VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

May 21, 2003

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

Serial No. 03-350
NLOS/ETS R0"
Docket Nos. 50-280/281
50-338/339
License Nos. DPR-32/37
NPF-4/7

VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION UNITS 1 AND 2
NORTH ANNA POWER STATION UNITS 1 AND 2
ANNUAL REPORT AND 30-DAY REPORT OF EMERGENCY CORE COOLING SYSTEM (ECCS) EVALUATION MODEL CHANGES PURSUANT TO THE REQUIREMENTS OF 10 CFR 50.46

Pursuant to 10 CFR 50.46(a)(3)(ii), Virginia Electric and Power Company (Dominion) is providing information concerning changes to the ECCS Evaluation Models and their application in existing licensing analyses. Information is also provided which quantifies the effect of these changes upon reported results for North Anna and Surry Power Stations and demonstrates continued compliance with the acceptance criteria of 10 CFR 50.46.

Attachment 1 provides a report describing plant-specific evaluation model changes associated with the application of the large break and small break LOCA evaluation models for North Anna Unit 1.

Attachment 2 contains excerpted portions of Westinghouse reports describing the changes to the Westinghouse Large Break ECCS Evaluation Model, which are applicable to North Anna and Surry and have been implemented during calendar year 2002.

Information regarding the effect of the ECCS Evaluation Model changes upon the reported LOCA analysis of record (AOR) results is provided for North Anna and Surry Power Stations in Attachments 3 and 4, respectively. To summarize the information in Attachments 3 and 4, the calculated peak cladding temperature (PCT) for the small and large break LOCA analyses for North Anna and Surry are given below. Results, which represent significant changes, based on the criterion established in 10 CFR 50.46(a)(3)(i), are designated with an asterisk.

North Anna Unit 1 - Small break: 1689°F
North Anna Unit 1 - Large break: 2154°F*
North Anna Unit 2 - Small break: 1689°F
North Anna Unit 2 - Large break: 2152°F*
Surry Units 1 and 2 - Small break: 1730°F
Surry Units 1 and 2 - Large break: 2117°F*

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Based upon our evaluation of this information and the associated changes in the applicable licensing basis PCT results, no further action is required to demonstrate compliance with 10 CFR 50.46 requirements. Reporting of this information is required in accordance with10 CFR 50.46(a)(3)(ii), which obligates each licensee to report the effect upon calculated temperature of any change or error in evaluation models or their application on an annual basis.

The changes in Attachments 3 and 4 for the North Anna and Surry large break LOCA are significant, as defined in 10 CFR 50.46(a)(3)(i). 10 CFR 50.46(a)(3)(ii) requires that the 30-day report include a proposed schedule for providing a reanalysis or taking other action as may be needed to show compliance with 10 CFR 50.46 requirements. Reanalysis of the large break LOCA for North Anna and Surry are scheduled to be completed by June 30, 2004 and March 31, 2006, respectively. No further action is required to demonstrate compliance with 10 CFR 50.46 requirements.

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

Very truly yours,

L. N. Hartz
Vice President – Nuclear Engineering and Services

Commitments made in this letter:

1. Complete re-analysis of the Large Break LOCA for North Anna by June 30, 2004
2. Complete re-analysis of the Large Break LOCA for Surry by March 31, 2006

Attachments:

1. Changes in Application of ECCS Evaluation Models - North Anna Units 1 and 2
2. Westinghouse Report of ECCS Evaluation Model Changes - North Anna Units 1 and 2 and Surry Units 1 and 2
3. Effect of ECCS Evaluation Model Changes - North Anna Units 1 and 2
4. Effect of ECCS Evaluation Model Changes - Surry Units 1 and 2

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ATTACHMENT 1

CHANGES IN
APPLICATION OF ECCS EVALUATION MODELS

NORTH ANNA UNITS 1 AND 2

LBLOCA/SEISMIC SG TUBE COLLAPSE

A generic steam generator LOCA/seismic load evaluation was performed by Westinghouse to quantify the potential steam generator tube collapse, which may occur at the time of a LOCA due to combined LOCA and seismic loads [1]. Based on this analysis, a peak cladding temperature (PCT) penalty of +30°F or an equivalent steam generator tube reduction of 5% was allocated as a permanent assessment for those plants that do not have a detailed analysis.

The steam generators have been replaced in both units at North Anna. No site-specific study has been performed with the replacement steam generators. Hence, the generic evaluation is applicable herein. Therefore, the PCT effect (penalty) of +30°F was allocated as a permanent assessment. This was reported to the NRC in a 30-Day Report [2].

With the onset of PCT penalties associated with the BASH-EM Transient Termination (Attachment 2), this report includes a change in application of the generic steam generator LOCA/seismic tube collapse effect. A 5% steam generator tube plugging reduction will be used to account for the effects of a combined LOCA/seismic event at North Anna. Accordingly, a PCT effect of -30°F is included in the PCT Assessments for 10 CFR 50.46(a)(3)(i) Accumulation for North Anna Units 1 and 2.

NORTH ANNA DESIGN CHANGE PACKAGE 59-DCP-02-011

A replacement reactor pressure vessel (RPV) upper head has been purchased from Framatome and installed at North Anna Unit 2 via 59-DCP-02-011 [3]. The impact of the replacement upper head is a slight increase in the water volume in the upper head region. Calculations, using conservative assumptions, have quantified this increase in upper head total volume as 11.3 ft^3. At steady state full power conditions this represents a change in the upper head fluid volume of about 2% and a change in the total reactor coolant system (RCS) volume on the order of 0.1%.

Evaluation

The North Anna small break and large break LOCA analyses of record (AOR) make a number of conservative assumptions in defining model input parameters for the RCS volume and the upper head temperature. The margins associated with these conservative assumptions accommodate any effects from the increased inventory volume under the new vessel head. Therefore, a value of 0°F is assigned to the small break and large break LOCA AORs as the effect upon PCT from the head replacement.

NORTH ANNA DESIGN CHANGE PACKAGE 59-DCP-02-014

A replacement reactor pressure vessel (RPV) upper head has been purchased from Framatome and installed at North Anna Unit 1 via 59-DCP-02-014 [4]. In addition, the part-length control rod drive mechanisms (CRDM) were removed during the installation of the replacement RPV upper head from North Anna Unit 1. (The part-length CRDMs had been previously removed from North Anna Unit 2.) The impact of the replacement upper head is a slight increase in the water volume in the upper head region. Calculations, using conservative assumptions, have quantified this increase in upper head total volume as 11.3 ft^3. At steady state full power conditions this represents a change in the upper head fluid volume of about 2% and a change in the total reactor coolant system (RCS) volume on the order of 0.1%.

As part of the Unit 1 RPV upper head replacement, the CRDMs from the current head were removed and installed on the replacement head. The proposed modification involved permanently removing the part length CRDMs from the current head and capping the part-length CRDM head penetration locations on the replacement head. Since the shaft of the CRDMs extends down into the upper guide tube structures on the upper support plate, their removal causes additional communication between the upper plenum (below the upper support plate) and the upper head (above the upper support plate). This change increases the total flow area between the upper plenum and upper head across the upper support plate by approximately 13%. This additional communication potentially impacts the results of the small and large break LOCA.

Evaluation

The North Anna small break and large break LOCA AOR make a number of conservative assumptions in defining model input parameters for the RCS volume and the upper head temperature. The margins associated with these conservative assumptions accommodate any effects from the larger inventory volume under the new vessel head. Therefore, a value of 0°F is assigned to the small break and large break LOCA AORs as the effect upon peak PCT from the head replacement.

The effect of the removal of the part-length CRDMs on the small break and large break LOCA was also considered for Unit 1. Values of +1°F and +22°F have been assigned to the small break and large break LOCA AORs, respectively, as the effects upon PCT from the removal of the part-length CRDMs.

References

1. Letter from W. L. Stewart (VEPCO) to Document Control Desk (USNRC), "Virginia Electric and Power Company, Surry Power Station Units 1 and 2, North Anna Power Station Units 1 and 2, Report of ECCS Evaluation Model Changes Per Requirements of 10 CFR 50.46," Serial No. 91-428, August 23, 1991.

2. Letter from J. P. O'Hanlon (VEPCO) to Document Control Desk (USNRC), "Virginia Electric and Power Company, North Anna Power Station Units 1 and 2, 30-Day Report of ECCS Evaluation Model Changes Per Requirements of 10 CFR 50.46," Serial No. 95-608, November 29, 1995.

3. North Anna Power Station Design Change Package, 59-DCP-02-011, "Reactor Vessel Head Replacement, North Anna Unit 2."

4. North Anna Power Station Design Change Package, 59-DCP-02-014, "Reactor Vessel Head Replacement (including Part-Length Control Rod Drive Mechanism Removal), North Anna Unit 1."

ATTACHMENT 2

WESTINGHOUSE REPORT OF
ECCS EVALUATION MODEL CHANGES

NORTH ANNA UNITS 1 AND 2
AND
SURRY UNITS 1 AND 2

BASH-EM TRANSIENT TERMINATION

Background

A method has been developed to extend BASH-EM transients beyond the point at which downcomer boiling is predicted to occur in BASH, by correlating the boiling induced reduction in downcomer driving head to a corresponding reduction in the core inlet flooding rate. This approach, which is referred to as the LOCBART transient extension method, is used to ensure adequate termination of the fuel rod cladding temperature and oxidation transients predicted by LOCBART, as required to demonstrate compliance with the pertinent acceptance criteria of 10 CFR 50.46. As requested by Reference 1, Westinghouse is submitting the LOCBART transient extension method to the USNRC for review and approval. In addition, 10 CFR 50.46 assessments have been completed for those plants that Westinghouse performs LOCA analysis to ensure adequate transient termination for the BASH-EM analyses. This represents a Non-Discretionary Change in accordance with Section 4.1.2 of WCAP-13451.

Affected Evaluation Models

1981 Westinghouse Large Break LOCA Evaluation Model with BASH

Estimated Effect

The estimated effect of this issue is determined on a plant-specific basis. For cases where transient termination can be demonstrated prior to downcomer boiling, no further action is considered necessary. For other cases, transient termination is demonstrated by applying the LOCBART transient extension method and the effects of downcomer boiling are considered to be implicit in the analysis results.

For North Anna, the LOCBART transient extension methodology has been applied and a peak cladding temperature (PCT) effect (penalty) of 37°F was determined for this item. It was concluded that the pertinent 10 CFR 50.46 criteria (i.e., peak cladding temperature, maximum local oxidation, and core-wide hydrogen generation) were met. This change will be treated as a +37°F PCT effect for 10 FR 50.46 reporting purposes.

For Surry, the LOCBART transient extension methodology had been included in the analysis of record. The transient termination criteria were verified to be met. It was concluded that the pertinent 10 CFR 50.46 criteria (i.e., peak cladding temperature, maximum local oxidation, and core-wide hydrogen generation) were met. This change will be treated as a 0°F PCT effect for 10 CFR 50.46 reporting purposes.

References

1. Letter from S. Dembek (USNRC) to H. Sepp (Westinghouse), "Potential Non-Conservative Modeling of Downcomer Boiling in the Approved Westinghouse 1981 Evaluation Model Using BASH", March 27, 2002.

LOCBART RADIATION TO LIQUID LOGIC ERROR

Background

A review of the LOCBART cladding-to-fluid heat transfer logic found that radiation to liquid could occur after the core inlet flooding rate dropped below 1 in/s, if the channel blockage fraction was simultaneously equal to zero. This logic was modified by deleting the check for a channel blockage fraction greater than zero in subroutine HTSORT, such that radiation to liquid is now ignored whenever the core inlet flooding rate is less than or equal to 1 in/s. This represents a Non-Discretionary Change in accordance with Section 4.1.2 of WCAP-13451.

Affected Evaluation Models

1981 Westinghouse Large Break LOCA Evaluation Model with BASH

Estimated Effect

A review of existing analyses, under Westinghouse Pittsburgh cognizance, determined that the situation described above does not occur for most PWR licensing calculations, in which case the subject modification has no effect on existing analysis results.

A review of the North Anna LBLOCA AOR results indicates that the hot assembly rod burst occurred prior to the time in the transient at which the core inlet flooding rate drops below 1 in/s. Per Westinghouse guidance, this change will be treated as a +0°F PCT effect for 10 CFR 50.46 reporting purposes.

A review of the Surry LBLOCA AOR results indicates that the hot assembly rod burst occurred prior to the time in the transient at which the core inlet flooding rate drops below 1 in/s. Per Westinghouse guidance, this change will be treated as a +0°F PCT effect for 10 CFR 50.46 reporting purposes.

LOCBART ZIRLO™ CLADDING SPECIFIC HEAT MODEL

Background

The ZIRLO™ cladding specific heat model in LOCBART has been revised to reflect data collected at the Thermophysical Properties Research Laboratory. This change was made to resolve differences between the model and data that could produce an increase in peak cladding temperature for some transients. This represents a Non-Discretionary Change in accordance with Section 4.1.2 of WCAP-13451.

Affected Evaluation Models

1981 Westinghouse Large Break LOCA Evaluation Model with BASH

Estimated Effect

Representative plant calculations using the LOCBART code showed that this change results in a moderate PCT penalty for early-reflood-PCT plants, a small-to-moderate PCT penalty for mid-reflood-PCT plants, and a negligible PCT effect for late-reflood-PCT plants. Additional BASH-EM sensitivity calculations indicated that the reduction in initial pellet average temperatures due to PAD Version 4.0 provides a PCT benefit that more than offsets any PCT penalty due to the change in specific heat. This PCT benefit was applied in some cases (listed on PCT Rackup Sheet as "PAD 4.0 Initial Pellet Temperatures") as a separate, offsetting credit.

The AOR for North Anna shows that Unit 1 is a mid-reflood PCT plant with PCT occurring between the onset of entrainment in LOCBART and 140 seconds after accident initiation. For a mid-reflood PCT plant, a PCT effect (penalty) of +15°F is assigned to this change. A compensating effect (benefit) of -15°F is also assigned since the PAD 4.0 initial pellet temperatures were not used in the AOR.

The AOR for North Anna shows that Unit 2 is a late-reflood PCT plant with PCT occurring 140 seconds after accident initiation. For a late-reflood PCT plant, a PCT effect (penalty) of 0°F is assigned to this change. A compensating effect (benefit) of 0°F is also assigned since the PAD 4.0 initial pellet temperature was not used in the AOR.

The AOR for Surry shows that Unit 1 and 2 are early-reflood PCT plant with PCT occurring less than 70 seconds after accident initiation. For an early-reflood PCT plant, a PCT effect (penalty) of +40°F is assigned to this change. A compensating effect (benefit) of -40°F is also assigned since the PAD 4.0 initial pellet temperatures were not used in the AOR.

BASHER CALCULATION OF FLOW LINK INPUTS

Background

BASHER is used to generate the plant-specific input models for BASH. Some minor errors were discovered in the calculation of elevation and length terms for the flow link that connects the upper head and upper plenum. As discussed below, it was determined that correcting these errors would have a negligible effect on results, so BASHER updates will be deferred to a future code release. When corrected, these changes will represent a closely-related group of Non-Discretionary Changes in accordance with Section 4.1.2 of WCAP-13451.

Affected Evaluation Models

1981 Westinghouse Large Break LOCA Evaluation Model with BASH

Estimated Effect

A sample BASH calculation demonstrated that these changes have a negligible effect on the core inlet flooding rate, which is consistent with the expected result given the

minimal importance of the affected flow path during a PWR reflood transient. These changes will be deferred to a future code release and are treated as having a 0°F PCT effect for 10 CFR 50.46 reporting purposes.

LOCBART PELLET-TO-CLADDING GAP CONDUCTANCE MODEL

Background

An error was discovered in a generic LOCBART input value used with the pellet-to-cladding gap conductance model. This error affected calculations performed using fuel rod initial conditions from PAD Version 4.0, and led to an underprediction of the gap heat transfer coefficients. The input guidance was corrected to reflect the appropriate value. This represents a Non-Discretionary Change in accordance with Section 4.1.2 of WCAP-13451.

Affected Evaluation Models

1981 Westinghouse Large Break LOCA Evaluation Model with BASH

Estimated Effect

Representative plant calculations using the LOCBART code demonstrated that this change leads to a small-to-moderate PCT benefit that will conservatively be treated as a 0°F PCT change for 10 CFR 50.46 reporting purposes.

LOCBART TIME STEP SELECTION LOGIC

Background

LOCBART was updated to resolve some inconsistencies in the time step selection logic, pertaining to the use of the fluid vs. fuel rod time step. This represents a closely-related group of Non-Discretionary Changes in accordance with Section 4.1.2 of WCAP-13451.

Affected Evaluation Models

1981 Westinghouse Large Break LOCA Evaluation Model with BASH

Estimated Effect

Representative plant calculations using the LOCBART code demonstrated that this change produces a negligible effect on results that will be treated as a 0°F PCT effect for 10 CFR 50.46 reporting purposes.

LOCBART CLADDING SURFACE HEAT TRANSFER LOGIC

Background

Some recent LOCBART calculations showed anomalous behavior in the cladding surface heat transfer coefficients when the local void fraction was high and the cladding surface temperature had decreased to the temperature at which a return to nucleate boiling is permitted to occur. This behavior was resolved by adding a void fraction criterion to the return-to-nucleate boiling logic in subroutine HTSORT. This represents a Non-Discretionary Change in accordance with Section 4.1.2 of WCAP-13451.

Affected Evaluation Models

1981 Westinghouse Large Break LOCA Evaluation Model with BASH

Estimated Effect

A sample LOCBART calculation demonstrated that this change produces a negligible effect on results that will be treated as a 0°F PCT effect for 10 CFR 50.46 reporting purposes.

LOCBART ZIRLO™ CLADDING CREEP CONSTANTS

Background

LOCBART was updated to correct two of the constants in the high-temperature creep model for ZIRLO™ cladding, which were found to disagree with the basis documentation. This represents a closely-related group of Non-Discretionary Changes in accordance with Section 4.1.2 of WCAP-13451.

Affected Evaluation Models

1981 Westinghouse Large Break LOCA Evaluation Model with BASH

Estimated Effect

The changes identified above lead to a small change in the creep rate over a limited range of temperatures, which is considered to have a negligible effect on results and will be treated as a 0°F PCT effect for 10 CFR 50.46 reporting purposes.

SBLOCTA TIME STEP SELECTION LOGIC

Background

SBLOCTA was updated to resolve some inconsistencies in the time step selection logic, pertaining to the use of the fluid vs. fuel rod time step. This represents a closely related group of Non-Discretionary Changes in accordance with Section 4.1.2 of WCAP-13451.

Affected Evaluation Models

1985 Westinghouse Small Break LOCA Evaluation Model with NOTRUMP

Estimated Effect

Representative plant calculations using the SBLOCTA code demonstrated that this change produces a small PCT benefit for cases modeling Zircaloy-4 cladding that are predicted to burst and a negligible effect on results for other cases. Accordingly, this change will be treated as a 0°F PCT effect for 10 CFR 50.46 reporting purposes.

SBLOCTA ZIRLO™ CLADDING SPECIFIC HEAT MODEL

Background

For consistency with the change made to LOCBART (as described previously), the ZIRLO™ cladding specific heat model in SBLOCTA has been revised to reflect data collected at the Thermophysical Properties Research Laboratory. This represents a Non-Discretionary Change in accordance with Section 4.1.2 of WCAP-13451.

Affected Evaluation Models

1985 Westinghouse Small Break LOCA Evaluation Model with NOTRUMP

Estimated Effect

Sensitivity calculations using the SBLOCTA code demonstrated that this change produces a negligible effect on results that will be treated as a 0°F PCT effect for 10 CFR 50.46 reporting purposes.

ATTACHMENT 3

EFFECT OF ECCS EVALUATION MODEL CHANGES

NORTH ANNA UNITS 1 AND 2

Effect of ECCS Evaluation Model Changes - North Anna Unit 1

The information provided herein is applicable to North Anna Power Station, Unit 1. It is based upon reports from Westinghouse Electric Corporation for issues involving the ECCS evaluation models and plant-specific application of the models in the existing analyses. Peak cladding temperature (PCT) values and margin allocations represent issues for which permanent resolutions have been implemented. The assessments for small break and large break LOCA are presented in Sections A and B, respectively.

Section A - Small Break LOCA Margin Utilization - North Anna Unit 1

A. PCT for Analysis of Record	1704°F	(1)
B. Prior PCT Assessments Allocated to AOR	**-29°F**	
1. NOTRUMP Specific Enthalpy Error	+20°F	(2)
2. SALIBRARY Double Precision Errors	-15°F	(2)
3. Fuel Rod Initialization Error	+10°F	(3)
4. Loop Seal Elevation Error	-44°F	(3)
SBLOCA Augmented PCT for AOR	1675°F	
C. PCT Assessments for 10 CFR 50.46(a)(3)(i) Accumulation {1}	**14°F**	
1. NOTRUMP – Mixture Level Tracking Errors	+13°F	(7)
2. Removal of Part-Length CRDMs {3} {5}	+1°F	
SBLOCA Licensing Basis PCT (AOR PCT + PCT Assessments)	1689°F	

Notes { } and References ( ) on pages 5 and 6.

Section B - Large Break LOCA Margin Utilization - North Anna Unit 1

A. PCT for Analysis of Record	2013°F	(1)
B. Prior PCT Assessments Allocated to AOR	**109°F**	
1. LBLOCA/Seismic SG Tube Collapse {6}	+30°F	(1)
2. BASH Accumulator Empty Flag	+10°F	(1)
3. Translation of Fluid Conditions from SATAN to LOCTA	+15°F	(4)
4. LOCBART Spacer Grid Single-Phase Heat Transfer	+15°F	(6)
5. LOCBART Zirc-Water Oxidation Error	+39°F	(6)
LBLOCA Augmented PCT for AOR	2122°F	
C. PCT Assessments for 10 CFR 50.46(a)(3)(i) Accumulation {2}	**146°F**	
1. LOCBART Cladding Emissivity Errors	+6°F	(7)
2. LOCBART Vapor Film Flow Regime Heat Transfer Error	+9°F	(7)
3. LOCBART Dispersed Flow Regime Wall Emissivity Error	-12°F	(7)
4. BASH EM Transient Termination {3} {4}	+37°F	
5. LOCBART ZIRLO™ Cladding Specific Heat Model Error {3} {4}	+15°F	
6. PAD 4.0 Initial Pellet Temperatures {3} {4}	-15°F	
7. LBLOCA/Seismic SG Tube Collapse {3} {5} {6}	-30°F	
8. Removal of Part Length Control Rod Drive Mechanisms {3} {5}	+22°F	
LBLOCA Licensing Basis PCT (AOR PCT + PCT Assessments)	2154°F	

Notes { } and References ( ) on pages 5 and 6.

Effect of ECCS Evaluation Model Changes - North Anna Unit 2

The information provided herein is applicable to North Anna Power Station, Unit 2. It is based upon reports from Westinghouse Electric Corporation for issues involving the ECCS evaluation models and plant-specific application of the models in the existing analyses. PCT values and margin allocations represent issues for which permanent resolutions have been implemented. The assessments for small break and large break LOCA are presented in Sections A and B, respectively.

Section A - Small Break LOCA Margin Utilization - North Anna Unit 2

A. PCT for Analysis of Record	1704°F	(1)
B. Prior PCT Assessments Allocated to AOR	**-29°F**	
1. NOTRUMP Specific Enthalpy Error	+20°F	(2)
2. SALIBRARY Double Precision Errors	-15°F	(2)
3. Fuel Rod Initialization Error	+10°F	(3)
4. Loop Seal Elevation Error	-44°F	(3)
SBLOCA Augmented PCT for AOR	1675°F	
C. PCT Assessments for 10 CFR 50.46(a)(3)(i) Accumulation {1}	**14°F**	
1. Removal of Part-Length CRDMs	+1°F	(5)
2. NOTRUMP – Mixture Level Tracking Errors	+13°F	(7)
SBLOCA Licensing Basis PCT (AOR PCT + PCT Assessments)	1689°F	

Notes { } and References ( ) on pages 5 and 6.

Section B - Large Break LOCA Margin Utilization - North Anna Unit 2

A. PCT for Analysis of Record	2013°F	(1)
B. Prior PCT Assessments Allocated to AOR	**129°F**	
1. LBLOCA/Seismic SG Tube Collapse {6}	+30°F	(1)
2. BASH Accumulator Empty Flag	+10°F	(1)
3. Translation of Fluid Conditions from SATAN to LOCTA	+15°F	(4)
4. Removal of Part-Length CRDMs	+18°F	(5)
5. LOCBART Spacer Grid Single-Phase Heat Transfer	+15°F	(6)
6. LOCBART Zirc-Water Oxidation Error	+41°F	(6)
LBLOCA Augmented PCT for AOR	2142°F	
C. PCT Assessments for 10 CFR 50.46(a)(3)(i) Accumulation {2}	**94°F**	
1. LOCBART Cladding Emissivity Errors	+6°F	(7)
2. LOCBART Vapor Film Flow Regime Heat Transfer Error	+9°F	(7)
3. LOCBART Dispersed Flow Regime Wall Emissivity Error	-12°F	(7)
4. BASH EM Transient Termination {3} {4}	+37°F	
5. LOCBART ZIRLO™ Cladding Specific Heat Model Error {3} {4}	0°F	
6. PAD 4.0 Initial Pellet Temperatures {3} {4}	0°F	
7. LBLOCA/Seismic SG Tube Collapse {3} {5} {6}	-30°F	
LBLOCA Licensing Basis PCT (AOR PCT + PCT Assessments)	2152°F	

Notes { } and References ( ) on pages 5 and 6.

Effect of ECCS Evaluation Model Changes - North Anna

Notes:

{1} The accumulation of changes (sum of absolute magnitudes) is less than 50°F and is **not** significant, as defined in 10 CFR 50.46(a)(3)(i).

{2} The accumulation of changes (sum of absolute magnitudes) is greater than 50°F and is significant, as defined in 10 CFR 50.46(a)(3)(i).

{3} The current report is the initial quantification of effects for this issue.

{4} Refer to the Westinghouse Report of ECCS Evaluation Model Changes provided in Attachment 2.

{5} Refer to the Changes in Application of ECCS Evaluation Model Changes provided in Attachment 1.

{6} A generic steam generator LOCA/seismic load evaluation was performed by Westinghouse to quantify the potential steam generator tube collapse, which may occur at the time of the LOCA due to, combined LOCA and seismic loads. Based on this analysis, a PCT penalty of +30°F (equivalent to a total steam generator tube reduction of 5%) was allocated as a permanent assessment for those plants, which do not have a detailed analysis. This report includes a change in application of this effect. See Attachment 1. A 5% steam generator tube plugging reduction will be used to account for the effects of a combined LOCA/seismic event at North Anna. Accordingly, a PCT effect of -30°F is included in the PCT Assessments for 10 CFR 50.46(a)(3)(i) Accumulation for North Anna Units 1 and 2.

References:

(1) Letter from J. P. O'Hanlon (VEPCO) to Document Control Desk (USNRC), "Virginia Electric and Power Company, North Anna Power Station Units 1 and 2, 30-Day Report of ECCS Evaluation Model Changes Per Requirements of 10 CFR 50.46," Serial No. 95-608, November 29, 1995.

(2) Letter from J. P. O'Hanlon (Va. Electric & Power Co.) to USNRC, "Virginia Electric and Power Company, North Anna and Surry Power Station Units 1 and 2, Report of ECCS Evaluation Model Changes and 30-Day Report of ECCS Evaluation Model Changes Per Requirements of 10 CFR 50.46," Serial No. 96-111, March 14, 1996.

(3) Letter from J. P. O'Hanlon (Va. Electric & Power Co.) to USNRC, "Virginia Electric and Power Company, North Anna Power and Surry Power Station Units 1 and 2, Report of ECCS Evaluation Model Changes and 30-Day Report of ECCS Evaluation Model Changes Per Requirements of 10 CFR 50.46," Serial No. 96-390, August 1, 1996.

Reference (continued)

(4) Letter from J. P. O'Hanlon (Va. Electric & Power Co.) to USNRC, "Virginia Electric and Power Company, Surry and North Anna Power Stations Units 1 and 2, Report of Emergency Core Cooling System (ECCS) Evaluation Changes Pursuant to the Requirements of 10 CFR 50.46," Serial No. 97-174, March 27, 1997.

(5) Letter from J. P. O'Hanlon (Va. Electric & Power Co.) to USNRC, "Virginia Electric and Power Company, Surry and North Anna Power Stations Units 1 and 2, Report of Emergency Core Cooling System (ECCS) Evaluation Changes Pursuant to the Requirements of 10 CFR 50.46," Serial No. 98-303, May 28, 1998.

(6) Letter from L. N. Hartz (Va. Electric & Power Co.) to USNRC, "Virginia Electric and Power Company, Surry and North Anna Power Station Units 1 and 2, 30-Day Report-Emergency Core Cooling System (ECCS) Evaluation Model Changes Pursuant to the Requirements of 10 CFR 50.46," Serial No. 99-558, November 18, 1999.

(7) Letter from L. N. Hartz (Va. Electric & Power Co.) to USNRC, "Virginia Electric and Power Company, Surry and North Anna Power Station Units 1 and 2, Annual Report and 30-Day Report of Emergency Core Cooling System (ECCS) Evaluation Model Changes Pursuant to the Requirements of 10 CFR 50.46," Serial No. 01-232, April 24, 2001.

ATTACHMENT 4

EFFECT OF ECCS EVALUATION MODEL CHANGES

SURRY UNITS 1 AND 2

Effect of Westinghouse ECCS Evaluation Model Changes - Surry

The information provided herein is applicable to Surry Power Station, Units 1 and 2. It is based upon reports from Westinghouse Electric Corporation for issues involving the ECCS evaluation models and plant-specific application of the models in the existing analyses. Peak cladding temperature (PCT) values and margin allocations represent issues for which permanent resolutions have been implemented. The assessments for small break and large break LOCA are presented in Sections A and B, respectively.

Section A - Small Break LOCA Margin Utilization - Surry Units 1 and 2

A. PCT for Analysis of Record (AOR)	1717°F	(1)
B. Prior PCT Assessments Allocated to AOR	**0°F**	
SBLOCA Augmented PCT for AOR	1717°F	
C. PCT Assessments for 10 CFR 50.46(a)(3)(i) Accumulation {1}	**13°F**	
1. NOTRUMP – Mixture Level Tracking Errors	+13°F	(2)
SBLOCA Licensing Basis PCT (AOR PCT + PCT Assessments)	1730°F	

Section B - Large Break LOCA Margin Utilization - Surry Units 1 and 2

A. PCT for Analysis of Record (AOR)	2117°F	(2)
B. Prior PCT Assessments Allocated to AOR	**0°F**	
1. LBLOCA/Seismic SG Tube Collapse {5}	0°F	(2)
LBLOCA Augmented PCT for AOR	2117°F	
C. PCT Assessments for 10 CFR 50.46(a)(3)(i) Accumulation {2}	**80°F**	
1. BASH EM Transient Termination {3} {4}	0°F	
2. LOCBART ZIRLO™ Cladding Specific Heat Model Error {3} {4}	+40°F	
3. PAD 4.0 Initial Pellet Temperatures {3} {4}	-40°F	
LBLOCA Licensing Basis PCT (AOR PCT + PCT Assessments)	2117°F	

Notes { } and References ( ) on the following page

Effect of Westinghouse ECCS Evaluation Model Changes - Surry

Notes:

{1} The accumulation of changes (sum of absolute magnitudes) is less than 50°F and is **not** significant, as defined in 10 CFR 50.46(a)(3)(i).

{2} The accumulation of changes (sum of absolute magnitudes) is greater than 50°F and is significant, as defined in 10 CFR 50.46(a)(3)(i).

{3} The current report is the initial quantification of effects for this issue.

{4} Refer to the Westinghouse Report of ECCS Evaluation Model Changes provided in Attachment 2.

{5} A generic steam generator LOCA/seismic load evaluation was performed by Westinghouse to quantify the potential steam generator tube collapse which may occur at the time of the LOCA due to combined LOCA and seismic loads. Based on this analysis, a total steam generator tube reduction equivalent to 5% tube plugging was allocated as a permanent assessment for those plants that do not have a detailed analysis. The 5% steam generator tube plugging reduction will be used to account for the effects of a combined LOCA/seismic event at Surry.

References:

(1) Letter from J. P. O'Hanlon (Va. Electric & Power Co.) to USNRC, "Virginia Electric and Power Company, Surry Power Station Units 1 and 2, 30-Day Report of ECCS Evaluation Changes Pursuant to the Requirements of 10 CFR 50.46," Serial No. 96-635, January 9, 1997.

(2) Letter from L. N. Hartz (Va. Electric & Power Co.) to USNRC, "Virginia Electric and Power Company, Surry and North Anna Power Station Units 1 and 2, Annual Report and 30-Day Report of Emergency Core Cooling System (ECCS) Evaluation Model Changes Pursuant to the Requirements of 10 CFR 50.46" Serial No. 01-232, April 24, 2001.