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Our ref: LTR-NRC-08-32
June 24, 2008

Subject: Second Supplemental Response to NRC Request for Additional Information by the Office Of Nuclear Reactor Regulation for Topical Report WCAP-16081-P-A Addendum 1, "SVEA-96 Optima2 CPR Correlation (D4): High & Low Flow Applications " (TAC No. MD3959) (Proprietary/Non-proprietary)

Enclosed are copies of the Proprietary and Non-Proprietary supplements to the prior Westinghouse response to the NRC Request for Additional Information by the Office Of Nuclear Reactor Regulation for Topical Report WCAP-16081-P-A Addendum 1, "SVEA-96 Optima2 CPR Correlation (D4): High & Low Flow Applications."

Also enclosed is:

1. One (1) copy of the Application for Withholding, AW-08-2450 (Non-proprietary) with Proprietary Information Notice.
2. One (1) copy of Affidavit (Non-proprietary).

This submittal contains proprietary information of Westinghouse Electric Company, LLC. In conformance with the requirements of 10 CFR Section 2.390, as amended, of the Commission's regulations, we are enclosing with this submittal an Application for Withholding from Public Disclosure and an affidavit. The affidavit sets forth the basis on which the information identified as proprietary may be withheld from public disclosure by the Commission.

Correspondence with respect to the affidavit or Application for Withholding should reference AW-08-2450 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,

R. M. Gresham /for

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

Enclosures
cc: A. Mendiola, NRR
Jon Thompson, NRR
George Bacuta, NRR

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Our ref: AW-08-2450
June 24, 2008

APPLICATION FOR WITHHOLDING PROPRIETARY
INFORMATION FROM PUBLIC DISCLOSURE

Subject: Second Supplemental Response to NRC Request for Additional Information By the Office Of Nuclear Reactor Regulation for Topical Report WCAP-16081-P-A Addendum 1, "SVEA-96 Optima2 CPR Correlation (D4): High & Low Flow Applications" (TAC No. MD3959) (Proprietary)

Reference: Letter from J. A. Gresham to Document Control Desk, LTR-NRC-08-32, dated June 24, 2008

The application for withholding is submitted by Westinghouse Electric Company LLC (Westinghouse) pursuant to the provisions of paragraph (b)(1) of Section 2.390 of the Commission's regulations. It contains commercial strategic information proprietary to Westinghouse and customarily held in confidence.

The proprietary material for which withholding is being requested is identified in the proprietary version of the subject report. In conformance with 10 CFR Section 2.390, Affidavit AW-08-2450 accompanies this application for withholding, setting forth the basis on which the identified proprietary information may be withheld from public disclosure.

Accordingly, it is respectfully requested that the subject 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 this application for withholding or the accompanying affidavit should reference AW-08-2450 and should be addressed to J. A. Gresham, Manager of Regulatory Compliance and Plant Licensing, Westinghouse Electric Company LLC, P. O. Box 355, Pittsburgh, Pennsylvania 15230-0355.

Very truly yours,

R. M. Gresham/for

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

Cc: A. Mendiola, NRR
J. Thompson, NRR

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

COUNTY OF ALLEGHENY:

Before me, the undersigned authority, personally appeared T. Rodack, 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:

T. Rodack, Director
Quality Licensing Programs

Sworn to and subscribed
before me this 25th day
of June, 2008.

Notary Public

COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Sharon L. Markle, Notary Public
Monroeville Boro, Allegheny County
My Commission Expires Jan. 29, 2011
Member, Pennsylvania Association of Notaries

(1) I am Director, Quality Licensing Programs, in Nuclear Fuel, 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 rulemaking 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" 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 which 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 "Second Supplemental Response to NRC Request for Additional Information By the Office Of Nuclear Reactor Regulation for Topical Report WCAP-16081-P-A Addendum 1, 'SVEA-96 Optima2 CPR Correlation (D4): High & Low Flow Applications' (TAC No. MD3959) (Proprietary)," for submittal to the Commission, being transmitted by Westinghouse letter (LTR-NRC-08-32) and Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk. The proprietary information as submitted by Westinghouse Electric Company is that associated with the supplemental response to NRC Request for Additional Information for WCAP-16081-P-A Addendum 1.

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

(a) Obtain generic NRC licensed approval for the SVEA-96 Optima2 CPR Correlation (D4): High & Low Flow Applications.

(b) Assist customers in improving their fuel performance (zero defects).

Further this information has substantial commercial value as follows:

(a) Westinghouse plans to continue to implement improvements to ensure the highest quality of fuel and analyses in order to meet the customer needs.

(b) Assist customers to obtain license changes.

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 evaluation justifications 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 for developing the enclosed improved core thermal performance methodology.

Further the deponent sayeth not.

Second Supplemental Response to NRC's Request for Additional Information By the Office Of Nuclear Reactor Regulation For Topical Report WCAP-16081-P-A Addendum 1, "SVEA-96 OPTIMA2 CPR Correlation (D4): High & Low Flow Applications" (TAC No. MD3959) (Non-Proprietary)

June 2008

Westinghouse Electric Company
P.O. Box 355
Pittsburgh, Pennsylvania 15230-0355

Second Supplemental Response to NRC Request for Additional information by the Office Of Nuclear Reactor Regulation for Topical Report WCAP-16081-P-A Addendum 1, WCAP-16081, Addendum 1, "SVEA-96 Optima2 CPR Correlation (D4): High and Low Flow Applications" in a telephone call on April 2, 2001

The following is a response containing the information requested by NRC reviewer Tai Huang during the April 2, 2008 and June 2, 2008 teleconferences regarding topical report WCAP-16081, Addendum 1, SVEA-96 Optima2 CPR Correlation (D4): High and Low Flow Applications.

NRC telecon participants: John Thompson, Tai Huang
Westinghouse participants: George Roberts, Gunilla Norback, Mike Riggs, Bill Harris, Tom Rodack (6/2/08 call only)
This information is intended to supplement the RAI responses provided in LTR-NRC-07-47 and LTR-NRC-08-12 (References 3 and 4).

Background:
Reference 1 describes the D4.1.1 CPR correlation for SVEA-96 Optima2 fuel and provides justification for the correlation based on a large FRIGG Loop Critical Power data base for SVEA-96 Optima2. Reference 1 identified upper and lower mass flux limits for the D4 CPR correlation of [ ]^{a,c}, respectively. Reference 1 was reviewed and accepted by the NRC as described in Reference 1.

Reference 2 described, justified, and requested NRC acceptance of the process by which Westinghouse intends to conservatively estimate SVEA-96 Optima2 CPR values for which the mass flux is outside of the data base range of [ ]^{a,c}.

Reference 3 is a response to the NRC's request for information in addition to that provided in References 1 and 2 further justifying the conservative process Westinghouse intends to use for calculating CPR outside of the mass flux range from [ ]^{a,c}. RAI 2 of Reference 3 identified the Westinghouse intention to adopt an expanded mass flux range of [ ]^{a,c} for the D4 CPR correlation.

Reference 4 is a supplemental response to information requested by the NRC during the February 15, 2008, teleconference regarding References 2 and 3. NRC Request 2 of Reference 3 requested that Westinghouse provide a non-zero lower mass flux limit based on the conclusion that it is not physically realistic to reach zero flow. Westinghouse responded with the intention to adopt a low mass flux limit of [ ]^{a,c} and noted that the D4 correlation prediction below [ ]^{a,c} becomes increasingly conservative as mass flux is reduced.

In April 2, 2008 and June 2, 2008 teleconferences, the NRC requested further information regarding the range of conditions outside of the currently approved range of [ ]^{a,c}.
The NRC request can be summarized as follows:

NRC Request 1: Please provide the results of POLCA calculations indicating the range of mass fluxes expected during steady-state operation and Anticipated Operational Occurrences.

NRC Request 2: Please provide the D4.1.1 CPR predictions for the cases discussed in Request 1.

NRC Request 3: Are there any more SVEA-96 Optima3 Critical Power data in the low mass flux region in addition to that shown in the Westinghouse Response to NRC Request 4 in Reference 4 which can be used to support operation at low mass fluxes?

NRC Request 4: Please address the impact of adopting a D4 mass flux range within the SVEA-96 Optima3 mass flux test data range of [ ]^{a,c}.

Westinghouse Response to Request 1:

A systematic evaluation of the mass flux range for which CPR evaluation might be required was performed based on Westinghouse core simulator (POLCA7) calculations on the periphery of Dresden and Quad Cities conditions. Conclusions regarding the conservative extrapolation process for CPR evaluation for mass flux values outside of the D4 data base based on Dresden and Quad Cities described herein as well as in References 1 through 4 are applicable to other U.S. BWRs as well.

This evaluation was performed for a Quad Cities 2 equilibrium SVEA-96 Optima2 core. Specifically, calculations were performed for the following cases:

1. Possibly limiting conditions on the boundary of the composite Dresden/Quad Cities Power-to-Flow map for anticipated operation are shown in Figure 1. Specifically, Points B, C, D, E, and G were considered. In addition, a point at 10 % power and 30 % flow simulating start-up on the Two-pump Minimum Pump speed trajectory in Figure 1 was considered.

2. While commercial reactors are not operated in the natural circulation condition, two limiting points on the natural circulation trajectory in Figure 1 were evaluated: Specifically, the point labeled "A" in Figure 1 and a point at 22 % power and 20 % flow were considered. It is judged that these points indicate a conservative bound on conditions at which low mass fluxes could be encountered.

3. The Recirculation Flow Run-Up (RFRU) Anticipated Operational Occurrence (AOO) can be evaluated with steady-state methods using POLCA7. Therefore, operation at a typical initial condition of 50 % power and 40 % flow as well as two final conditions simulating the final state of a non-pressurization RFRU transient (RFRU-nonpressurize) at 110 % power and 110 % flow and a bounding pressurization final state at 125 % power and 110 % flow (RFRU-pressurize) were considered.

4. While U.S. commercial BWR's can not be critical without at least one recirculation pump operating, startup in Single Loop Operation (SLO) is generally acceptable. For example, start-up in the SLO mode is permitted for the Dresden and Quad Cities plants. 25 % core power is the threshold for requiring CPR monitoring in U.S. BWRs in general including Dresden and Quad Cities. It is estimated that the minimum SLO core flow at this power would be about 29 %. Consequently, a case at 25 % core power and 29 % core flow was evaluated.

The results are summarized in Table 1. The following conclusions are based on the results in Table 1.

1. Low mass flux values (< [ ]^{a,c}) typically, but not always, occur in tightly-orificed peripheral assemblies. The data in Table 1 indicate a lowest mass flux of [ ]^{a,c} for operating conditions for the SLO startup up point in Table 1. However, the very bounding points on the Natural Circulation (NC) line in Figure 1 indicate that very low mass fluxes are possible. While these two NC cases are unrealistic, these sensitivity studies indicate that mass flux points somewhat lower than [ ]^{a,c} might occur for allowed conditions. Therefore, [ ]^{a,c} is considered to be a prudent choice, and was recommended in Reference 4 for the low mass flux limit line.

2. High mass flux values (> [ ]^{a,c}) typically occur in the sub-bundle immediately adjacent to the control rod in a fully or highly controlled assembly. As shown in Table 1,

exceeding the D4 upper mass flux limit of [ ]^{a,c} can occur for steady-state points at and near rated conditions and approach the [ ]^{a,c} range in the final condition of the RFRU pressurization AOO. Therefore, an upper limit greater than or equal to [ ]^{a,c} would be a prudent choice for the high mass flux limit.

Westinghouse Response to Request 2:

D4 CPR predictions for each of the SVEA-96 Optima2 minimum and maximum mass flows in Table 1 are provided in Table 1. Table 1 also shows the core Minimum Critical Power Ratio (MCPR) for each case for comparison. A comparison of the CPR in the minimum or maximum mass flux assembly with the core MCPR demonstrates that, even with the conservative CPR treatment outside of the [ ]^{a,c} range by the D4 CPR correlation discussed in References 2, 3, and 4, the margin to CPR limits is relatively large for the assemblies above and below the data base range of [ ]^{a,c}.

Westinghouse Response to Request 3:

Westinghouse does not have additional SVEA-96 Optima3 Critical Power FRIGG Loop data below [ ]^{a,c} which can be used to help justify a D4 mass flux limit below [ ]^{a,c}.

Westinghouse Response to Request 4:

The proposed D4 mass flux upper limit of [ ]^{a,c} specified in response to RAI question #2 (Ref. 3) is below the mass flux of the SVEA-96 Optima3 data base range of [ ]^{a,c}, and would be acceptable provided that mass fluxes above [ ]^{a,c} would be conservatively evaluated using a mass flux of [ ]^{a,c}. [ ]^{a,c} is the upper mass flux limit of the D4 Critical Power measurements. This is consistent with Reference 2, which established that D4 CPR evaluations for all mass flux values above [ ]^{a,c} would be performed using a mass flux of value of [ ]^{a,c}.

Increasing the D4 lower mass flux range minimum value from [ ]^{a,c}, which was proposed in the supplemental response provided in Reference 4, to [ ]^{a,c} would increase the probability of a D4 CPR mass flux range violation during plant operation. Therefore, an acceptable method for conservatively calculating critical power below [ ]^{a,c} is needed. In order to address NRC concerns about the lack of measured data for mass flux below [ ]^{a,c}, it is proposed that [

]^{a,c}, be used to conservatively calculate Critical Power for mass velocity below [ ]^{a,c}. [ ]^{a,c}

Conclusion

[ ]^{a,c} will be adopted for the SVEA-96 Optima2 D4 CPR correlation with the following conditions:

1. [

]^{a,c}

2. [

]^{a,c}

a,c

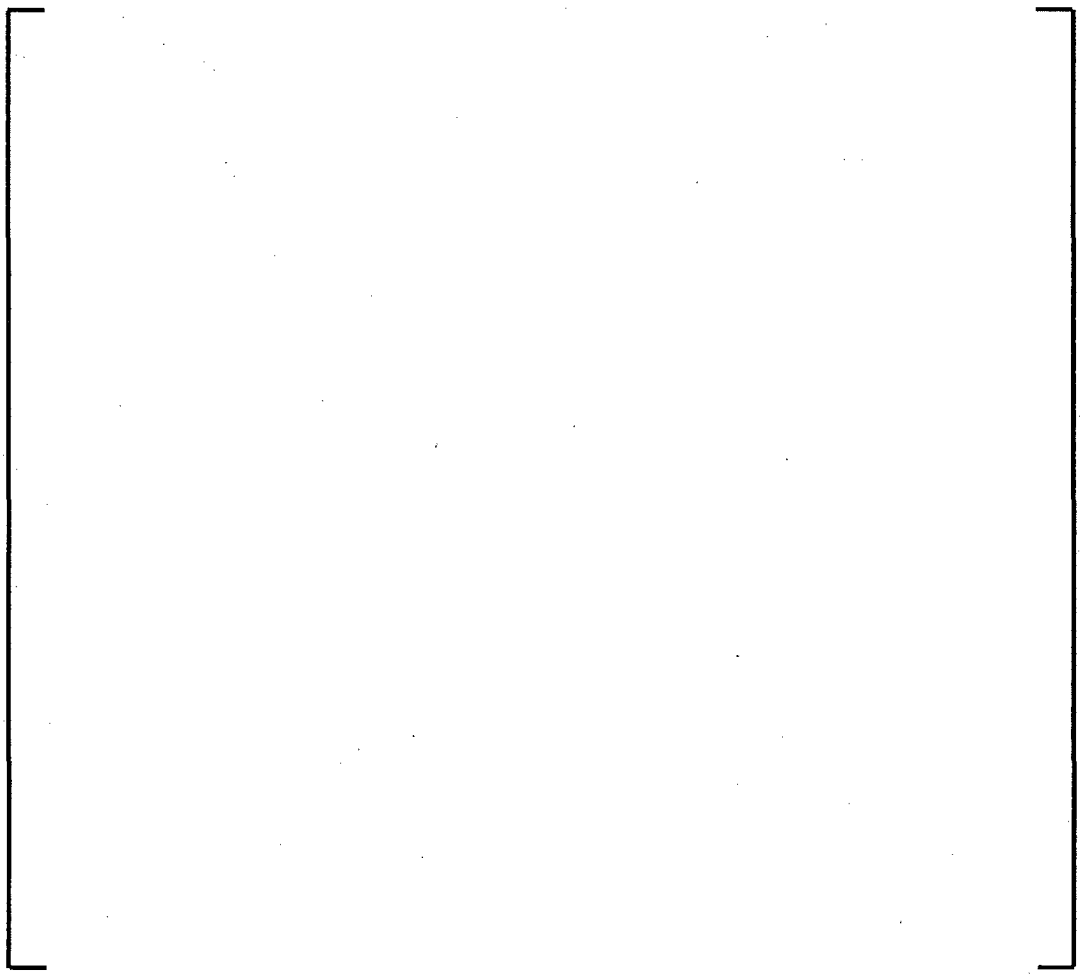

Figure 1 [ ]^{a,c} and [ ]^{a,c} Composite Power-to-Flow Map

a,c

[ ]

References

1 WCAP-16081-P-A, "10×10 SVEA Fuel Critical Power Experiments and CPR Correlation: SVEA-96 Optima2," March 2005.
2 WCAP-16081, Addendum 1, SVEA-96 Optima2 CPR Correlation (D4): High and Low Flow Applications, November 2006.
3 LTR-NRC-07-47, Response to NRC's Request for Additional Information By the Office of Nuclear Reactor Regulation for Topical Report WCAP-16081-P-A Addendum 1, SVEA-96 Optima2 CPR Correlation (D4): High and Low Flow Applications, 9/13/2007.
4 LTR-NRC-08-12, Supplemental Response to NRC Request for Additional Information by the Office of Nuclear Reactor Regulation for Topical Report WCAP-16081, Addendum 1, "SVEA-96 Optima2 CPR Correlation (D4): High and Low Flow Applications", March 14, 2008.
5 N.Zuber, M. Tribus, J.W. Westwater, The Hydrodynamic Crises in Pool Boiling of Saturated and Subcooled Liquids, International Developments in Heat Transfer Part II, 1961, pg. 230-236.
6 P. Griffith, K.T. Avedisian, J.F. Walkush, Countercurrent Flow Critical Heat Flux, National Heat Transfer Conference San Francisco, Aug. 1975.
7 WCAP-16081, Addendum 2, SVEA-96 Optima2 CPR Correlation (D4): Modified R-factors for Part-Length Rods, July 2007.