



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

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555-0001

Direct tel: (412) 374-4643
Direct fax: (412) 374-4011
e-mail: greshaja@westinghouse.com

Our ref: LTR-NRC-07-35
July 19, 2007

Subject: Response to NRC's Request for Proprietary Review of Request for Additional Information by the Office of Nuclear Reactor Regulation for Topical Report (TR) WCAP-16608-P, "Westinghouse Containment Analysis Methodology" (TAC No. MD2953) (Proprietary/Non-proprietary)

Enclosed are copies of the Proprietary and Non-Proprietary responses to NRC's Request for Proprietary Review of Request for Additional Information by the Office of Nuclear Reactor Regulation for Topical Report (TR) WCAP-16608-P, "Westinghouse Containment Analysis Methodology."

Also enclosed is:

1. One (1) copy of the Application for Withholding, AW-07-2307 (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-07-2307 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,

A handwritten signature in black ink, appearing to read "J. A. Gresham", written over a horizontal line.

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

Enclosures

cc: A. Mendiola, NRR
R. Lobel, NRR
J. Thompson, NRR
L. M. Feizollahi, NRR

Handwritten initials in black ink, appearing to read "TOD" over "NRR".



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

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555

Direct tel: 412/374-4643
Direct fax: 412/374-4011
e-mail: greshaja@westinghouse.com

Our ref: AW-07-2307
July 19, 2007

APPLICATION FOR WITHHOLDING PROPRIETARY
INFORMATION FROM PUBLIC DISCLOSURE

Subject: LTR-NRC-07-35 P-Enclosure, "Response to NRC's Request for Proprietary Review of Request for Additional Information by the Office of Nuclear Reactor Regulation for Topical Report (TR) WCAP-16608-P, 'Westinghouse Containment Analysis Methodology' " (TAC No. MD2953) (Proprietary)

Reference: Letter from J. A. Gresham to Document Control Desk, LTR-NRC-07-35, dated July 19, 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-07-2307 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-07-2307 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,

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

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

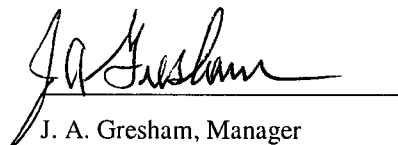
AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

SS

COUNTY OF ALLEGHENY:

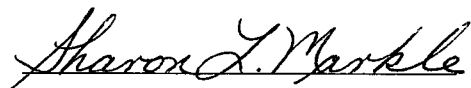
Before me, the undersigned authority, personally appeared J. A. Gresham, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Company LLC (Westinghouse) and that the averments of fact set forth in this Affidavit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



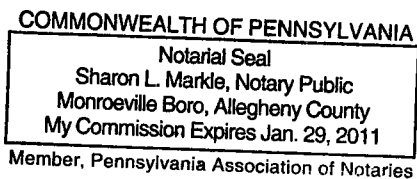
J. A. Gresham, Manager

Regulatory Compliance and Plant Licensing

Sworn to and subscribed
before me this 24th day
of July, 2007.



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 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 LTR-NRC-07-35 P-Enclosure, "Response to NRC's Request for Proprietary Review of Request for Additional Information by the Office of Nuclear Reactor Regulation for Topical Report (TR) WCAP-16608-P, 'Westinghouse Containment Analysis Methodology'" (TAC No. MD2953) (Proprietary), for submittal to the Commission, being transmitted by Westinghouse letter (LTR-NRC-07-35) and Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk. The proprietary information as submitted by Westinghouse Electric Company is responses to NRC's Request for Proprietary Review of Request for Additional Information.

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

- (a) Demonstrate the acceptability of Westinghouse Containment Analysis Methodology.
- (b) Assist customers in implementing an improved fuel product.

Further this information has substantial commercial value as follows:

- (a) Westinghouse can use correlation to further enhance their licensing position over their competitors.
- (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 fuel design 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.

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.

**Response to NRC's Request for Proprietary Review of Request for Additional
Information by the Office of Nuclear Reactor Regulation for Topical Report
(TR) WCAP-16608-P, "Westinghouse Containment Analysis Methodology"
(TAC No. MD2953) (Non-Proprietary)**

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

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REQUEST FOR ADDITIONAL INFORMATION
RELATED TO WCAP 16608-P
WESTINGHOUSE CONTAINMENT ANALYSIS METHODOLOGY

RAI 1. Section 4.1 of WCAP 16608P states that although the containment models and methods described in this report were developed using GOTHIC 7.2a, Westinghouse intends to use future versions of GOTHIC for plant specific containment analyses as they become available.

This, as stated, is not acceptable. (a) A new version of GOTHIC may contain models or yield results that would not be acceptable to the staff, at least without more justification than might be provided in the NAI documentation. On the other hand, the staff would prefer not to perform a complete review of the application of a new version of GOTHIC. Therefore, please propose a procedure that will allow Westinghouse flexibility but that still meets the staff's responsibility to review significant changes from one version of GOTHIC to another. (b) For the calculation of containment backpressure for the 10 CFR 50.46 LOCA analyses, the version of GOTHIC proposed in this topical report (7.2a) must be considered part of the LOCA evaluation model. Therefore, please describe the Westinghouse proposal for including GOTHIC 7.2a in the Westinghouse BWR ECCS evaluation model. (c) Describe how the Westinghouse use of GOTHIC 7.2a will comply with 10 CFR Part 50 Appendix B and 10 CFR Part 21. (d) Please describe the Westinghouse procedure for responding to EPRI notifications of discovered errors in GOTHIC 7.2a so that licensing calculations done by Westinghouse with GOTHIC 7.2a remain valid.

RAI 2. Introduction WCAP 16608P lists 9 applications of the methodology for both BWRs and PWRs. However, only BWR Mark I containment applications are described in detail in the report in Appendices A and B. Therefore, the staff SER will only discuss application to BWR Mark I containments.

RAI 3. What steps are taken to verify that all GOTHIC 7.2a empirical correlations will be used within their range of applicability?

RAI 4. What characteristic length is used in the heat transfer correlations applied to BWR Mark I containment heat transfer?

RAI 5. Subcompartment analysis (Standard Review Plan Section 6.2.1.2 is not listed as one of the applications of this methodology. Please verify that the methods of WCAP 16608-P (i.e., GOTHIC) will not be applied to BWR Mark I subcompartment analysis.

RAI 6. For the applications considered in WCAP 16608P, is surface-to-surface radiation heat transfer considered? If so, please describe and provide the source of the emissivities and shape factors used. For which, if any, of the BWR Mark I containment safety analyses is thermal radiation heat transfer significant?

RAI 7. Please verify that the GOTHIC height scaling factor is not included in the calculation of heat transfer to structures.

RAI 8. Discuss how suppression pool level and/or volume changes during postulated events are calculated. If level and/or volume change is not included in the calculation, why is this acceptable, especially for the available NPSH calculation?

RAI 9. Do any of the calculations of WCAP 16608P use the GOTHIC jet and drop breakup model? If yes, which calculations. If yes, please reference qualification studies or other references to demonstrate that the model is conservative.

RAI 10. Standard Review Plan 6.2.1.1.A.II.5.b states that to satisfy the requirements of GDC 38 the containment pressure should be reduced to less than 50% of the peak calculated pressure for the design basis loss-of-coolant accident within 24 hours after the postulated accident. Demonstrating that the containment pressure is reduced by 50% in 24 hours permits the containment leakage rate to be reduced by 50% after 24 hours. This guidance was intended for PWRs. However, the NRC staff has approved the reduction in leakage with a reduction in pressure for BWRs also. Does Westinghouse intend to perform this type of calculation for BWR Mark I containments? If so, please provide information on how the calculation would be done.

RAI 11. Section 2. Table 2-1 Item 1 What assurance is there that the []^{a,c} if analyzed with GOTHIC?

RAI 12. Section 4.2.4 Page 4-7 Item 4. Licensing calculations maximizing BWR suppression pool temperature typically assume the torus outside surface is adiabatic, i.e., no heat transfer from the torus outer surface to the reactor building atmosphere. The staff requests that, for added conservatism, you reconsider including this heat transfer.

RAI 13. WCAP 16608P Table A.3-1 This table gives values of []^{a,c} for Model 1, Model 2 and the Generic Model. There is a large discrepancy between the values for Model 1 and Model 2 and the Generic Model. The large values for Model 1 and Model 2, according to the description on Page A-40, were chosen to match the benchmark data. The value []^{a,c} for the Generic Model appears to be more consistent with values used in other BWR modeling.

Figures A.3-3 and A.3-8 for Models 1 and 2, respectively, give peak drywell pressures of approximately 46 psig and 42 psig, respectively, while the peak drywell pressure for the Generic Model is approximately 44 psia or 29.3 psig - considerably less than either Model 1 or Model 2.

It therefore appears that when attempting to reproduce other BWR calculations, a high []^{a,c} is necessary. When using a []^{a,c} GOTHIC calculates a pressure much less than the other cases.

One explanation for this could be the modeling of droplets in the drywell and the downcomer flow. If a large fraction of the droplets are removed in the drywell, this would account for the need to []^{a,c} in Models 1 and 2 and also account for the low drywell pressure calculated by the Generic Model. This might also explain the lack of agreement with the wetwell pressure in Figure A.3-4.

It has been the NRC position that 100% entrainment should be assumed []^{1 a,c} This is consistent with comparisons with Humboldt Bay and Bodega Bay data.²

Please verify that GOTHIC is not removing droplets from the drywell atmosphere prior to flowing through the vents.

If removal of droplets is not the cause of the discrepancy between the []^{a,c} Models 1 and 2 and the Generic Model, please explain why []^{a,c} are necessary.

Please also assess the impact of droplet behavior on vent flow for the small and intermediate break accidents.

RAI 14. ANS 56.4-1983 guidelines state that flashing should be assumed at the transient atmosphere steam partial pressure. GOTHIC calculates flashing based on the atmosphere total pressure. Since the partial pressure results in a higher steam fraction, shouldn't the recommendations of the ANS standard be used for peak pressure and the GOTHIC approach used for conservative suppression pool temperature?

¹ CONTAIN Code Qualification Report/User Guide for Auditing Design basis BWR Calculations, Table 2.1, SMSAB-03-02, USNRC , March 2003 (ML030700335)

² The General Electric Pressure Suppression Containment Analytical model, NEDO 10320 Supplement 1, Section 3.2, General Electric Company, May 1971

RAI 15. Please provide the information in the table below to reflect the Westinghouse approach to BWR containment analyses. The first row is completed as an example.

BWR Accident Parameter	Event Interval Analyzed (seconds)	Short-Term Mass and Energy Release Computer Code	Long-Term Mass and Energy Release Computer Code	Decay Heat Model and Uncertainty	Assumed Single Active Failure	Passive heat sinks included	Drywell and Wewtwell Spray Credited		
Double-ended RSLB Peak Pressure	[]	a,c
Hydrodynamic loads criteria Double-ended recirculation suction line break (RSLB), Intermediate (IBA)/ and Small (SBA) LOCAs									
RSLB Minimum ECCS Back Pressure (All breaks considered to									

demonstrate compliance with 10 CFR 50.46)							
Minimum NPSHA							
RSB Long Term Pressure and Temperature							
MSLB Peak Pressure							
MSLB Long-Term Pressure and Temperature							
ATWS							
SBA							

RAI 16. WCAP 16608P Section 4.2.1.1 This section states that the DEFAULT option for revaporization will be used. Justify not limiting the revaporization fraction to 8%, according to the guidelines of NUREG 0588. If possible to determine, what revaporization fractions are typical for BWR Mark I calculations?

RAI 17. WCAP 16608P Section 4.2.1.2 For which calculations discussed in WCAP 16608P is the mist model used? For these cases, provide a sensitivity to show the calculated effect of the mist model on BWR containment peak pressure and peak temperature. What is the basis for the 200 micron drop size? How sensitive are BWR conditions to the default assumption of a 200 micron mist droplet size.

RAI 18. Section 4.2.2 states that: [

] ^{a,c} This contradicts the approach of a

BWR licensee who assumes a []^{3 a,c} Please perform a sensitivity calculation to verify that []^{a,c} is the conservative approach for peak containment pressure. Should this be determined on a plant specific basis?

RAI 19. Appendix A Section A.4.3 (a) Describe how feedwater is modeled in the BWR applications described in WCAP 16608P. (b) What assurance is there that the feedwater model added to GOBLIN models the feedwater system correctly and conservatively?

RAI 20. Appendix A Section A.4.3 In considering NPSHa for the ECCS pumps during BWR Mark I postulated events, it is also important to consider events other than the LOCA, including a stuck open relief valve, and non-design basis events such as Appendix R fire, anticipated transients without scram (ATWS) and station blackout (i.e., ability to cool the suppression pool following restoration of AC power). These events may either be discussed in this topical report review or the staff will request information on the calculation of these events for each plant-specific application which includes consideration of ECCS pump net positive suction head. Such information as that listed below should be discussed and all licensing analyses referencing WCAP 16608P should then be consistent with these descriptions:

- +assumed initial power level
- +assumed initial pressures, temperatures and relative humidities in the drywell and wetwell
- +decay heat model (with or without 2 σ uncertainty)
- +pump configuration and flow rates assumed
- +credit for non-safety systems
- +use of drywell and wetwell sprays
- +suppression pool level
- +initial pressures, temperatures and relative humidity values for drywell and wetwell
- +passive heat sinks

RAI 21. The limiting NPSH margin for a Mark I BWR may occur during the short-term period following the initiation of a LOCA (that is, the first ten minutes prior to operator action) or the long-term period (after 10 minutes when the operator can reduce the RHR and core spray pump flow rates and activate sprays). WCAP 16608P did not separately address the analysis of available NPSH for the short-term period. Are there any differences between the containment analyses for available NPSH between the short term and long term periods in terms of assumptions and modeling?

³

Letter from William D. Crouch, TVA, to USNRC, Browns Ferry Nuclear Plant (BFN) - Units 1, 2 and 3 - Technical Specifications (TS) Changes TS-431 and TS 418 - Extended Power Uprate (EPU) - Response to Round 6 Request for Additional information July 21, 2006 RAI ACVB 38/36 [ADAMS ML0620900710]

RAI 22. Appendix A Section A.4.3 Although a loss of one train of emergency AC power (following an assumed loss of offsite power) was assumed as the worst single failure for the example, this may not always be the worst single failure. The worst single failure should be assessed for each plant to which this methodology is applied.

RAI 23. Section A.4.3 (Item 6) Explain why []^{a,c} is conservative for available NPSH calculations.

RAI 24. Section A.4.3 Containment leakage should be included in available NPSH calculations which credit containment accident pressure.

RAI 25. Section A.4.3 (Item 8) It is the staff's position to request that available NPSH calculations be carried out until credit for containment accident pressure is no longer needed. This time period could be greater than 50,000 seconds.

RAI 26. Section A.4.3 Figure A.4.3-1 Explain the initial decrease in drywell pressure during blowdown.

RAI 27. []^{a,c} Justify their use for the DLM model.

RAI 28. Verify that for minimum backpressure and available NPSH calculations, nonsafety equipment which cools the containment will be included in the calculations.

RAI 29. Appendix A Figure A.4.4-1 At times greater than 2×10^3 seconds, the wetwell pressure appears to be slightly greater than the drywell pressure. Please explain.

RAI 30. Appendix A Section A.4.1 In Table 2.9-1, please provide the bias assumed in each analysis (peak DW pressure, ECCS minimum backpressure, etc.) for wetwell humidity. Why is this conservative? How important is the wetwell humidity for each analysis?

RAI 31. Section A.4.2 states that the []^{a,c} Is the same method used for the available NPSH calculations?

RAI 32. Section A.4.8 How does GOTHIC calculate core power after BISON? Is it just decay heat?

RAI 33. Please provide Reference A-10.

RAI 34. For the cases described in Table B-3, please provide the calculated containment parameters of drywell and wetwell pressure and temperature and suppression pool temperature, if available.

RAI 35. Section B.3 lists several assumptions made to minimize the mass and energy release for the minimum containment pressure calculations. (a) Please indicate the significance of these assumptions on containment pressure. (b) Why couldn't other assumptions be included such as critical flow correlation less conservative than Moody, assuming 100% power rather than 102% power, a nominal decay heat, etc.

RAI 36. Westinghouse states (Table B-1 of Appendix B) that the licensed core power plus uncertainty is used as input to the BWR mass and energy release model. Please verify that this will be a 2% uncertainty as specified by NRC Regulatory Guide 1.49 unless the licensee has justified a smaller uncertainty based on more accurate feedwater flow measurements.