection Pumps

The pump supplier has verified the adequacy of the original miniflow design value.

B. Low Pressure Safety Injection Pumps

The pump supplier has recommended monitoring vibration levels during miniflow conditions. This is accomplished as part of our ASME Section XI pump monitoring program. No augmented pump inspection is required if vibration levels remain unchanged. With acceptable stable vibration levels at the miniflow level, performance and reliability will be acceptable. The inlet velocity is relatively low and the impeller material is stainless steel, therefore, any resulting damage due to recirculation is expected to be negligible.

C. Containment Spray Pumps

The pump supplier did not recommend any changes in miniflow quantity. They provided an inspection interval based on calendar time and cumulative time in low flow operation. Based on the small amount of time the pumps are operated in miniflow conditions, we are implementing a calendar-based inspection requirement into our Preventive Maintenance Program.

D. Steam-Driven Auxiliary Feedwater Pumps

Same response as for CS Pump.

E. Motor-Driven Auxiliary Feedwater Pumps

These pumps were installed with adequate miniflow capacity.

F. Saltwater Pumps

There is no miniflow line installed. However, since we have noted that operation at low flow results in a recirculation condition, operating controls are being revised to ensure adequate minimum flow. Even so, during shutdown operation, it may not be possible to maintain the required flow. We will be working with the pump supplier to determine any augmented maintenance inspection requirements.

G. Service Water Pumps

There is no miniflow line installed. We are reviewing our Operating Instructions and will revise them as necessary to ensure adequate flow through the pump.

ATTACHMENT (I)

RESPONSE to NRC BULLETIN 88-04 POTENTIAL SAFETY-RELATED PUMP LOSS

H. Component Cooling Water Pumps

There is no miniflow line installed. Minimum plant heat loads ensure that adequate flow will be delivered by the pump.

I. Spent Fuel Cooling Pumps

These are 100 hp pumps. An article published in Power and Fluids, Worthington Group, 1982, Volume 8, Number 2, "Flow Recirculation in Centrifugal Pumps", and training material provided by a pump vendor, indicates that the energy levels are not sufficient to cause damage or operational problems even though the pumps are operated in the recirculation zone. These pumps were provided with an orificed miniflow line back to their respective suction lines. Based on the low susceptibility to recirculation damage, evaluation of miniflow capacity was not necessary.

J. Boric Acid Pumps

These are 25 hp pumps. They were installed with independent miniflow recirculation lines back to their respective Boric Acid Storage Tanks. Based on the discussion for the Spent Fuel Cooling Pumps, evaluation of miniflow capacity was not necessary.

ITEM 4

NRC Request

Within 60 days of the receipt of the Bulletin, provide a written response to the requested information.

BG&E Response

The information requested by this item is provided by our response to Items 1, 2, 3, 5 and 6, except for the implementation of the following. All actions will be completed by December 31, 1988. Based upon the information provided, justification for continued operation is not necessary.

A. Containment Spray Pumps

The pump Preventive Maintenance instructions will be modified to reflect the augmented inspection.

B. Steam-Driven Auxiliary Feedwater Pumps

The pump Preventive Maintenance instructions will be modified to reflect the augmented inspection.

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POTENTIAL SAFETY-RELATED PUMP LOSS

C. Saltwater Pumps

Vendor recommendations will be finalized and implemented as appropriate and operating instructions will be modified as necessary.

D. Service Water Pumps

Changes to Operating Instructions for maintaining minimum flow will be finalized.

ITEM 5

NRC Request

Within 30 days of the completion of the long-term actions, provide a written response describing the actions taken.

BG&E Response

Not applicable.

ITEM 6

NRC Request

An evaluation of your actions in response to this Bulletin should be documented and maintained at the plant site for a minimum of two years.

BG&E Response

Our evaluation in response to this Bulletin will be documented and maintained at Calvert Cliffs for a minimum period of two years.