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Our ref: LTR-NRC-07-21

April 13, 2007

Subject: Response to NRC Request for Additional Information on WCAP-10266-P-A, Revision 2, Addendum 3, "Incorporation of the LOCBART Transient Extension Method into the 1981 Westinghouse Large Break LOCA Evaluation Model with BASH (BASH-EM)" (Proprietary/Non-Proprietary)

Enclosed are copies of the proprietary and the non-proprietary versions of "Response to NRC Request for Additional Information on WCAP-10266-P-A, Revision 2, Addendum 3, 'Incorporation of the LOCBART Transient Extension Method into the 1981 Westinghouse Large Break LOCA Evaluation Model with BASH (BASH-EM)'."

Also enclosed are:

One (1) copy of the Application for Withholding, AW-07-2268 (Non-Proprietary) with Proprietary Information Notice.

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-07-2268 and should be addressed to B. F. Maurer, Acting Manager, Regulatory Compliance and Plant Licensing, Westinghouse Electric Company LLC, P.O. Box 355, Pittsburgh, Pennsylvania 15230-0355.

Very truly yours,

A handwritten signature in black ink, appearing to read 'B. F. Maurer'.

B. F. Maurer, Acting Manager
Regulatory Compliance and Plant Licensing

Enclosures

cc: Jon Thompson /NRR
Ed Throm /NRR

T007

Distribution for LTR-NRC-07-21

bcc: B. F. Maurer (ECE 4-7A) 1L
R. Bastien (Nivelles, Belgium) 1L, 1A
C. B. Brinkman (Rockville) 1L, 1A
RCPL Administrative Aide (ECE 4-7) 1L w/affidavit
R. R. Schoff (ECE 430D) 1L, 1A

Internal References: LTR-LIS-07-211, Revision 1; LTR-LIS-07-212



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Our ref: AW-07-2268

April 13, 2007

APPLICATION FOR WITHHOLDING PROPRIETARY
INFORMATION FROM PUBLIC DISCLOSURE

Subject: LTR-NRC-07-21 P-Attachment, "Response to NRC Request for Additional Information on WCAP-10266-P-A, Revision 2, Addendum 3, 'Incorporation of the LOCBART Transient Extension Method into the 1981 Westinghouse Large Break LOCA Evaluation Model with BASH (BASH-EM)'," (Proprietary)

Reference: Letter from B. F. Maurer to U.S. NRC Document Control Desk, LTR-NRC-07-21, dated April 13, 2007.

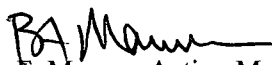
The Application for Withholding is submitted by Westinghouse Electric Company LLC (Westinghouse), pursuant to the provisions of Paragraph (b) (1) of Section 2.390 of the Commission's regulations. It contains commercial strategic information proprietary to Westinghouse and customarily held in confidence.

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-07-2268 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-07-2268 and should be addressed to B. F. Maurer, Acting Manager, Regulatory Compliance and Plant Licensing, Westinghouse Electric Company LLC, P.O. Box 355, Pittsburgh, Pennsylvania 15230-0355.

Very truly yours,


B. F. Maurer, Acting Manager
Regulatory Compliance and Plant Licensing

Enclosures

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

SS

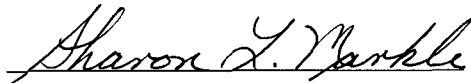
COUNTY OF ALLEGHENY:

Before me, the undersigned authority, personally appeared B. F. Maurer, 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:

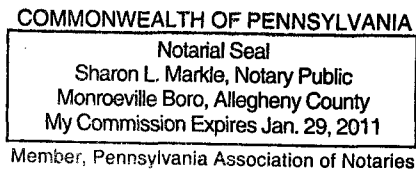


B. F. Maurer, Acting Manager
Regulatory Compliance and Plant Licensing

Sworn to and subscribed before me
this 13th day of April, 2007



Notary Public



- (1) I am Acting 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" 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-NRC-07-21 P-Attachment, "Response to NRC Request for Additional Information on WCAP-10266-P-A, Revision 2, Addendum 3, 'Incorporation of the LOCBART Transient Extension Method into the 1981 Westinghouse Large Break LOCA Evaluation Model with BASH (BASH-EM)'," (Proprietary), for submittal to the Commission, being transmitted by Westinghouse letter (LTR-NRC-07-21) 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 Westinghouse's request for NRC approval of WCAP-10266-P-A, Revision 2, Addendum 3, "Incorporation of the LOCBART Transient Extension Method into the 1981 Westinghouse Large Break LOCA Evaluation Model with BASH (BASH-EM)."

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

- (a) Obtain NRC approval of WCAP-10266-P-A, Revision 2, Addendum 3, "Incorporation of the LOCBART Transient Extension Method into the 1981 Westinghouse Large Break LOCA Evaluation Model with BASH (BASH-EM)."

Further this information has substantial commercial value as follows:

- (a) Westinghouse plans to sell the use of this information to its customers for purposes of meeting NRC requirements for licensing documentation.
- (b) Westinghouse can sell support and defense of the use of large break LOCA analysis predictions including the LOCBART Transient Extension Method.
- (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 calculations 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.

LTR-NRC-07-21 NP-Attachment
TAC NO. MB7485

**Response to NRC Request for Additional Information on
WCAP-10266-P-A, Revision 2, Addendum 3, "Incorporation of the LOCBART Transient
Extension Method into the 1981 Westinghouse Large Break LOCA Evaluation Model with
BASH (BASH-EM)"**

April 13, 2007

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1. In light of Figure 1b-1 of Reference 1, please clarify the number of cells that Westinghouse will be using in the axial nodding void fraction calculation to develop the downcomer head loss for use in LOCBART.

Reference

1. LTR-NRC-04-4, "Response to NRC Request for Additional Information on Addendum 3 to WCAP-10266-P-A, Rev. 2 (Proprietary) and WCAP-11524-A, Rev. 2 (Non-Proprietary), 'Incorporation of the LOCBART Transient Extension Method into the 1981 Westinghouse Large Break LOCA Evaluation Model with BASH (BASH-EM)'," January 26, 2004.

Several changes to the LOCBART Transient Extension Method are proposed to address the technical questions identified in RAIs 1 and 3-5. Sensitivity calculations have been completed to demonstrate the effect of the proposed changes on the core inlet flooding rate during downcomer boiling, the peak cladding temperature (PCT) and the maximum local oxidation (MLO) for a sample plant with a neutron pad design. The base calculation used the LOCBART Transient Extension Method as described in the Topical Report and was modified as follows for the sensitivity calculations (note that each case builds on the preceding case):

[

J^{a,c}

[

$J^{a,c}$

Figure 1-1 compares the core inlet flooding rate during downcomer boiling for the base case and Cases A to G. [

$J^{a,c}$

Figures 1-2 and 1-3 compare the hot rod cladding temperature at the PCT elevation and the hot rod local oxidation at the MLO elevation, respectively, for the base case and Cases A to G. [

$J^{a,c}$

Based on the preceding information, Case G is proposed for standard PWR calculations. A similar approach would apply for a plant with a thermal shield design, with the most notable differences being an increased wall heat release rate, decreased flow area and decreased characteristic diameter in the thermal shield region; these differences would be expected to reduce the core inlet flooding rate during downcomer boiling with all other things being equal. For plants of either design (i.e., neutron pads or thermal shield), the limitations identified in Section 2.4 of Reference 1-4 will continue to apply until the transition to realistic large break LOCA analysis methods is complete.

References

- 1-1. Sudo, Y., and Akimoto, H., "Downcomer Effective Water Head during Reflood in Postulated PWR LOCA," Journal of Nuclear Science and Technology, 19(1), pp. 34-45, January 1982.
- 1-2. LTR-NRC-04-4, "Response to NRC Request for Additional Information on Addendum 3 to WCAP-10266-P-A, Rev. 2 (Proprietary) and WCAP-11524-A, Rev. 2 (Non-Proprietary), 'Incorporation of the LOCBART Transient Extension Method into the 1981 Westinghouse Large Break LOCA Evaluation Model with BASH (BASH-EM)'," January 26, 2004.
- 1-3. LTR-NRC-04-20, "Response to NRC Request for Additional Information on Addendum 3 to WCAP-10266-P-A, Rev. 2 (Proprietary) and WCAP-11524-A, Rev. 2 (Non-Proprietary)," April 15, 2004.
- 1-4. LTR-NRC-06-23, "Response to NRC Request for Additional Information on WCAP-10266-P-A, Revision 2, Addendum 3, 'Incorporation of the LOCBART Transient Extension Method into the 1981 Westinghouse Large Break LOCA Evaluation Model with BASH (BASH-EM)', and Transmittal of Slide Package Entitled 'Update on Large Break LOCA Evaluation Model Issue' (Proprietary/Non-Proprietary)," April 28, 2006.

Figure 1-1

[

]a.c

Figure 1-2

[

]a,c

Figure 1-3

[

] ^{a,c}

2. In Reference 2, Sudo bounds his correlation for steam-water to pressures of 6-111 atm, tube diameters 63-486 mm and superficial liquid velocities 0-30 cm/s. The author suggests that “more experiments should be done to investigate the range in which [the Sudo correlation] is applicable”. In Reference 3, the author provides very limited test data to confirm the validity of the correlation in the desired range. Please provide additional test data in the desired range of use of the correlation (i.e., the full testing report from Sudo’s test) to demonstrate its adequacy for use with LOCBART.

References

2. Sudo, Y., “Estimation of Average Void Fraction in Vertical Two-Phase Flow Channel under Low Liquid Velocity,” *Journal of Nuclear Science and Technology*, 17(1), pp. 1-15, January 1980.
3. Sudo, Y., and Akimoto, H., “Downcomer Effective Water Head during Reflood in Postulated PWR LOCA,” *Journal of Nuclear Science and Technology*, 19(1), pp. 34-45, January 1982.

Additional simulations of experiments from the JAERI downcomer boiling test facility have been completed to demonstrate the applicability of the Sudo correlation for the conditions of interest. The simulations incorporated the applicable changes from the response to RAI 1 except for the [

]^{a,c}. Table 2-1 is based primarily on Table 2 of Reference 2-1 and Table 1 of Reference 2-2 and shows the gap width (S), number of heated walls (N_{WALLS}), initial wall temperature (T_W), extracted water velocity (V_{EX}), injection temperature (T_{INJ}) and injection mode (Mode) for the 5 experiments that have been simulated as part of the present effort.

Table 2-1: Test Conditions for JAERI Run Nos. 115, 116, 120, 211 and 213

Run No.	S, mm (in)	N _{WALLS}	T _W , °C (°F)	V _{EX} , cm/s (in/s)	T _{INJ} , °C (°F)	Mode
115	200 (7.9)	2	250 (482)	0 (0)	98 (208)	A
116	200 (7.9)	2	275 (527)	0 (0)	100 (212)	A
120	200 (7.9)	2	300 (572)	2 (0.8)	100 (212)	A
211	50 (2.0)	1	250 (482)	0 (0)	99 (210)	A
213	50 (2.0)	1	250 (482)	0 (0)	97 (207)	B

The wall surface heat flux histories used in the simulations of Run Nos. 115, 116, 120, 211 and 213 are based on [

] ^{a,c}

Figures 2-2 to 2-4 provide sample results from the simulations of Run Nos. 115, 116, 120, 211 and 213 including the vapor superficial velocity and void fraction at the top of the heated length and the collapsed liquid level across the heated length. Review of these figures leads to the following observations:

[

] ^{a,c}

Figures 2-5 to 2-8 compare the measured and predicted collapsed liquid levels for Run Nos. 115, 116, 120 and 211, using measured values based on [

] ^{a,c}

Figure 2-10 compares the measured and predicted collapsed liquid levels for Run No. 213, using measured values based on [

] ^{a,c}

References

- 2-1. JAERI-M 7978, "Experiment of the Downcomer Effective Water Head during a Reflood Phase of PWR LOCA," October 1978.
- 2-2. JAERI-M 8978, "Experimental Results of the Effective Water Head in Downcomer during Reflood Phase of a PWR LOCA (2nd Report, 50 mm Gap Size)," July 1980.

Figure 2-1

[

]a,c

Figure 2-2

[

]a,c

Figure 2-3

[

]a.c

Figure 2-4

[

] ^{a,c}

Figure 2-5

[

]a,c

Figure 2-6

[

]a,c

Figure 2-7

[

]a,c

Figure 2-8

[

j^{a,c}

Figure 2-9

[

]a,c

Figure 2-10

[

] ^{a,c}

3. In Reference 2, Sudo states that “[the Sudo correlation] can predict the experimental data referred to in [his] study within $\pm 15\%$ ”. He also explains that “the effect of [the superficial velocity] can be neglected in the velocity range of 0-30 cm/s because the difference of these tendencies is included within the same range of error of $\pm 15\%$ ”. In Reference 4, Westinghouse stated this uncertainty-based agreement between the correlation and experimental data need not be considered based on other conservatisms within the BASH Evaluation Model. Please demonstrate that the conservatisms in the BASH Evaluation Model capture the source of the $\pm 15\%$ uncertainty in the Sudo correlation.

Reference

4. LTR-NRC-04-20, “Response to NRC Request for Additional Information on Addendum 3 to WCAP-10266-P-A, Rev. 2 (Proprietary) and WCAP-11524-A, Rev. 2 (Non-Proprietary),” April 15, 2004.

(Please see the response to RAI #1.)

4. In keeping with SRP 6.2.1.5, “Minimum Containment Pressure Analysis for Emergency Core Cooling System Performance Capability Studies”, please clarify the pressure to be used for a licensing analysis. It would appear the minimum expected pressure over the duration of the analysis should be used to develop the downcomer head loss for use in LOCBART. As noted in References 1 and 4, the expected decrease in the system pressure following the onset of downcomer boiling would inhibit the reflood.

(Please see the response to RAI #1.)

5. The downcomer extends below the bottom of the active core. It appears that the modeling approach credits no boiling in this region which would result in a larger downcomer head and better reflood than if boiling were considered. Please provide a discussion of the importance of this region and the treatment of wall heat from this region in the LOCBART analysis.

(Please see the response to RAI #1.)