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A Member of the Constellation Energy Group

December 30, 1999

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
Revised and New Relief Requests for the Third Ten Year Inservice Test Program

The purpose of this letter is to forward for your review one revised relief request Pump Relief (PR)-05 and two new relief requests [PR-11 and Valve Relief (VR)-14]. Relief request PR-05 is associated with the frequency response of vibration measurement equipment for charging pumps. Relief request PR-11 is associated with elevated vibration levels of low pressure safety injection pumps which are caused by minimum flow phenomena. Relief request VR-14 is necessary because following our initial (for inservice test purposes) hands-on inspection of vacuum breaker valves, we concluded they are more appropriately classified as check valves and not as relief valves. As recommended by Generic Letter 89-04, "Guidance on Developing Acceptable Inservice Testing Programs" and NUREG-1482, "Guidelines for Inservice Testing at Nuclear Power Plants," a revision to our Inservice Test Program Plan will be provided separately when an appropriate number of changes have been made to the plan.

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

Very truly yours,

CHC/JMO/bjd

Enclosures:
(1) Relief Request Pump Relief-05
(2) Relief Request Pump Relief-11
  Attachment (1): Effect of Pump Operation at Low Flow Rates
  Attachment (2): Evaluation Method of Raw Vibration Data
(3) Relief Request Valve Relief-14

A047

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ENCLOSURE (1)

RELIEF REQUEST PUMP RELIEF-05

Baltimore Gas and Electric Company
Calvert Cliffs Nuclear Power Plant
December 30, 1999

COMPONENTS:

Reactor Coolant Charging Pumps

PART 6 REQUIREMENT:

The frequency response range of the vibration measuring transducers and their readout system shall be from one-third minimum pump shaft rotational speed to at least 1000 Hz. [paragraph 4.6.1.6]

BASIS FOR RELIEF:

The rotational shaft speed of the charging pumps is 209 rpm relating to a rotational frequency of approximately 3.48 Hz. In order to satisfy the requirements of paragraph 4.6.1.6, a vibration measurement system capable of measuring vibration to a lower limiting frequency of 1.16 Hz would be required.

The instruments currently being used at Calvert Cliffs have a lower frequency limit for reliable, accurate measurement of 3 Hz. This instrumentation is "state-of-the-art" industrial grade, high quality equipment. Satisfying the Code requirements with respect to frequency response would require special calibration by off-site vendors which would involve extra expense. Because calibration of the instrument would require sending it off-site, and because of the extra expense of this special calibration, the use of this instrumentation would have to be restricted to monitoring charging pump vibration only in order to minimize the potential for damage to the instrument. Since this special calibration would require sending the instrument off-site, additional analyzers that were used solely for monitoring the charging pumps would be required in order to ensure at least two (one primary and one backup) were always in calibration and available on-site.

According to Table 6.0, "Illustrated Vibration Diagnostic Chart," contained in "Predictive Maintenance and Vibration Signature Analysis I," by J. E. Berry, Technical Associates of Charlotte, Inc., the anomaly which would normally be expected to produce only sub-harmonic vibrations is oil whip/whirl. Other conditions that could result in low frequency vibration (less than shaft speed) would normally also be detectable at shaft running speed, and harmonic and non-harmonic frequencies. Therefore, monitoring lower frequencies (less than rotational speed) is performed primarily for the purpose of detecting oil whirl or whip in journal bearings. However, the main bearings in Calvert Cliffs' charging pumps are oil-mist lubricated tapered roller bearings that are not susceptible to the oil whip or whirl phenomena. Calibrating the instruments down to 3 Hz will include some sub-harmonic frequencies. Additionally, although the instrumentation used by Calvert Cliffs will only be calibrated down to 3 Hz which is slightly less than pump running speed (approximately 85%), it will remain capable of detecting vibrations at frequencies as low as 1 Hz. This means we would still expect to detect any developing sub-harmonic vibrations which could still at least be qualitatively evaluated.

Seal rub and bearing looseness are two other conditions which may be detected at sub-harmonic frequencies. The primary indicator for seal rub is a truncation of the waveform observed through time-domain waveform analysis. Bearing looseness can also be identified through waveform analysis. Normally, harmonics of shaft speed would also be detectable in order to confirm this condition.

In addition to the American Society of Mechanical Engineers pump testing, Calvert Cliffs has implemented a "Rotating Machinery Vibration Monitoring Program" that includes periodic vibration monitoring of the charging pumps. This program is inclusive and encompasses a wider range of vibration analyses and frequencies, including time-domain waveform analysis, phase analysis, and spectral analysis, at various critical pump and motor locations. The data derived from this expanded program along with the Inservice Test vibration data will provide a high degree of assurance that the anomalies of concern can be identified and significant pump degradation will not go undiscovered.

Based on: (1) the fact that Calvert Cliffs' charging pumps are not susceptible to oil whip/whirl which is the major anomaly which would normally be expected to produce only sub-harmonic vibrations, (2) the low probability of any other anomalies producing vibrations at only sub-harmonic frequencies and not at running speed or harmonic and/or non-harmonic frequencies, and (3) Calvert Cliffs' "Rotating Machinery Vibration Monitoring Program," the added expense of the special calibration and additional test equipment necessary outweighs their benefit.

ALTERNATE TESTING:

The instruments used for measuring vibration on the reactor charging water pumps will have a frequency response calibrated range that extends to a lower limiting frequency of 3 Hz.

The charging pumps will be included in the Calvert Cliffs' "Rotating Machinery Vibration Monitoring Program" that includes periodic vibration monitoring and analysis of each pump.

ENCLOSURE (2)

RELIEF REQUEST PUMP RELIEF-11

COMPONENTS:

Low Pressure Safety Injection (LPSI) Pumps

PART 6 REQUIREMENT:

Pump vibration acceptance criteria shall be in accordance with OMa-1988, Part 6, Table 3a. Table 3a provides the following acceptance criteria for vibration measurement (in terms of velocity, inches per second) for centrifugal pumps with a running speed equal to or greater than 600 rpm:

The acceptable range is $\leq$ 2.5 times the reference value, but not to exceed 0.325 inches per second (ips).

The alert range is from > 2.5 times the reference value, but not to exceed 0.325 ips, up to 6 times the reference value, but not to exceed 0.700 ips.

BASIS FOR RELIEF:

The LPSI Pumps are tested quarterly using the minimum recirculation flow path from each pump through the minimum recirculation piping associated with each pump to the minimum recirculation flow common header and back to the refueling water tank. The common header is instrumented with an ultrasonic flow meter. During the quarterly test, the pumps are operated one at a time. After the required stabilization period, flow rate and differential pressure are measured, recorded, and compared to acceptance criteria developed in accordance with the hydraulic acceptance criteria requirements specified in Table 3b. However, as discussed in Calvert Cliffs Nuclear Power Plant (CCNPP) Pump Relief (PR)-01 Request, flow is not throttled during the quarterly test to eliminate the potential for pump overheating and damage should flow inadvertently be throttled below that required to ensure adequate pump cooling.

As further discussed in PR-01, the LPSI pumps are tested at a substantial flow rate (approximately 3000 gpm) during every refueling outage, as well as during planned and unplanned cold shutdown periods when plant conditions and circumstances permit. These tests are known at CCNPP as "Large Flow Rate" tests. Calvert Cliffs Nuclear Power Plants' PR-01 Request was previously approved in the Safety Evaluation Report for CCNPP's Third Ten-Year Inservice Test (IST) Interval provided by the Nuclear Regulatory Commission, dated February 11, 1998.

During refueling outages and cold shutdown periods, the LPSI pumps are used for shutdown cooling. However, during the normal operating cycle, the LPSI pumps generally are operated only for quarterly minimum recirculation flow IST pump testing, quarterly Engineered Safety Feature Actuation System testing, and to support quarterly IST testing of the High Pressure Safety Injection (HPSI) Header Loop Isolation Check Valves.

During the Second Ten-Year IST Interval, Article IWP requirements did not permit measuring and recording vibration in terms of velocity. Therefore, historically, the surveillance procedures used to perform these tests required vibration measurements to be recorded in terms of displacement (mils), not velocity. In recognition of the better indications provided by vibration measurements in terms of velocity, and as now permitted by OM-6, CCNPP is converting the vibration testing in the surveillance procedures to utilize velocity. However, CCNPP long ago recognized the benefit of velocity over displacement for analyzing pump vibrations and has included such measurements in the CCNPP Rotating Machinery Vibration Monitoring Program, which conducts periodic vibration monitoring and analysis of numerous pumps and motors (including the LPSI pumps) beyond that required for the IST Program. The

CCNPP Rotating Machinery Vibration Monitoring Program includes spectral analysis of the vibration measurements.

The long-term vibration trend (1995 through present) during quarterly testing of the LPSI pumps using the minimum recirculation flow path shows consistent results and stable performance with no unexplainable significant changes. The quarterly tests are performed at approximately 40-50 gpm which is between approximately 1.3%-1.6% of the LPSI pumps' "Best Efficiency Flow Rate". The Best Efficiency Flow Rate is based on the original Vendor Pump Curve. It is used instead of the system's design flow rate because the onset of pump internal recirculation and cavitation is a function of the pump's performance characteristics, not the system's design requirements.

As discussed in Attachment 1, "Effect of Pump Operation at Low Flow Rates," operating the LPSI pumps at these low flow rates results in a variety of effects (e.g., internal recirculation, cavitation, and force imbalance on the impeller) which contribute to increased vibration. Spectral analysis of the LPSI pump vibration measurements reveals: (1) a general increase in the broadband noise levels which is indicative of internal recirculation and cavitation, and (2) discrete spikes at frequencies corresponding to the blade pass frequency which is indicative of force imbalances acting on the impeller. (References: "Centrifugal Pump Clinic," 2nd edition, by Igor Karassik, Published by Marcel Dekker Inc., 1989, and "Predictive Maintenance and Vibration Signature Analysis I," by J. E. Berry, Technical Associates of Charlotte, Inc., Table 6.0, "Illustrated Vibration Diagnostic Chart.")

The "Large Flow Rate" tests for the LPSI pumps have been in use at CCNPP since approximately 1991. At a minimum, each pump has been tested during each refueling outage since these tests were implemented. Vibration data (in both displacement and velocity) was collected during these tests via the surveillance tests themselves and the CCNPP Rotating Machinery Vibration Monitoring Program. The vibration data recorded during these large flow tests show the overall vibration levels drop significantly, as expected. Furthermore, spectral analysis of these results show the general broadband noise and spikes at discrete frequencies caused by the blade passing are significantly reduced.

The following factors lead to the conclusion that the current vibration levels recorded during LPSI minimum recirculation flow testing are acceptable and are not indicative of any pump mechanical problems or degradation, and, therefore, that the LPSI pumps are operating acceptably.

(1) The long-term stability of the vibration trend based on data from the surveillance tests and CCNPP Rotating Machinery Vibration Monitoring Program obtained during quarterly minimum recirculation flow testing.

(2) Spectral analysis confirmed the major contributor to the overall vibration levels recorded during quarterly minimum recirculation flow testing is consistent with phenomena which are well known to be associated with operation of a centrifugal pump at low flow rates and also well known to cause higher vibrations at these low flow rates.

(3) The overall vibration levels recorded during large flow testing of the LPSI pumps are significantly reduced compared to the levels recorded during the quarterly minimum recirculation flow tests and are consistent with vibration levels experienced while testing centrifugal pumps at substantial flow rates in other systems and applications.

(4) Spectral analysis confirmed that the major contributors to the overall vibration levels observed during quarterly minimum recirculation flow testing which are associated with operation of a

centrifugal pump at low flow rates are significantly reduced during large flow testing of the LPSI pumps.

(5) Similar vibration patterns have been observed for the other standby Emergency Core Cooling System pumps, although the effects are not as pronounced as they are for the LPSI pump because the LPSI pumps are the pumps which are tested at the lowest flow condition relative to their Best Efficiency Flow Rate.

(6) The LPSI pumps have no history of mechanical failures nor have they required significant maintenance on a regular basis.

The overall vibration levels observed during quarterly LPSI pump minimum recirculation flow testing, augmented by spectral analysis, are not sufficiently high as to prevent detection of increases in the LPSI pump vibration levels which would be indicative of mechanical degradation. Furthermore, the vibration monitoring during less frequent LPSI pump large flow testing, also augmented by spectral analysis, provides even greater opportunities to detect increases in the LPSI pump vibration levels which would be indicative of mechanical degradation. Calvert Cliffs Nuclear Power Plant's experience has shown that spectral analysis of the vibration measurements obtained during quarterly minimum recirculation flow testing is sufficiently sensitive to changes in the pumps' mechanical condition and provides reasonable assurance that mechanical degradation can be detected early.

Performing pump testing at double the normal quarterly frequency when vibration levels exceed the acceptance criteria specified in Table 3a is physically possible, i.e., it is practicable. However, based on the discussions contained in Attachment 1, "Effect of Pump Operation at Low Flow Rates," such increased frequency testing will potentially reduce LPSI pump reliability and increase the probability of LPSI pump degradation, damage, or failure. Therefore, such testing is considered impractical because, though it is possible to perform such increased frequency testing, the potential reduction in LPSI pump reliability and potential increase in the probability of LPSI pump degradation, damage, or failure is a result which is contrary to the intent of the IST Program.

The running time of these pumps during the operating cycle is very limited since operation at low flow rates is detrimental to the pumps. Performing increased frequency testing on a regular basis during the operating cycle would increase the run time of these pumps by as much as approximately 30%. Title 10 Code of Federal Regulations 50.55a(a)(3)(i) and (ii) address alternatives when the Code requirement would result in either a use of resources or a hardship/burden with no commensurate increase in the level of quality or safety. Not only would increased frequency testing of the LPSI pumps be both a waste of resources and a hardship/burden with no commensurate increase in the level of quality or safety, but such unnecessary testing will actually result in a very real potential to reduce the level of quality and safety and, therefore, should be considered impractical.

ALTERNATE TESTING:

Table 3a specifies the value defining the upper limit of the acceptable range and the lower limit of the alert range shall be 2.5 times the reference value, not to exceed 0.325 ips. This means that up to a reference value of 0.13 ips, a 250% margin is allowed between the reference value and the "alert limit."

Clearly, relief is required for any vibration measurement with a reference value which is greater than the absolute alert limit of 0.325 ips specified by OM-6. However, there are also several vibration measurements which are "close" to the limit of 0.325 ips but do not exceed it. For these velocity measurements, relatively small increases in the overall vibration level which would normally be considered acceptable will cause them to exceed 0.325 ips, thus reducing the benefit and effectiveness of this relief request. Therefore, the following criteria is intended to allow a minimum of a 25% margin between each vibration reference value and the respective alert limit.

However, in no case shall the alert limit exceed 90% of the maximum vibration level allowed by the Code (i.e., the "action limit"). This corresponds to a maximum allowable alert limit of 0.630 ips (90% X 0.700 ips). Based on the vibration instrumentation accuracy requirements in OM-6, this level is sufficient to ensure that a reading in the acceptable range cannot actually be greater than the action limit of 0.700 ips due to instrument accuracy/uncertainty. Attachment (2) provides a detailed discussion regarding the manner in which the reference values were developed and evaluated, and also includes the specific reference values and alert/action limits to be used at this time for information.

Reference Value (V_R)	Acceptable Range	Alert Range	Action Range
$V_R \leq 0.11$ ips	$V \leq 2.5V_R$	$2.5V_R < V \leq 6V_R$	$6V_R < V$
0.11 ips $< V_R \leq 0.13$ ips	$V \leq 2.5V_R$	$2.5V_R < V \leq 6V_R$	0.700 ips $< V$
0.13 ips $< V_R < 0.26$ ips	$V \leq 0.325$ ips	0.325 ips $< V \leq 0.700$ ips	0.700 ips $< V$
0.26 ips $\leq V_R \leq 0.50$ ips	$V \leq 1.25V_R$	$1.25V_R < V \leq 0.700$ ips	0.700 ips $< V$
0.50 ips $\leq V_R$	$V \leq 0.630$ ips	0.630 ips $< V \leq 0.700$ ips	0.700 ips $< V$

Calvert Cliffs Nuclear Power Plant believes this approach provides greater flexibility than does seeking approval of specific values. This flexibility will permit CCNPP to revise the alert limits (within the guidelines contained in this relief request) should the need arise, such as following maintenance, after the necessary technical evaluation without using significant additional CCNPP or Nuclear Regulatory Commission resources.

Spectral analysis of quarterly minimum flow vibration results and less frequent large flow vibration results in accordance with CCNPP's Rotating Machinery Vibration Monitoring Program will continue to provide adequate assurance that increases in vibration levels at discrete frequencies which are not sufficiently large to effect the overall vibration reading will be detected and analyzed.

Attachment (1)

Effect of Pump Operation at Low Flow Rates

"Centrifugal Pump Clinic," 2nd edition, by Igor Karassik, Published by Marcel Dekker Inc., 1989, includes several pertinent discussions regarding the effect of pump operation at low flow rates. Throughout the book, the author discusses numerous topics.

In Chapter 6, "Field Troubles," the author addresses several pertinent questions.

The answer to Question 6.31, "Vibration Caused by Operation at Low Flow," states, in part:

> If a volute pump is operated at other than its design capacity, a certain imbalance of the hydraulic forces acting radially on the impeller takes place. The maximum imbalance occurs generally at zero capacity and is reduced as rated capacity is approached. This imbalance creates a radial load on the pump shaft.

The answer to Question 6.32, "More About Operation at Reduced Flow," also states, in part:

> All pumps exhibit a condition at low flows referred to as recirculation. Some pumps are worse than others, and the severity of the symptoms is dependent on the speed and diameter of the impeller. Recirculation is a turbulent reversal of a portion of the flow at the discharge of the impeller. The result is cavitation-like damage at the discharge tips of the vanes and a disturbance of the rotational flow patterns on each side of the impeller between the impeller shrouds and the casing walls. When the pump operates at or near its design capacity, the rotational flow patterns on each side of the impeller are symmetrical and impose no side thrust on the impeller. At low flows, however, the rotational flow patterns are no longer symmetrical, and a pressure differential exists between the two sides of the impeller. The result is an end thrust on the bearing.

Between the answers to Question 6.31 and 6.32, the author offers two possible solutions. The first is to switch to a dual volute pump to balance the hydraulic forces. The second is to install a bypass line to allow increasing the pump flow rate and reduce this force imbalance. Both of these solutions require significant modifications.

The intent of installing a bypass line is to increase the flow rate and reduce the magnitude of the hydraulic force imbalance. The flow path used when these pumps are tested at low flow rates is from the discharge of the pump through the individual pump minimum flow recirculation piping to the common minimum flow recirculation flow piping and back to the refueling water tank. The only adjustable valve in this flow path is the manual valve which can be used to isolate each individual pump's minimum recirculation flow piping from the common header. This valve is already maintained in the full open position at all times, including during pump testing. (This eliminates the potential to over-throttle pump recirculation flow which could result in overheating and damaging a pump.) Therefore, this is a fixed resistance flow path in which system resistance has already been minimized.

As a result, there is no simple way to increase pump flow rate during these tests. (Pump Relief PR-01 Request explains why these pumps cannot be tested at higher flow rates using discharge to the reactor coolant system more frequently.)

Effect of Pump Operation at Low Flow Rates

Based on the answers to Question 4.14, "Basis for Minimum Flow," Question 4.17, "Continuous Versus Intermittent Operation," and Question 4.34, "Testing for Shutoff Head," (Chapter 4, "Operation") there are several potential effects of operation at low flows:

1. For single volute pumps, the increased radial load at reduced flows may impose excessive loads on the thrust bearing and can lead to shaft or bearing failure.
2. As the pump capacity is reduced, the temperature rise of the pumped liquid increases resulting in a lower water density and increased dissolution of dissolved gases inside the pump (leading to cavitation), as well as increased thermal expansion of pump components. Cavitation generally causes long-term cumulative damage to the impeller.
3. At reduced flow, internal circulation will occur in the suction or discharge areas of the impeller, or in both. Internal circulation can create hydraulic pulsations and mechanical vibrations leading to possible mechanical failure of pump components, such as the impeller, the bearings, or the seals. Such failures may occur catastrophically or be the result of cumulative damage. Internal circulation also results in cavitation-type damage to the impeller.

Attachment (2)

Evaluation Method of Raw Vibration Data

Calvert Cliffs Nuclear Power Plant has had a Rotating Machinery Vibration Monitoring Program for over eight years. During the Second Ten-Year IST Interval, the IST reference values, alert and action limits, and vibration measurements used displacement (mils). During this same time frame, the vibration measurements for the Rotating Machinery Vibration Monitoring Program used velocity (inches per second - ips). For numerous years, these measurements have been recorded simultaneously (i.e., at the same time and the same pump operating conditions) and at the same locations on each pump during the IST surveillance tests. Although there is no direct quantitative correlation which can be made between displacement and velocity, a qualitative comparison was made in that no degrading trend exists in terms of displacement or velocity.

The new velocity reference values and alert/action limits were developed using this data. Although there are several years of data available, the evaluation was generally limited to data acquired since 1995 to ensure the reference values reflected and validated current pump performance levels. Where major maintenance (such as pump/driver overhaul/replacement or changes in the attached piping configuration) changed baseline pump vibration levels, a shorter period of time may have been used. During this time frame, there were numerous quarterly tests performed for each LPSI pump in the minimum recirculation flow configuration. Additionally, each LPSI pump was tested at least once in the large flow configuration during this time frame. Although in some cases the large flow reference values may be based primarily on one test result, such as due to comparatively recent maintenance, it should be noted that CCNPP implemented large flow testing of standby pumps approximately 1991 and has performed large flow testing during each refueling outage, at a minimum, since then. Therefore, several data points for each pump bearing vibration measurement were available for qualitative comparison even if they could not be directly incorporated into calculating the new reference value due to subsequent maintenance.

The process used to develop the new velocity reference values is outlined below:

1. The raw data was evaluated to determine if any long-term or short-term degrading trends or significant unexplainable changes in vibration levels existed. This included spectral analysis which confirmed the source of the higher overall vibration levels recorded during quarterly minimum recirculation flow testing are a result of the phenomena discussed in Attachment (1).

2. The vibration data obtained during quarterly minimum recirculation flow testing was compared to the vibration data obtained during large flow testing. This also included spectral analysis to confirm that the reduction in overall vibration levels recorded during large flow testing was due to the reduction of the contributors identified during the spectral analysis of the overall vibration levels recorded during quarterly minimum recirculation flow testing.

3. The major maintenance history during the time frame being evaluated was reviewed for each pump/driver. Where vibration levels were significantly changed following major maintenance (e.g., overhaul or replacement of the pump or driver), the performance data prior to the maintenance was discarded.

4. The raw data was reviewed to evaluate its consistency. Data points which appeared to be outliers (i.e., anomalous data points which were unusually high or low) were evaluated and generally eliminated from the data population, as long as they were unique and not part of a degrading trend.

5. The data trends for all the pump bearing vibration measurements were compared to each other to identify any pump bearing vibration measurements with unusual characteristics. No significant differences were noted.

6. The reference value for each pump bearing vibration measurement was based on averaging the remaining raw data points. The sensitivity of each reference value was evaluated by comparing the reference values with the averages obtained using all the raw data, including the data points considered anomalous. In all cases, there were a sufficient number of data points available so that eliminating the data points of lower confidence did not have an appreciable effect on the reference value.

7. The results were then qualitatively compared to the results obtained from similar evaluations performed to establish the reference values for the HPSI pumps and containment spray pumps. The same effects were noted for the HPSI and containment spray pumps, although the magnitude was not as great because they are operated at approximately 8% and 4%, respectively, of their Best Efficiency Flow Rate during quarterly minimum recirculation flow tests. (Additionally, the HPSI pumps are multi-stage which reduces the magnitude of the force imbalance.) The Best Efficiency Flow Rate for each pump type is based on the original Vendor Pump Curve. It is used instead of the system's design flow rate because the onset of pump internal recirculation and cavitation is a function of the pump's performance characteristics, not the system's design requirements.

11 LPSI	Minimum Recirculation Flow Test					Large Flow Test				
	PIH	PIV	POH	POV	POA	PIH	PIV	POH	POV	POA
Reference Value	0.24	0.55	0.11	0.34	0.09	0.09	0.08	0.06	0.06	0.04
Alert Limit	0.325	0.630	0.275	0.425	0.225	0.225	0.200	0.150	0.150	0.100
Action Limit	0.700	0.700	0.660	0.700	0.540	0.540	0.480	0.360	0.360	0.240

12 LPSI	Minimum Recirculation Flow Test					Large Flow Test				
	PIH	PIV	POH	POV	POA	PIH	PIV	POH	POV	POA
Reference Value	0.40	0.43	0.13	0.29	0.08	0.17	0.12	0.08	0.16	0.05
Alert Limit	0.500	0.538	0.325	0.363	0.200	0.325	0.300	0.200	0.325	0.125
Action Limit	0.700	0.700	0.700	0.700	0.480	0.700	0.700	0.480	0.700	0.300

21 LPSI	Minimum Recirculation Flow Test					Large Flow Test				
	PIH	PIV	POH	POV	POA	PIH	PIV	POH	POV	POA
Reference Value	0.22	0.45	0.10	0.31	0.09	0.08	0.12	0.05	0.08	0.03
Alert Limit	0.325	0.563	0.250	0.388	0.225	0.200	0.300	0.125	0.200	0.075
Action Limit	0.700	0.700	0.600	0.700	0.540	0.480	0.700	0.300	0.480	0.180

22 LPSI	Minimum Recirculation Flow Test					Large Flow Test				
	PIH	PIV	POH	POV	POA	PIH	PIV	POH	POV	POA
Reference Value	0.25	0.31	0.09	0.28	0.10	0.08	0.09	0.06	0.05	0.04
Alert Limit	0.325	0.388	0.225	0.350	0.250	0.200	0.225	0.150	0.125	0.100
Action Limit	0.700	0.700	0.540	0.700	0.600	0.480	0.540	0.360	0.300	0.240

ENCLOSURE (3)

RELIEF REQUEST VALVE RELIEF-14

Baltimore Gas and Electric Company
Calvert Cliffs Nuclear Power Plant
December 30, 1999

SYSTEM:

Condensate Storage (60717-E, Sheet 1)

COMPONENTS:

0-CD-6303A-VBV & 0-CD-6303B-VBV

CATEGORY:

C

FUNCTION:

These check valves open to prevent drawing a vacuum in the 12 Condensate Storage Tank (CST) which could threaten its structural integrity in the event the non-safety-related nitrogen blanketing system fails while suction is being taken by either Unit's auxiliary feedwater system. During normal operation, this tank is maintained under a nitrogen blanket to prevent oxygen absorption in the condensate and these valves close to minimize the loss of nitrogen; this is not a safety function.

PART 10 REQUIREMENT:

Check valves shall be exercised nominally every 3 months, except as provided by paragraphs 4.3.2.2, 4.3.2.3, 4.3.2.4, and 4.3.2.5. [paragraph 4.3.2]

The necessary valve obturator movement shall be demonstrated by exercising the valve and observing that either the obturator travels to the seat on cessation or reversal of flow, or opens to the position required to fulfill its function. [paragraph 4.3.2.4(a)]

If a manual mechanical exerciser is used to move the obturator, the force or torque required to initiate movement (breakaway) shall be measured and recorded. The breakaway torque shall not vary by more than 50% from the established reference value. [paragraph 4.3.2.4(b)]

As an alternative to the testing in (a) or (b) above, disassembly every refueling outage to determine operability of check valves may be used. [paragraph 4.3.2.4(c)]

BASIS FOR RELIEF:

A. These check valves have no "position indication" which can be used to verify their full-stroke other than visual observation of the disc. However, stroking these check valves requires purging the nitrogen blanket on 12 CST for personnel safety. This will result in increased oxygen absorption in the stored condensate (and increased system/tank corrosion), as well as increased waste of nitrogen.

B. Exercising these check valves by "blowing" air into 12 CST at the rated flow rate is also not practical. This could pressurize 12 CST and increase absorbed oxygen levels. Use of nitrogen would prevent oxygen absorption, but would introduce personnel safety concerns due to the enclosed area. Furthermore, due to the physical constraints, setting up the required equipment and obtaining reliable data would be very difficult and potentially dangerous to personnel. There are no other similar parameters which could be used to establish "quantifiable acceptance criteria" or serve as "other positive indication" of obturator movement as discussed in NUREG-1482.

C. In theory, these valves could be exercised by securing the nitrogen blanketing system and taking a suction from 12 CST at the required flow rate in order to verify the valves open and prevent drawing a vacuum in the tank. However, in order to show that each vacuum breaker could provide the required overpressure protection (i.e., air flow rate), the other vacuum breaker would have to be blank-flanged. This creates the potential of damaging the vacuum breakers but, more importantly, also creates the potential for damaging 12 CST if a vacuum breaker should fail or, more likely, be damaged.

D. These valves could be manually exercised in place by pushing in on the disc (there is no built-in manual operator). However, such operation is contrary to the Vendor's guidance. Additionally, the "setpoint" is so low (as recognized in the original Baltimore Gas and Electric Company Purchase Specification) that the required torque to open the valve could not be reliably measured on a repeatable basis nor trended.

E. These valves could be removed and inspected every refueling outage (because of their design, there is no valve disassembly required to inspect all moving parts and seating surfaces). However, 12 CST is common to both Units. As a result, a Temporary Alteration is required to avoid placing the operating Unit in a Technical Specification Action Statement. Clearly, removing and inspecting these valves during outages for both Units (i.e., every year) is not required. Per Generic Letter 89-04 Position 2, removing one of the two valves (on an alternating basis) each refueling outage (tied to Unit 1 or Unit 2) would be acceptable.

However, CCNPP considers the removal/inspection frequency permitted by this option to require a degree of resources, and to present potential concerns, which are disproportionate to the level of safety and quality provided. In other words, it does not provide a compensating increase in the level of safety or quality which is commensurate with the resources required or potential concerns. (Similarly, the Vendor recommendation that these valves being subject to preventive maintenance annually is also considered excessive.) This conclusion is based on the following:

1. The Temporary Alteration required to minimize the impact on both Units (i.e., prevent entering an Action Statement),
2. The potential personnel safety concerns, the potential increase in oxygen absorption of the stored condensate, and the economic cost presented by more frequent purging of the nitrogen blanket,
3. The satisfactory as-found condition of these valves when they were removed and inspected in October 1997 after more than 10 years of continuous service without inspection or maintenance,
4. The design and service conditions (e.g., stainless steel seat, disc, and spring in an inert atmosphere), and
5. The potential for damaging these valves each time they are handled (i.e., removed, inspected, and re-installed).
6. Removal and inspection of these valves does not require a refueling outage for either Unit. Therefore, the frequency should not be tied to a refueling outage in order to permit maximum scheduling flexibility and preclude unnecessary diversion of resources during an outage.

F. These valves are not easily accessible. They are located on top of 12 CST which is a high tank with a sloping top. As a result, accessing these valves presents potential personnel safety hazards due to the height and limited space. The entire tank is contained within an enclosure which is equipped with "bird doors" to prevent nesting of birds in the building. The valves, which hang vertically and open into the tank, are also protected by screens. During the inspection in October 1997, minimal dust and debris was found even though the valves had not been cleaned since their original installation.

ALTERNATE TESTING:

Each of these valves will be removed and inspected at a four year frequency for any signs of degradation which might affect their ability to perform their safety function. The removal and inspection schedule will not be specifically tied to the refueling schedule for either Unit. It is expected that both vacuum breaker valves will be removed and inspected at approximately the same time. However, such scheduling would be solely to minimize the potential safety impact on the Units and the cost/resources involved. Part-stroking these valves while installed is not considered practical. The accessible portions of the valves will be inspected in-place to the maximum extent practical on a two year frequency (i.e., alternating between in-place inspection and removal/inspection every two years).

If, in the course of these inspections a valve is found to be inoperable with respect to its function to open, then appropriate corrective action will be taken. During activities associated with valve removal and inspection and prior to system closure, appropriate precautions will be applied and inspections performed to ensure internal cleanliness standards are maintained and foreign materials are excluded from system internals. These measures may include creating controlled work areas, maintaining a tool and equipment accounting system, installation of covers during non-work periods, and final close-out inspections. Because there is no actual disassembly of the valves themselves required for an inspection, there is minimal potential to introduce a failure.