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Our ref: LTR-NRC-04-56

Attn: J. S. Wermiel, Chief
Reactor Systems Branch
Division of Systems Safety and Analysis

September 28, 2004

Subject: "Preliminary Responses to Request for Additional Information of Topical Report WCAP-16259-P/WCAP-16259-NP, Westinghouse Methodology for Application of 3-D Transient Neutronics to Non-LOCA Accident Analysis," (Proprietary/Non Proprietary) and "Answers to Preliminary Questions from the NRC (provided August 10, 2004) regarding WCAP-16260-P/ WCAP-16260-NP, The Spatially Corrected Inverse Count Rate (SCICR) Method for Subcritical Reactivity Measurement" (Proprietary/Non-Proprietary)

Dear Mr. Wermiel:

Enclosed is one (1) copy each of the "Preliminary Responses to Request for Additional Information of Topical Report WCAP-16259-P/WCAP-16259-NP, Westinghouse Methodology for Application of 3-D Transient Neutronics to Non-LOCA Accident Analysis," (Proprietary/Non Proprietary) and "Answers to Preliminary Questions from the NRC (provided August 10, 2004) regarding WCAP-16260-P/ WCAP-16260-NP, The Spatially Corrected Inverse Count Rate (SCICR) Method for Subcritical Reactivity Measurement" (Proprietary/Non-Proprietary).

Also enclosed is:

1. One (1) copy of the Application for Withholding, AW-04-1899 (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.

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Correspondence with respect to this affidavit or Application for Withholding should reference AW-04-1899 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: F. M. Akstulewicz/NRR
A. Attard/NRR
E. Kendrick/NRR
W. A. Macon Jr./NRR
E. S. Peyton/NRR

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Our ref: AW-04-1899

September 28, 2004

APPLICATION FOR WITHHOLDING PROPRIETARY
INFORMATION FROM PUBLIC DISCLOSURE

Subject: "Preliminary Responses to Request for Additional Information of Topical Report WCAP-16259-P/WCAP-16259-NP, Westinghouse Methodology for Application of 3-D Transient Neutronics to Non-LOCA Accident Analysis," (Proprietary) and "Answers to Preliminary Questions from the NRC (provided August 10, 2004) regarding WCAP-16260-P/WCAP-16260-NP, The Spatially Corrected Inverse Count Rate (SCICR) Method for Subcritical Reactivity Measurement" (Proprietary)

Reference: Letter from J. A. Gresham to J. S. Wermiel, LTR-NRC-04-56, dated September 28, 2004

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-04-1899 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-04-1899 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

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA:

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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

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

Sworn to and subscribed
before me this 28th day
of September, 2004

Sharon L. Fiori

Notary Public

Notarial Seal
Sharon L. Fiori, Notary Public
Monroeville Boro, Allegheny County
My Commission Expires January 29, 2007
Member, Pennsylvania Association Of Notaries

(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 2.390 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, "Preliminary Responses to Request for Additional Information of Topical Report WCAP-16259-P/WCAP-16259-NP, Westinghouse Methodology for Application of 3-D Transient Neutronics to Non-LOCA Accident Analysis," (Proprietary) and "Answers to Preliminary Questions from the NRC (provided August 10, 2004) regarding WCAP-16260-P/WCAP-16260-NP, The Spatially Corrected Inverse Count Rate (SCICR) Method for Subcritical Reactivity Measurement" (Proprietary) dated September 28, 2004, for submittal to the Commission, being transmitted by Westinghouse letter (LTR-NRC-04-56) 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 requests for NRC approval of WCAP-16259 "Westinghouse

Methodology for Application of 3-D Transient Neutronics to Non-LOCA Accident Analysis" and WCAP-16260 "The Spatially Correct Inverse Count Rate (SCICR) Method for Subcritical Reactivity Measurement."

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

(a) Obtain generic NRC license approval for the Westinghouse Methodology for Application of 3D Transient to Non-LOCA Accident Analysis.

(b) Obtain generic NRC license approval for the Westinghouse Methodology for Spatially Corrected Inverse Count Rate (SCICR) Methodology for Subcritical Reactivity Measurement.

Further this information has substantial commercial value as follows:

(a) Westinghouse can use its methodology capabilities to further enhance their licensing position over their competitors.

(b) Westinghouse can aassist customers to obtain license changes.

(c) Westinghouse can sell support and defense of SCICR.

(d) 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 technical evaluation justifications, methodology, measurements 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

Preliminary Responses to Request for Additional Information of Topical Report WCAP-16259-P/WCAP-16259-NP
Westinghouse Methodology for Application of 3-D Transient Neutronics to Non-LOCA Accident Analysis

NEUTRONICS related RAIs

Section 1.0 Introduction

1. **The 1st and 2nd paragraphs on page 2 require additional discussion regarding applicability of this 3-D methodology.**

Response: The purpose of this report (WCAP-16259-P) is to provide the documentation for NRC review and approval of the Westinghouse Methodology for Application of the 3-D transient Neutronics to Non-LOCA Accident Analysis (RAVE™ methodology). The methodology is applicable to all of the events listed in Table 3.6-1 of WCAP-16259-P.

Specifically; Westinghouse is seeking generic approval from the NRC for the use of the RAVE methodology with the linked NRC-approved core neutron kinetics code (SPNOVA (ANC)), NRC-approved core thermal-hydraulics code (VIPRE), and NRC-approved RCS loop thermal-hydraulics code (RETRAN). The generic approval of the RAVE topical should be applicable to any PWR where SPNOVA, VIPRE and RETRAN codes and models are approved for use in compliance with the conditions identified in the NRC SERs. The RAVE methodology is applicable to versions of SPNOVA, VIPRE, and RETRAN that are licensed for plant application and have the appropriate external communications interface.

The RAVE Methodology should be approved for use at all PWRs where SPNOVA, VIPRE and RETRAN are approved for use. Westinghouse has demonstrated that the RAVE methodology can successfully link SPNOVA, VIPRE and RETRAN.

For those plants which have licensed the use of SPNOVA, VIPRE and RETRAN, no additional regulatory action on the external linkage is required; the applicability of the RAVE methodology is addressed by reference to WCAP-16259-P.

If a specific plant has not licensed the use of the codes and models for which RAVE has been approved, then the plant will need to take appropriate licensing action for application of these codes. As a part of the licensing action, any changes to the Chapter 15 analyses would need to be addressed; however, if SPNOVA, VIPRE and RETRAN have been approved for use at the plant, no specific licensing action should be required to apply the RAVE methodology.

2. **Regarding the assumptions in the last paragraph of page 3, how do you ensure/verify that the "key safety parameters" themselves remain the same for the 3-D methodology and that the "values" of these key parameters remain bounded by the "reference safety analysis"? i.e. for each code, please provide the assumption used and show how these codes still meet imposed conditions and limitation on valid ranges.**

Response: The "key safety parameters" with respect to a reload safety analysis are those parameters which have been found to have a significant influence on the event, and could become changed as a result of a reload. Typically, these are [

] a,c. These parameters may vary as a result of the reload core design and with cycle burnup.

Typically, it is expected that the reload core design will be very similar to the previous cycle, and these parameters will be unchanged; however, they are checked for each cycle in accordance with the NRC-approved reload methodology in WCAP-9272-P-A (Reference 15 of WCAP-16259-P).

[

] a,c

The 3-D analyses for the reloads will be limited and bounded by the reference analyses provided in the safety analysis reports.

Section 2.0 Generic Models

3. **The 2nd paragraph on page 5 and following, describes a W-3-loop plant as the sample application. Is this considered a limiting plant type for any reason?**

Response: A 3-loop core may not be the most limiting for the transients, but it represents [

] a,c

4. **The 2nd paragraph on page 9 refers to an "input multiplier" on the Doppler feedback. Please provide additional information/discussion.**

Response: [

] a,c

5. **How does Westinghouse assure that all the staff conditions and limitations, associated with the approval of all the codes involved in this methodology, have been satisfied and will continue to be satisfied when the pertinent codes are coupled?**

Response: Westinghouse has addressed the SER conditions and limitations on NRC-approved RETRAN, SPNOVA and VIPRE codes involved in the new methodology as summarized in Appendix A of WCAP-16259-P.

6. **The 4th paragraph on page 9 alludes to a "potential cycle history factor". Is this based on a calculation/prediction or are the input parameters to the calculation based on the available data from the last cycle of the plant?**

Response: The range of previous cycle length is defined by the operator prior to the safety analysis being performed. [

] a,c

7. **The last paragraph on page 9 discusses the Westinghouse methodology regarding the reload process.**

   a. **Please provide a one or two-page outline of this process, showing the key parameters involved. Discuss how and why they are determined to be valid for the current cycle.**

   Response: The reload evaluation process and key parameters for each event considered in the FSAR are described in the NRC-approved bounding analysis approach for reload in WCAP-9272-P-A (Reference 15 of WCAP-16259-P). The key parameters are then confirmed using static calculations. A sample reload safety analysis checklist (RSAC) is available to review to understand the scope of the RSAC process.

b. **Also, please provide technical justification as to why the topical report, which was approved by the staff in 1985, is verified to still be valid/applicable to analyzing modern cores.**

Response: The reload evaluation process and methodologies have not been changed. However, the neutronic codes and methods described in the original topical report (WCAP-9272-P-A) have been supplemented by NRC-approved topical reports (WCAP-10965-P-A, WCAP-11596-P-A and WCAP-12394-A) as applied to current reload safety evaluations. The reload safety analysis process verifies that the behavior of the core is still bounded by the parameters that were used for the reference safety evaluation.

8. **The last paragraph in Section 2.3.2 introduces a sample CE vessel/core design RETRAN nodalization and states its similarity to a Westinghouse 4-vessel/core design. This statement needs further discussion.**

Response: The vessel/core nodalization presented for the CE-designed plant is similar to the Westinghouse-designed 4-loop plant, such that both models use:

[ ] a, c

The models differ in the [

] a,c

9. **On page 20, Section 2.6 describes the application of "conservative allowances". It is stated that only the deterministic method will be used in the updated methodology, to determine the necessary uncertainties. Are these uncertainties more conservative when they are obtained in the deterministic manner?**

Response: The "deterministic" method of applying uncertainties refers to the method in which the uncertainty for each of the key analysis parameters is applied simultaneously in the most limiting direction in the analysis. The use of the deterministic method, and the magnitude of the uncertainty allowances used, is the same as in the current (point-kinetics) methodology. The deterministic method is more conservative than the "statistical" approach, in which the total uncertainty is determined by the square root of the sum of the squares (SRSS) of the effect of the individual uncertainty allowances on the analysis results.

Section 3.0 Sample Application of 3-D Methodology

10. On page 27, under section 3.1.5, (b), regarding assumptions used in reactor core calculations, it is stated that BOC HFP equilibrium xenon conditions lead to the "least negative" MTC. Are plants with heavy burnable poison loadings always least negative at BOC?

Response: The most positive MTC may occur later in the cycle than at BOL due to the soluble boron concentration increase with the burnable absorber depletion. Traditionally, the most limiting MTC was at BOL, and many times the wording reflects that traditional approach. The reference bounding case will address the actual Technical Specification limits on MTC.

11. In the same paragraph, the choice of AOs is discussed. Was a search conducted to determine the most limiting AO for these circumstances?

Response: The sensitivity study evaluated the impact of different axial offset preconditions for the transient. [

] a,c

12. On page 28, 1st paragraph the statement is made that a multiplier was used on the Doppler feedback cross-sections, as an adjustment. Please explain further.

Response: See the response to question 4.

13. Figure 3.1-2 on page 37, shows the 3-D results crossing over the point kinetics results. Please explain the phenomena affecting this result.

Response: [

] a,c

[ ] a, c

[

] a,c

14. Figure 3.1-4, shows comparisons for the pressurizer pressure. Please explain the phenomena being modeled in 3-D that lead to the large difference.

Response: [

] a,c

15. Figure 3.1-5, page 43, please provide additional discussion

Response: [

] a,c

16. The 1st paragraph on page 49 states that DNBR will be calculated with the WRB-2 correlation. On the same page, the 2nd paragraph from the bottom makes reference to a limiting DNB axial power shape. What is that shape and how is it determined?

Response: [

] a,c The NRC-approved RAOC methodology is described in WCAP-10216-P-A, Rev. 1-A (Reference 16 of WCAP-16259-P).

17. On page 51, it is stated that the same beta (delayed neutron fraction) was used in the 3-D analysis. Why was a more pessimistic value of beta not used, such as the approach used for the Doppler coefficient?

Response: The value of beta used for the 3-D analysis was the same pessimistic value as was used in the current (point-kinetics) analysis. Typically, accidents are not very sensitive to beta (except for the RCCA Withdrawal from Subcritical and RCCA Ejection events); therefore, beta is assumed to be either a maximum or minimum bounding value over the entire cycle, which includes a variable amount of conservatism. The value chosen for this analysis was a [ ] a,c value, and already includes[ ] a,c

18. Figure 3.3-2 on page 81 shows no cross-over as in the previous runs. Please explain.

Response: The reason that there is no cross-over for this overpressure event is due to the use of the [ ] a,c

19. What are the conservative values used for the Doppler coefficient and the EOC MTC (also page 93, 3rd paragraph) as stated in the 2nd paragraph from the bottom of page 90?

Response: [ ] a,c

20. Please discuss Figure 3.4-5.

Response: Figure 3.4-5 is discussed in more detail in Section 3.4.6 of the report (see paragraph 4 on page 95). The figure shows the transient variation in the radial power peaking factor ($F_{\Delta H}$) and the core average axial offset (A.O.) during the event. The purpose of the figure is to show the variation in the $F_{\Delta H}$ and A.O. during the transient, since these are related to the calculated DNBR vs. time. [

] a,c

21. **What is the source of oscillations in Figure 3.5-1 and 3.5-2 for the 3-D case at the cross-over point for the point kinetics case?**

Response: They are caused by the activation of the accumulators which come on when the pressure falls below 600 psia. [

] a,c

<u>THERMAL-HYDRAULIC Related RAIs</u>

1. **Page 6 notes that there are two types of analyses using the VIPRE code. A VIPRE model of the entire core is used to calculate the transient local coolant density and fuel effective temperature for reactivity feedback calculations by SPNOVA. VIPRE is also utilized in a separate calculation to determine the hot rod minimum DNBR vs. time and the fuel cladding temperature vs. time. The hot rod VIPRE model is described in Section 2.4 which references WCAP-14565-P-A for the approved methodology. The total core VIPRE model is not described in detail. Please describe this model including the following information:**

   a. **Noding diagrams applicable to all reactor types for which you seek approval using the methodology of WCAP-16259-P.**

   Response: [

   ] a,c

   b. **Discuss sensitivity studies used to establish the proper noding, both radial and axial. Discuss noding requirements to determine thermal/hydraulic conditions in the vicinity of a stuck out control rod for N-1 analysis. What different noding is required to analyze the condition of control bank A and shutdown banks A and B not tripping to obtain local thermal/hydraulic conditions to transfer to SPNOVA?**

   Response: [

] a,c

The individual code models are consistent with the SPNOVA and VIPRE topical reports previously approved by the NRC.

[

] a,c

[

] a,c

[

] a,c

c. **In response to Question 5 which was asked during the NRC staff's review of VIPRE as described in WCAP-14565-A it was stated that the void fractions models selected for use in VIPRE over-predict the actual void fraction and this is conservative for calculation of DNBR. In calculating the coolant voiding for input into the neutronics calculations in SPNOVA perhaps it would be conservative to minimize void fraction. Please justify that the void fraction models selected to use in the VIPRE total core model are conservative for the neutronics calculations. Please consider all the transients and accidents for which the coupled code model will be utilized.**

Response: [

] [a,c]

2. **Page 19 describes use of VIPRE to perform calculations of post DNBR fuel performance. In the staff's SER for use of VIPRE by Westinghouse (WCAP-14565), Condition 4 in the conclusion stated that the staff's review did not extend to use of VIPRE for post DNBR calculations. Therefore, justification for use of the code calculations of this type would have to be submitted with each application. Please provide this supporting information for the post DNBR calculations described in Section 2.4.2.**

Response: Condition 4 of the SER on WCAP-14565 states that "Because VIPRE does not model the time-dependent physical changes that may occur within the fuel rods at elevated temperatures, appropriate justification should be submitted with each usage of VIPRE in the post-CHF region to ensure that conservative results are obtained."

Westinghouse VIPRE post-CHF (or post-DNBR) applications are limited to FACTRAN replacement in non-LOCA Condition IV events. The VIPRE model retains the same conservatism as the current design model using the FACTRAN code. The conservative modeling assumptions in WCAP-7908-A (Ref. 21 of WCAP-16259-P) remain unchanged for the VIPRE post-CHF applications. The VIPRE applications are in compliance with the conditions in the FACTRAN SER. Therefore, the VIPRE code with Westinghouse modeling method is justified to replace the FACTRAN code for non-LOCA post-CHF transient analysis.

a. **VIPRE may not model all the time-dependent physical changes that may occur within the fuel rods at elevated temperatures. If the code were to be run beyond the conditions for which physical changes in the fuel might occur, the results would no longer be valid. Please provide the physical limits beyond which VIPRE results would no longer be acceptable. What checks are made within the code to ensure that it is not used beyond its range?**

Response: The Westinghouse version of VIPRE is used in place of the USNRC-approved FACTRAN code. The VIPRE results are used to confirm that the fuel acceptance criteria [

] [a,c] are met. Since the fuel acceptance criteria are all within the conditions of applicability for the VIPRE code, the VIPRE code is not used beyond its validity range.

The VIPRE code will not be used for LOCA analysis.

b. **Page 19 of WCAP-16529 states that the dynamic gap conductance model in VIPRE will be used to account for changes in the fuel dimensions and fill gas pressure. Section 3.3.3 of WCAP-14565-P-A indicates that a constant gap conductance will be used or the gap conductance will be adjusted to a high value to simulate clad collapse onto the fuel pellet similar to as is done using FACTRAN. Please justify that Westinghouse will utilize the dynamic gap conductance model in VIPRE in such a manner so that conservative results will be obtained.**

Response: [

] a,c

c. **Discuss fuel rod failure models to be used with the VIPRE hot rod model. Provide and justify as conservative assumptions for cladding collapse, overheating of cladding, overheating of fuel pellets, excessive fuel enthalpy, pellet cladding interaction and bursting. Compare the assumptions you will use to the guidance of SRP 4.2. Will cladding failure be assumed immediately after DNBR limits are exceeded? If not please provide appropriated justification.**

Response: The following fuel rod failures in SRP 4.2 are addressed through design analysis using the fuel performance code such as PAD: hydriding, cladding collapse, fretting, overheating of fuel pellets, and pellet/clad interaction. The VIPRE hot rod model is not used for such analysis.

The following fuel rod failures are part of the LOCA analysis for which the VIPRE code is not applicable: bursting and mechanical fracturing.

Overheating of cladding is protected by the DNB design criterion using NRC-approved DNB correlations in the VIPRE code. Cladding failure is assumed immediately if the DNBR limit is exceeded.

The VIPRE code is used for predicting fuel enthalpy for a Condition IV reactivity initiated accident (RIA). The fuel failure criteria are discussed in WCAP-15806-P-A (Reference 7 of WCAP-16259-P).

d. **Following transients and accidents which are calculated to produce fuel damage, fuel coolability must be demonstrated. Acceptance criteria for fuel**

coolability are described in SRP 4.2. Please address Westinghouse assumptions for fuel coolability as a result of cladding embrittlement, violent expulsion of fuel, generalized cladding melting, and fuel rod ballooning. Does Westinghouse propose to use fuel coolability acceptance criteria different from those of SRP 4.2? If so, please provide appropriate justification.

Response: The submittal of WCAP-16259-P does not change the fuel coolability acceptance criteria of SRP 4.2. There is also no change to the currently NRC-approved Westinghouse evaluation methodology for addressing those criteria in safety analysis as described in WCAP-12488-A and WCAP-15806-P-A, except that the FACTRAN code is replaced by the VIPRE code.

Reference:

2-1 Davidson, S. L., "Westinghouse Fuel Criteria Evaluation Process," WCAP-12488-A, October 1994.

3. **Page 27 states that for the initial core condition using the new methodology that an initial axial power distribution of +10% was used since that represents the most positive limit of APD at the 3-loop plant for which the analysis was performed. On page 29 it is stated that using the current methodology which uses point kinetics that an axial offset (AO) of approximately +10% is assumed. Page 30 states that the difference in initial DNBR between the two methods (~1.8 vs. ~2.2) in Figure 3.2-6 is caused by the conservative reference axial power shape in the current method. Since the initial AO is the same for the two methods, DNBR is apparently reduced in the proposed method by some other cause. Please identify the initial DNBR reduction in the proposed methodology and justify the validity.**

Response: [

] a,c

4. **Page A-4 states that 6 axial nodes are used to describe the core in the RETRAN model. Figures 2.3-1 and 2.3-2 show but 3 axial nodes in the RETRAN models.**

   a. **Please provide the corrected figures.**

   Response: Corrected figures are provided below.

b. **What sensitivity studies were performed to ensure that 6 nodes in the RETRAN model were adequate?**

Response: The WCAP-14882-P-A RETRAN core model with three axial nodes has already been approved by the NRC. The functionality of the RETRAN core in terms of the thermal-hydraulic calculations is not changed in the 3-D neutron kinetics methodology. [

] a,c

c. **It is stated that the increased core noding was done to facilitate data transfer between the VIPRE core model to the RETRAN core model. Compare the axial core noding in VIPRE model to that of the RETRAN core model. If the noding is different, discuss how data the pressure, temperature and flow data from RETRAN is manipulated to accommodate the different noding between the two computer codes.**

Response: [

] a,c

[

] a,c

a, c

Sample VIPRE Average Core Nodalization for a Westinghouse-design 3-loop Core

a, c

Revised Figure 2.3-1: Reactor Pressure Vessel Nodalization – Three Loop Plant

a, c

Revised Figure 2.3-2: Reactor Pressure Vessel Nodalization – CE-Designed Plant

5. Page A-5 describes 4 methods by which 2-, 3- or 4-channel conditions of the RETRAN model are applied to the inlet for each of the SPNOVA/VIPRE model core channels. These are 1) the average model, 2) the core sector model, 3) the currently licensed model, and 4) the fine mesh model.

   a. Please list the postulated transients and accident for which each of these models will be used and justify that each usage is conservative for the analysis being performed.

   Response: [

   ] a,c

   [

   ] a,c

   [

   ] a,c

   b. With the exception of the fine mesh mixing model, the mixing models discussed on page A-5 have previously been reviewed by the NRC staff. So that the staff may review the fine mesh mixing model please provide the details of this model and discuss how the model had been validated by comparison to applicable experimental data.

   Response: [

] a,c

[ ] a, c

[

] a,c

[

] a,c

6. Appendix B describes results from Westinghouse participation in the OECD MSLB benchmark. The benchmark was structured into 3 phases. In Phase I, the ability of the RETRAN code to model the reactor system performance was investigated. Phase II investigated the ability of the three combine codes to analyze the entire transient. The results for Phase I are reported to be in excellent agreement with the other participants however, the results are not shown since the conclusions would be common to Phase III. For Phase II, the results are shown and graphs are provided showing the comparison with the results of other participants. For Phase III, graphs of the results are provided and the results are stated to be in excellent agreement with those from the other participants. No comparisons are provided, however. Please provide the results from the other benchmark participants for Figures b.4-1 to B.4-4 in a manner

similar to that which was done for Phase II. Discuss the reasons for any disagreements between the Westinghouse results and those of the other participants.

Response: Revised Figures B.4-1 to B.4-4 are provided. The revised figures include a comparison with the average benchmark participants solution in a manner similar to that which was done for Phase II. Appendix B.4 includes a discussion of the differences between the Westinghouse results and those of the other participants. This discussion remains valid, as confirmed by the provided revised figures.

The deviation in power from the benchmark results is directly related to the deviation in Broken Loop Cold Leg temperature (where temperature is high, the power is low and vice-versa). When the power drops below the standard deviation range, the temperature deviates high out of the standard deviation range which occurs during the SG dryout. The Westinghouse model dryout occurs earlier due to the over predicted entrainment earlier in the transient.

7. **Table C.5-1 provides the results of a sensitivity study for main steam line break from hot zero power. The case of loss of offsite power (LOOP) is shown not to challenge minimum DNBR limits. With the current point kinetics model, main steam line break and LOOP is calculated to produce return to power which at low flow could lead to the occurrence of DNB. Please provide a comparison of the results from the current model with those from the proposed model showing reactor system pressure, flow, reactivity, and core power. Provide a discussion for the cause for the difference in results.**

Response: An evaluation of the main steam line break with loss of offsite power (LOOP) using the current method is described in Section 3.1.1.14 of WCAP-9226-P-A (Ref. 7-1). The evaluation concluded that the LOOP case [ ] a,c The results of the sensitivity study for the LOOP case in Table C.5-1 of WCAP-16259-P are consistent with the conclusion in WCAP-9226-P-A.

Reference:

7-1 Scherder W. J. and McHugh C. J. (Editors), "Reactor Core Response to Excessive Secondary Steam Releases," WCAP-9226-P-A Revision 1, February 1998.

Figure B.4-1 MSLB Benchmark Phase III Scenario 2: Total Break Flow Rate vs. Time

a, c

Figure B.4-2 MSLB Benchmark Phase III Scenario 2: Broken Loop Cold Leg Temperature vs. Time

a, c

Figure B.4-3 MSLB Benchmark Phase III Scenario 2: Intact Loop Cold Leg Temperature vs. Time

a, c

Figure B.4-4 MSLB Benchmark Phase III
Scenario 2: Total Core Power vs. Time

a, c

Answers to Preliminary Questions from the NRC (provided August 10, 2004) regarding WCAP-16260-P/WCAP-16260-NP, The Spatially Corrected Inverse Count Rate (SCICR) Method for Subcritical Reactivity Measurement

Issues to be discussed

5. **The application of SCICR to the 4 specified measurements (4 bullets on page 33) will need to be discussed.**

   Westinghouse Response: The basic idea of SCICR is to convert the 3D core measurement data to an effective point core model result. [

   ]^{a,c} The 10-steps process on page 11 of the Topical describes how this 3D core to point core conversion is performed. The answer to question #12 in the following details how the determination of the core reactivity is obtained via this SCICR methodology for any core sub-critical state.

   [

   ]^{a,c}

5. **Pg. 5, please elaborate further on the 3rd. and 5rd. paragraphs, demonstrating the non-linear behavior of the point core model.**

   Westinghouse Response: Provide copy of the Reactor Engineering Surveillance Approach to Criticality.

6. **Pg. 5, last paragraph. Please provide definition/explanation of the spatial weighting function and the normalization constant alluded to in the same paragraph.**

   Westinghouse Response: [

   ]^{a,c}

   [

   ]^{a,c}.

7. **Pg. 6, last paragraph needs further discussion at the site.**

ACTION Required: Rob Sisk will work with the NRC to address proprietary issues. Consideration to be given to relaxing the bracketing.

10. **On page 7, the 5th paragraph alludes to secondary sources contributions and modifications that should be made to equation 2-6. But, secondary sources are defined, and neither is the modification stated anywhere. Please provide clarifications.**

Westinghouse Response: Neutrons emitted by Secondary Source (SS) are of energy 24Kev, which is much lower than the 2Mev energy of fission source neutrons. The SS neutrons do not have energy high enough to reach the excore detector, although they certainly activate fission reactions that can reach the detector. In equation 2-6, [

]a, c

12. **For chapter 3, Methodology, please provide two examples demonstrating the ten steps of the methodology. Be specif, demonstrating each and sub-step along the way.**

Westinghouse Response: Provided latest version of the outline of site SCPT/SRWM.

15. **Table 4-2 of the same page, tabulates some of the statistics associated with the SCICR methodology. Please provide the database for the tabulated results and the associated equations for each of the headings.**

Westinghouse Response: As an example, the data base for the cases of Plant 6 Cycle 10 and Plant 7 Cycle 25 is provided in the attached Excel file.

16. **The 1st paragraph on page 22 attempts to summarize the results in Table 4-2. The same paragraph also alludes to the 20% discrepancy/ 250 pcm presented in the table, as being due to very low detector signal. Is it proposed that the SCICR should not be used below a define detector signal??**

Westinghouse Response: 16 and 17 (below) were combined.

[

]a, c.

[

]^{a,c}

17. The next paragraph of the same page also alludes to short comings associated with the SCICR methodology. Please be prepared to provide qualitative and quantitative technical justification as to why conditions should not be imposed on the SCICR methodology (particularly regarding rod worth) to insure that detector signal is of high quality at all time when this methodology is applied.

    Westinghouse Response: see 16 above.

20. Please provide clarification to the 3`d. paragraph on page 26 regarding the subject of "bias".

    Westinghouse Response: [

]^{a,c}

ABSTRACT
Sub-Critical Rod Worth Measurement (SRWM) Process

DISCLAMER: The following description of the SRWM process is subject to change as experience is gained during performance of the measurements.

[

]a,c

ABSTRACT
Sub-Critical Rod Worth Measurement (SRWM) Process

Outline of Site SCPT/SRWM Testing Condition Requirements

Plant Conditions:

a, c

ABSTRACT
Sub-Critical Rod Worth Measurement (SRWM) Process

a, c

ABSTRACT
Sub-Critical Rod Worth Measurement (SRWM) Process

a, c

ABSTRACT
Sub-Critical Rod Worth Measurement (SRWM) Process

a, c

ABSTRACT
Sub-Critical Rod Worth Measurement (SRWM) Process

a, c

Appendix A

Isothermal Temperature Coefficient Measurement **a, c**