September 13, 2000

Mr. David A. Christian
Senior Vice President - Nuclear
Virginia Electric and Power Company
5000 Dominion Blvd.
Glen Allen, Virginia 23060

SUBJECT: CLOSEOUT FOR GENERIC LETTER (GL) 96-06, "ASSURANCE OF EQUIPMENT OPERABILITY AND CONTAINMENT INTEGRITY DURING DESIGN-BASIS ACCIDENT CONDITIONS," NORTH ANNA POWER STATION, UNITS 1 AND 2, AND SURRY POWER STATION, UNITS 1 AND 2 (TAC NOS. M96838, M96839, M96873 AND M96874)

Dear Mr. Christian:

On September 30, 1996, the staff issued GL 96-06 to address several issues of concern. (1) Cooling water systems serving the containment air coolers may be exposed to the hydrodynamic effects of waterhammer during either a loss-of-coolant accident (LOCA) or a main steamline break (MSLB). These cooling water systems were not designed to withstand the hydrodynamic effects of waterhammer. (2) Cooling water systems serving the containment air coolers may experience two-phase flow conditions during postulated LOCA and MSLB scenarios. The heat removal assumptions for design basis accidents were based on single-phase flow conditions. (3) Thermally induced overpressurization of isolated water-filled piping sections in containment could jeopardize the ability of accident mitigating systems to perform their safety functions and could lead to a breach of containment integrity via bypass leakage.

In GL 96-06, the staff requested licensees to determine: (1) if containment air cooler cooling water systems are susceptible to either waterhammer or two-phase flow conditions during postulated accident conditions; and (2) if piping systems that penetrate the containment are susceptible to thermal expansion of fluid so that overpressurization of piping could occur. If such systems were found to be susceptible to the aforementioned conditions, licensees were expected to assess the operability of affected systems and take corrective actions in accordance with Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix B, and the plant technical specifications.

Licensees were requested to submit a written response within 120 days of September 30, 1996, stating actions taken in response to the requested actions of GL 96-06, conclusions that were reached relative to the susceptibility for waterhammer and two-phase flow in the containment air cooler cooling water system and overpressurization of piping that penetrates containment, the basis for continued operability of affected systems and components, and proposed corrective actions. If systems were found to be susceptible to these described conditions, then the systems affected were to be identified and the specific circumstances described. In addition, licensees were required to provide a written response within 30 days of September 30, 1996, indicating whether or not the requested actions would be completed, whether or not the requested information would be submitted, and whether or not the

requested submittal dates would be met within the requested time period. GL 96-06, Supplement 1, issued on November 13, 1997, provided guidance on the completion of GL 96-06, and as such did not require any specific actions to be performed.

Regarding the issue of vulnerability to waterhammer and two-phase flow conditions occurring in the containment air cooler cooling water system, Virginia Electric Power Company (VEPCO) provided its assessment for the North Anna and Surry Power Stations (NAPS and SPS) on January 28, 1997. Supplemental information was provided for NAPS and SPS on June 11 and July 30, 1998, respectively. Based upon the staff's review of the information provided, as clarified by VEPCO during an April 26, 2000, telephone call, it is our understanding the containment air recirculation coolers (CARCs) are not required for accident mitigation, and the design and operating restrictions placed on the CARCs and associated cooling water systems prelude the occurrence of waterhammer and two-phase flow during the event scenarios of interest. In particular, VEPCO credited the following features detailed in paragraphs 1) through 4) below.

1) During a design basis accident, the CARCs are automatically tripped and/or de-energized, and cooling water flow through the CARCs is automatically isolated by the return containment isolation trip valves and the supply check valves.

2) Thermal relief valves are provided to relieve excessive pressure in the isolated sections of CARC cooling water piping as the trapped water volume heats up, but they reseat at a high enough pressure to keep voids from forming in the isolated piping sections.

3) In the case of the SPS units, a surge tank of sufficient water volume and static head keeps the isolated sections of CARC cooling water piping fully charged and void-free during the event scenarios of interest.

4) In the case of the NAPS units, it is possible for steam to form in the CARC cooling water piping if a thermal relief valve should stick open because (unlike the SPS units) the CARC cooling water supply is switched to the service water system, which is an open loop cooling water system that does not have a surge tank to maintain water inventory and system overpressure. In order to avoid waterhammer during this unlikely scenario, VEPCO will revise applicable procedures to provide a slow, manually controlled fill and restoration of CARC cooling water flow, in the event that post-accident use of the CARCs is desired.

The staff has completed a review of VEPCO's submittals, and considers the waterhammer and two-phase flow issues of GL 96-06 to be closed for the NAPS and SPS units.

On the issue of thermally induced pressurization of piping penetrating the containment, the staff has completed its review of VEPCO's January 28 and October 23, 1997, February 25, 1998, and March 30 and June 22, 1999, submittals. VEPCO has identified 12 penetrations at each unit at the SPS and 19 at each unit at NAPS as being potentially vulnerable to a water solid volume that may be subjected to a pressure increase due to the heating of trapped fluid. Based upon subsequent reviews and final analyses, VEPCO determined that 12 penetrations at NAPS Unit 1, and 15 penetrations at NAPS Unit 2, required further evaluation, while 3 penetrations at each unit of SPS required additional evaluation.

VEPCO indicated that two of these penetrations at each of the two units at NAPS are only used during refueling outages, and committed to revise the operating procedures to drain these penetrations prior to unit start up following a refueling outage. Two additional penetrations contained weir-type diaphragm valves with rubber diaphragms. The overpressure will be relieved when these rubber diaphragms are deformed. For one penetration, VEPCO concluded that thermally induced pressurization will be relieved to acceptable values by lifting off of the outside containment air-operated isolation valve. In addition, VEPCO has indicated that the relief of the system pressure will occur below the pressure at which pipe stresses exceed the design basis allowable stress limits. VEPCO has determined all the remaining penetrations to be operable, based on the piping plastic deformation. For long-term corrective action, VEPCO agreed in its February 25, 1998, submittal to incorporate the methodology of Section III, Appendix F of the American Society of Mechanical Engineers (ASME) Code, for use in the analysis of isolated piping sections in containment under post-accident conditions.

VEPCO, in its submittal of March 30, 1999, provided the results of its piping analysis based on the criteria in Appendix F to Section III of the ASME Code. In response to the staff's request for additional information, VEPCO, in its submittal of June 22, 1999, revised its analytical results in full compliance with Appendix F of the ASME Code. The staff finds VEPCO's evaluation of NAPS reasonable and acceptable.

For SPS, VEPCO indicated that 6 of the 12 penetrations at each of the two units were only used during refueling outages. VEPCO committed to revising its operating procedures to drain these penetrations prior to unit start up following a refueling outage.

VEPCO also stated that 2 of the 12 penetrations at each unit at SPS contain weir-type diaphragm valves with rubber diaphragms. The overpressure will be relieved due to the deformation of the rubber diaphragm. For one of the penetrations at each unit, VEPCO concluded that thermally induced pressurization will be relieved to acceptable values by lifting off of the outside containment air-operated isolation valve. VEPCO stated the relief of the system pressure will occur below the pressure at which pipe stresses exceed the design basis allowable stress limits. VEPCO determined all remaining penetrations to be operable based on the piping plastic deformation.

For a long-term corrective action, VEPCO, in its submittal of February 25, 1998, committed to incorporate the methodology of Section III, Appendix F of the ASME Code for use in the analysis of isolated piping sections in containment under post-accident conditions.

For the final resolution of the three penetrations requiring additional evaluation, VEPCO, in its submittal of March 30, 1999, provided the results of its piping analysis based on the criteria in Appendix F to Section III of the ASME Code. In response to the staff's request for additional information, VEPCO, in its submittal of June 22, 1999, revised its analytical results in full compliance with Appendix F of the ASME Code. The staff finds VEPCO's evaluation of the SPS reasonable and acceptable.

The staff concludes that VEPCO's evaluation and subsequent corrective action provide an acceptable resolution for the issue of thermally induced pressurization of piping runs penetrating the containment at both NAPS and SPS.

On the basis of our review of your submittals, the staff has concluded that VEPCO has met the intent of GL 96-06, and the staff's efforts relative to VEPCO's responses to GL 96-06 have been completed; therefore, TAC Nos. M96838, M96839, M96873 and M96874 are closed.

Sincerely,

/RA/

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/RA/

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Docket Nos. 50-280, 50-281, 50-338
and 50-339

On the basis of our review of your submittals, the staff has concluded that VEPCO has met the intent of GL 96-06, and the staff's efforts relative to VEPCO's responses to GL 96-06 have been completed; therefore, TAC Nos. M96838, M96839, M96873 and M96874 are closed.

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