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JOSEPH A. TIERNAN
VICE PRESIDENT
NUCLEAR ENERGY

September 29, 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
NRC Bulletin 88-08; Thermal Stresses in Piping Connected To Reactor Coolant Systems

Gentlemen:

The purpose of this letter is to provide a response to NRC Bulletin 88-08. The review requested in Action #1 of the Bulletin is complete. The results of the review and a discussion addressing Action #2 and Action #3 of the Bulletin are included in Enclosure (1).

The review supplemented an evaluation of our pressurizer surge and spray lines which was already underway as part of a Combustion Engineering Owners Group (CEOG)-identified activity. The response in Enclosure (1) consolidates our findings from both efforts.

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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,

GC Creel/dr

J. A. Tiernan
Vice President
Nuclear Energy

STATE OF MARYLAND :
: TO WIT:
CITY OF BALTIMORE :

I hereby certify that on the 29th day of September, 1988, before me, the subscriber, a Notary Public of the State of Maryland in and for City of Baltimore, personally appeared George C. Creel, 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:

Minnie L. Johnson
Notary Public

My Commission Expires:

July 1, 1990
Date

JAT/DLS/KBC/dlm

Enclosure

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

ENCLOSURE (1)

RESPONSE TO NRC BULLETIN 88-08

Action #1

Action #1 requested that we review systems connected to the Reactor Coolant System (RCS) to determine whether unisolable sections of piping connected to the RCS can be subjected to stresses from temperature stratification or temperature oscillations that could be induced by leaking valves and that were not evaluated in the design analysis of the piping.

Results

We have reviewed the following RCS penetrations: Refueling Water Level Indication System, Reactor Vessel Gas Vent System, drain lines, instrument taps, ICI nozzles, reactor coolant pump (RCP) seal lines, PORVs, SRVs, pressurizer spray lines, pressurizer surge lines, safety injection and shutdown cooling lines, and the CVCS connections.

We have identified four areas of potential concern: the pressurizer main spray line, the pressurizer surge line, the PORV piping, and the safety injection system penetrations.

Our review indicates that we do not have any potentially significant thermal stresses that could be caused by leaking valves that separate the RCS from other systems. The only flow path for flow to the RCS caused by leaking valves is the charging pump discharge flow through the auxiliary HPSI header to the RCS. This flow path is addressed in the discussion of Safety Injection System Penetrations, and is determined not to be of concern.

A discussion of our review results for the four areas of potential concern is provided below.

The Pressurizer Main Spray Line - The upper portion of the spray system consists principally of a horizontal section of piping leading to the pressurizer spray nozzle. During plant heatups and cooldowns, when less than four RCPs are operating, the normal bypass spray flowrate may be insufficient to maintain this uppermost horizontal section of spray piping full of liquid. During this potential low flow condition, pressurizer steam will fill the upper part of the spray piping, with cooler liquid flowing in the lower half, resulting in a diametrical temperature difference across the pipe.

While stratified flow conditions were detected during plant heatups, as part of our ongoing monitoring program, no known fatigue cracking has been detected in the pressurizer spray piping. Further evaluation of stratified flow loading conditions in the Pressurizer Main Spray Line is being considered by the Combustion Engineering Owners Group (CEOG).

The Pressurizer Surge Line connects the bottom of the pressurizer to the hot leg primary piping. Due to the generally horizontal nature of the surge line routing and the low flow rate (2 to 5 gpm) conditions, the surge line piping and nozzles may be subjected to stratified flow loading conditions. Although further definition of actual in-plant thermal loadings would be needed to perform a realistic fatigue evaluation, no

known fatigue cracking in surge line piping has been confirmed. Ongoing CEOG activities intend to resolve potential concerns associated with flow stratification in CEOG plant surge lines.

The Power Operated Relief Valves (PORVs) are connected to the pressurizer by a vertical line coming off the top of the pressurizer leading to horizontal runs of 4" piping. These lines are filled with steam that could condense and settle in the bottom of the lines. Condensing steam could then be replaced by pressurizer steam while the condensate along the bottom of the pipes would either pool or drain back to the pressurizer. In either case, the resultant steam to water interface could result in top to bottom temperature gradients. Although there have been no known cracks in PORV piping to date, further monitoring and evaluation of actual in-plant conditions would be required to determine the existence and effects of thermal stratification-induced fatigue on the piping.

The Safety Injection System Penetration piping taps off the top of the respective cold leg at approximately a 60° angle from horizontal and then makes a horizontal run to the safety injection check valve. Due to the geometry of this piping, heat transfer occurs quickly as the distance from the RCS increases toward the safety injection check valve, such that fluid temperature in the pipe is expected to approach containment ambient before reaching the check valve. As the fluid cools it would tend to settle to the bottom of the pipe and drain back into the RCS. This volume would be replaced by warmer RCS fluid which would rise up the 60° inclined section into the horizontal run. Thus, a steady state natural convection loop could be initiated which would allow warmer water to flow along the top of the pipe, away from the RCS, and cooler water to flow along the bottom back towards the RCS. This flow could result in bending stresses on the pipe and, possibly, additional stresses in the safety injection nozzle. The potential thermal distributions would need to be more accurately defined before a conclusive fatigue evaluation could be performed. No known fatigue failures in this piping due to thermal stresses have been identified in any Combustion Engineering plant to the best of our knowledge.

In addition to the potential for the above scenario, the safety injection flow path could allow cool liquid from the charging system to enter the RCS through the safety injection check valves if the charging system to safety injection system isolation valves were to leak. However, an existing alarm function would indicate that pressure between the check valves is increasing, possibly due to leaking charging flow. The operators are directed to vent the line to the reactor coolant drain tank upon receiving the alarm. This action would eliminate the possibility of RCS in-leakage because the alarm setpoint is well below RCS operating pressure.

Summary

We do not have any unisolable sections of piping connected to the RCS that can be subjected to stresses that could be induced by leaking valves as stated in Action Item #1 to NRC Bulletin 88-08. Therefore, Action Items #2 and #3 are not applicable. However, we do recognize that flow stratification for reasons other than leaking valves may exist that could cause thermal stresses in some lines. This issue is the subject of an ongoing evaluation being conducted through the CEOG.