Charles H. Cruse
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BGE

August 29, 1997

U. S. Nuclear Regulatory Commission
Washington, DC 20555

ATTENTION: Document Control Desk

SUBJECT: Calvert Cliffs Nuclear Power Plant
Unit No. 2; Docket No. 50-318
Request for Additional Information -- License Amendment Request: Modification to the Service Water Head Tanks, Unreviewed Safety Question (TAC No. M98093)

REFERENCES:

(a) Letter from Mr. C. H. Cruse (BGE) to NRC Document Control Desk, dated March 6, 1997, License Amendment Request: Modification to the Service Water Head Tanks

(b) Letter From Mr. C. H. Cruse (BGE) to NRC Document Control Desk, dated March 26, 1997, Request for Additional Information - License Amendment Request: Modification to the Service Water Head Tanks, Unreviewed Safety Question (TAC No. M98093)

(c) Letter from Mr. A. W. Dromerick (NRC) to Mr. C. H. Cruse (BGE), dated June 4, 1997, Request for Additional Information Regarding Modification to Service Water Head Tanks at Calvert Cliffs Nuclear Power Plant, Unit No. 2 (TAC No. M98093)

This modification would pressurize the Service Water System. The NRC requested additional information in Reference (c). In responding to that request, we noted that some of the requested information had already been provided in References (a) and (b). Where appropriate, this has been noted. Attachment (1) provides our response to the requested information to aid in understanding the Service Water System better. A simplified system drawing has been provided as Attachment (2).

The attached information does not change the Significant Hazards Determination presented in Reference (a). Should you have further questions regarding this matter, we will be pleased to discuss them with you.

Very truly yours,

for
C. H. Cruse
Vice President - Nuclear Energy

STATE OF MARYLAND :
: **TO WIT:**
COUNTY OF CALVERT :

I, R. E. Denton, being duly sworn, state that I am Senior Vice President - Generation, Baltimore Gas and Electric Company (BGE), and that I am duly authorized to execute and file this License Amendment Request on behalf of BGE. To the best of my knowledge and belief, the statements contained in this document are true and correct. To the extent that these statements are not based on my personal knowledge, they are based upon information provided by other BGE employees and/or consultants. Such information has been reviewed in accordance with company practice and I believe it to be reliable.

Subscribed and sworn before me, a Notary Public in and for the State of Maryland and County of Calvert, this 29 day of August, 1997.

WITNESS my Hand and Notarial Seal: Denise D. Smith
Notary Public

My Commission Expires: 2/2/98
Date

CHC/EMT/dlm

Attachments: (1) Response to Request for Additional Information
(2) Simplified Drawing

cc: R. S. Fleishman, Esquire
J. E. Silberg, Esquire
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ATTACHMENT (1)

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Baltimore Gas and Electric Company
Calvert Cliffs Nuclear Power Plant
August 29, 1997

NRC Question

1. Discuss the relevant aspects of the design and design basis of the Service Water (SRW) System in sufficient detail to enable the staff to understand how the system function and design basis is affected by the planned modification, and what the specific requirements are for maintaining system operability. For example:

   - Describe the various modes of operation of the SRW System that are allowed by the Technical Specifications and Updated Final Safety Analysis Report (UFSAR) that do not require entry into a Technical Specification Limiting Condition for Operation Action Statement. For example, operation with one SRW heat exchanger out for maintenance and the two subsystems cross-connected is referred to in note (a) of UFSAR page 9.5-21.
   - Discuss the required SRW System response for accident conditions, and describe the worst-case situation for the Generic Letter 96-06 scenario, including (for example) initial operating conditions and system alignment, sequencing and timing of equipment (including valves) and basis for the timing sequence, and relevant parameters and assumptions. Discuss how the system response will be affected by the planned modifications.
   - Describe any system leakage restrictions necessary to assure system operability, including measures that are taken to assure that allowed leakage rates are not exceeded.
   - Provide a simplified system diagram that identifies the various components and valves, including component identification.

BGE Response

1a. An overview of the operation of the SRW System and component interaction was provided in Reference (2). The added pressure in the SRW System does not have any effect on modes of operation of the system as they relate to Technical Specification Limiting Condition for Operation Action Statements.

1b. The operation of the SRW System during normal and accident conditions was described in Response 1a of Reference (2). We have reviewed the addition of pressure to the SRW System head tanks and found that the modification to the system has no impact on the response of the system in accident conditions.

1c. System leakage restrictions, pressure decay restrictions, and monitoring measures were discussed in Response 5a of Reference (2).

1d. A more detailed simplified drawing of the SRW System is included as Attachment (2). We believe that the drawing will enhance the operating description previously provided in Reference (2).

NRC Question

2. Describe the specific design requirements and limiting assumptions for the nitrogen overpressurization system that are relied on to assure that the SRW System is operable. For example:

   - Explain the limiting assumptions for sizing the nitrogen accumulators (e.g., head tank level, temperature, system leak rate, etc.). Also, discuss why it is necessary to designate the nitrogen pressurization system and accumulators "safety-related."

- Describe the specific head tank pressure, level, and temperature requirements (maximum and minimum) necessary to assure system operability, including basis. (Examples: explain how 14 psig was arrived at as minimum required pressure, including limiting assumptions; assuming that 14 psig are required in the head tanks to avoid saturation in the SRW System, what is the minimum pressure requirement assuming the maximum allowed pump degradation, instrument uncertainties, maximum system leak rate, isolation times for non-essential loads, etc.). Describe the measures that will be taken to assure that these head tank parameters are maintained in the required band.
- Explain how the head tank level and pressure alarm setpoints were established.
- Describe the worst-case accident response scenario for the SRW System (post modification) relative to the water hammer, two-phase flow, and thermal overpressurization concerns expressed in Generic Letter 96-06 (assuming single active failure, ultimate heat sink conditions, system leakage, etc.); discuss the minimum time available to boiling.
- Discuss the impact (if any) that the water hammer, two-phase flow, and thermal overpressurization concerns of Generic Letter 96-06 have on the station blackout coping analysis.
- Discuss the results of the failure modes and effects analysis relative to the water hammer, two-phase flow, and thermal overpressurization concerns expressed in Generic Letter 96-06. Note: This should not be limited to only the newly installed components, but should include all component failures that can have an impact, such as system valve failures, electrical failures, air system failures, failure of fans to shift speed, failure of breakers to trip, etc.

BGE Response:

2.a The limiting assumption used in sizing the nitrogen accumulators was to allow a single accumulator to replenish the nitrogen contents of both head tanks. This allows for an adequate nitrogen supply, assuming failure of a train of nitrogen. A secondary requirement was to provide adequate time for operators to respond to a failure in the nitrogen supply. Since the nitrogen supply to the two accumulators is from a non-safety-related source, it is considered to fail during operation. The low pressure alarm setpoints for the accumulators was based on providing at least 30 minutes of operator response time at the maximum postulated leakage rate from a single train of the SRW System, and greater than 20 minutes in the unlikely event that the maximum postulated SRW leakage would occur in both trains simultaneously.

Nitrogen pressurization will now be relied upon to respond to a Design Basis Event; therefore, appropriate parts of the system are safety-related.

2.b Two limiting conditions for the Nitrogen/SRW System are the minimum (alarm level) SRW head tank level and 14 psig nitrogen in the head tank. The 14 psig nitrogen pressure was arrived at by calculating the time to boil in the containment air coolers (CACs) versus SRW over-pressure based on the limiting (worst-case) containment heat-up following a loss-of-coolant accident. The pressure at the uppermost CACs is determined by assuming a stagnant (no-flow) SRW System with the head tanks at their lowest allowable (i.e. - alarm) level. The acceptable time to boil is based on a time greater than the maximum SRW restart time, which in turn is based on the maximum emergency diesel generator start time.

The nitrogen-pressure versus time-to-boiling determination employed the following conservative assumptions:

1. Maximum heat transfer to the CACs (i.e. - no fouling).
2. Boiling is determined by calculating the temperature at the end of the uppermost (lowest pressure) tube, and comparing it to the saturation temperature at that point.

The maximum nitrogen pressure is limited by pressure-relieving devices. Pressure and fluid level are monitored to prevent excessive levels.

This analysis is based on loss-of-offsite power conditions with SRW pumps not running; therefore, pump degradation is not a factor in the minimum pressure requirement. With the pumps on, regardless of degraded conditions, boiling is not an issue at the CACs because sufficient subcooling exists to prevent boiling. Isolation times, leak rates, etc. have no bearing on this analysis.

The important parameters, such as head tank pressure and level, and nitrogen accumulator pressure, are all annunciated in the Control Room. This will help to ensure that the parameters are maintained. Additionally, local indication is provided in the room with the head tanks.

2.c The existing head tank low level alarm setpoint was used in the conservative time to boiling analysis. The new head tank pressure alarm, including uncertainty, was based on providing sufficient nitrogen pressure to ensure no boiling in the worst case CAC prior to the maximum SRW pump restart time, based on the maximum allowable emergency diesel generator restart time with the head tank at its lowest level.

The remainder of this question concerned the effects of water hammer, two-phase flow and thermal overpressurization. These phenomena potentially apply to the pre-modification configuration. The proposed modification that created the unreviewed safety question under consideration is designed to eliminate this water hammer concern. Therefore, discussion of the effects of water hammer are not relevant to the unreviewed safety question of increased pressure in the SRW head tanks.

NRC Question

3. Discuss the measures that are or will be taken to assure that the Turbine Building return check valves do not leak excessively (e.g., periodic testing, inspection, trending). In particular, explain what the specific program requirements are for these check valves.

BGE Response

The ability of the Turbine Building return check valves to close is verified on a "Cold Shutdown Frequency," as defined in Calvert Cliffs procedures, and following maintenance or modification. This is accomplished using a seat leak test on each individual check valve. Acceptance criteria is included in the test procedure to ensure appropriate check valve performance is maintained. In this regard, increased seat leakage is used as an indicator that the ability of the check valve to close may be degrading.

Previous studies have shown that the Turbine Building header is seismically rugged and would remain intact following a seismic event. Therefore, these check valves would not serve a pressure boundary function for inventory retention. That function would remain with the normal pressure boundary components, which are functionally leak checked by a monthly system leak test. Because the supply header has two series control valves automatically actuated by Engineered Safety Features Actuation Signal, and system differential pressure is such that backflow will not occur through these check valves except due to turbine building header leakage (which is already known and accounted for), the seat leakage through these check valves is not considered significant. These check valves are included in the Inservice Test (IST) Program as "Category B" valves only because they are the boundary between American Society of Mechanical Engineers Section XI Class 3 and non-class piping.

NRC Question

4. Per the UFSAR, the SRW heat exchanger is limited to 20[illegible] s this or any other temperature or design limitation exceeded as a consequence of the planned [illegible]difications? Explain.

BGE Response

This modification has no impact on the design temperature for any SRW component. The combination of loss of offsite power and maximum postulated loss-of-coolant accident results in SRW temperatures near the CACs in excess of 200°F. However, the transient nature of the temperature spike, combined with SRW mixing prior to returning to the heat exchangers, ensures that no component's design temperature is exceeded. All SRW components continue to meet applicable Code design limits under LOOP/LOCA conditions.

An extensive review of all of the components served by SRW was performed during the modification process to determine the acceptability of the additional nitrogen pressure. The maximum SRW pump discharge pressure remains below the overall system design pressure. There are individual components in the SRW System that are equipped with pressure control devices. These components were re-rated, as required, in accordance with their governing construction code, to ensure that they would be able to withstand the post-modification expected pressure. Their protective device (i.e. - relief valves) setpoints were also revised as required commensurate with their design pressure changes to ensure adequate margin to lifting.

NRC Question

5. Discuss the potential for vapor binding of the SRW pumps during normal operation and during accident conditions (post modification).

BGE Response

Calculations were performed to determine the maximum amount of nitrogen that would be saturated in the SRW fluid due to the nitrogen over-pressure. The additional amount of nitrogen in solution is approximately 2.5 times the current amount of nitrogen present in the system with atmospheric head tanks. Although the nitrogen concentration is greater than the current concentration, the actual concentration is still very low.

Under pump operating conditions, the bulk fluid pressure at the suction of the pump is such that nitrogen would remain in solution for temperatures in excess of the maximum containment temperature. Also, the local minimum pressure established at the eye of the pump impeller is also considered to be insufficient to cause gas liberation under normal operating temperatures and the maximum expected actual accident temperatures at the pump. Therefore, neither pump cavitation nor vapor binding is expected to occur under either normal operating or accident conditions.

NRC Question

6. Explain what effect (if any) nitrogen saturation of the service water will have on heat transfer and accident analysis assumptions.

BGE Response

As described in the previous response, the maximum expected concentration of nitrogen in the SRW System is approximately 2.5 times the current maximum nitrogen concentration. This maximum concentration assumes that the local head tank concentration has equilibrated in the entire SRW System. This concentration, although greater than the current concentration, is insufficient to affect the bulk fluid properties. Also, as demonstrated previously, nitrogen is not expected to be liberated under normal or accident conditions of temperature and operating pressure. During the brief period when the SRW pump is inoperable during a LOOP/LOCA, some nitrogen would be expected to desorb at the highest containment air cooler. The amount of nitrogen released would be small and would, most likely, be swept out of the cooler at pump restart. Even if nitrogen remained in the cooler, it would have negligible impact on the heat transfer capabilities of the cooler. Therefore, the maximum theoretical system nitrogen concentration has no impact on the heat transfer capabilities of the SRW and no impact on the accident analyses.

NRC Question

7. Recognizing that head tank indication and alarm instrumentation is not safety-related, discuss measures that will be taken to assure that operator indications of head tank conditions are accurate (e.g., temperature, pressure, level, alarms).

BGE Response

Even though the alarms and instruments are non-safety-related, they will be calibrated and checked periodically in accordance with BGE procedures.

NRC Question

8. Describe and justify any aspects of the proposed modification that will not conform to the design basis requirements for Calvert Cliffs Unit 2.

BGE Response

There are no aspects of this modification that do not conform with the Unit 2 design basis.

NRC Question

9. Describe any post-modification testing, periodic testing, and periodic surveillances that will be credited for assuring system operability.

BGE Response

The answer to this question remains as provided in our response 5b in Reference 2. The following additional information is provided:

Components installed by this modification have been reviewed against IST Program requirements and will be included in the IST Program, as appropriate. In addition, existing components have been reviewed to determine if the changes in operating conditions warrant their inclusion in the program. For non-IST components, procedures are being developed to ensure their functionality. Such procedures may include Operations Performance Evaluations, Maintenance Procedures, or other appropriate procedures. Specific test , has been performed to evaluate the increase in system pressure on individual components. Final system evaluation of system leakage testing will include evaluation of system leakage. Hydrostatic testing has been performed as required on new and existing components to validate the acceptability of the higher design pressure. Additionally, new instrumentation is included in the calibration program. Existing instrumentation is being recalibrated as required by the increase in system pressure.

NRC Question

10. Discuss personnel safety and operational limitations associated with head tank nitrogen leakage, and discuss measures that will be taken to assure that these limitations are not exceeded.

BGE Response

Personnel safety remains as described in Description of Proposed Modification of Attachment (1) to Reference (1). Ventilation in the room containing the nitrogen accumulators and the system head tanks is sufficient to prevent nitrogen accumulation due to system leakage. Operational limitations caused by low pressure resulting from nitrogen leakage remain as described in Response 5a of Reference (2).

NRC Question

11 Describe any Technical Specification Surveillance Requirements that will be implemented to assure continued operability of the SRW System.

BGE Response

No specific Technical Specification Surveillance Requirements will apply to the nitrogen system. The existing SRW Technical Specifications will remain in effect with the nitrogen system treated as an ancillary system to SRW.

NRC Question

12. Recognizing that the SRW System is a closed loop system that consists primarily of demineralized water, explain the basis for assuming a 50% reduction in water hammer loads due to "dissolved gasses," including a discussion of supporting test data. Also, discuss to what extent the water hammer loads were increased (including basis for the determination) to account for system-structure interaction effects.

BGE Response

The discussion on dissolved gasses in Reference (2) only applies to the current (vented) configuration of the SRW Water System. The modification to add pressure to the head tanks is being undertaken to eliminate water-hammer concerns so the dissolved gasses/water hammer discussion does not apply to the unreviewed safety question under consideration.

REFERENCES:

(1) Letter From Mr. C. H. Cruse (BGE) to NRC Document Control Desk, dated March 6, 1997, License Amendment Request: Modification to the Service Water Head Tanks

(2) Letter From Mr. C. H. Cruse (BGE) to NRC Document Control Desk, dated March 26, 1997, Request for Additional Information - License Amendment Request: Modification to the Service Water Head Tanks, Unreviewed Safety Question (TAC No. M98093)

ATTACHMENT (2)

SIMPLIFIED DRAWING

Baltimore Gas and Electric Company
Calvert Cliffs Nuclear Power Plant
August 29, 1997

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