VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

January 24, 2007

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
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Serial No. 06-1107
NL&OS/ETS R0
Docket Nos. 50-338/339
License Nos. NPF-4/7

**VIRGINIA ELECTRIC AND POWER COMPANY (DOMINION)
NORTH ANNA POWER STATION UNITS 1 AND 2
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION
PROPOSED TECHNICAL SPECIFICATION CHANGE AND
SUPPORTING SAFETY ANALYSES REVISIONS TO ADDRESS
GENERIC SAFETY ISSUE 191**

In an October 3, 2006 letter (Serial No. 06-849), Dominion requested an amendment to Operating License Numbers NPF-4 and NPF-7 in the form of changes to the Technical Specifications (TS) for North Anna Power Station Units 1 and 2, respectively. The proposed changes were submitted as part of Dominion's resolution to NRC Generic Safety Issue 191 (GSI-191). In a December 28, 2006 letter, the NRC requested additional information to complete the review of the proposed TS and supporting safety analyses. The requested information is provided in the attachment to this letter.

Dominion continues to request NRC staff approval of the proposed TS change and supporting safety analyses revisions by February 15, 2007 in order to implement the proposed changes during the spring 2007 refueling outage for North Anna Unit 2 and during the fall 2007 refueling outage for North Anna Unit 1. This schedule is necessary to meet the required implementation schedule for GSI-191/GL 2004-02 resolution. A staggered implementation of the TS change is required due to the plant modifications, which only can be performed during a plant outage. However, it remains Dominion's intention to implement the North Anna Units 1 and 2 containment analyses with the GOTHIC code (replacing the Stone and Webster LOCTIC computer code) for both units during the spring 2007 North Anna Unit 2 refueling outage. Attachment 1 of our October 3, 2006 letter includes GOTHIC analyses for the current and proposed plant configurations. The current configuration analyses will be applicable to North Anna Units 1 and 2 upon NRC approval of the application of the GOTHIC methodology for North Anna.

If you have any questions regarding this submittal, please contact Mr. Thomas Shaub at (804) 273-2763.

Very truly yours,

Gerald T. Bischof
Vice President – Nuclear Engineering

Commitments made in this letter: None

Attachment – Response to Request for Additional Information

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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 the 24TH day of January, 2007.
My Commission Expires: May 31, 2010.

Vicki L. Hull
Notary Public

(SEAL)

ATTACHMENT

SERIAL NO. 06-1107

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

PROPOSED TECHNICAL SPECIFICATION CHANGE AND SUPPORTING SAFETY ANALYSES REVISIONS TO ADDRESS GENERIC SAFETY ISSUE 191

VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION UNITS 1 AND 2

REQUEST FOR ADDITIONAL INFORMATION REGARDING GENERIC SAFETY ISSUE 191 TECHNICAL SPECIFICATION AMENDMENT NORTH ANNA POWER STATION UNIT NOS. 1 AND 2

NRC Question 1:

Attachment 4, Insert # 4, last two sentences of your application dated October 3 2006, state: "An operator can initiate [recirculation spray] RS at any time from the control room by using the pump control switch. The manual function would be used only when adequate water inventory is present in the containment sump to meet the RS sump strainer functional requirements." Please explain how the operator would verify that adequate water inventory is present in the sump that meets the RS pump minimum net positive suction head (NPSH) requirement in order to prevent an erroneous pump start.

Dominion Response - Question 1:

Currently, the NAPS Emergency Operating Procedures (EOPs) allow the operator to manually start the recirculation spray (RS) pumps if the containment sump water level (indicated wide range) is greater than 16 inches. This setpoint ensures adequate net positive suction head (NPSH) for the RS pumps, considering sump level instrument uncertainty in a harsh environment and the existing containment sump screens. The containment sump wide range level instrumentation is classified as safety-related for RG 1.97 monitoring of the post-accident containment environment. Sump wide range water level indication is located in the control room.

The replacement sump strainer for the RS system imposes a new requirement on the operation of the RS pumps. Specifically, the RS pumps can only be started after the RS strainer is fully submerged to prevent air ingestion into the strainer. Thus, as part of the containment sump strainer design change, the EOP setpoint for starting the RS pumps manually will be revised to ensure the containment sump water level is sufficient to provide adequate submergence for the RS strainer and adequate NPSH for the RS pumps.

NRC Question 2:

Attachment 4, Insert # 9, first sentence states: "Refueling water storage tank (RWST) Level-Low coincident with Containment Pressure-High High provides the automatic start signal for the inside RS [IRS] and outside RS [ORS] pumps." Please explain how does the automatic logic verify that adequate water is present in the sump that meets the RS pump minimum NPSH requirement in order to prevent an erroneous pump start.

Dominion Response - Question 2:

The recirculation spray (RS) system actuates to mitigate a design basis loss of coolant accident (LOCA) with the most limiting single active failure. During a design basis LOCA, the refueling water storage tank (RWST) inventory is added to the containment by the quench spray (QS) system and to the reactor coolant system (RCS) by the safety injection (SI) system. The SI fluid eventually reaches the containment via the break in the RCS. The GOTHIC containment analyses explicitly model the time-dependent RWST mass addition, as well as the addition of water from the casing cooling tank, the accumulators, and the RCS (above the break location). The RWST Level Low setpoint of 60% wide range provides adequate margin for all containment analysis acceptance criteria (see Table 3.11-1 in Attachment 1 of the October 3, 2006 submittal) as well as a minimum containment sump water level that meets the RS strainer submergence requirements and RS pump NPSH requirements. This conclusion was validated by analysis for the full range of design basis LOCA and single failure scenarios.

The automatic logic for the RWST Level Low function does not use the containment sump level as an input. For all design basis LOCAs, the GOTHIC analyses for a nominal 60% RWST Level Low setpoint confirm that sufficient water volume will reach the containment sump to meet the RS strainer submergence and NPSH requirements before the RS pumps start automatically. The GOTHIC analyses include conservatisms for the parameters that affect containment sump water level (e.g., water held up that would not reach the containment sump, initial RWST level, and uncertainty on the RWST Level Low setpoint) to ensure that the RS strainer submergence and NPSH requirements are met before RS pump start.

NRC Question 3:

Attachment 2, proposed Technical Specification Section 3.6.5 revises the upper limit of the containment average air temperature from "120°F" to "≤115°F." Section 9.4.9.1, second paragraph of the Updated Final Safety Analysis Report (UFSAR) states: "The ventilation systems are designed to maintain the containment bulk air temperature within the Technical Specification limits when two of the three recirculation system fans and three dome recirculation fans are running, the (control rod drive mechanism) CRDM cooling systems are operating, and the cooling system for the reactor coolant pump motors is functioning. Normally, all three main recirculation fans will be operating during summer periods." Please confirm that the existing containment ventilation system design has been re-evaluated to verify that it has sufficient capacity to maintain the containment bulk air temperature ≤115°F under the worst design conditions.

Dominion Response - Question 3:

The ventilation systems were designed to maintain the containment bulk air temperature less than 105°F, which was the original Technical Specification limit, when two of the three recirculation fans are running, the CRDM cooling systems are operating, and the cooling system for the reactor coolant pump motors is functioning. The ventilation system design was confirmed to maintain temperature less than 105°F for the current (uprated) licensed reactor power of 2893 MWt. In a letter dated March 2, 1988, Virginia Power submitted a license amendment request to the NRC to increase the North Anna Technical Specification containment temperature limit from 105°F to 120°F, to obtain operating relief during summer months when the containment bulk air temperature would approach 105°F. The NRC approved the TS limit increase to 120°F in a letter dated December 14, 1988 (License Amendments 110 for NAPS Unit 1 and 96 for NAPS Unit 2). While the TS limit for containment temperature was increased to 120°F, the design of the ventilation systems was not altered and containment temperature is usually maintained at less than 105°F. The ventilation systems continue to provide adequate capacity to maintain containment temperature less than 105°F for the design conditions cited in the UFSAR statement, and the proposed TS limit change does not alter this conclusion.

NRC Question 4:

Attachment 1, Section 2.2 under the heading "Plant Safety Analysis Impact", fifth bullet, third sentence states: "This pump [ORS and IRS] start delay reduces the early loads on the emergency diesel generator." However, since the loading of diesel generator with ORS and IRS motor loads is delayed, please confirm that the revised loading sequence has been re-evaluated to verify that it meets Regulatory Position 4 of Safety Guide 9 as it pertains to its load accepting capability of the ORS and IRS motor loads in conjunction with other Engineered Safety Features (ESF) step loads with which the system is loaded. Position 4 of Safety Guide 9 states: "At no time during the loading sequence should the frequency and voltage decrease to less than 95 percent of nominal and 75 percent of nominal, respectively. During recovery from transients caused by step load increases or resulting from the disconnection of the largest single load, the speed of the diesel generator set should not exceed 75 percent of the difference between nominal speed and the overspeed trip setpoint or 115 percent of nominal, whichever is lower. Voltage should be restored to within 10 percent of nominal and frequency should be restored to within 2 percent of nominal in less than 40 percent of each load sequence time interval."

Dominion Response - Question 4:

Colt Industries, Fairbanks Morse Engine Division Emergency Standby Engine Dynamic Loading Analysis provided a final load block analysis for the North Anna Power Station Emergency Diesel Generators (EDGs) that bounds the starting of the inside recirculation spray (IRS) and outside recirculation spray (ORS) pumps. The dynamic loading analysis conservatively models a 450 horsepower (hp) motor start with an existing load of 2800 kW. The maximum voltage deviation is a decrease of 13.2% to 86.8% of nominal in 0.08 seconds, recovered to 90% of nominal in 0.21 seconds and 100% of nominal in 0.59 seconds. The maximum frequency deviation is a decrease of 2.91% to 97.09% of nominal in 1.5 seconds, recovered to 98% of nominal in 6.0 seconds and 100% of nominal in 11.9 seconds.

Currently, the EDG load sequencing is 210 seconds for the ORS pump and 400 seconds for the IRS pump after a Containment Depressurization Actuation (CDA) signal on Containment Pressure High High. The RS pump starts are the final load blocks (i.e., the last automatically connected loads) and produce the peak loading on the EDG. The worst case EDG loading for a Loss of Coolant Accident (LOCA) with a Loss of Offsite Power (LOOP) during the RS pump motor starts occurs on the Unit 1H EDG. The EDG loading is 2451 kW prior to the start of the ORS pump (400 hp motor) and 2723 kW prior to the start of the IRS pump (300 hp motor). Both of these pump motor starts are conservatively bounded by the existing dynamic load analysis.

After the proposed GSI-191 modifications to the RS pump start logic, the EDG load sequencing will be based on 60% RWST wide range level for the ORS pumps and 60% RWST wide range level plus a 2-minute time delay for the IRS pumps. The GOTHIC containment analyses for a large break LOCA show the 60% RWST level setpoint is reached between 14 minutes (2 trains of engineered safeguards, maximum pump flow, and minimum initial RWST level) and 40 minutes (1 train of engineered safeguards, minimum pump flow, maximum initial RWST level) after the CDA signal. Based on the predicted system response during a LOCA with a LOOP, the RS pumps remain in the final load blocks and there is no change to the current analyzed EDG loading or the current voltage and frequency response. Therefore, the existing dynamic load analysis remains bounding for the proposed change.

NRC Question 5:

Attachment 1, Section 3.9, fourth sentence states: "Composite pressure and temperature profiles were developed that bounded the [loss-of-coolant accident] LOCA and [main steam line break] MSLB pressure and temperature profiles from GOTHIC." Please provide the developed composite pressure and temperature profiles which are the revised basis for equipment qualification.

Dominion Response - Question 5:

Figures 1 and 2 compare GOTHIC containment vapor temperature and pressure profiles for the most limiting MSLB analyses to the equipment qualification (EQ) composite profiles that were developed to bound all GOTHIC results for LOCA and MSLB analyses. The MSLB accident produces long-term containment temperature and pressure profiles that bound the LOCA event, because the MSLB analyses do not credit the recirculation spray (RS) system and assume only one quench spray (QS) pump is available for containment atmosphere cooling. Thus, the MSLB long-term pressures and temperatures are more severe than LOCA analyses that assume one QS pump and two RS pumps. Figures 1 and 2 compare the most limiting MSLB profiles and the effect of not crediting the RS system in the MSLB analysis is evident. The most adverse long-term temperature is obtained for a 0.001 ft^2 MSLB at 0% power. This small break size has a significant amount of steam generator (SG) liquid mass remaining when auxiliary feedwater is terminated at 30 minutes. The SG secondary boiloff continues until 5,270 seconds, at which time containment pressure and temperature begin to decrease. When QS spray is terminated at about 12,000 seconds, there is no active containment heat removal and the containment temperature increases to a peak that is less than 150°F. In the long-term, the containment temperature decreases as energy is transferred through the containment walls to the outside atmosphere.

The EQ composite profiles in Figures 1 and 2 were compared to the test reports for all environmentally qualified equipment inside containment, and it was concluded that the environmentally qualified equipment inside containment remain qualified for the GOTHIC accident analysis profiles for pressure and temperature.

Figure 1: GOTHIC Containment Temperatures and Composite Profile for EQ

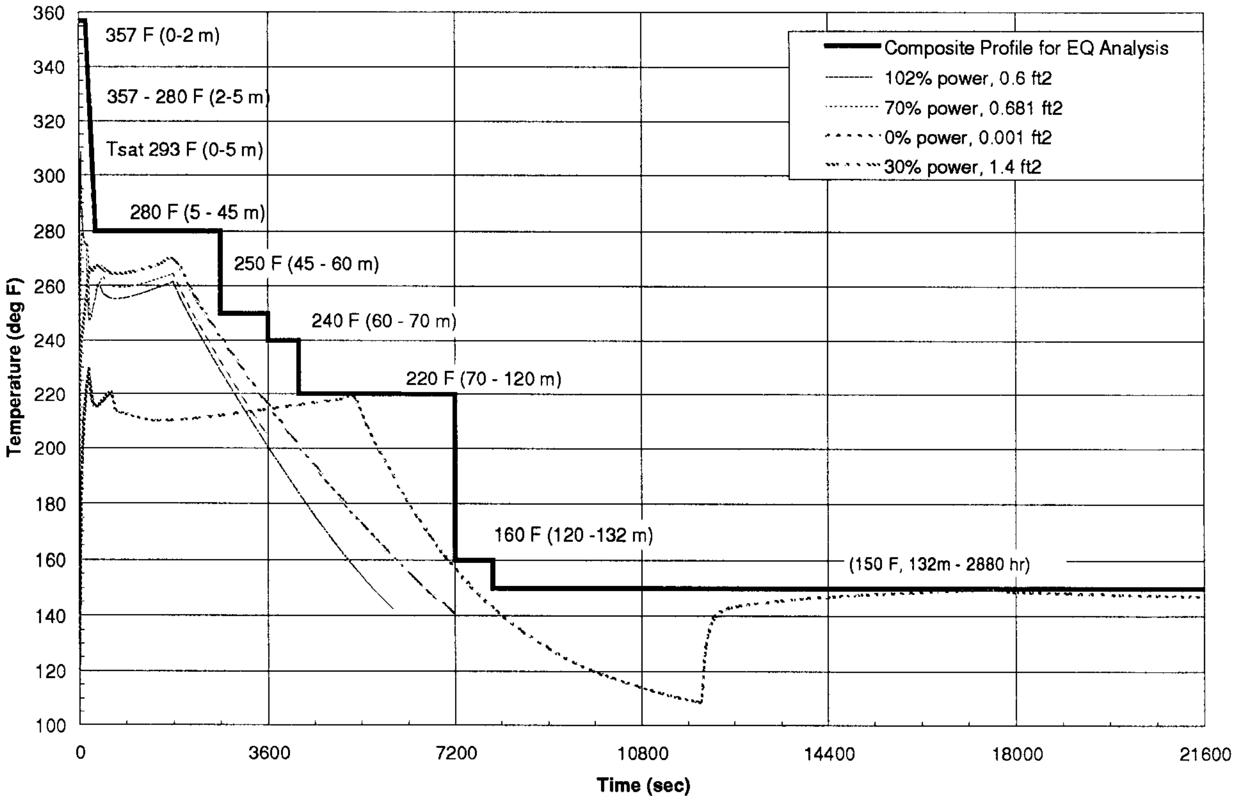
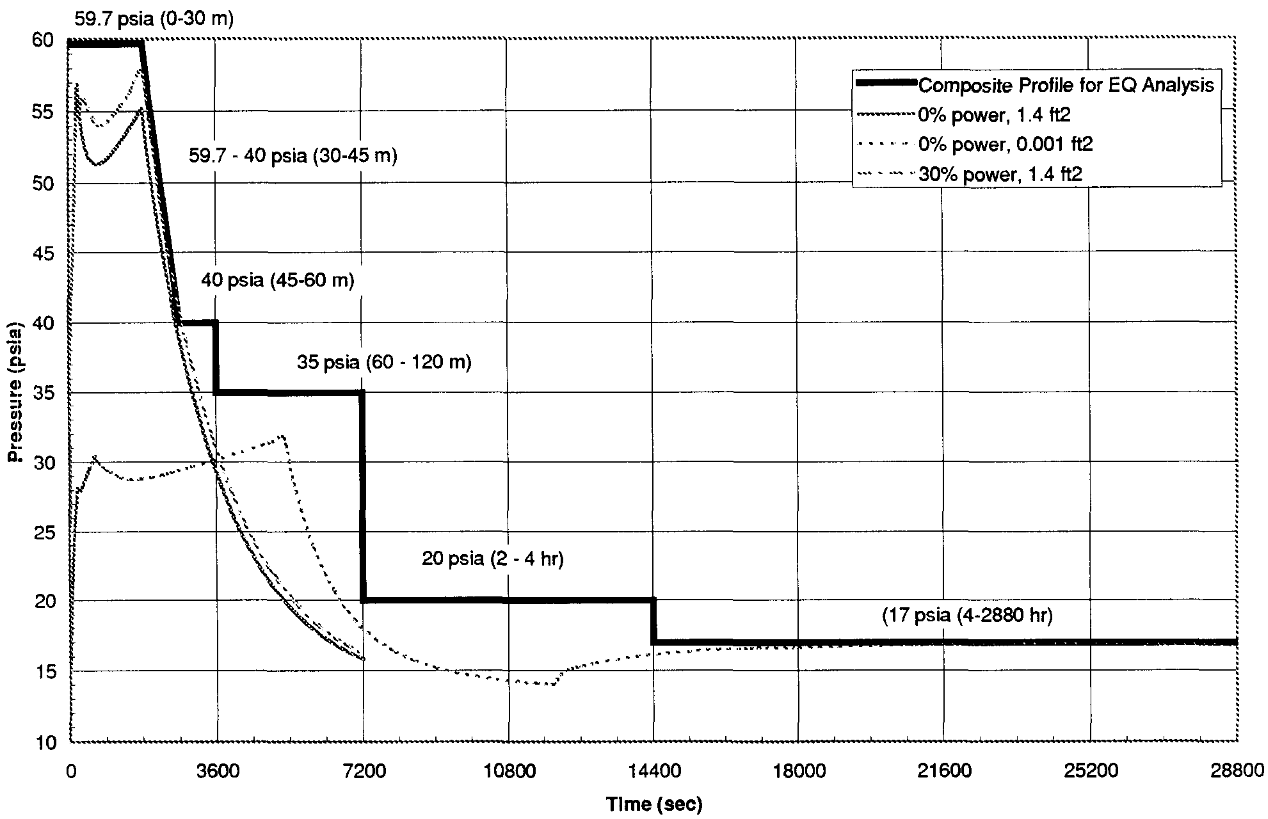


Figure 2: GOTHIC Containment Pressures and Composite Profile for EQ



NRC Question 6:

Attachment 4, Insert #13, last sentence states: "This frequency has been found to be sufficient to detect abnormal degradation and is confirmed by operating experience." Please specify what kind of abnormal degradation has been found in sump components that are confirmed by operating experience.

Dominion Response - Question 6:

The sump component inspections are performed every 18 months during refueling outages to assess the structural integrity and abnormal corrosion of the trash racks and screens. The existing carbon steel sump components inspected include: trash racks, screens, vortex breakers, sump well screens, and associated bolted connections and anchor bolts. In addition, the recirculation spray system suction inlets are inspected for debris. These components are located in the containment sump. Some of these components are constantly wetted and all these components are wetted during the 18-month flow test of the Inside Recirculation Spray pumps.

Over the last four outages for each unit, no significant structural integrity or corrosion issues have been identified. No abnormal degradation was identified. Only minor debris and general corrosion of the carbon steel trash racks, screens, vortex breaker and associated anchors have been identified. However, due to the general corrosion, anchor bolts and portions of the vortex breakers have been replaced. In addition, any gaps/holes identified during the inspections that did not meet the acceptance criteria were repaired.

The new sump components (strainers, headers, piping, baseplates and anchors) are constructed of stainless steel and the majority of the components are located outside of and at a higher elevation than the sump. Only a small portion on the headers, which ties the strainer headers into the recirculation spray system and low head safety injection system suction inlets, are located in the sump. This small portion of the headers is constantly wetted and the larger portion of the headers will be wetted during the 18-month flow test of the Inside Recirculation Spray pumps. The actual strainers are never wetted and will be maintained dry.

Over the last six years, the North Anna containment sump component operating experience for both units indicates that the 18-month frequency is adequate to detect any corrosion or other degradation that could affect sump operability. Furthermore, the existing carbon steel sump components trash racks, screens, vortex breakers, sump well screens, and associated bolted connections and anchor bolts) are being replaced with stainless steel sump components (strainers and headers) that are less susceptible to corrosion and only a small portion of the headers will be wetted during plant operation. The new strainers will not be wetted during operation or testing.

NRC Question 7:

Attachment 4, pages B 3.6.1-2 and B 3.6.2-2, under "Applicable Safety Analyses" on both pages, the current value of P_a of 44.1 psig is shown deleted. Please replace it with the revised value.

Dominion Response - Question 7:

Dominion intentionally deleted the value for Pa (calculated LOCA peak containment pressure) from the Technical Specification (TS) Basis to minimize the number of controlled documents that report this accident analysis result and require revision every time a change is necessary. The value for Pa is controlled by TS 5.5.15, Containment Leakage Rate Testing Program, and redundant occurrences in the TS Basis merely requires additional revisions to controlled documents. Therefore, Dominion concludes that TS 5.5.15 sufficiently and appropriately documents the value of Pa and does not intend to duplicate documentation of the value of Pa by inclusion in the Basis for North Anna TS 3.6.

NRC Question 8:

Attachment 1, Section 3.2.1, fifth paragraph, last sentence refers to Response #8 to the Nuclear Regulatory Commission's Request for Additional Information on the Surry GOTHIC analysis submittal. Please correct "Response [No.] # 8" to "Response No. 9."

Dominion Response - Question 8:

Dominion agrees that the reference should be directed at the Dominion response to NRC Question No. 9 on page 8 in Attachment 2 of our letter dated July 28, 2006 for Surry Power Station (Serial No. 06-545). Our intent was to direct the NRC staff to the detailed description that had already been provided to the staff for Surry regarding how the GOTHIC post-reflood mass and energy release modeling is conservative for the long-term containment analysis acceptance criteria.

NRC Question 9:

Attachment 1, first bullet in Section 3.1.4 states: The minimum surface area for metal heat sinks in containment was changed based on a revised inventory that was documented in an internal calculation. The passive heat sink data used in the GOTHIC analyses is provided in Table 3.1-3. The metal and concrete heat sink minimum surface areas are 5% less than the nominal calculated values." Please explain the following:

(a) What does "Minimum Surface Area" mean and how did you determine that?
(b) What is the basis for 5%?
(c) Noting that the minimum surface area would give conservative results for the containment peak pressure calculation while the maximum surface area would give conservative results for available NPSH calculations, please explain and justify what areas you used for these calculations.

Dominion Response - Question 9:

(a) The “minimum surface area” is an analysis input that is derived to be a conservative underprediction, with respect to the actual plant configuration, of metal and concrete surface area that is in contact with the containment atmosphere and available for condensation and convection heat transfer. For this GOTHIC analysis, the concrete heat sink inputs from LOCTIC were not changed. The North Anna containment metal heat sink inventory was reviewed based on a prior discovery that significant metal heat sink inventory had been omitted from past Surry containment analyses (see Dominion's answer to NRC Question No. 5 in Attachment 2 of letter Serial No. 06-545 dated July 28, 2006). We discovered that past LOCTIC analyses for North Anna had excluded all thin metal (e.g., grating and conduit) and some thick metal structures (e.g., steam generator structural supports) that qualify as condensing surfaces during a LOCA or MSLB inside containment. These materials were added to the previously identified heat sinks to determine a new baseline set of design inputs. Consistent with Section 3.3.1 of topical report DOM-NAF-3-0.0-P-A, the heat sinks were grouped by thickness and material type in a manner that preserves the total mass and surface area. The calculated heat sink surface area for each conductor thickness group is reduced by 5% to develop the "minimum surface area" that is used in the GOTHIC containment analysis model.

(b) Engineering calculations for North Anna have calculated the surface area of metal in contact with the containment atmosphere using plant drawings. Reducing the calculated surface area by 5% is a conservative approach to account for uncertainty in calculating the material surface areas. This method of reducing the calculated surface area by 5% has been used historically by Stone & Webster for developing LOCTIC containment analysis inputs for North Anna and Surry. Dominion maintains that a 5% reduction in the calculated surface area remains appropriate and sufficiently conservative for containment design analyses.

(c) Table 3.11-2 in Attachment 1 of our submittal documents the results of GOTHIC sensitivity studies that were performed to identify the limiting assumptions for the containment analysis acceptance criteria. Minimum heat sink surface area is conservative for all criteria, including NPSH available (NPSHa) calculations. Sensitivity studies showed that minimum NPSHa for the RS and LHSI pumps was mostly insensitive to the selection of heat sink surface area. The passive heat sinks absorb energy early in the containment heatup but return the energy to the containment atmosphere as the spray systems depressurize and cool the containment. When the minimum NPSHa occurs, the containment is depressurized below atmospheric pressure and the integral energy that has been added to the conductors is about the same whether using minimum or maximum heat sink surface areas. In the GOTHIC studies, the minimum heat sink surface area produced a slightly lower minimum NPSHa than a case with more metal. As a result of the sensitivity studies, all GOTHIC containment analyses reported in Attachment 1 of our submittal applied the minimum heat sink surface areas from Table 3.11-2 for conservatism.