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Our ref: LTR-NRC-03-66

November 13, 2003

**Subject:** 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)"

- References:**
1. Addendum 3 to WCAP-10266-P-A, Revision 2 and WCAP-11524-A, Revision 2, "Incorporation of the LOCBART Transient Extension Method into the 1981 Westinghouse Large Break LOCA Evaluation Model with BASH (BASH-EM)", December 2002.
  2. Letter from H. A. Sepp (Westinghouse) to J. S. Wermiel (NRC), "Submittal of 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)'", LTR-NRC-02-67, December 18, 2002.

Enclosed are copies of proprietary and non-proprietary versions of the Westinghouse responses to Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) items 2d, 3a, 3b, 3c, 4a, 4b, 4c (partial), 4d, and 4f regarding Addendum 3 to WCAP-10266-P-A, Revision 2 and WCAP-11524-A, Revision 2 (Reference 1). This topical report was submitted for NRC review and approval on December 18, 2002 (Reference 2).

This submittal contains Westinghouse proprietary information consisting of trade secrets, commercial information, or financial information which we consider privileged or confidential pursuant to 10 CFR 9.17(a)(4). Therefore, it is requested that the Westinghouse proprietary information attached hereto be handled on a confidential basis and be withheld from public disclosure. Accordingly, the following documents are enclosed:

1. One copy of the Application for Withholding, AW-03-1738, with Proprietary Information Notice and Copyright Notice.
2. One copy of Affidavit, AW-03-1738.

This material is for your internal use only and may be used solely for the purpose for which it is submitted. It should not be otherwise used, disclosed, duplicated, or disseminated, in whole or in part, to any other person or organization outside the Commission, the Office of Nuclear Reactor Regulation, the Office of Nuclear Regulatory Research, and the necessary subcontractors that have signed a proprietary non-disclosure agreement with Westinghouse without the expressed prior written approval of Westinghouse.

Correspondence with respect to any Application for Withholding should reference AW-03-1738 and should be addressed to J. S. Galembush, Acting Manager of Regulatory Compliance and Plant Licensing, Westinghouse Electric Company, P. O. Box 355, Pittsburgh, Pennsylvania, 15230-0355.

Very truly yours,



J. S. Galembush, Acting Manager  
Regulatory Compliance and Plant Licensing

Enclosures

cc: B. J. Benney, NRC (w/3 proprietary and 1 non-proprietary copies)



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Our ref: AW-03-1738

November 13, 2003

APPLICATION FOR WITHHOLDING PROPRIETARY  
INFORMATION FROM PUBLIC DISCLOSURE

Subject: 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)"

Reference: LTR-NRC-03-66, dated November 13, 2003

The Application for Withholding is submitted by Westinghouse Electric Company LLC (Westinghouse), pursuant to the provisions of Paragraph (b) (1) of Section 2.790 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 Enclosure to the Reference letter. In conformance with 10 CFR Section 2.790, Affidavit AW-03-1738 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 2.790 of the Commission's regulations.

Correspondence with respect to this Application for Withholding or the accompanying affidavit should reference AW-03-1738 and should be addressed to J. S. Galembush, 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 'J. S. Galembush'.

J. S. Galembush, Acting Manager  
Regulatory Compliance and Plant Licensing

Enclosures

cc: B. Benney

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

ss

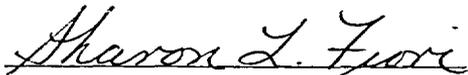
COUNTY OF ALLEGHENY:

Before me, the undersigned authority, personally appeared J. S. Galembush, 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:

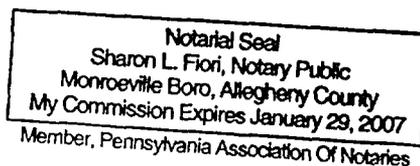


J. S. Galembush, Acting Manager  
Regulatory Compliance and Plant Licensing

Sworn to and subscribed  
before me this 13<sup>th</sup> day  
of November, 2003



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 2.790 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 2.790 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.
- (g) The information is not the property of Westinghouse, but must be treated as proprietary by Westinghouse according to agreements with the owner.

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.
  - (g) Unrestricted disclosure would violate a proprietary agreement between Westinghouse and the owner of the information.
- (iii) The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR Section 2.790, 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 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)", dated November, 2003, being transmitted by Westinghouse letter (LTR-NRC-03-66) and Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk. The proprietary information as submitted for use by Westinghouse is expected to be applicable in other licensee submittals in response to certain NRC requirements for justification of large break LOCA analysis predictions.

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

- (a) Extend LOCBART calculations beyond the point at which downcomer boiling is predicted to occur in BASH.

Further this information has substantial commercial value as follows:

- (a) Westinghouse plans to sell the use of similar information to its customers for purposes of meeting NRC requirements for licensing documentation.
- (b) Westinghouse can sell support and defense 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 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 several months of development 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 2.790 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 (g) 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)(g) of the affidavit accompanying this transmittal pursuant to 10 CFR 2.790(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 2.790 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.

**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)"**

- 2d. **Please describe the wall nodalization detail employed in the downcomer to model heat transfer to the fluid in this region. Show that an adequate number of cells in the wall are used to properly characterize the temperature in the walls just prior to and during boiling. Reference [3] presents the wall temperature distribution at the wall surface and at interior cells. Please show a comparison of the wall conduction solution described in Section 5.1 with the data of Reference [3].**

**Reference**

**[3] Sudo, Yukio, and Akimoto, Hajime, "Downcomer Effective Water Head During Reflood in Postulated PWR LOCA", *Journal of Nuclear Science and Technology*, 19(1), pp. 34-45, January 1982.**

**Response**

Reference [3] does not describe the wall nodalization used in the inverse heat conduction calculations, and does not provide sufficient detail to facilitate sensitivity studies without requiring the development of a stand-alone model. Referring to Table 4-2 of the Topical Report, the wall heat flux values at 15 s, 50 s, 100 s, and 200 s were obtained from Reference [3], and the wall heat flux value at 75 s was estimated using linear interpolation of the neighboring points. These values correspond to Figure 5 of Reference [3] for Run No. 100, and would be essentially the same for Run No. 115 which according to Table 1 of Reference [3] has the same wall temperature (250°C), extracted water velocity (0 cm/s), injection mode (A), and gap size (200 mm), and approximately the same injected water temperature (98°C vs. 100°C) as Run No. 100.

- 3a. **What is the boiling length (downcomer liquid head) in the downcomer for the heat load shown in Figure 5-2? What is the height of the downcomer from the connection to the lower plenum to the bottom of the cold leg?**

**Response**

Figure 3a-1 shows the downcomer liquid level corresponding to Figure 5-2 of the Topical Report. The times are relative to the BOC (bottom-of-core recovery) time of about 50 seconds, and the elevations are relative to the inside bottom of the reactor vessel. The height of the downcomer from the connection to the lower plenum to the bottom of the cold leg is 20.17 feet.

**Figure 3a-1**

[

]a,c

**3b. Please show the downcomer inside and outside wall temperatures that are consistent with Figure 5-2.**

**Response**

Figure 3b-1 shows the inside and outside wall temperatures for the core barrel between the bottom of the downcomer and the bottom of the cold leg, and Figures 3b-2, 3b-3, and 3b-4 show the inside and outside wall temperatures for the lower third, middle third, and upper third (respectively) of the vessel wall between the bottom of the downcomer and the bottom of the cold leg.

**Figure 3b-1**

[

] <sup>a,c</sup>

**Figure 3b-2**

[

]a,c

**Figure 3b-3**

[

j<sup>a,c</sup>

**Figure 3b-4**

[

j<sup>a,c</sup>

3c. *Please discuss how the value of heat flow rate is selected for use in a LOCBART extension method calculation of core reflood rate.*

Response

[

] <sup>a,c</sup>

4a. *When and where does subcooled nucleate boiling occur in the downcomer in Figure 5-6?*

Response

[

] <sup>a,c</sup>

*What is the downcomer wall thickness and the flow area in this region?*

Response

The vessel wall thickness in the downcomer region is 8.661 inches. The core barrel thickness is 5.45 inches in the neutron pad region, and 2.285 inches outside the neutron pad region. The downcomer flow area is 33.213 ft<sup>2</sup> in the neutron pad region, and 37.366 ft<sup>2</sup> outside the neutron pad region.

4b. *What is the void fraction in the downcomer during boiling vs. time for case C in Figure 5-6?*

Response

The void fraction in the downcomer below the cold leg for case C [

] <sup>a,c</sup>

**Figure 4b-1**

[

]a,c

**4c. What are the flooding rates in inch/sec versus time for case G in Figure 5-6?**

**Response**

For case G in Figure 5-6 of the Topical Report, the flooding rate is [

] <sup>a,c</sup>

***How are the reflood flood heat transfer coefficients (especially steam cooling heat transfer coefficients) calculated during the fourth reflood rate after the adjustment is applied for the case when the reflood rate remains above one inch/sec and for the case below one inch/sec?***

**Response**

(This response will be provided later.)

**4d. Referring to Figure 5-6, please carry out the analysis to quench. Please show the impact on peak local oxidation similar to those in Figure 5-7. Please also show the containment pressure response during the entire fourth reflood rate period until quench of the entire core. What pressure was used to generate the PCT curves in Figure 5-6?**

**Response**

The calculations shown in Figure 5-6 of the Topical Report were rerun using the latest version of LOCBART and were extended until the hot assembly quench front reached the top of the active fuel. Figures 4d-1 and 4d-2 show the peak cladding temperature and the local oxidation at the maximum oxidation elevation corresponding to Figures 5-6 and 5-7 of the Topical Report. [

] <sup>a,c</sup>

**Figure 4d-1**

[

] <sup>a,c</sup>

Figure 4d-2

[

]a,c

- 4f. Please show the PCT plot in Figure 5-6 assuming the downcomer boiling length occurs from the bottom of the downcomer to the bottom of the cold leg. Please also show the downcomer void fraction vs. time for this case.

Response

[

] <sup>a,c</sup>

Figure 4f-1

]a,c

Figure 4f-2

[

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] <sup>a,c</sup>

**Figure 4f-3**

[

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]a,c