



**Westinghouse**

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Our ref: LTR-NRC-04-4

January 26, 2004

**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 1b, 2a, 2b, 2c, and 4c (partial) 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). Also enclosed are:

1. One (1) copy of the Application for Withholding, AW-04-1782 (Non-Proprietary) with Proprietary Information Notice and Copyright Notice.
2. One (1) copy of Affidavit, AW-04-1782 (Non-Proprietary).

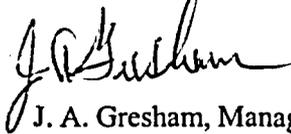
This submittal contains proprietary information of Westinghouse Electric Company, LLC. In conformance with the requirements of 10 CFR Section 2.790, as amended, of the Commission's regulations, we are enclosing with this submittal an Application for Withholding from Public Disclosure and an affidavit. The affidavit sets forth the basis on which the information identified as proprietary may be withheld from public disclosure by the Commission.

TOD?

A BNFL Group company

Correspondence with respect to the affidavit or Application for Withholding should reference AW-04-1782 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

cc: B. J. Benney

**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)"**

- 1b. It is a simple process to add additional downcomer volumes to show a sensitivity study on downcomer nodalization. The boiling front and impact on head are expected to be better approximated as the axial and azimuthal detail are increased. As required in 10 CFR 50.46 and Appendix K, please show a sensitivity study on downcomer nodalization and the impact on reflood rate during boiling.***

**Response**

In order to demonstrate the effect of downcomer nodalization on the calculated void distribution and collapsed liquid level, additional calculations have been completed for JAERI Run No. 115 [

j<sup>a,c</sup>

**Table 1b-1**

[

] <sup>a,c</sup>

**Figure 1b-1**

[

] <sup>a,c</sup>

- 2a. *Figure 6 of Reference [3] shows the pressure difference in the test section. Inspection of the curves shows that the lowest DP cell (i.e., DP6) indicates that there is no boiling in this region. If the integrated void is used to compute the head in the boiling region above 1.0 meter, the calculated head at 200 seconds is now about 3.5 m (See Figure 2, attached). Please explain how the head was determined in the test comparison in Section 4.0.*

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.

[

]a,c

**Response**

The predicted values of collapsed liquid level shown in Table 4-1 of the Topical Report were calculated using a [

] <sup>a,c</sup>

- 2b. *At the onset of boiling, the tests show a large loss in head due to the initial swell at about 75 seconds that is not captured in the Westinghouse model. The initial swell and loss of head will greatly reduce the reflood rate. Please show that the Westinghouse model conservatively masks this effect or modify the model appropriately.*

**Response**

The transient effects observed in JAERI Run No. 115 are more severe than would be expected in a PWR, due primarily to the injection of saturated water during the rapid initial filling of the downcomer. The subcooling typical of PWR accumulator injection would remove a significant fraction of the initial wall superheat from the downcomer, leading to a substantial reduction in the transient effects observed in the JAERI experiments. In any case, further consideration of transient effects after the onset of downcomer boiling will be deferred to RAI 6 and/or 7, as appropriate.

- 2c. *In Figure 4-7 was the effect of depressurization on the downcomer and core liquid heads considered in determining the reflood rate? Please explain. (See also 1.d).*

**Response**

The variation in core collapsed liquid level reflected in Figure 4-7 of the Topical Report was based on the variation observed in a sample LOCBART PWR calculation and does not consider the effect of depressurization on the downcomer and core liquid heads. Further consideration of depressurization and related effects will be deferred to other RAI responses, as appropriate.

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

**Response**

(This response was provided previously.)

*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**

The following describes the calculation of the hot rod clad-to-fluid heat transfer coefficient for elevations above the quench front in the dispersed droplet regime.

[

j<sup>a,c</sup>

In LOCBART, the dispersed droplet regime applies for local void fractions greater than or equal to 0.99 (Reference 4c-1, Appendix C) and less than 1.0. The heat transfer is assumed to consist of convection and radiation, with convection divided into the free convection, laminar forced convection, and turbulent forced convection regimes, and radiation separated into liquid and vapor components. The convective heat transfer coefficient is increased to account for the spacer grid single-phase heat transfer enhancement, and rod-to-grid radiation is included for nodes associated with spacer grids.

[

] <sup>a,c</sup>

### References

- 4c-1. WCAP-10266-P-A, Revision 2, "The 1981 Version of the Westinghouse ECCS Evaluation Model Using the BASH Code", March 1987.
- 4c-2. WCAP-9561-P-A, "BART-A1: A Computer Code for the Best Estimate Analysis of Reflood Transients", March 1984.
- 4c-3. WCAP-10484-P-A, "Spacer Grid Heat Transfer Effects During Reflood", March 1991.
- 4c-4. Yao, S., Hochreiter, L. E., and Dodge, C. E., "A Simple Method for Calculating Radiative Heat Transfer in Rod Bundles with Droplets and Vapor as Absorbing Media", Transactions of the ASME, Journal of Heat Transfer, Vol. 101, pp. 736-739, 1979.
- 4c-5. NSBU-NRC-00-5970, "1999 Annual Notification of Changes to the Westinghouse Small Break LOCA and Large Break LOCA ECCS Evaluation Models, Pursuant to 10 CFR 50.46 (a)(3)(ii)", May 12, 2000.



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Our ref: AW-04-1782

January 26, 2004

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)"

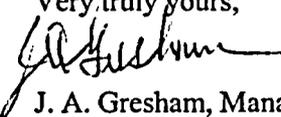
**Reference:** LTR-NRC-04-4, dated January 26, 2004.

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-04-1782 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-04-1782 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

cc: B. Benney

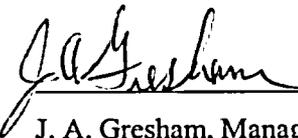
AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

SS

COUNTY OF ALLEGHENY:

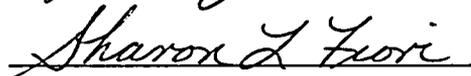
Before me, the undersigned authority, personally appeared J. A. Gresham, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Company LLC (Westinghouse), and that the averments of fact set forth in this Affidavit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

  
\_\_\_\_\_

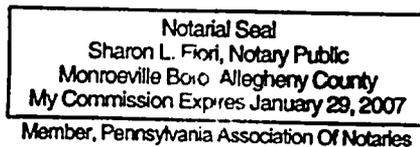
J. A. Gresham, Manager

Regulatory Compliance and Plant Licensing

Sworn to and subscribed,  
before me this 26<sup>th</sup> day  
of January, 2004

  
\_\_\_\_\_

Notary Public



- (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 2.790 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)", being transmitted by Westinghouse letter (LTR-NRC-04-4) 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.