VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

November 14, 2007

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U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555

Serial No.	07-0690
NLOS/GDM	R3
Docket Nos.	50-280
	50-281
License Nos.	DPR-32
	DPR-37

VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION UNITS 1 AND 2
PROPOSED LICENSE AMENDMENT REQUEST
INCREASED MAXIMUM SERVICE WATER TEMPERATURE LIMIT
REQUEST FOR ADDITIONAL INFORMATION

By letter dated June 25, 2007 (Serial No. 07-0401), Virginia Electric and Power Company (Dominion) requested amendments, in the form of changes to the Technical Specifications (TS) to Facility Operating License Numbers DPR-32 and DPR-37 for Surry Power Station Units 1 and 2, respectively. The proposed change increases the maximum service water temperature limit from 95°F to 100°F. The proposed change is necessary to proactively address observed increases in service water intake temperatures during the past two summers, which have approached the existing TS limit.

In a letter dated October 3, 2007, the NRC staff requested additional information to facilitate their review of the proposed license amendment request. Dominion's response to the staff's request is included in the attachment. The additional information provided herein does not affect the significant hazards consideration determination or environmental assessment that were previously provided in support of the proposed license amendment request.

If you have any questions or require additional information, please contact Mr. Gary D. Miller at (804) 273-2771.

Sincerely,

Gerald T. Bischof
Vice President – Nuclear Engineering

Commitments made in this letter:

1. Operability limit curves will be incorporated into station CCHX periodic tests as acceptance criteria to verify the ability of the CCHXs to adequately perform their required safety function.

Attachment:
Response to NRC Request for Additional Information

COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by Gerald T. Bischof, who is Vice President – Nuclear Engineering, of Virginia Electric and Power Company. He has affirmed before me that he is duly authorized to execute and file the foregoing document in behalf of that Company, and that the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this 14th day of November, 2007.

My Commission Expires: August 31, 2008.

MARGARET B. BENNETT
Notary Public 354302
Commonwealth of Virginia
My Commission Expires Aug 31, 2008

Margaret B. Bennett
Notary Public

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ATTACHMENT

LICENSE AMENDMENT REQUEST TO INCREASE THE MAXIMUM SERVICE WATER TEMPERATURE LIMIT

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION

Virginia Electric and Power Company
(Dominion)
Surry Power Station Units 1 and 2

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION SURRY POWER STATION UNITS 1 AND 2

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1. *The application states: "Equipment supported by the CC [component cooling] system will not be impacted by increasing the SW [service water] temperature to 100°F due to the analytical restrictions imposed by this evaluation. In this evaluation the maximum CCHX [component cooling water heat exchanger] outlet temperature was constrained to the same value as in previous evaluations in which the SW temperature was 95°F. The CC fluid outlet temperature of the CCHXS will be no more than the 120°F currently supplied to the CC system loads."*

   a. *The only apparent analytical restriction described in the application is limiting the "...CCHX outlet temperature..." to the value used in previous evaluations. What other analytical restrictions have been imposed in the evaluation?*

   b. *In constraining the CCHX outlet temperature to the same values as in previous evaluations, describe any changes in the way the CC or SW systems are operated or maintained?*

   c. *UFSAR [Updated Final Safety Analysis Report] Table 9.4-1, "Component Cooling Water System Component Design Data," indicates that with a service water temperature of 95°F, the operating temperatures for the CC water CCHX inlet temperature is 119.7°F and CCHX outlet temperature is 105.0°F. With an increase in the SW temperature to 100°F what will be the impact on these values and what impact will there be on the cooldown rates?*

Dominion Response

1.a The following analytical restrictions have been imposed in support of the proposed license amendment request:

- CCHX tube fouling values in the analytical model have been limited to the values provided in the CCHX design specification data sheet, (i.e., Ri = 0.008 and Ro = 0.002.) CCHX testing demonstrated that, for micro-fouling, the CCHX design specification data sheet values are bounding. This restriction conservatively assumes maximum specification data sheet CCHX tube fouling when determining CCHX operability.

- The CCHX CC water outlet temperature is limited to the same value (i.e., 120°F) for the increased maximum SW temperature limit of 100°F as it was for the existing maximum SW temperature limit of 95°F.

- The heat duty required for the CCHXs is limited to a specific value as determined by system operating requirements. Specifically, a revised acceptable operability range for the CCHXs has been determined considering the increase in the maximum SW temperature limit to 100°F.

1.b In support of the proposed license amendment request, CC system performance was evaluated to establish the required acceptance criteria for operating at the increased maximum SW temperature limit of 100°F. Specifically, a CCHX performance test was conducted to define the fouling that the chemically treated CCHXs could experience under expected operating conditions. This test demonstrated that the CCHXs' design specification data sheet fouling values can be used in support of the development of the CCHX test acceptance criteria.

The CCHXs were determined to be sensitive to two types of fouling: macro-fouling and micro-fouling. Macro-fouling is any major blockage occurring when biological growth begins to foul the tubesheet and tubes. When testing the CCHXs, a relationship for SW flow versus tubesheet pressure drop is used to evaluate the amount of macro-fouling occurring in a CCHX. Since the SW supply to the CCHXs is gravity fed, as opposed to pump driven, any plugged tubes will reduce the SW flow in direct proportion to the number of tubes (or area) lost to plugging. Micro-fouling is assumed to be at the design specification data sheet fouling values. As noted above, testing confirmed the use of the datasheet fouling values in the CCHX test acceptance criteria development.

Additionally, a review of the heat loads on the CC system was performed to ensure that the CCHX acceptance criteria are based upon the most recent plant system heat loads. The maximum expected heat load was determined and was used as the constant heat load in the development of the new CCHX acceptance criteria for operation.

A calculation was performed to develop curves to show the operable limits for the service water flow expected during normal plant operation. The curves identify an operable range for each heat exchanger. This indicates that the heat exchanger is capable of removing the necessary heat load for a given service water flow. The curves also identify an alert condition for a heat exchanger. This indicates that the heat exchanger is capable of removing the required heat, but consideration must be given to heat exchanger cleaning. The inoperable region of the curves identifies that the heat exchanger has degraded below the minimum capability to remove the required heat load.

Two such curves are presented in the two figures provided below for CCHX operability at SW temperatures of 95°F and 100°F, respectively. The x-axis of the chart represents the annubar differential pressure that measures the total SW flow through the CCHX. The y-axis of the chart represents the tubesheet differential pressure that indicates the pressure drop across the tubesheet. The line designating the area of CCHX inoperability for a specific SW temperature was developed by determining the extent of tube plugging (i.e., tubesheet differential pressure) at various SW total flow values, while holding the heat load constant, beyond which the CCHXs could not adequately perform their heat removal function. For a constant heat load, as SW temperature drops, required SW flow can be reduced.

As indicated in the two figures below, the operability limit curves are temperature sensitive. Therefore, operability limit curves have been developed for the CCHXs for SW temperatures ranging from 60°F to 100°F in five degree increments. The operability limit curves will be incorporated into station CCHX surveillance tests to verify the ability of the CCHXs to adequately perform their required safety function at various SW temperatures.

CCHX OPERABILITY LIMITS
AT 95°F MEASURED SW TEMPERATURE

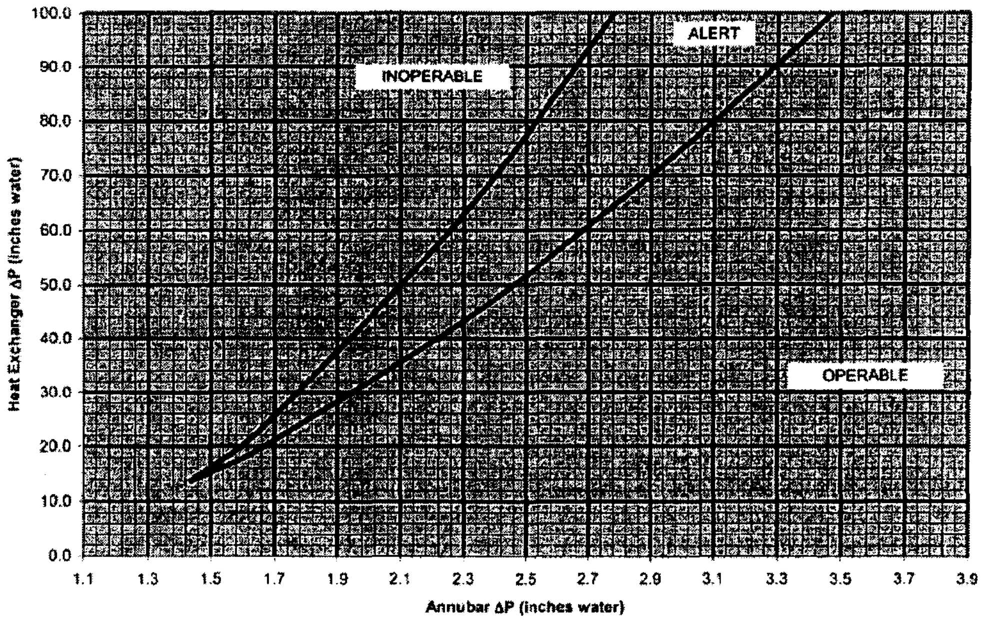

Figure 7-4

CCHX OPERABILITY LIMITS
AT 100°F MEASURED SW TEMPERATURE

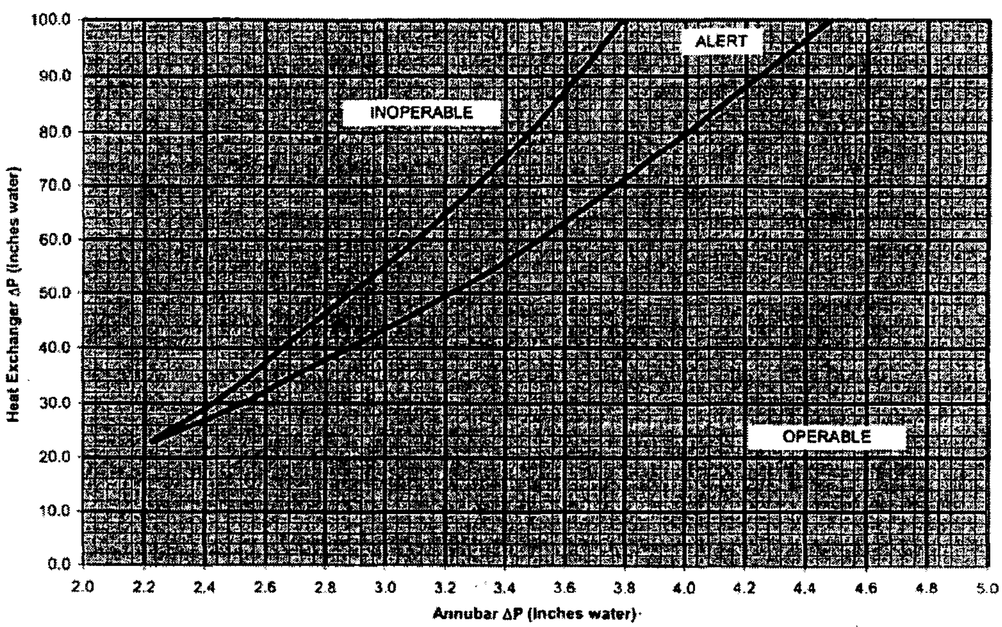

Figure 7-3

1.c An evaluation was performed to demonstrate that with: 1) two units at power, 2) normal CC heat loads, 3) minimal tube blockage, and 4) a normal SW flow of 9000 gpm per CCHX, the CC water (CCW) outlet temperature is predicted to remain below the normal limit of 105°F. Furthermore, the CCW outlet temperature is expected to remain below the alarm value of 110°F for SW flows as low as 6500 gpm assuming tubesheet and tube blockage is minimal. In addition, with fully open SW inlet valves to the CCHXs, flows greater than 9000 gpm have been measured during previous flow tests with the Circulating Water intake canal (which supplies the SW system) at normal operating levels. Thus, the values in UFSAR Table 9.4-1 remain unchanged since they continue to represent normal operating conditions. The impact on plant cooldown rates is discussed in Dominion's response to Question 5 below.

2. *When the maximum SW temperature was increased from 92°F to 95°F in 1993, the application (Accession No. 9307230230) stated that the main control room (MCR) and emergency switchgear room (ESGR) air conditioning systems (ACS) "...are designed for service water temperatures up to 95°F." The current application states that there will be a "small decrease" in the capacity of the ACS chillers. Please provide a description of any analyses/evaluations that have been performed for the higher SW temperature. What is the projected reduction on the ACS chiller capacity and the basis for this reduction, and what are the resulting environmental conditions in the MCR and the ESGR with SW temperature of 100°F and the most-limiting operating conditions?*

Dominion Response

During the preparation of the proposed license amendment request, testing was performed to determine the effect of a 100°F SW temperature on the MCR/ESGR envelope over a period of several hours. The testing demonstrated that the MCR/ESGR envelope space temperatures could be maintained within the normal operating range (75°F-85°F) with no observed space temperature increase during the test period.

Furthermore, the MCR and ESGR ACS chillers were specified for a refrigeration capacity of 90 tons with a 95°F inlet SW temperature. For two operating chiller units (approximate capacity of 180 tons), the chiller design load requirements under design basis conditions [no loss of offsite power (LOOP)] are between 110 tons and 120 tons. For single chiller unit operation (with a LOOP), the expected normal design basis heat loads are below 85 tons. Given these margins and the demonstrated capacity to maintain space temperatures within the normal operating range with 100°F SW temperature, the MCR and ESGR ACS chiller units are capable of performing their design basis function.

3. *The application states that the lube oil coolers and the intermediate seal coolers will continue to have "adequate margin" with a SW temperature of 100°F. Please provide a description of the evaluation performed and the results of the evaluation that demonstrated adequate margin will be available with the increased SW temperature.*

<u>Dominion Response</u>

- <u>Charging Pump Lube Oil Coolers</u>

  The charging pump lube oil coolers were designed to remove heat from the charging pump bearings and gear drive under operating and accident conditions. There is one cooler per charging pump with oil on the shell side and service water on the tube side. The charging pump and gear box manufacturers have provided an operating limitation on bearing temperature at 185°F. To maintain the bearings below this temperature, the upper temperature limit for lube oil supplied to the charging pump is 160°F. Bearing temperatures are continuously checked via a trend recorder that is monitored by the plant computer system (PCS). The PCS alarms prior to the bearing temperature reaching 180°F. Also, plant operators log the oil temperature at the outlet of the cooler. If the oil temperature is above 110°F, the assigned system engineer is notified.

  Engineering evaluations have shown that these coolers have considerable design heat load margin such that micro-fouling would not be a concern. Furthermore, the coolers are flushed bi-weekly to remove any silt which may have accumulated in the head or tubes of a cooler serving a non-running charging pump. Based on the above information, an increase in the maximum SW temperature limit to 100°F would not be a concern considering the charging pump lube oil coolers oil temperature upper temperature limit for lube oil supplied to the charging pump is 160°F.

- <u>Charging Pump Intermediate Seal Coolers</u>

  The charging pump seal water is cooled by a closed system that is cooled by the SW via the charging pump intermediate seal coolers. There are two intermediate seal coolers per Unit. The coolers have charging pump CCW on the shell side and SW on the tube side. The function of the charging pump intermediate seal coolers is to remove heat from the seal cooling loop, thereby maintaining the charging pump seals within their required temperature range. The charging pump seal temperature is approximately 130°F during normal operation. During accident conditions, the seal temperature peaks at approximately 191°F but doesn't exceed the maximum seal operating temperature of 250°F; consequently, significant margin exists.

  The design heat transfer capacity of the charging pump intermediate seal coolers is 760 Btu/min. A calculation was performed that demonstrated the design heat load could be removed even if the cooler is 40% fouled. The design margin of the coolers, as determined by calculation and operating experience, is very large. A previous engineering evaluation of these coolers concluded that performance testing is not even required to be performed because: 1) the thermal load under normal operating conditions is so low that meaningful data cannot be obtained, and 2) the heat exchanger specification data sheet shows a 2°F tube side temperature rise under design heat loads. Evaluation of heat exchanger performance for such a small change would not provide any meaningful information.

Therefore, based on the above information, the proposed increase in SW temperature to 100°F does not present a concern for these coolers.

4. *The application states the "Emergency Service Water Pumps (ESWP) diesels were evaluated and found to have no significant effects from an increase in the SW temperature limits." Please provide a description and the results of the evaluation performed that determined there were no significant effects from an increase in SW temperature limits to 100°F.*

Dominion Response

The effect of a SW temperature increase of 100°F on density, vapor pressure, and brake horsepower was evaluated for the ESWPs, and it was determined that delivered flow is not affected significantly. Also, for a maximum SW temperature of 100°F, the diesel jacket outlet water temperature will not exceed 200°F, and a conservative maximum jacket water temperature of 200°F remains below the current setting for the high jacket water temperature switches, which trip the diesels at approximately 210°F. Consequently, it was determined that there were no significant effects on the ESWP diesels from an increase in the maximum SW temperature limit to 100°F.

5. *Technical Specification 3.13.A.2 requires: "For two unit operation, three component cooling water pumps and heat exchangers shall be OPERABLE." The Basis for this specification states: "Each of the component cooling water heat exchangers is designed to remove during normal operation the entire heat load from one unit plus one half of the heat load common to both units. Thus, one component cooling water pump and one component cooling water heat exchanger are required for each unit which is at POWER OPERATION." Therefore, having three pumps/heat exchangers operable will leave adequate component cooling water capability in the event of a single failure.*

The application states: "For the worst-case heat load (normal shutdown of two units following a loss of offsite power) and 100°F SW temperature, three CCHXs have the *capacity to support the CC design requirements." If three CCHXs are required to support the CC design requirements, four CCHXs should be required to be OPERABLE in TS 3.13 in order to maintain minimum required capability after a single failure. Please provide a proposed change to TS 3.13 or an explanation for maintaining TS 3.13 in its current form.*

Dominion Response

As noted in the TS 3.13 Basis, each of the CCHXs is designed to remove the entire heat load from one unit plus one half of the heat load common to both units during normal operation. Additionally, the TS Basis states that two CC pumps and two CCHXs are *normally* operated during the removal of residual and sensible heat from one unit during cooldown. As stated in the Surry Updated Final Safety Analysis Report, Section 9.4, "Operation of two pumps and two heat exchangers is the standard procedure during the removal of residual and sensible heat during unit cooldown, although one pump and one exchanger may be safely used under these conditions." Consequently, one CC pump and one CCHX is capable of accomplishing unit shutdown; however, it isn't the preferred (i.e., normally used) method since it takes a longer, though acceptable, period of time to accomplish shutdown.

Note that the TS 3.13 Basis also states that failure of a single CC component may extend the time required for cooldown but does not affect safe operation of the station. This statement refers to a single unit cooldown. Evaluations were performed for the license amendment request that demonstrated, with an increase in the maximum SW temperature limit to 100°F, two-unit cooldown and removal of required heat loads can be accomplished with three CC pumps/CCHXs. However, if only two CCHXs were available, the time to accomplish plant cooldown would be extended, but the CCHXs would still be capable of removing the required heat loads.

6. *In Generic Letter (GL) 96-06, "Assurance of Equipment Operability and Containment Integrity during Design-Basis Accident Conditions," licensees were requested to address a) cooling water system waterhammer and two-phase flow in the containment air cooler cooling water system, and b) thermal overpressurization of piping (fluid systems) that penetrates containment. Changes in the SW temperature limit could affect a nuclear plant's analyses that address the GL 96-06 issues. The statement on page 11 of the subject license amendment request (LAR), in reference to GL 96-06, only addresses the impact the increase in SW temperature limit will have on the cooling water system, which is one of the two concerns of the GL. Table 1, page 18 of the LAR, states that in a loss-of-coolant accident "increasing SW temperature will .... increase containment pressures...." Please explain how you have evaluated the second concern of the GL relative to the piping thermal overpressurization of fluid systems that penetrate containment due to the increase of the SW temperature limit to 100°F and discuss the results of your evaluation.*

Dominion Response

The response to GL 96-06 for Surry Power Station is based on an evaluation that determined that the Containment Air Cooling System is not susceptible to two phase flow or a water hammer event during a design basis accident (DBA) because the system is isolated and de-energized. Therefore, there is no detrimental effect from an increase in the maximum SW temperature limit from 95°F to 100°F.

Dominion's GL 96-06 evaluation of potential thermal overpressurization of containment piping penetrations assumed an initial inside fluid temperature of 120°F for the penetrations, which equals the CCHX CCW outlet temperature used in the evaluation performed for the proposed license amendment request. Therefore, since the CCW temperature limit is not being changed as a result of the maximum SW temperature limit increase to 100°F, the previous evaluation of potential piping thermal overpressurization of fluid systems that penetrate containment is unchanged and remains valid.

7. *In reference to the safety-related fiberglass piping, it is stated on page 11 of the LAR that this piping has the most-limiting stress margins of any of the piping at Surry 1 and 2 related to the increase in the maximum SW temperature limit to 100°F. For the safety-related fiberglass piping, please provide a summary of the results of your evaluation showing current maximum stresses, maximum stresses due to SW temperature increase and compare it to the allowable stresses.*

Dominion Response

Unlike metal pipe, the fiberglass piping was qualified to the criteria of ASME Code Case N155-2, where the qualification is performed with combined primary and secondary stresses. Therefore, fiberglass piping was considered more limiting than metal pipe in the review for temperature increase which produces an increase in secondary stress. In fiberglass pipe, the expansion occurs due to both pressure and temperature; therefore, the additional expansion due to the marginal increase in temperature from 95°F to 100°F was evaluated. The review showed that the combined primary and secondary stresses in the piping remained under the Code Case N155-2 allowable stress at 100°F, as was the case at 95°F. From many different configurations of fiberglass piping evaluated for the proposed temperature increase, the stresses at a few highly stressed locations are given in the following table.

Loading Condition	Calculated Stress (psi)		
	Prior to Increasing Temperature	After Temperature Increase	Allowable Stress (psi)*
Normal Condition Press+Weight+Thermal	2904	2969	3000
	2837	2953	3000
	2741	2960	3000
	1194	1223	2280
	1701	1806	2280
Upset Condition Pressure+Weight+ Thermal+OBE	2215	2244	2736
	2466	2571	2736
Faulted Condition Pressure+Weight+ Thermal+DBE	3343	3408	3600**
	2971	3087	3600**
	2904	3123	3600**
	3453	3482	4104
	3371	3476	4104

* Different grade of fiberglass material was used resulting in different allowable values.

** The Faulted stresses were compared with Upset allowable values; therefore, Upset condition was not evaluated separately.

8. *Describe the effect that the increase of the maximum SW temperature limit to 100°F will have in the SW and SW-influenced piping and pipe supports. Also, indicate how the impact of the increased temperature was evaluated.*

Dominion Response

The metal service water piping for Surry Power Station was qualified to the applicable piping code, i.e., ANSI B31.1. Allowable stress in the metal pipe does not change with a temperature increase from 95°F to 100°F. In the B31.1 Code analysis of metal pipe, the stresses due to primary loading (deadweight, pressure and seismic) are not combined with secondary (thermal expansion) stresses for qualification. Therefore, the qualification of metal pipe for primary loading is not affected due to the proposed increase in service water temperature from 95°F to 100°F.

However, the range of thermal expansion stress increases by about 10% for the change in expansion of piping due to the proposed increase in temperature. It is common industry practice not to analyze metal piping for thermal expansion in this temperature range. The existing piping analysis shows that there is adequate margin in the expansion stresses to accommodate this proposed change. The review of fiberglass piping is included in the Dominion response to Question No. 7 above.

Pipe supports are designed for combined deadweight, thermal and seismic loadings. A small increase in thermal load will only insignificantly influence overall support design loads.