BALTIMORE
GAS AND
ELECTRIC

1650 CALVERT CLIFFS PARKWAY • LUSBY, MARYLAND 20657-4702

GEORGE C. CREEL
SENIOR VICE PRESIDENT
(410) 260-3690

September 16, 1992

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
Summary of Completed Actions; NRC Generic Letter 89-13,
"Service Water System Problems Affecting Safety Related Equipment"
(TAC Nos. M73978 and M73979)

REFERENCES:

(a) NRC Generic Letter 89-13, dated July 18, 1989, "Service Water System Problems Affecting Safety Related Equipment"

(b) Letter from Mr. G. C. Creel (BG&E) to NRC Document Control Desk, dated January 29, 1990, Response to NRC Generic Letter 89-13, same subject

(c) NRC Generic Letter 89-13, Supplement 1, dated April 4, 1990, same subject

(d) Letter from Mr. G. C. Creel (BG&E) to NRC Document Control Desk, dated January 6, 1992, Revised Response to NRC Generic Letter 89-13, same subject

(e) Letter from Mr. G. C. Creel (BG&E) to NRC Document Control Desk, dated August 4, 1992, Revised Testing Schedule, same subject

Gentlemen:

NRC Generic Letter 89-13, Reference (a), outlined concerns regarding the safe operation and maintenance of the service water (SRW) systems and identified several recommendations associated with ensuring proper heat transfer capability of SRW system components.

Baltimore Gas and Electric (BG&E) Company's response to Generic Letter 89-13 was provided in Reference (b). In that response we outlined our planned actions and stated all initial activities will be completed before plant start-up (Mode 2) from the next refueling outages for each unit. This letter summarizes the Generic Letter 89-13 activities completed for Unit 1.

A048 Cert No
1/1 P886603394

Reference (b) outlined five tasks that would be performed to address the recommended actions of the generic letter.

TASK 1 Saltwater Biofouling Program

All initial activities have been completed.

TASK 2 Test Program

The original commitment to test heat exchangers was revised in References (d) and (e). Enclosure (1) is a summary of the initial test results. Generic Letter 89-13 requests us to implement the recommended actions or justify our alternatives to them. Enclosure (2) is a "Justification of Alternatives to Testing" requested in the Reporting Requirements of Generic Letter 89-13 page 7. Initial activities are complete. For testing the SRW and Component Cooling Heat Exchangers, we could not establish satisfactory plant conditions to meet EPRI Heat Exchanger Performance Monitoring Guidelines. Consequently, the baseline tests for these heat exchangers did not produce conclusive results. As described in Enclosure (2), we are confident that these heat exchangers adequately perform their heat removal functions. In order to provide further assurances that these open-cycle heat exchangers can perform their heat removal function, we are developing test methods to retest these heat exchangers when plant conditions are satisfactory.

In Reference (b), we committed to perform initial testing of our closed-cycle systems (SRW and Component Cooling) to determine which heat exchangers should be included in the periodic test program. This commitment was a result of our inability to confirm the adequacy of our chemistry control program over the total operating history of the plant. Based on the results of testing and inspecting these closed-cycle systems, we have concluded the quality of our chemistry control program maintains adequate heat transfer capability. Future periodic testing of Unit 1 closed-cycle systems under the scope of Generic Letter 89-13 is not necessary and will not be performed.

TASK 3 Inspection and Maintenance Program

All planned actions have been completed. All underground saltwater pipe was inspected. Repairs were made as necessary. The ultrasonic test program has been reviewed and revised.

TASK 4 Licensing Basis Review

The planned actions described in Reference (b) have been completed. System and heat exchanger software hydraulic models have been developed. The software was validated by duplicating a number of BG&E hydraulic calculations and comparing the results to the original calculations and actual plant data. System drawings were reviewed and walkdowns were performed to ensure the systems were not vulnerable to single active failures

TASK 5 Service Water Systems Program Review

The planned actions described in Reference (b) have been completed with the exception of procedure upgrades. The Procedure Update Project is on schedule to complete the upgrades to the technical procedures by December 1994.

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

Very truly yours,

for
G. C. Creel
Senior Vice President

GCC/JMO/dlm/bjd

Enclosures

cc: D. A. Brune, Esquire
J. E. Silberg, Esquire
R. A. Capra, NRC
D. G. McDonald, Jr., NRC
T. T. Martin, NRC
P. R. Wilson, NRC
R. I. McLean, DNR
J. H. Walter, PSC

ENCLOSURE (1)

HEAT EXCHANGER TEST PROGRAM

SYSTEM	HEAT EXCHANGER	IN TEST PROGRAM	TEST TYPE	TEST RESULTS	COMMENTS
SALTWATER SYSTEM	Component Cooling Heat Exchangers 11 & 12	Y	I or II.B	Inconclusive due to low saltwater flow. See Enclosure (2) for details.	Tube side cleaned each quarter. Transient Test Methodology will be developed by January 31, 1993. Transient test will be performed during the next planned shutdown to Mode 5 after April 30, 1993.
	Service Water Heat Exchangers 11 & 12	Y	I or II.B	Inconclusive due to low heat load. See Enclosure (2) for details	Tube side cleaned each quarter. Test will be performed when the other train is removed from service after January 31, 1993.
	ECCS Pump Room Air Coolers 11 & 12	Y	I III.A or III.B	11 & 12 SAT	Air side cleaned.
	Intake Structure Air Coolers	N	N/A	N/A	N/A

ENCLOSURE (1)

HEAT EXCHANGER TEST PROGRAM

SYSTEM	HEAT EXCHANGER	IN TEST PROGRAM	TEST TYPE	TEST RESULTS	COMMENTS
SERVICE WATER SYSTEM	Containment Air Coolers 11, 12, 13, 14	Y	III.A. or III.B	12 & 13 SAT	Based on cleaning all coolers and testing the two most limiting coolers, it was not necessary to test #11 and #14.
	Spent Fuel Pool Cooling Heat Exchangers	Y	II.B.	11 & 12 SAT	No cleaning necessary.
	Diesel Generator Coolers	Y	II.A	11 EDG Jacket Water Cooler & Air Coolant Heat Exchanger tested SAT. 11 EDG Lube Oil cooler inconclusive due to low oil flow	Nos. 11, 12 & 21 EDG coolers are inspected at 18-month intervals. Results have been SAT. All coolers are identical. Testing Lube Oil Coolers is not practical; however, inspections indicate there has been no need to clean them. See Enclosure (2) for details.
	Main Feed Pump Turbine Lube Oil Coolers	N	NA	NA	NA
	EHC Oil Coolers	N	NA	NA	NA
	Main Turbine Lube Oil Coolers	N	NA	NA	NA
	Generator/Exciter Air Coolers	N	NA	NA	NA
	Stator Liquid Cooling Heat Exchangers (U-1)	N	NA	NA	NA
	Hydrogen Seal Oil Coolers (U-2)	N	NA	NA	NA

ENCLOSURE (1)

HEAT EXCHANGER TEST PROGRAM

SYSTEM	HEAT EXCHANGER	IN TEST PROGRAM	TEST TYPE	TEST RESULTS	COMMENTS
SERVICE WATER SYSTEM	Aux Feedpump Room Air Coolers	N	NA	NA	NA
	Isophase Bus Duct Coolers	N	NA	NA	NA
	Condenser Air Removal Pump Seal Coolers	N	NA	NA	NA
	Waterbox Priming Pump Seal Coolers	N	NA	NA	NA
	Condensate Booster Pump Lube Oil Coolers	N	NA	NA	NA
	Instrument and Plant Air Compressor Coolers	N	NA	NA	NA
	Turbine Plant Sample Coolers	N	NA	NA	NA
	M/U Demin Vacuum Pump Cooler (U-1)	N	NA	NA	NA
	N_2 Compressor After Coolers (U-1)	N	NA	NA	NA
	Steam Generator Blowdown Recovery System Heat Exchanger	N	NA	NA	NA

ENCLOSURE (1)

HEAT EXCHANGER TEST PROGRAM

SYSTEM	HEAT EXCHANGER	IN TEST PROGRAM	TEST TYPE	TEST RESULTS	COMMENTS
COMPONENT COOLING SYSTEM	Shutdown Cooling Heat Exchangers 11 & 12	Y	II.B.	11 & 12 SAT	No cleaning necessary.
	HPSI Pump Seal & Bearing Coolers 11, 12, & 13	Y	IV.B.	Flow test for 12 coolers SAT	Bearing and seal cooler temperature maintained below design limit. Based on testing the limiting pump coolers (#12 HPSI), testing of the #11 & 13 coolers was not necessary.
	LPSI Pump Seal & Bearing Coolers	N	NA	NA	NA
	Containment Penetration Coolers Main Steam Main Feedwater Letdown RC Sample S/G Blowdown	N	NA	NA	NA
	Reactor Vessel Support Coolers	N	NA	NA	NA
	S/G Lateral Support Coolers	N	NA	NA	NA

ENCLOSURE (1)

HEAT EXCHANGER TEST PROGRAM

SYSTEM	HEAT EXCHANGER	IN TEST PROGRAM	TEST TYPE	TEST RESULTS	COMMENTS
COMPONENT COOLING SYSTEM	Reactor Coolant Waste Evaporators	N	NA	NA	NA
	Control Element Drive Mechanism Coolers	N	NA	NA	NA
	Reactor Coolant Pump Seal and Lube Oil Coolers	N	NA	NA	NA
	Reactor Coolant Drain Tank Heat Exchangers	N	NA	NA	NA
	Letdown Heat Exchanger	N	NA	NA	NA
	Waste Gas Compressor Coolers	N	NA	NA	NA
	RCW Degasifier Vacuum Pump Coolers	N	NA	NA	NA
	NSSS Sample Coolers RC Sample SG Blowdown Sample MWS Sample	N	NA	NA	NA
	Post Accident Sample System Cooler	N	NA	NA	NA

ENCLOSURE (1)

HEAT EXCHANGER TEST PROGRAM

SYSTEM	HEAT EXCHANGER	IN TEST PROGRAM	TEST TYPE	TEST RESULTS	COMMENTS
COMPONENT COOLING SYSTEM	Gas Analyzer Sample Coolers	N	NA	NA	NA
	MWS Heat Exchanger	N	NA	NA	NA
	S/G Blowdown RAD Monitor Sample Cooler	N	NA	NA	MA

ENCLOSURE (1)

HEAT EXCHANGER TEST PROGRAM

TEST TYPES

I. Monitor and record cooling water flow and inlet and outlet temperatures for all affected heat exchangers during the modes of operation in which cooling water is flowing through the heat exchanger. For each measurement, verify that the cooling water temperatures and flows are within design limits for the conditions of the measurement. The test results from periodic testing should be trended to ensure that flow blockage or excessive fouling accumulation does not exist.

II.A. Perform functional testing with the heat exchanger operating, if practical, at its design heat removal rate to verify its capabilities. Temperature and flow compensation should be made in the calculations to adjust the results of the design conditions. Trend the results, as explained above, to monitor degradation.

II.B. If it is not practical to test the heat exchanger at the design heat removal rate, then trend test results for the heat exchanger efficiency or the overall heat transfer coefficient. Verify that heat removal would be adequate for the system operating with the most limiting combination of flow and temperature.

III.A Perform efficiency testing with the heat exchanger operating under the maximum heat load that can be obtained practically. Test results should be corrected for the off-design conditions. Design heat removal capacity should be verified. Results should be trended, as explained above, to identify any degraded equipment.

III.B If it is not possible to test the heat exchanger to provide statistically significant results (for example, if error in the measurement exceeds the value of the parameter being measured), then

1. Trend test results for both the air and water flow rates in the heat exchanger.

2. Perform visual inspections, where possible, of both the air and water sides of the heat exchanger to ensure cleanliness of the heat exchanger.

IV.A. If plant conditions allow testing at design heat removal conditions, verify that the heat exchanger performs its intended functions. Trend the test results, as explained above, to monitor degradation.

IV.B. If testing at design conditions is not possible, then provide for extrapolation of test data to Design conditions. The heat exchanger efficiency or the overall heat transfer coefficient of the heat exchanger should be determined whenever possible. Where possible, provide for periodic visual inspection of the heat exchanger. Visual inspection of a heat exchanger that is an integral part of a larger component can be performed during the regularly scheduled disassembly of the larger component. For example, a motor cooler can be visually inspected when the motor disassembly and inspection are scheduled.

ENCLOSURE (2)

JUSTIFICATION OF ALTERNATIVES TO TESTING

FOR GENERIC LETTER 89-13

Described below is the justification of actions we have tak : in lieu of the testing we committed to in Reference (b) for the following heat exchangers: Service Water (SRW), Component Cooling, High Pressure Safety Injection (HPSI) pumps, Emergency Diesel Generator (EDG) and Containment Air Cooling. While evaluating the initial test data for the current Unit 1 refueling outage, we discovered some of the measured parameters did not meet the criteria of Heat Exchanger Performance Monitoring Guidelines (EPRI NP-7552). Specifically for the SRW and Component Cooling Heat Exchangers, we were unable to obtain enough heat load at steady state conditions to achieve minimum acceptable differential temperature to assure conclusive test results. The EPRI Guidelines are based on steady state conditions. Section 5.5.1 of the guideline recommends a minimum acceptable differential temperature that is based on test instrument accuracy. For No. 11 EDG, we are unable to obtain sufficient lube oil flov through the EDG lube oil cooler to assure conclusive test results. The EPRI guideline recommen that the flow should be a fully developed turbulent flow (Section 5.4.3). For the HPSI pumps' seal and bearing coolers, we concluded, since testing verified that No. 12 HPSI coolers can perform their heat removal function and all Unit 1 HPSI pumps are identical, testing of the Nos. 11 and 13 HPSI pumps is not necessary. Similarly for Containment Air Coolers, we concluded, since testing verified that cooler Nos. 12 and 13 can perform their heat removal function and all Unit 1 containment coolers are identical, testing of the Nos. 11 and 14 Coolers is not necessary.

I. SERVICE WATER AND COMPONENT COOLING HEAT EXCHANGERS

Service Water Heat Exchanger

Insufficient heat load was available on the SRW Heat Exchangers during initial tests to obtain a minimum acceptable differential temperature. Both of these heat exchangers will be retested with maximized heat loads during normal operations at 100% Reactor Power. Their normal operating heat loads at 100% Reactor Power are approximately 25% of their accident heat load. A new test method, requiring minor modifications to the Saltwater System, will be developed. The new test will be performed on each heat exchanger after January 31, 1993, when the test method and modifications are completed.

Component Cooling Heat Exchangers

Similarly, insufficient heat load was available on the Component Cooling Heat Exchangers. During normal operations, the system maintains component cooling water temperature at 95°F to ensure the controlled bleed-off temperature for the Reactor Coolant Pump Seal does not fall below 110°F. In order to meet this requirement, the saltwater flow was insufficient to consider the test valid. A test methodology will be developed and validated to account for the transient heat exchanger conditions that will exist during a plant cooldown. The methodology will be developed by January 31, 1993. We will develop the performance test and obtain required instrumentation within three months of completing the test methodology. We expect to be able to test the component cooling heat exchangers during the next planned shutdown after April 30, 1993, that includes a cooldown to Mode 5 when the transient heat load on them is maximized.

There is no safety impact due to extending the heat exchanger test schedule. Generic Letter 89-13, Supplement 1 [Reference (c), Question 6, page 19] states that a program of periodic inspection, maintenance and cleaning may be proposed as an alternative to heat exchanger testing when it is impractical to perform these tests. It is our opinion that conclusive results can only be obtained if these heat exchangers are tested at higher heat loads when the effect of instrument inaccuracies are at acceptable levels. Therefore, BG&E is not proposing an alternative to testing the SRW and Component Cooling Heat Exchangers. However, we have concluded an extension to the schedule is acceptable based on the following actions that we have taken. These actions are similar to those that would be appropriate for a proposed alternative:

1. A design review of these heat exchangers has been conducted. We have confirmed from the review that their design is adequate to accomplish the required safety functions under worst-case accident conditions.

2. The tube side of both sets of heat exchangers have been cleaned by "bulleting" during the current Unit 1 outage. Tube bulleting is currently performed quarterly.

3. The combination of maintenance, inspection, testing activity and chemistry control of the SRW and Component Cooling System provides us with reasonable assurance that these systems have not experienced any change in heat transfer capability since these inspections.

   - SRW - The shell side of the SRW Heat Exchangers was inspected and videotaped in June 1990, and found clean.

   - Component Cooling - The shell side of the Shutdown Cooling Heat Exchanger was visually inspected during the current outage and found clean. Component Cooling Water flows through its shell side.

Therefore, there is no safety impact from extending the heat exchanger test schedule.

II. EMERGENCY DIESEL COOLERS

The EDGs have three coolers each - a lube oil cooler, a jacket water cooler and an air coolant heat exchanger - which are cooled by SRW (a closed system). After our original tests failed to provide conclusive test results, we made permanent and temporary modifications to the No. 11 EDG to improve the test. From the second test, we obtained conclusive results that both the jacket water cooler and the air coolant heat exchanger are capable of performing their heat removal function for No. 11 EDG. We did not obtain conclusive test results for the No. 11 lube oil cooler since the lube oil flow was not the fully developed turbulent flow recommended by the EPRI Guidelines. Performing a test that meets the vendor recommended minimum lube oil temperature of 160° F would not allow us to obtain acceptable lube oil flow. The vendor has reviewed the No. 11 EDG test data and confirmed that no other options are available to obtain conclusive test results without removing the cooler from the EDG for further testing. Therefore, we have concluded that it is not practical to test any EDG lube oil cooler. We inspect EDG coolers on 18-month intervals per vendor recommendations to verify their cleanliness. These inspections indicate there is

no need to clean them. The lube oil is sampled and analyzed monthly. Reference (c) [Question 6, page 19] states that when it is not practical to test a heat exchanger, an alternative such as inspection may be proposed. Additionally, during the performance of the engineering test for Generic Letter 89-13, we observed high heat exchanger bypass flow for the No. 11 EDG lube oil cooler. This is a qualitative indication that its heat transfer capabilities are adequate to perform its intended function.

We are confident that all of the EDG coolers are performing their heat removal function. Our decision is consistent with Reference (c) [Question 8, page 20] which states that the initial heat exchanger test program may consist of performance testing of the most limiting heat exchangers combined with maintenance or cleaning of others. The family of heat exchangers is identical for each EDG. The engine-side water for all EDGs is similar. The water chemistry of the jacket water cooler and air coolant heat exchanger is identical since these systems are typically cross-connected. However, the water for No. 11 EDG is the most limiting since historically we have had more problems maintaining its water chemistry control than the other two EDGs.

Therefore, there is no safety impact from substituting inspection for a heat exchanger test. Since the SRW System is a closed system that is exhibiting no system-wide corrosion, we can now confirm the quality of our chemistry control program is sufficient to maintain adequate heat transfer capability. Future periodic testing of the heat exchangers is not necessary as long as the chemistry control program is adequately maintained [Reference (a), page 5].

III. HIGH PRESSURE SAFETY INJECTION PUMP COOLERS

The HPSI pumps include integral seal and bearing coolers that are mounted to the pump base and supplied by the pump vendor. There is continuous flow through the component cooling water side of the coolers. There is flow through the Reactor Coolant System (RCS) side of the bearing cooler only when the pump is operating. Otherwise, the RCS side is stagnant. The No. 12 pump was tested to verify adequate component cooling flow and that the bearing and seal cooler temperatures can be maintained below the design limit as we committed in Reference (b). After reviewing these results and confirming the Unit 1 pumps are identical, we concluded there was no benefit from testing the other two pumps. Plant records were reviewed. There is no history of operating problems or maintenance orders for the Unit 1 pump coolers. The water chemistry program for the RCS side of the seal cooler is a documented, high quality closed loop water system. The component cooling water side of the HPSI bearing coolers are always operated cross-connected, so the water chemistry is identical in all HPSI coolers. Visual inspection of the shell side of the Shutdown Cooling Heat Exchanger indicates that the Component Cooling Water System is clean. We have determined the No. 12 HPSI pump bearing cooler is the most limiting since No. 12 HPSI pump has had the lowest run time. Therefore, it has experienced the largest amount of stagnant conditions where any foulant on the RCS side is most likely to form a colloid and precipitate.

ENCLOSURE (2)

JUSTIFICATION OF ALTERNATIVES TO TESTING

FOR GENERIC LETTER 89-13

The combination of the visual inspection of the Shutdown Cooling Heat Exchanger, the results of the No. 12 HPSI test and identical construction of the Unit 1 HPSI pumps gives us confidence that the HPSI coolers have adequate heat transfer capability to perform their intended function. Our decision is consistent with Reference (c). Therefore, there is no safety impact from testing only the No. 12 HPSI Coolers. Since the Component Cooling Water System is a closed system that is exhibiting no system-wide corrosion, we can now confirm the quality of our chemistry control program is sufficient to maintain adequate heat transfer capability. Future periodic testing of the heat exchangers is not necessary as long as the chemistry control program is adequately maintained [Reference (a), page 5].

IV. **CONTAINMENT AIR COOLERS**

There are four Containment Air Coolers in Unit 1. Cooler Nos. 11 and 12 are normally supplied by SRW Subsystem 11. Cooler Nos. 13 and 14 are normally supplied by SRW Subsystem 12. However, any cooler can be supplied from any subsystem.

All four coolers were cleaned. We have determined the most limiting cooler from each subsystem. For Subsystem 11, it is Cooler No. 12 since it has the lowest SRW flow. For Subsystem 12, it is Cooler No. 13 since it has the most restrictive air flow configuration. Testing verified that these two limiting coolers adequately perform their heat removal function. Therefore, the test results and identical construction of the coolers gives us confidence that Unit 1 containment air coolers have adequate heat transfer capability to perform their intended function. Our decision is consistent with Reference (c). Therefore, there is no safety impact from testing two of the four air coolers. Similar to the HPSI coolers, future periodic testing of the air coolers is not necessary as long as the chemistry control program is adequately maintained [Reference (a), page 5].