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June 17, 1994

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
Reply to Request for Additional Information - Service Water System Operational Performance Inspection

REFERENCE: (a) Letter from Mr. M. W. Hodges (NRC) to Mr. R. E. Denton (BGE), dated May 19, 1994, Calvert Cliffs Units 1 and 2 Service Water System Inspection (NRC Combined Inspection Report Nos. 50-317/94-80 and 50-318/94-80)

In Reference (a), you requested that we provide information related to our efforts to increase the margin available to support safety functions at peak bay temperatures. Attachment (1) is provided for your information and details the current status of our efforts. We have approved a revision to the Saltwater System operating instructions. This revision credits a series of new saltwater differential pressure limits for the Service Water Heat Exchangers that have been calculated to include changes in design basis assumptions and system configurations.

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

Very truly yours,

Charles H Cruse

CHC/JMO/dlm

Attachment

cc: D. A. Brune, Esquire
J. E. Silberg, Esquire
R. A. Capra, NRC
D. G. McDonald, Jr., NRC
T. T. Martin, NRC
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ATTACHMENT (1)

REPLY TO NRC REQUEST FOR INFORMATION
SERVICE WATER SERVICE OPERATIONAL PERFORMANCE INSPECTION
BAY TEMPERATURE LIMIT

I. BACKGROUND

As a result of testing performed to verify heat removal capabilities of the Service Water (SRW) Heat Exchangers (HX), we reported the possibility that they may not have been capable of meeting their intended safety function during certain past periods when bay temperature was greater than 78°F. Since the Service Water System Operational Performance Inspection (SWSOPI) concluded, we have continued to address the low margin issue for SRW HX.

II. NEW TRANSIENT ANALYSIS

A. Current Status

The new transient analysis has been completed. The results have been compared to the current bay temperature limit in Operating Instruction (OI) 29, "Saltwater (SW) System" and the operability determination made in October 1993 which reduced the maximum bay temperature to 78°F. We have concluded that the results show that our original actions were sufficiently conservative. A revision to OI-29 that credits the new transient analysis has been approved. This revision will permit plant operation at bay temperatures up to 87°F. We have installed new temporary pressure gauges to indicate SW differential pressure for the SRW HXs. This modification improves instrument accuracy and allows manual dampening of the oscillations that were present in the previously installed gauges. In the near future, we will install new permanent differential pressure gauges. This modification will improve instrument accuracy and dampen the oscillations that were present in the earlier permanently-installed gauges.

1. Assumptions and Results of New Transient Analysis

The new SW differential pressure (dP) limits for the SRW HX are derived in Design Calculation (Calc) M-94-32. The assumptions in Calc M-94-32 are essentially identical to those in Calc M-94-13 which you reviewed in detail during the SWSOPI. In Calc M-94-13, we made the following assumptions:

- a bay temperature of 87°F;
- clean Containment Air Coolers (CACs);
- a 0.0012°F-ft^2-hr/BTU fouling factor (microfouling);
- the loss of coolant accident (LOCA) containment temperature profile; and,
- an initial SRW temperature of 95°F.

Calc M-94-13 had already removed the known non-conservatisms from previous SRW HX calculations and raised the design fouling factor to 0.0012°F-ft^2-hr/BTU. The primary purpose of Calc M-94-13 was to develop the methodology for analyzing transient performance. The calculation used full SRW flow to

CACs and only evaluated a single bay temperature of 87°F. The calculation provided a methodology and verified that lowering the bay temperature limit by 11°F was conservative.

Calc M-94-32 has been completed and approved since the SWSOPI. It combines the transient analysis methodology developed in Calc M-94-13 with the general approach used in Calc M-91-16 (reviewed during the SWSOPI) to develop SW dP limits for the SRW HXs. The only difference between the assumptions of the new transient analysis (Calc M-94-32) and Calc M-94-13 is the reduced SRW flow to the CACs during the initial stages of a LOCA. The modification that reduces SRW flow is described in II.A.2 below.

The approach used in Calc M-94-32 was to assume a fouling factor of 0.0012°F-ft^2-hr/BTU (microfouling) and select a given bay temperature. Then the number of tubes available was reduced (macrofouling) until the SRW HX outlet temperature peaked at 115°F. The emergency diesel generator (EDG) manufacturer has reviewed this transient and concluded that EDG performance is not impacted. All SRW temperature transients were verified to return to 105°F within 25 minutes. The number of blocked tubes was then used to compute a set of dPs across the heat exchanger for a number of different flow rates during normal operation. This set of dPs established a new dP limit for the heat exchanger at the selected bay temperature. The calculation was repeated for a range of bay temperatures in 1°F increments to provide a series of new dP limits for OI-29.

Calc M-94-32 indicates that safe plant operation is possible at a bay temperature up to 87°F. The uncertainties of the installed instrumentation scheme are included in the revised OI-29 dP limits.

2. Modeling of Reduced SRW flow rates to Containment Air Coolers

Since the SWSOPI concluded, Units 1 and 2 have been modified per Facility Change Request (FCR) 93-207 as follows:

- SRW flow to the Containment Air Coolers (CACs) is automatically reduced during a Loss of Coolant Accident (LOCA) prior to the recirculation actuation signal (RAS).
- After the RAS, full SRW flow to the CACs is automatically restored.

The FCR design package was reviewed during the SWSOPI. The reduced flows are analyzed in M-94-30 and M-94-31 using the hydraulic models which you reviewed during the SWSOPI. Post modification testing verified the flow calculations. Calc M-94-32 uses these SRW flows to analyze the worst case accident heat loads of a LOCA.

B. Use of Additional Margin from New Transient Analysis

Any additional margin has been applied to an increase in macrofouling allowance, i.e., higher dP limits. In Calc M-94-32, the microfouling factor is assumed to be 0.0012°F-ft^2-hr/BTU. The additional margin gained by both the modification and the new transient analysis has been used to raise the dP limit and reduce the frequency of SRW HX tubesheet cleaning. The result is SW header availability will be increased.

III. VERIFICATION OF FOULING FACTOR ASSUMPTION

The design SRW HX fouling factor of 0.0012°F-ft^2-hr/BTU was developed through extensive analyses and thermal performance testing. It includes adequate allowance for microfouling uncertainties and test result inaccuracies. It is consistent with Tubular Exchanger Manufacturers Association (TEMA) recommended practices.

We do not expect to be able to verify the fouling factor with thermal performance testing. Our conclusion is based on the inability to mathematically separate the effects of microfouling (fouling factor) and the area reduction effect of macrofouling. Additionally, thermal performance testing reduces SW header availability. Therefore, we are maintaining the current periodicity of 90 days for HX bulleting pursuing other evaluation techniques.

We are evaluating other techniques for verifying the microfouling factor. One example of an evaluation technique that shows promise is a side-stream monitor. This device is essentially a single tube heat exchanger that is precisely modeled and operated to reflect a system's thermal hydraulic conditions. Its advantage is that it should allow us to continuously monitor fouling factors and microfouling rates without affecting SW header availability. Such information could be used to further revise SRW HX operating limits.

Additionally, in the near future, we anticipate that the State of Maryland will approve our use of Clamtrol, a chemical biocide. We expect Clamtrol to slow fouling build-up. A maximum fouling factor of 0.0012°F-ft^2-hr/BTU will remain in the design calculations until firm empirical data is available to substantiate different values.