Vogtle Electric Generating Plant Units 1 and 2
License Amendment Request to Revise Technical Specification (TS) Sections 5.5.9, "Steam Generator (SG) Program" and TS 5.6.10, "Steam Generator Tube Inspection Report" for Temporary Alternate Repair Criteria

Enclosure 8

LTR-SGMP-10-78, "Effects of Tubesheet Bore Eccentricity and Dilation on Tube-to-Tubesheet Contact Pressure and Their Relative Importance to H*," September 7, 2009. (Non-Proprietary)

Effects of Tubesheet Bore Eccentricity and Dilation on Tube-to-Tubesheet Contact Pressure and their Relative Importance to H*

September 7, 2010

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1.0 Introduction

The technical justification of H* provided by References 1, 2, 3 and 4 utilize thick-shell equations to calculate the contact pressure between the tubes and the tubesheet bores. This approach has been used for many years including technical justifications in 1996 for installing sleeves. During the sleeve justification, a technical concern was raised regarding the effect on the contact pressure calculations if the tubesheet bore were distended (ovalized) due to tubesheet bending. An engineering model, known as the Slice Model in the H* analysis, was developed to estimate the effect on tube to tubesheet contact pressure and this model was also applied in the technical justifications of Reference 1, 2, 3 and 4.

Because the definition of the accident conditions (SLB) for the model D5 SGs differs significantly from that for the Models F, 44F and 51F SGs, application of the Slice Model yielded physically unrealistic, unacceptable results. A new model (the "Unit Cell" or "Square Cell" model) was developed to address the Model D5 SLB condition. Originally provided as Reference 5, the new model focuses on eccentricity as a key contributor to the tube to tubesheet contact pressure.

During the NRC technical review of the H* documents, multiple questions were raised about the efficacy of the Slice Model challenging the contribution of eccentricity to the calculation of contact pressure (Reference 6). The NRC staff maintained that eccentricity had small, if any, effect on contact pressure and that the contact pressure was dominated by tubesheet bore dilation A study was performed to address how bore dilation and, separately, bore eccentricity might affect the contact pressure between a cylinder within a collar when the cylinder is allowed to expand due to application of a thermal load while the collar inner diameter (ID) is constrained to a constant average diameter. Average diameter is defined as the 2-point average of the maximum and minimum diameters.

A second study was performed using the calculation models for H*, but setting the scale factor to 0.5 in the H* calculation process. This results in consideration of only the change in average diameter in the calculations and eliminates any effect from the Slice Model on the calculation of contact pressure.

This document summarizes the results of these studies. The terms Slice Model and Scale Factor Model are synonymous in this document.

2.0 Separating Eccentricity and Dilation (Slice Model)

Three different approaches were utilized to compare the efficacy of the different models for predicting contact pressures and to compare the relative importance of bore dilation vs. bore eccentricity.

The three methods utilized were:

1. Finite Element Analysis (FEA) using *ANSYS* models.
2. Correlation of contact pressure reduction with eccentricity based on an engineering approximation known as the Slice Model (Reference 7). The original Slice Model was

developed to address a similar issue for sleeve installation and performance and included a sleeve, the tube and a TS collar. For the current analysis, the sleeve was removed from the model but otherwise, the model is the same. This model was used to provide the input for the scale factor correlation that is used in the H* analysis

3. Direct application of thick-shell equations. This approach utilized the classical thick-shell equations to calculate the tube-to-collar contact pressures for different average diameters of the collar ID.

This assessment does not address a specific question in Reference 6 but provides additional information that may be used in the resolution of the technical concern regarding the Slice Model and its effect on the H* calculations (References 1, 2, 3 and 4).

2.1 FEA Models

An analytical study was made in which a series of FEA (*ANSYS*) models similar to the Slice Model (Reference 7) were built but with some significant differences:

1. The model included only a collar and a tube.

2. The x- and y- radii of the collar bore were set to provide desired values of mean bore radius by iteratively applying forces in the x- and y- direction until the desired mean radius had been achieved. The collar was free to deform elastically between the x- and y-axes. By this method, mean bore radius (defined as $(R_{max}+R_{min})/2$) could be varied while providing the means to vary the bore eccentricity (defined as $(R_{max}-R_{min})/R_{mean}$). Therefore, among several different models, the mean bore radius could be kept constant while the eccentricity was varied. The shape of the collar was not constrained by any mathematical representation.

3. The collar was not permitted to expand during application of the temperature increase by setting the coefficient of thermal expansion to zero. However, the true at-temperature material properties were used.

4. The initial dimension of the tube was the same for all model variations (different collar geometries); the models established compatibility between the tube and the collar by requiring that the tube adjust to the geometry of the collar after loading by application of a temperature increase.

Two different loading conditions were considered: A temperature increase of 500°F and a temperature increase of 227°F. The reference temperature for all cases was 70°F.

Various different mean collar radii were considered: 0.3810 inch, 0.3811 inch, 0.3813 inch, 0.3815 inch, and for each of these, different combinations of maximum and minimum diameters were considered to provide a range of eccentricities. The collar bore average radius range is consistent with the range included in the existing documentation for H* that was previously discussed with the NRC staff. The collar bores are not intended to prototypically represent any real SG model or condition but are intended to be representative of the range of conditions that may be expected to occur among different SG models and operating conditions.

The maximum, minimum and average contact pressures between the tube and the collar were calculated. The average contact pressure is a multi-point (~180 points) average over the quarter round sector model.

2.2 Application of Thick-Shell Equations (TSE)

For each of the different average radii, contact pressures were also calculated using the TSE. The input to the thick-shell equations was the average diameter of the collar. Only average diameter can be addressed with the thick-shell equations; eccentricity cannot be addressed with the thick shell equations.

2.3 Application of the Slice Model

The original Slice Model (Reference 7) was modified by eliminating the sleeve from the model. The contact pressure results for the Slice Model are based on the same process as defined in the References 1, 2, 3, and 4, that is, the scale factor determined from application of the Slice Model was applied to the TSE calculations.

2.4 Results

The results of the studies are presented as normalized values; the normalization basis is the maximum value of contact pressure calculated with each method: FEA and Thick Shell equation and Slice Model. This is appropriate because the relative change in contact pressure due to eccentricity, not the absolute value of contact pressure, is of interest in this study. For information, the maximum contact pressures calculated with each model are shown on Table 1.

The TSE contact pressures on Table 1 were calculated using classical thick-shell equations for an open cylinder within an open cylinder based on Reference 8. This application is appropriate for the problem at hand, that is, to study the effects of collar eccentricity and average radius on contact pressure, but leads to different values of contact pressure than those that would be calculated using the equations in Section 6.4 of Reference 1(typ). The difference in absolute value of contact pressure between the different approaches is not important because the normalized values for different conditions have been shown to be the same regardless of the equations utilized.

Table 1
Calculated Maximum Contact Pressures for Normalization

Model	Maximum Contact Pressure (psi)	
	570°F	**297°F** a,c,e
FEA	[	]
TSE		
Slice Model Correlation	[	]

Table 2 provides the results of the study.

The FEA results are directly calculated from the specific FEA models.

The results for the TSE model are based on only the change in average radius of the model sing the equations from Reference 8.

The results from the Slice Model are from the previously existing cases of equivalent mean diameter and eccentricity when the polynomial correlation between eccentricity and contact pressure is applied (i.e., application of the Slice Model as described in section 2.3). Prior results from the Slice Model were not available for all the cases considered in this study. Where no result was available from the Slice Model from existing work, Table 2 shows no available (na) data.

The eccentricities in cases 1 through 19 were achieved by iteratively applying external loads until the average radius achieved the desired value. Cases 20, 21 and 22 differ from Cases 1-19 in that the eccentricity was built into the geometric model prior to subsequent loading by application of the thermal load. Consequently, these cases include an increase in average diameter because the collar was permitted to expand. Although cases 20, 21 and 22 are shown on Table 2, they should not be considered a part of a common population with cases 1-19.

Negative values of normalized contact pressures indicate that contact between the tube and the collar has been lost. Only the Slice Model can predict negative values of normalized contact pressure because the correlation between eccentricity and contact pressure is applied as a subtraction from the contact pressure predicted using the thick shell equations. The TSE and FEA approaches, by definition, cannot predict contact pressures less than zero.

The TSE results, as expected, appropriately reflect the change in average radius of the models. As expected, contact pressure decreases with increased average radius; eccentricity cannot be addressed. Note that, for increasing eccentricity at a constant average radius, the contact pressures are constant.

An example of this is the comparison of cases 0 and 9 on Table 2 (mean radius of 0.381 inch but eccentricity of 0.0 and 2.62E-03, respectively).

The Slice Model results reflect a reduction in contact pressure with increasing eccentricity for each constant mean radius (see Table 2, cases 4, 5 and 6 for mean radius of 0.3815 inch, and cases 7 and 8 for mean radius 0.3813 inch[1]). As expected, cases 1, 5 and 7 show a linear reduction of contact pressure with an increasing average radius when the eccentricity is constant (5.25E-04 in/in).

The FEA results show essentially no impact on contact pressure with changes in eccentricity (e.g., cases 1, 2 and 3 at 0.3811 inch average radius, cases 7 and 8 at 0.3813 inch average radius, and cases 4, 5, and 6 at 0.3815 inch average radius), but show a reduction in contact pressure with increasing average radius (e.g., cases 1, 5 and 7 for 5.25E-04 in/in eccentricity and cases 6 and 8 at 21.0E-03 in/in eccentricity). The FEA results are considered to be the most accurate results because they are not subject to the limitations of the other two methods. The Slice Model results depend on the correlation between eccentricity and scale factor, a useful approach but an engineering approximation. The TSE approach cannot consider the effects of eccentricity superimposed on dilation.

In the columns in Table 2 headed by "% Relative Change," the relative change in the normalized results for the TSE and Scale Factor models compared to the FEA model are calculated. The comparison of the FEA to the thick shell equations is the relative change from the maximum value of each for the specific case in question. For example, considering case 4, the normalized value from the FEA model is [ ]^{a,c,e} and that from the TSE model is [ ]^{a,c,e}. The percent relative change is calculated by

$$\%D_1 = 100x[N_{FEA} - N_{TSE}]/N_{TSE}$$

Similarly, the percent relative change between the Slice Model and the FEA model is calculated by

$$\%D_2 = 100x[N_{FEA} - N_{SM}]/N_{SM}$$

As is readily observed from Table 2, both the TSE model and the Scale Factor model exhibit a much greater reduction in contact pressures from their respective maxima than does the FEA model.

Figures 1 through 4 graphically show the information on Table 2. Figures 1 and 2 show the normalized contact pressure for all three models (FEA, TSE, and Scale Factor) as a function of mean tubesheet collar bore radius for a 500°F and 227°F temperature increase, respectively. Figures 3 and 4 show the normalized contact pressure for the FEA and Scale Factor models for a 500°F and 227°F temperature increase, respectively. The TSE model is not shown on Figures 3 and 4 because it is limited to considering dilation only. Linear fits are provided for all data sets; the Scale Factor results are shown as calculated including some negative values. (Note that the apparent positive slope of the contact

[1] Cases 20 and 21 have nominally the same eccentricity and temperature loading as cases 7 and 8; however, the eccentricity was built into the geometric model before thermal loading and is, thus, not directly comparable to cases 7 and 8 in which eccentricity was achieved by external loading in addition to thermal loading.

pressure vs. eccentricity trend line on Figures 3 and 4 is not considered to be real and is believed to be an artifact of including all of the FEA results in a single population for the trend line.)

2.5 Observations and Conclusions on Comparison of Contact Pressure Models

When one considers the relative changes in the TSE approach and in the Slice Model approach compared to the FEA approach, conclusions emerge that are significant to the calculation of the value of H*:

1. At high temperatures, the change in TSE predicted contact pressures is much greater than the change in FEA predicted contact pressures. This is because the TSE approach ignores the effects of eccentricity which tends to moderate the change in contact pressure change for increased average diameter in the FEA results.

2. At low temperatures, the change in contact pressure based on the TSE approach is much greater than that at high temperatures noted in conclusion 1.

3. Taken together, conclusions 1 and 2 indicate that the TSE approach is extremely conservative in calculating contact pressures because the FEA approach (the most accurate approach) predicts a much smaller change (reduction) in contact pressure when the tubesheet bore both dilates and becomes eccentric.

4. At High temperature, the slice (scale factor) model predicts much greater reduction in contact pressure compared to the FEA model than does the TSE model. Taken together with conclusion 3, this indicates that application of the scale factor model to the H* calculation is even more conservative than application of the TSE model by itself.

5. At low temperatures, the scale factor model tends to fail in that no contact pressure is predicted for most of the cases. This supports the conclusions in the current technical justification for the Model D5 H* (Reference 2) that application of a different model is required for the SLB condition for the Model D5.

6. When using the scale factor model, at high temperature, and for a constant bore average radius, increasing eccentricity results in a significant reduction in normalized contact pressure (see cases 4, 5 and 6 and cases 7 and 8 on Table 2). A realistic comparison is not available at low temperature because the scale factor model predicts principally negative normalized values.

Table 2 Comparison of Normalized Contact Pressures for Different Models

Model D5				Normalized Contact Pressure Results			% Relative Change	
Case	ΔT	Avg. Rad	e	Slice Model	Avg. FEA	Thick Shell	FEA vs. Thick Shell	FEA vs. Slice Model
#	ºF	in	in/in	psi/psi	psi/psi	psi/psi	-	a,c,e
0	500	0.3810	0.00E+00					
1	500	0.3811	5.25E-04					
2	500	0.3811	3.15E-03					
3	500	0.3811	4.20E-03					
4	500	0.3815	1.05E-03					
5	500	0.3815	5.25E-04					
6	500	0.3815	2.10E-03					
7	500	0.3813	5.25E-04					
8	500	0.3813	2.10E-03					
9	500	0.3810	2.62E-03					
10	227	0.3810	0.00E+00					
11	227	0.3811	5.25E-04					
12	227	0.3811	3.15E-03					
13	227	0.3811	4.20E-03					
14	227	0.3815	1.05E-03					
15	227	0.3815	5.25E-04					
16	227	0.3815	2.10E-03					
17	227	0.3813	5.25E-04					
18	227	0.3813	1.05E-03					
19	227	0.3810	2.62E-03					
20	500	0.3813	1.10E-06					
21	500	0.3815	1.30E-03					
22	227	0.3813	1.30E-03					

a,c,e

Figure 1 Normalized Contact Pressure as a Function of Average Collar Hole Radius (500° F)

a,c,e

Figure 2 Normalized Contact Pressure as a Function of Average Collar Hole Radius (227° F)

a,c,e

Figure 3 Normalized Contact Pressure as a Function of Collar Hole Eccentricity (500° F)

a,c,e

Figure 4 Normalized Contact Pressure as a Function of Collar Hole Eccentricity (227° F)

3.0 Physical Significance of the Study to Separate Dilation and Eccentricity

The investigation of the effect of eccentricity only on contact pressure provides information on separation of bore eccentricity from bore dilation. The study can only be done analytically by forcing geometry and boundary conditions on analytical models to create conditions that cannot be physically achieved in a real structure with an initially circular bore with an initially circular tube in line-on-line contact. To eliminate dilation (dilation is defined as a change in average hole diameter, or the average of the maximum and minimum diameter of the bore), the average diameter of the hole must be maintained constant from the initial circular condition to the deformed condition. To achieve this, a positive change in one diameter (i.e., on the y-axis) must be compensated for by a negative change of equal magnitude in the orthogonal diameter (i.e., on the x-axis).

The average diameter of a bore hole in a real material must change when the hole is distended. An increase of the diameter in one direction causes a decrease in the diameter in the orthogonal axis by Poisson contraction. Since the value of Poisson's ratio is 0.3 in steel, an increase in the major diameter of the bore causes a decrease in the minor diameter of 0.3 times the increase in major diameter. To maintain a constant average diameter, a decrease in the minor diameter equal to the increase in major diameter is required. Therefore, in a real material, eccentricity cannot occur without concurrent dilation, defined as an increase in the average diameter, without significant external forces to cause contraction of the minor diameter. Such external forces do not occur in the real configuration of the tubesheet complex considered in the H* analysis

4.0 Impact of the Slice Model on H* Calculations

The Slice Model (Reference 7) is not directly utilized in the calculation of the H* values; rather, it is utilized in References 1, 2, 3 and 4 exclusively to provide input to a correlation (scale factor polynomial) that relates reduction in contact pressure resulting from distention of the tubesheet bores due to tubesheet bending, which is directly used in the calculation of H*. The scale factor is applied to change in bore diameter through the equation:

[ ] a,c,e

To eliminate all influence of the Slice Model on the H* calculation, the scale factor (SF) can be set to 0.5, which results in only hole dilation (change in average diameter) without any influence of eccentricity. This effectively eliminates all influence of the Slice Model on the calculation of contact pressures that determine the H* distance as discussed in the analyses of record (References 1, 2, 3 and 4).

In the H* analysis of record, calculation of contact pressure utilizes the thick shell equations based on bore dilation with an additional factor that reduces the contact pressure due to both bore dilation and eccentricity of the hole. Using the analysis process described in References 1, 2, 3 and 4, separate cases were run for the Models D5, F, 44F and 51F SGs with the original scale factor correlation and with the scale factor set to a constant value of 0.5. The results of these studies follow:

Figure 5 shows the results of this approach for the critical tubesheet radius for the Model D5 SG (26.7 inches) as documented in WCAP-17072-P for the normal operating condition and for the steam line break condition when applying the polynomial scale factor relationship. The figure shows the components of contact pressure for both the NOP and SLB condition; that is, the contact pressure calculation based on the thick-shell equation without tubesheet bending and the reduction of the non-bending contact pressures due to hole dilation and eccentricity due to tubesheet bending. Also shown is the net predicted contact pressure as a function of the tubesheet thickness. These are shown for both NOP and SLB conditions on Figure 5.

Figure 6 shows the same analysis but with the scale factor set to 0.5 which eliminates the eccentricity effect but retains the mean diameter effect (dilation) for the same tubesheet radius in the Model D5 SG.

Figure 7 shows the final net contact pressure profile through the TS thickness at 26.7 inches TS radius in the Model D5 SG for both NOP and SLB conditions for both polynomial scale factor application and for average dilation only (SF=0.5). For NOP conditions, the contact pressure profiles are essentially identical for both the polynomial scale factor and average dilation cases. For SLB conditions, the polynomial scale factor approach predicts slightly smaller contact pressures near the bottom and near the top of the tubesheet as would be expected due to the greater bending deflections at SLB conditions. Although the difference is small, use of the polynomial scale factor approach provides conservative (lower) contact pressures than average bore dilation only.

The results obtained for the Model F SGs are provided in Figure 8. For the Model F SG, there is essentially no difference in the contact pressure profile for both NOP and SLB conditions with, or without, application of the scale factor.

Table 3 provides a comparison of the predicted H* values for both NOP and SLB conditions for the Model D5 SG at the TS radii included in WCAP-17072-P for both the application of the polynomial scale factor and mean dilation only. In all cases, application of the polynomial scale factor results in slightly greater (conservative) H* values at all radii.

Table 4 provides similar results for the Model F SGs; no effect is observed when application of the scale factor (Slice Model) is eliminated.

Similar results are obtained for the Model 44F and 51F SGs.

Figures 9, 10, 11 and 12 show the results of the analysis described above for different radii in the Model D5, F, 44F and 51F SGs, respectively. Except for the Model D5 SG (Figure 9), the difference between the contact pressures predicted with, and without, application of the scale factor is indiscernible at each of the tubesheet radii. For the Model D5, application of the scale factor in the calculations produces lower contact pressures over most of the axial contact pressure profile at the largest tubesheet radius and slightly lower contact pressures at the top and bottom of the tubesheet at the other radii.

Consequently, it is concluded that application of the scale factor polynomial has relatively little effect in the calculation of the contact pressures, but that its application results in conservative (lower) values of contact pressure in all cases.

4.1 Conclusions

In aggregate, this study shows that application of the scale factor polynomial has essentially negligible influence on the calculation of H*. Given that the Slice Model is used in the H* calculations only to provide the input data on which the scale factor correlation is based, the influence of the Slice Model on the technical justification of H* is also negligible.

It is noted that Figure 7 shows that the SLB contact pressure exceeds the NOP contact pressure for the Model D5 SGs only over approximately the first 5 inches from the bottom of the tubesheet. This is the known condition that led to the application of the square cell model to address conditions where application of the polynomial scale factor approach was not considered appropriate (see Reference 2 and Reference 5). It has been, and continues to be, the objective to calculate the contact pressures and the value of H* for the Model D5 SGs using the alternate methodology, the square cell model. It is the expectation that application of the square cell model will show that the H*calculations of record are conservative.

The results of the study to separate dilation from eccentricity show that application of the polynomial scale factor relationship is conservative compared to application of only average tubesheet bore dilation. The results of the comparing the thick-shell equation approach based on only average bore dilation show that this approach is itself conservative compared to a finite element approach, which is considered to be the best available methodology.

Table 3 Model D5- Change in H* Distance When Only Mean Bore Dilation is Considered (SF=0.5)

TUBESHEET RADIUS (INCH)						
4.437	10.431	18.139	26.703	42.974	49.825	
NOP (inch)						
[					]	a,c,e
SLB (based on Model D5 SLB temperature definition) (inch)						
[					]	a,c,e

Table 4 Model F- Change in H* Distance When Only Mean Bore Dilation is Considered (SF=0.5)

TUBESHEET RADIUS (INCH)						
4.016	11.772	20.498	30.193	48.613	58.308	
NOP (inch)						
[					]	a,c,e
SLB (inch)						
[					]	a,c,e

a,c,e

Figure 5 Model D5 SG H* Tubesheet Bow Contact Pressure Study; Polynomial Scale Factor

a,c,e

Figure 6 Model D5 SG H* Tubesheet Bow Contact Pressure Study; Scale Factor = 0.5

a,c,e

Figure 7 Model D5 SG H* Tubesheet Bow Contact Pressure Study; Comparison of Polynomial Scale Factor Results with Average TS Hole Dilation Results

a,c,e

Figure 8 Model F SG H* Tubesheet Bow Contact Pressure Study; Comparison of Polynomial Scale Factor Results with Average TS Hole Dilation Results

a,c,e

Figure 9 Model D5: Comparison of Contact Pressures Using Average Bore Dilation and Using the Polynomial Scale Factor Model

a,c,e

Figure 10 Model F: Comparison of Contact Pressures Using Average Bore Dilation and Using the Polynomial Scale Factor Model

a,c,e

Figure 11 Model 44F: Comparison of Contact Pressures Using Average Bore Dilation and Using the Polynomial Scale Factor Model

a,c,e

Figure 12 Model 51F: Comparison of Contact Pressures Using Average Bore Dilation and Using the Polynomial Scale Factor Model

References:

1. WCAP-17071, Rev. 0, "H*: Alternate Repair Criteria for the Tubesheet Expansion Region in Steam Generators with Hydraulically Expanded Tubes (Model F)," April 2009.
2. WCAP-17072, Rev. 0, "H*: Alternate Repair Criteria for the Tubesheet Expansion Region in Steam Generators with Hydraulically Expanded Tubes (Model D5)," May 2009.
3. WCAP-17091, Rev. 0, "H*: Alternate Repair Criteria for the Tubesheet Expansion Region in Steam Generators with Hydraulically Expanded Tubes (Model 44F)," June 2009.
4. WCAP-17092, Rev. 0, "H*: Alternate Repair Criteria for the Tubesheet Expansion Region in Steam Generators with Hydraulically Expanded Tubes (Model 51F)," June 2009.
5. LTR-NRC-09-26, "LTR-SGMP-09-66 P-Attachment, "White Paper: Low Temperature Steam Line Break Contact Pressure and Local Tube Bore Deformation Analysis for H*" (Proprietary)," May 13, 2009.
6. USNRC Letter, "Vogtle Electric Generating Plant, Units 1 and 2- Transmittal of Unresolved Issues Regarding Permanent Alternate Repair Criteria for Steam Generators (TAC Nos. ME1339 and ME1340)," November 23, 2009.
7. LTR- SGMP-09-109 P-Attachment "Response to NRC Request for Additional Information on H*; RAI # 4; Model F and Model D5 Steam Generators," dated August 25, 2009.
8. A.P. Boresi and R.J. Schmidt, *Advanced Mechanics of Materials*, Sixth Edition; John Wiley and Sons, Inc., 2003.

Vogtle Electric Generating Plant Units 1 and 2
License Amendment Request to Revise Technical Specification (TS)
Sections 5.5.9, "Steam Generator (SG) Program" and TS 5.6.10,
"Steam Generator Tube Inspection Report" for Temporary Alternate Repair Criteria

Enclosure 9

Westinghouse Electric Company LLC LTR-CAW-10-2939, "Application for Withholding Proprietary Information from Public Disclosure"

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CAW-10-2939

September 13, 2010

APPLICATION FOR WITHHOLDING PROPRIETARY
INFORMATION FROM PUBLIC DISCLOSURE

Subject: LTR-SGMP-10-78 P-Attachment, "Effects of Tubesheet Bore Eccentricity and Dilation on Tube-to-Tubesheet Contact Pressure and their Relative Importance to H*" (Proprietary)

The proprietary information for which withholding is being requested in the above-referenced report is further identified in Affidavit CAW-10-2939 signed by the owner of the proprietary information, Westinghouse Electric Company LLC. The affidavit, which accompanies this letter, sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of 10 CFR Section 2.390 of the Commission's regulations.

Accordingly, this letter authorizes the utilization of the accompanying affidavit by Southern Nuclear Operating Company.

Correspondence with respect to the proprietary aspects of the application for withholding or the Westinghouse affidavit should reference this letter, CAW-10-2939, and should be addressed to J. A. Gresham, Manager, Regulatory Compliance and Plant Licensing, Westinghouse Electric Company LLC, P.O. Box 355, Pittsburgh, Pennsylvania 15230-0355.

Very truly yours,

J. A. Gresham, Manager
Regulatory Compliance and Plant Licensing

Enclosures

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF ALLEGHENY:

Before me, the undersigned authority, personally appeared J. A. Gresham, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Company LLC (Westinghouse), and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:

J. A. Gresham, Manager
Regulatory Compliance and Plant Licensing

Sworn to and subscribed before me
this 13th day of September 2010

Notary Public

COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Cynthia Olesky, Notary Public
Manor Boro, Westmoreland County
My Commission Expires July 16, 2014
Member, Pennsylvania Association of Notaries

(1) I am Manager, Regulatory Compliance and Plant Licensing, in Nuclear Services, Westinghouse Electric Company LLC (Westinghouse), and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rule making proceedings, and am authorized to apply for its withholding on behalf of Westinghouse.

(2) I am making this Affidavit in conformance with the provisions of 10 CFR Section 2.390 of the Commission's regulations and in conjunction with the Westinghouse Application for Withholding Proprietary Information from Public Disclosure accompanying this Affidavit.

(3) I have personal knowledge of the criteria and procedures utilized by Westinghouse in designating information as a trade secret, privileged or as confidential commercial or financial information.

(4) Pursuant to the provisions of paragraph (b)(4) of Section 2.390 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.

(i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse.

(ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes Westinghouse policy and provides the rational basis required.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

(a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of

Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.

(b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.

(c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.

(d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.

(e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.

(f) It contains patentable ideas, for which patent protection may be desirable.

There are sound policy reasons behind the Westinghouse system which include the following:

(a) The use of such information by Westinghouse gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.

(b) It is information that is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.

(c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.

(d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.

(e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market advantage to the competition of those countries.

(f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

(iii) The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR Section 2.390; it is to be received in confidence by the Commission.

(iv) The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.

(v) The proprietary information sought to be withheld in this submittal is that which is appropriately marked in LTR-SGMP-10-78 P-Attachment, "Effects of Tubesheet Bore Eccentricity and Dilation on Tube-to-Tubesheet Contact Pressure and their Relative Importance to H*" (Proprietary), dated September 7, 2010, for submittal to the Commission, being transmitted by Southern Nuclear Operating Company letter and Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk. The proprietary information as submitted by Westinghouse is that associated with technical justification of the H* Alternate Repair Criteria for hydraulically expanded steam generator tubes at Vogtle Units 1 and 2 and may be used only for that purpose.

This information is part of that which will enable Westinghouse to:

(a) License the H* Alternate Repair Criteria.

Further this information has substantial commercial value as follows:

(a) Westinghouse plans to sell the use of the information to its customers for the purpose of licensing the H* Alternate Repair Criteria.

(b) Westinghouse can sell support and defense of the H* criteria.

(c) The information requested to be withheld reveals the distinguishing aspects of a methodology which was developed by Westinghouse.

Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Westinghouse because it would enhance the ability of competitors to provide similar technical justification and licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without purchasing the right to use the information.

The development of the technology described in part by the information is the result of applying the results of many years of experience in an intensive Westinghouse effort and the expenditure of a considerable sum of money.

In order for competitors of Westinghouse to duplicate this information, similar technical programs would have to be performed and a significant manpower effort, having the requisite talent and experience, would have to be expended.

Further the deponent sayeth not.

PROPRIETARY INFORMATION NOTICE

Transmitted herewith are proprietary and/or non-proprietary versions of documents furnished to the NRC in connection with requests for generic and/or plant-specific review and approval.

In order to conform to the requirements of 10 CFR 2.390 of the Commission's regulations concerning the protection of proprietary information so submitted to the NRC, the information which is proprietary in the proprietary versions is contained within brackets, and where the proprietary information has been deleted in the non-proprietary versions, only the brackets remain (the information that was contained within the brackets in the proprietary versions having been deleted). The justification for claiming the information so designated as proprietary is indicated in both versions by means of lower case letters (a) through (f) located as a superscript immediately following the brackets enclosing each item of information being identified as proprietary or in the margin opposite such information. These lower case letters refer to the types of information Westinghouse customarily holds in confidence identified in Sections (4)(ii)(a) through (4)(ii)(f) of the affidavit accompanying this transmittal pursuant to 10 CFR 2.390(b)(1).

COPYRIGHT NOTICE

The reports transmitted herewith each bear a Westinghouse copyright notice. The NRC is permitted to make the number of copies of the information contained in these reports which are necessary for its internal use in connection with generic and plant-specific reviews and approvals as well as the issuance, denial, amendment, transfer, renewal, modification, suspension, revocation, or violation of a license, permit, order, or regulation subject to the requirements of 10 CFR 2.390 regarding restrictions on public disclosure to the extent such information has been identified as proprietary by Westinghouse, copyright protection notwithstanding. With respect to the non-proprietary versions of these reports, the NRC is permitted to make the number of copies beyond those necessary for its internal use which are necessary in order to have one copy available for public viewing in the appropriate docket files in the public document room in Washington, DC and in local public document rooms as may be required by NRC regulations if the number of copies submitted is insufficient for this purpose. Copies made by the NRC must include the copyright notice in all instances and the proprietary notice if the original was identified as proprietary.

Southern Nuclear Operating Company

Letter for Transmittal to the NRC

The following paragraphs should be included in your letter to the NRC:

Enclosed is:

1. __ copies of LTR-SGMP-10-78 P-Attachment, "Effects of Tubesheet Bore Eccentricity and Dilation on Tube-to-Tubesheet Contact Pressure and their Relative Importance to H*" (Proprietary)

2. __ copies of LTR-SGMP-10-78 NP-Attachment, "Effects of Tubesheet Bore Eccentricity and Dilation on Tube-to-Tubesheet Contact Pressure and their Relative Importance to H*" (Non-Proprietary)

Also enclosed is the Westinghouse Application for Withholding Proprietary Information from Public Disclosure CAW-10-2939, accompanying Affidavit, Proprietary Information Notice, and Copyright Notice.

As Item 1 contains information proprietary to Westinghouse Electric Company LLC, it is supported by an affidavit signed by Westinghouse, the owner of the information. The affidavit sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of Section 2.390 of the Commission's regulations.

Accordingly, it is respectfully requested that the information which is proprietary to Westinghouse be withheld from public disclosure in accordance with 10 CFR Section 2.390 of the Commission's regulations.

Correspondence with respect to the copyright or proprietary aspects of the items listed above or the supporting Westinghouse affidavit should reference CAW-10-2939 and should be addressed to J. A. Gresham, Manager, Regulatory Compliance and Plant Licensing, Westinghouse Electric Company LLC, P.O. Box 355, Pittsburgh, Pennsylvania 15230-0355.