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BGE

*A Member of the*
*Constellation Energy Group*

May 19, 2000

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 Request for Additional Information: Relief Request PR-11 Low Pressure Safety Injection Pumps

**REFERENCES:**

(a) Letter from Mr. C. H. Cruse (BGE) to NRC Document Control Desk, dated December 30, 1999, "Revised and New Relief Requests for the Third Ten-Year Inservice Test Program"

(b) Telephone Conference between Mr. J. Colaccino (NRC) and Mr. J. M. Osborne et al. (BGE), on March 21, 2000, "Request for Additional Information Regarding the Revised and New Relief Requests for the Third Ten-Year Inservice Test Program dated December 30, 1999"

(c) Telephone Conference between Mr. J. A. W. Dromerick, et al. (NRC) and Mr. J. M. Osborne et al. (BGE), on April 10, 2000, "Request for Additional Information: Relief Request PR-11 Low Pressure Safety Injection Pumps"

Reference (a) forwarded a request from Baltimore Gas and Electric Company for your review of three revised relief requests. During Reference (b), various issues with each of these requests were discussed and clarified. During Reference (c), you requested additional information regarding Relief Request PR-11. This request is associated with elevated vibration levels of low pressure safety injection pumps which are caused by minimum flow phenomena. Attachment (1) provides our response to the questions posed in Reference (c).

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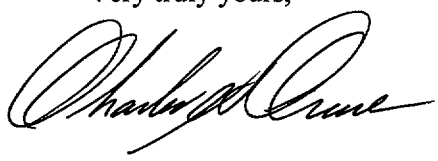
Should you have questions regarding this matter, we will be pleased to discuss them with you.

Very truly yours,



CHC/JMO/bjd

Attachment: (1) Response to Request for Additional Information: Relief Request PR-11, Low Pressure Safety Injection Pumps

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# ATTACHMENT (1)

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION:

## RELIEF REQUEST PR - 11

## LOW PRESSURE SAFETY INJECTION PUMPS

**Baltimore Gas and Electric Company**
**Calvert Cliffs Nuclear Power Plant**
**May 19, 2000**

## ATTACHMENT (1)

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION: RELIEF REQUEST PR-11, LOW PRESSURE SAFETY INJECTION PUMPS

**Question 1:**

Please confirm that it is Calvert Cliffs' intention not to use the vibration ranges proposed in PR-11 to revise the Alert Ranges when low pressure safety injection (LPSI) pump vibration levels degrade.

**RESPONSE:**

Revising any acceptance criteria solely to accommodate changes in parameters that occur due to degradation is contrary to the requirements that are already included in the American Society of Mechanical Engineers Code. Specifically, reference values are supposed to represent a baseline value for the measured parameter when the component is "known to be operating acceptably." Therefore, we will not intentionally revise a reference value (and the associated acceptance criteria) simply to avoid corrective action. We would consider this type of action unacceptable and contrary to the spirit and intent of the Code.

Furthermore, the higher vibration Alert Ranges proposed in PR-11 are not intended to permit "high" low-flow LPSI pump vibration reference values that occur for any reason. These ranges are only intended for use when the cause of any "high" vibration levels can be confirmed as being due to testing these centrifugal pumps at low-flow conditions. Our expectation is the high vibration levels that might occur during low-flow testing of these pumps due to other reasons, particularly bearing degradation, will be investigated and appropriately resolved.

**Question 2:**

Please identify the specific bearings/orthogonal directions for which relief is required. In other words, which bearings/orthogonal directions have either exceeded and/or challenged the Code Alert level of 0.325 inches.

**RESPONSE:**

For the reasons discussed below, we are requesting relief for the following bearings/orthogonal directions:

1. those that regularly exceed the 0.325 inches alert level (Table 5 below); and,
2. those that periodically exceed or regularly challenge the 0.325 inches alert level (Table 6 below).

Calvert Cliffs has invested significant time and effort into collecting and evaluating supporting data in order to thoroughly understand the effects of low-flow operation on centrifugal pumps. Our experience has shown that the vibration level due to the effects of low-flow operation are relatively stable.

As shown in the tables below, we have also seen that maintenance can cause these baseline vibration levels to change. Even minor changes in the alignment between the pump and its motor or the pump and its discharge piping can effect these baseline levels. Spectral analysis of the post-maintenance test results confirms that the changes in baseline vibration levels are still associated with the effects of low-flow operation. Therefore, it is our assessment that these changes occur because the unbalanced forces that occur during low-flow operation are effected by the stresses applied to the pump and its casing. Our data shows that once a new baseline is established, the vibration levels due to low-flow operation again

became relatively stable. Furthermore, there is a significantly less pronounced effect of these minor alignment changes on the baseline vibration levels at full-flow.

Because maintenance can have an unpredictable impact on vibration readings, PR-11 was originally submitted to seek "generic" relief for all the LPSI pump bearings/orthogonal directions. Most have either exceeded or challenged the Code Alert level of 0.325 inches. However, some of the bearing measurements on the following list have not had a long-term history of exceeding or challenging the Code Alert level of 0.325 inches. Some bearing measurements that previously were considered to be relatively low either exceeded or challenged the Code Alert level of 0.325 inches after major maintenance on the affected pump. Note that prior to maintenance, spectral analysis did show the impact on vibration due to low-flow operation. Therefore, we are concerned that any bearings/orthogonal directions for which relief is not granted may require an additional relief request in the future. As stated above, our intent is not to use PR-11 to accept "high" bearing vibration levels at low-flow operation that occur for reasons other than those due to the effects of low-flow operation.

Calvert Cliffs does not consider it critical that the pump inboard axial (PIA) vibration measurements be included since the force imbalances associated with low-flow operation act on the impeller and shaft in a radial direction. As a result, it is not considered as likely that the PIA measurements would change significantly following any foreseeable maintenance activity.

The following four tables (Tables 1-4) provide examples of the actual impact of maintenance on vibration measurements for LPSI pumps 11, 12, 21 & 22:

**Table 1**
**Effects of Maintenance: 11 LPSI Pump**

| | | |
|---|---|---|
| Prior to 5/1998 (inches) | PIH: 0.28 – 0.33 | PIV: 0.35 – 0.39 |
| After 5/1998 Check Valve Replacement (inches) | PIH: 0.21 – 0.25 | PIV: 0.47 – 0.57 |
| After 4/2000 Motor Replacement (inches) | PIH: 0.49 | PIV: 0.46 |

**Table 2**
**Effects of Maintenance: 12 LPSI Pump**

| | | |
|---|---|---|
| Prior to 5/98 (inches) | PIH: 0.25 – 0.31 | POV: 0.20 – 0.24 |
| After 5/98 Check Valve Replacement (inches) | PIH: 0.29 – 0.42 | POV: 0.25 – 0.32 |

**Table 3**
**Effects of Maintenance: 21 LPSI Pump**

| | | | |
|---|---|---|---|
| Prior to 4/99 (inches) | PIH: 0.20 – 0.25 | PIV: 0.37 – 0.43 | POV: 0.21 – 0.24 |
| After 4/99 Check Valve Replacement (inches) | PIH: 0.22 – 0.34 | PIV: 0.43 – 0.53 | POV: 0.29 – 0.34 |

**Table 4**
**Effects of Maintenance: 22 LPSI Pump**

| | | |
|---|---|---|
| Prior to 4/99 (inches) | PIH: 0.23 – 0.30 | POV: 0.16 – 0.20 |
| After 4/99 Check Valve Replacement (inches) | PIH: 0.18 – 0.25 | POV: 0.27 – 0.35 |

The following tables (Tables 5 and 6) are the specific bearings/orthogonal directions which we are requesting relief for. Table 5 lists those bearings/orthogonal directions that regularly exceed the 0.325 inches alert level. Table 6 lists those bearings/orthogonal directions that periodically exceed or regularly challenge the 0.325 inches alert level.

**Table 5**
**Bearings/Orthogonal Directions that Regularly Exceed 0.325 inches**

| LPSI Pump | Bearing | Orthogonal Direction | Abbreviation | Typical Vibration Value/Range (inches) |
|---|---|---|---|---|
| 11 | Pump Inboard | Horizontal | 11 PIH | 0.49 |
| 11 | Pump Inboard | Vertical | 11 PIV | 0.46 |
| 12 | Pump Inboard | Horizontal | 12 PIH | 0.29 – 0.42 |
| 12 | Pump Inboard | Vertical | 12 PIV | 0.37 – 0.44 |
| 21 | Pump Inboard | Vertical | 21 PIV | 0.43 – 0.53 |
| 21 | Pump Outboard | Vertical | 21 POV | 0.29 – 0.34 |
| 22 | Pump Inboard | Vertical | 22 PIV | 0.29 – 0.37 |
| 22 | Pump Outboard | Vertical | 22 POV | 0.27 – 0.35 |

**Table 6**
**Bearings/Orthogonal Directions that Periodically Exceeds or Regularly Challenges 0.325 inches**

| LPSI Pump | Bearing | Orthogonal Direction | Abbreviation | Typical Vibration Value/Range (inches) |
|---|---|---|---|---|
| 11 | Pump Outboard | Vertical | 11 POV | 0.28 – 0.34 |
| 12 | Pump Outboard | Vertical | 12 POV | 0.25 – 0.32 |
| 21 | Pump Inboard | Horizontal | 21 PIH | 0.22 – 0.34 |
| 22 | Pump Inboard | Horizontal | 22 PIH | 0.18 – 0.25 |

Relief is not requested for the bearings/orthogonal directions in Table 7. They have neither exceeded nor challenged the Alert Level of 0.325 inches. They are only included in this response for completeness. Please note that based on the impact of maintenance discussion above, we may need relief for the bearings/orthogonal directions listed below at some future time.

**Table 7**
**Bearings/Orthogonal Directions not Requiring Relief**

| LPSI Pump | Bearing | Orthogonal Direction | Abbreviation | Typical Vibration Value/Range (inches) |
|---|---|---|---|---|
| 11 | Pump Outboard | Horizontal | 11 POH | 0.10 – 0.14 |
| 11 | Pump Outboard | Axial | 11 POA | 0.09 – 0.13 |
| 12 | Pump Outboard | Horizontal | 12 POA | 0.09 – 0.13 |
| 12 | Pump Outboard | Axial | 12 POA | 0.07 – 0.09 |
| 21 | Pump Outboard | Horizontal | 21 POH | 0.08 – 0.12 |
| 21 | Pump Outboard | Axial | 21 POA | 0.07 – 0.09 |
| 22 | Pump Outboard | Horizontal | 22 POH | 0.08 – 0.10 |
| 22 | Pump Outboard | Axial | 22 POA | 0.08 – 0.11 |