VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

July 30, 1998

Document Control Desk
United States Nuclear Regulatory Commission
Washington, D. C. 20555

Serial No. 98-367
NLOS/GDM R3
Docket Nos. 50-280/50-281
License Nos. DPR-32/DPR-37

Gentlemen:

VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION UNITS 1 AND 2
GENERIC LETTER 96-06 ASSURANCE OF EQUIPMENT OPERABILITY AND CONTAINMENT INTEGRITY DURING DESIGN-BASIS ACCIDENT CONDITIONS
REQUEST FOR ADDITIONAL INFORMATION

In a letter dated January 28, 1997 (Serial No. 96-516A), Virginia Electric and Power Company provided our response to Generic Letter 96-06. The response included our assessment of the potential for water hammer and two phase flow in containment cooling water systems, as well as our plans to further evaluate containment penetration integrity under the conditions postulated in the generic letter. In a June 8, 1998 letter, the staff requested additional information regarding the operation and control of the containment cooling water system to complete their review. The attachment to this letter provides the requested information.

If you have any questions or require additional information, please contact us.

Very truly yours,

James P. O'Hanlon
Senior Vice President - Nuclear

Attachment

Commitments contained in this letter: None.

A072

cc: U.S. Nuclear Regulatory Commission
Region II
Atlanta Federal Center
61 Forsyth Street, SW
Suite 23T85
Atlanta, Georgia 30303

Mr. R. A. Musser
NRC Senior Resident Inspector
Surry Power Station

ATTACHMENT

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION GENERIC LETTER 96-06

NRC Question 1

Describe measures that have been taken to assure that plant operators will not use the containment air recirculation fans and associated cooling water system as an option during or following a plant accident. Also, confirm that plant Emergency Operating Procedures (EOPs) do not allow plant operators to use the containment air recirculation fan coolers as an option following a plant accident.

Response - The containment air recirculation fans (1(2)-VS-F-1A, 1B & 1C) and associated coolers (1(2)-VS-E-2A, 2B & 2C) are used to cool the containment atmosphere during normal plant operation and are not relied upon for accident mitigation during a Design Basis Accident (DBA). The safety related function of the Containment Spray and Recirculation Spray Systems is to restore containment to a subatmospheric condition. During a DBA (Loss of Coolant Accident or Main Steam Line Break with a loss of offsite power), the containment air recirculation fans are automatically tripped and/or de-energized. It should be noted that, based on performance data, the containment air recirculation fans will also trip if operated with containment pressure approximately 10 psig or greater.

The cooling water supply, either component cooling water or chilled component cooling water, to the containment air recirculation coolers is isolated during a DBA. The operation of the containment air recirculation fans in conjunction with containment air recirculation coolers is not directed in the EOPs used for immediate response to a DBA. However, the operation of the containment air recirculation fans and air coolers to facilitate restoration of the containment to sub-atmospheric condition may be appropriate when specific containment conditions exist. The steps for such operation are provided in the Functional Restoration (FR) procedures. At the point in time where the FR procedures permit the use of the containment air recirculation fans and air coolers, the containment conditions are such that steam voids and subsequent water hammer are not anticipated, as discussed in the response to Question 2.

NRC Question 2

Implementing measures to assure that water hammer will not occur, such as prohibiting post accident operation of the affected system, is an acceptable approach for addressing the water hammer concern. However, all scenarios must be considered to assure that the vulnerability to water hammer has been eliminated. Confirm that all scenarios have been considered, including those where the affected containment penetrations are not isolated (if this is a possibility), such that the measures that have been established are adequate to prevent the occurrence of water hammer during (and following) all postulated accident scenarios.

Response - The containment air recirculation coolers are not relied upon during a DBA to reduce containment air temperature and pressure. The Containment Spray and Recirculation Spray Systems provide the function of reducing containment atmospheric temperature and pressure during a DBA. However, the containment air recirculation fans and associated coolers may be used to facilitate long-term containment cooling and pressure reduction if containment conditions permit fan operation. At such time, if cooling water flow is re-established to the containment air recirculation coolers, steam induced water hammer caused by steam void collapse in the coolers will not occur due to a reduced containment air temperature compared to the higher saturation temperature of the fluid existing in the cooler piping.

During a DBA the cooling water flow through the air recirculation coolers is isolated by the return containment isolation trip valves 1(2)-CC-TV-110A, B & C (210A, B & C). The cooling water supply containment isolation valves are 1/2-CC-224, 233, 242. The air recirculation coolers are located in the lowest elevation in containment (floor elevation –27'-7") as shown on Figure 1.

With the recirculation air cooler water flow isolated by the containment isolation valves, it is postulated that containment ambient heat is transferred to the trapped fluid through the exposed recirculation air coolers. As the bulk temperature of the isolated fluid in the coolers and the 6 inch supply and return piping rises, the internal pressure increases. Each air recirculation cooler is protected by a thermal relief valve, 1(2)-CC-RV-112A, B & C (212A, B & C), which is set at 146 psig. If the trapped fluid expands enough to raise the pressure to the set pressure of the cooler relief valve, then the relief valve will lift and reset at a lower pressure. If containment conditions warrant, heat would again be transferred to the exposed cooling coils and the set pressure of the relief valve may be reached again. This scenario would continue until not enough heat could be transferred to the trapped fluid to cause the relief to lift. It should be noted that no steam voids are formed due to the pressure and associated high saturation temperature of the fluid in the coolers and piping during this time. The corresponding saturation temperature associated with a pressure of 146 psig is 364°F. In addition, when the cooling water flow is restored through the coolers, the cooling water would be at approximately 90 psig. At this pressure (associated saturation temperature of 331°F), no steam voids would exist in the cooler piping.

In the above scenario, if the containment air recirculation cooler thermal relief valve does not reseat, water would be discharged to the containment floor. The component cooling water surge tank would provide make-up to the cooler via the supply line containment isolation check valve. The component cooling water surge tank would provide two functions in this case: 1) inventory makeup to replace lost volume caused by the relief valve failure to reseat and 2) indication of lost inventory via the component cooling water surge tank level indication. Therefore if the relief valve were to lift and not reseat properly, the operators would have indication of the situation via the component cooling water surge tank level indication.

NRC Question 3

Confirm that the water hammer and two phase flow analyses included a complete failure modes and effects analysis (FMEA) for all components (including electrical and pneumatic failures) that could impact performance of the cooling water system and confirm that the FMEA is documented and available for review, or explain why a complete and fully documented FMEA was not performed.

Response – A complete FMEA was determined not to be necessary. The Containment Spray and Recirculation Spray systems perform containment cooling and depressurization during a DBA. The cooling water flow to the containment air recirculation coolers is isolated via containment isolation valve closure as shown on Figure 1. At such time that cooling water flow is re-established to the containment air recirculation coolers, steam induced water hammer caused by steam void collapse in the coolers will not occur due to a reduced containment air temperature compared to the higher saturation temperature of the fluid in the cooler piping. Even if a containment air recirculation cooler relief valve did not reseat properly, the component cooling water surge tank would provide inventory replacement and indication of inventory loss. Therefore, it was concluded that water hammer and two phase flow is not a concern during a DBA, and a complete FMEA is not warranted.

NRC Question 4

Provide a simplified diagram of the affected systems, showing major components, active components, relative elevations, lengths of piping runs, and the location of any orifices and flow restrictions.

Response - Figure 1 provides a simplified diagram of the affected systems as requested.

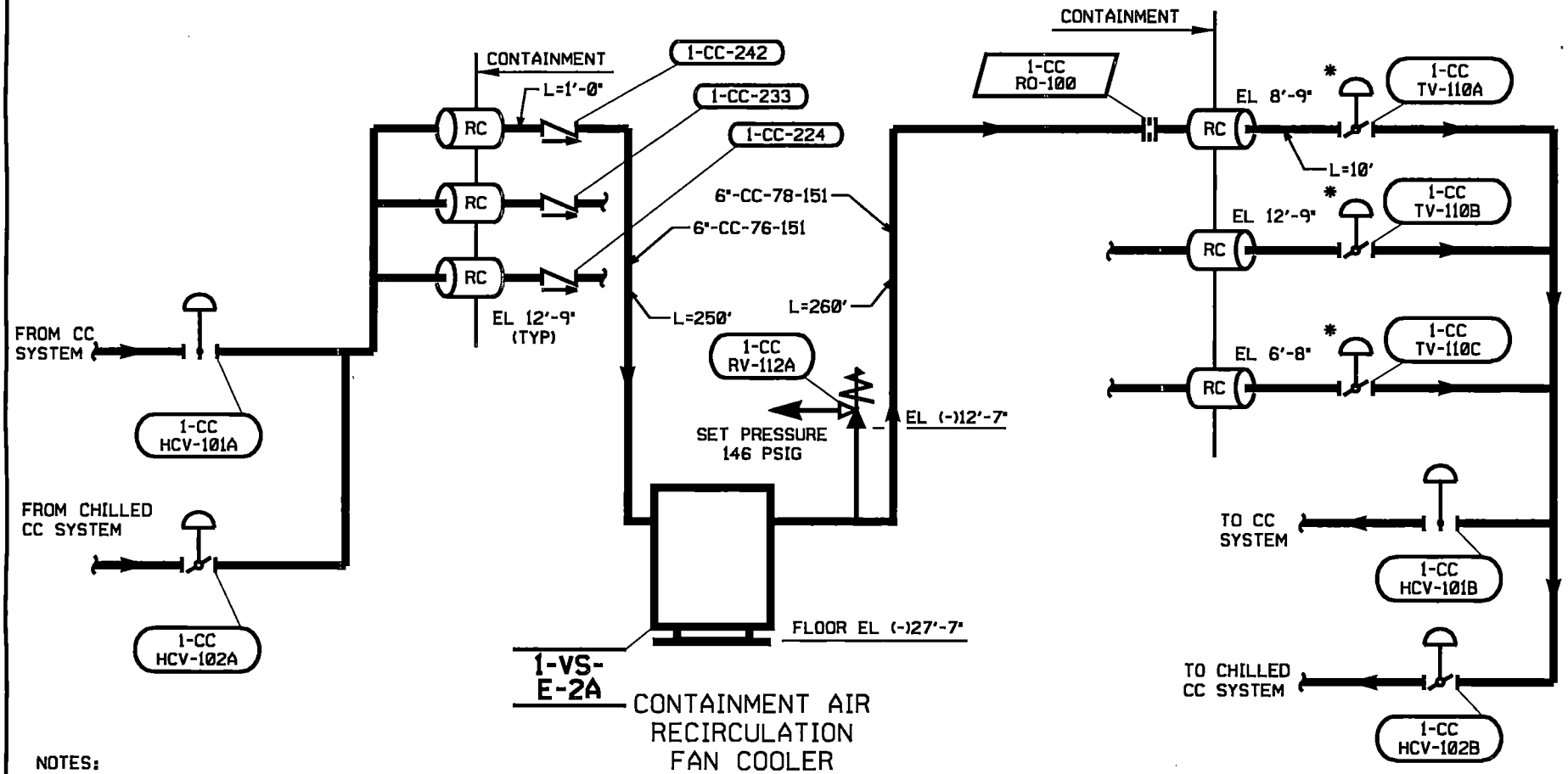
NRC Question 5

Describe in detail any plant modifications or procedure changes (other than those already described in response to question 1, above) that have been made or are planned to be made to resolve the water hammer issue.

Response - Virginia Power is not performing any physical or procedural modifications as a result of the water hammer issue. Virginia Power believes that it is still beneficial to have the flexibility of using the containment air recirculation fans and associated cooling coils to facilitate long-term containment cooling following a DBA. Virginia Power believes that the cooling water system piping configuration and existing procedural controls for containment air recirculation fan cooler operation is adequate to prevent water hammer.

SIMPLIFIED CONTAINMENT AIR RECIRCULATION FAN COOLER PIPING CONFIGURATION

LOOP A SHOWN (LOOPS B & C SIMILAR)



NOTES:

1. REF DWG 11448-FM-072B, SH-2.
   REF DWG 11448-FP-3M & 3L
2. * CLOSE ON CONTAINMENT ISOLATION SIGNAL.
3. UNIT 1 SHOWN, UNIT 2 SIMILAR.
4. PIPE LENGTHS ARE APPROXIMATE.

FIGURE 1

C:\usr\dgn\NRC72B2MDGNkc1