June 22, 2009

Mr. James A. Gresham, Manager
Regulatory Compliance and Plant Licensing
Westinghouse Electric Company
P.O. Box 355
Pittsburgh, PA 15230-0355

SUBJECT: WESTINGHOUSE ELECTRIC COMPANY - FINAL SAFETY EVALUATION RELATED TO REVIEW OF TOPICAL REPORT WCAP-16766-P, "WESTINGHOUSE NEXT GENERATION CORRELATION (WNG-1) FOR PREDICTING CRITICAL HEAT FLUX IN ROD BUNDLES WITH SPLIT VANE MIXING GRIDS" (TAC NO. MD7230)

Dear Mr. Gresham:

By letter dated October 26, 2007, Westinghouse Electric Company (Westinghouse) submitted Topical Report (TR) WCAP-16766-P, "Westinghouse Next Generation Correlation (WNG-1) for Predicting Critical Heat Flux in Rod Bundles with Split Vane Mixing Grids" to the U.S. Nuclear Regulatory Commission (NRC) staff for review and approval. By letter dated April 30, 2009, an NRC draft safety evaluation (SE) regarding our approval of TR WCAP-16766-P was provided for your review and comments. By e-mail dated May 19, 2009, Westinghouse commented on the draft SE and indicated that there is no Westinghouse Proprietary information included in the draft SE. The NRC staff's disposition of Westinghouse's comments on the draft SE are discussed in the attachment to the final SE enclosed with this letter.

The NRC staff has found that WCAP-16766-P is acceptable for referencing in licensing applications for Westinghouse designed fuel for pressurized water reactors to the extent specified and under the limitations delineated in the TR and in the enclosed final SE. The final SE defines the basis for our acceptance of the TR.

Our acceptance applies only to material provided in the subject TR. We do not intend to repeat our review of the acceptable material described in the TR. When the TR appears as a reference in license applications, our review will ensure that the material presented applies to the specific plant involved. License amendment requests that deviate from this TR will be subject to a plant-specific review in accordance with applicable review standards.

In accordance with the guidance provided on the NRC website, we request that Westinghouse publish accepted proprietary and non-proprietary versions of this TR within three months of receipt of this letter. The accepted versions shall incorporate this letter and the enclosed final SE after the title page. Also, they must contain historical review information, including NRC requests for additional information and your responses. The accepted versions shall include an "-A" (designating accepted) following the TR identification symbol.

If future changes to the NRC's regulatory requirements affect the acceptability of this TR, Westinghouse and/or licensees referencing it will be expected to revise the TR appropriately, or justify its continued applicability for subsequent referencing.

Sincerely,

/RA/

Thomas B. Blount, Deputy Director
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

Project No. 700

Enclosure: Final SE

cc w/encl:

Mr. W. Anthony Nowinowski, Manager
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nowinowa@westinghouse.com

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FINAL SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

TOPICAL REPORT WCAP-16766-P, "WESTINGHOUSE NEXT GENERATION

CORRELATION (WNG-1) FOR PREDICTING CRITICAL HEAT FLUX IN

ROD BUNDLES WITH SPLIT VANE MIXING GRIDS"

WESTINGHOUSE ELECTRIC COMPANY

PROJECT NO. 700

1.0 INTRODUCTION

By letter dated October 26, 2007 (Reference 1), Westinghouse Electric Company (Westinghouse) submitted Topical Report (TR) WCAP-16766-P, "Westinghouse Next Generation Correlation (WNG-1) for Predicting Critical Heat Flux in Rod Bundles with Split Vane Mixing Grids" to the U.S. Nuclear Regulatory Commission (NRC) for review and approval. The purpose of this report was to identify and justify the use of the WNG-1 Critical Heat Flux (CHF) correlation for pressurized water reactor (PWR) fuel designs containing structural mixing vane (MV) grids and Intermediate Flow Mixer (IFM) grids. The WNG-1 correlation was developed for 17x17 Robust Fuel Assembly (RFA), 17x17 Next Generation Fuel (NGF), and 16x16 NGF fuel designs. The WNG-1 correlation's coefficients were derived with the Westinghouse version of the VIPRE-01 (VIPRE) (Reference 2) sub-channel code. The correlation was developed based on CHF test data obtained from the Heat Transfer Research Facility of Columbia University. The test data are from 5x5 and 6x6 rod bundles which simulated the Westinghouse PWR fuel designs with split mixing vane grids, with uniform and non-uniform axial power shapes, with non-uniform radial power distributions, with and without guide thimbles, with varied heated lengths, and with varied grid spacing.

In response to the NRC staff's request for additional information (RAI), dated May 6, 2008 (Reference 3), Westinghouse clarified the TR by LTR-NRC-08-37, dated July 25, 2008 (Reference 4). Further, in response to the NRC staff's additional RAI, dated November 25, 2008 (Reference 5), Westinghouse clarified the TR by LTR-NRC-09-11, dated February 12, 2009 (Reference 6). Where appropriate, the NRC staff commented on the responses to the RAIs in the Safety Evaluation (SE). Responses to RAIs not commented on in this SE were for NRC staff information or clarification and were found adequate (these include responses to RAI #2, #3, and #6 (Reference 4) and responses to further clarification on RAI #7e (Reference 6)).

2.0 REGULATORY EVALUATION

Section 50.34 of Title 10 of the *Code of Federal Regulations* (10 CFR), "Contents of construction permit and operating license applications; technical information", requires that Safety Analysis

Reports be submitted that analyze the design and performance of structures, systems, and components provided for the prevention of accidents and the mitigation of the consequences of accidents. As part of the core reload design process, licensees are responsible for reload safety evaluations to ensure that their safety analyses remain bounding for the design cycle. To confirm that the analyses remain bounding, licensees confirm those key inputs to the safety analyses (such as the CHF) are conservative with respect to the current design cycle. If key safety analysis parameters are not bounded, a re-analysis or a reevaluation of the affected transients or accidents is performed to ensure that the applicable acceptance criteria are satisfied.

The NRC staff's review was based on the evaluation of the technical merit of the submittal and its compliance with the applicable regulations associated with the subject matter of this TR.

3.0 TECHNICAL EVALUATION

3.1 Background Information

Boiling crisis occurs when the boiling water flowing past a fuel rod transitions from nucleate boiling to film boiling. This transition decreases the heat transfer rate at the fuel rod surface, forcing the fuel rod surface temperature to dramatically increase in order to maintain the same total heat transfer. This large increase in fuel rod surface temperature may lead to fuel damage. The heat flux which causes this transition from nucleate boiling to film boiling is known as the CHF. To prevent possible fuel damage, boiling crisis is prevented via correlations used to predict the CHF. For normal reactor operations, thermal-hydraulic analysis is used to demonstrate that the peak heat flux in the core will remain below the CHF.

In Pressurized Water Reactors (PWR), CHF is primarily a local phenomenon caused by bubbles which crowd the surface of the fuel rod. If the bubbles prevent the cooling water from reaching the surface of the fuel rod, the flow can transition from nucleate boiling to film boiling. This form of CHF happens very quickly and is known as Departure from Nucleate Boiling (DNB). Keeping with common practice, the reviewers use DNB and CHF interchangeably. To prevent DNB, the Departure from Nucleate Boiling Ratio (DNBR) is used. DNBR is the ratio of the CHF at a location along the fuel rod divided by the current heat flux at that same location under the same coolant conditions.

Many parameters can impact DNB such as: flow pattern, bubble size and population, bubble layer thickness, wall superheat and flow memory, flow instability, local pressure, local enthalpy, mass velocity, inlet conditions, heated length, rod bundle shape, grid spacers, etc. (Reference 7). Due to the complex nature of the phenomenon of DNB, the functional form of DNB correlations are generally empirical and are often based solely on experimental observations of the relationship between the measured DNB and the measured DNB parameters.

The WNG-1 CHF correlation includes the following parameters: pressure, local mass velocity, local quality, heated length from the inlet to the CHF location, the distance between the grids, heated hydraulic diameter ratio as defined in response to RAI #1 (Reference 4), matrix heated hydraulic diameter as defined in response to RAI #1 (Reference 4), and a grid spacing term. The form of the correlation is essentially the same as that of the WSSV and WSSV-T CHF correlations (Reference 8).

Westinghouse has developed the WNG-1 correlation to accurately reflect thermal performance of NGF designs with split vane grids and with a wider parameter range than the existing CHF correlations in support of extended power uprates (local qualities higher than 30 percent). The WNG-1 correlation is applicable to the 16x16 NGF, 17x17 RFA, and 17x17 NGF fuel designs.

Initially, and reflected in the TR, Westinghouse intended to use the WNG-1 correlation for the 15x15 Upgrade fuel design. However, during the review the NRC staff raised questions on the data from the 15x15 Upgrade fuel design as well as the appropriate use of a DNBR generated from the combined database from all fuel designs for the 15x15 Upgrade fuel design. Westinghouse response in the further clarification to RAI #5 a, #7 b, d (Reference 6) and further discussion with the NRC staff demonstrated that there were issues which would need to be addressed if Westinghouse intended to use the WNG-1 correlation to analyze the 15x15 Upgrade fuel design. Westinghouse agreed that the 15x15 Upgrade fuel design would no longer be included as one of the fuel designs which could apply the WNG-1 correlation. The removal of the 15x15 Upgrade fuel design slightly changed the parameter range of the WNG-1 correlation as there were certain parameter values specific to the 15x15 Upgrade fuel design not found in the other three fuel designs. The WNG-1 correlation's range is limited to those parameter values found in the three fuel designs the correlation is applicable to: 16x16 NGF, 17x17 RFA, 17x17 NGF and as reiterated in Table 1 of this SE.

3.2 Database

CHF test data were taken with all four fuel designs. The test data used for development of the correlation were taken from nineteen test bundles with either 5x5 or 6x6 arrays with a split vane design mixing grid. Seven of the bundles had a uniform axial power shape and twelve had a non-uniform axial power shape. Sixteen of the bundles were representative of Westinghouse fuel with 0.374 inch outside diameter (O.D.) heated rods, 0.496 inch rod pitch, and 0.474 – 0.482 O.D. guide thimble. (Three of these sixteen bundles contained two IFM grids in each structural grid span to examine the impact of short grid spacing.) Two of the bundles were representative of Westinghouse fuel with 0.360 inch O.D. heated rods, 0.485 inch rod pitch, and 0.471 O.D. guide thimble. One of the bundles was representative of Westinghouse fuel with 0.423 inch O.D. heated rods and 0.563 inch rod pitch. These data were used to determine the coefficients of the WNG-1 correlation.

The test data used for validation of the correlation were taken from seven test bundles with either 4x4, 5x5 or 6x6 arrays with a split vane design mixing grid. Three of the bundles had a uniform axial power shape and four had a non-uniform axial power shape. Three of the bundles were also used in the development of the WRB-1 and WRB-2 correlations. Additional validation tests were split vane designs that are used outside the United States. Five of the bundles were representative of Westinghouse fuel with 0.374 inch O.D. heated rods, 0.496 inch rod pitch, and 0.474 – 0.482 O.D. guide thimble. Two of the bundles were representative of Westinghouse fuel with 0.422 inch O.D. heated rods and 0.555 – 0.563 inch rod pitch. The size of the validation database is 29 percent the size of the correlation database and was selected to demonstrate that the WNG-1 correlation was robust and predicts data well for conditions that are slightly outside the parameter range of the correlation database.

The test data used for development of the correlation and the test data used for the validation of the correlation were combined and used in generating the minimum allowable DNBR. Data from the 15x15 Upgrade fuel design were not taken out of the development or validation databases as including the data were conservative.

The correlation database is only valid if it is representative of the respective fuel types. The NRC staff asked if there were any anticipated changes in grid spacer location with reference to the tested assembly and the corresponding fuel design. Westinghouse responded to RAI #4 (Reference 4) stating that minor adjustments may be needed in mixed cores to ensure grid to grid overlap. The NRC staff agrees that minor adjustments should have little to no effect on the accuracy of the WNG-1 correlation.

The NRC staff reviewed the database and finds that the database used to develop the WNG-1 CHF correlation for Westinghouse was based on data representative of the fuel designs.

3.3 Trend Analysis

Westinghouse provided analysis which identify trends in the Measured to Predicted (M/P) values of CHF versus the variables of the WNG-1 correlation (pressure, local mass velocity, local quality, heated length from the inlet to the CHF location, the distance between the grids, heated hydraulic diameter ratio, matrix heated hydraulic diameter, and a grid spacing term). These plots were generated for the database as a whole and demonstrated that there were no significant trends in the WNG-1 prediction of CHF as a function of any variable.

The NRC staff reviewed the trend analysis and finds that there are no significant trends in the WNG-1 prediction of CHF as a function of any variable for any fuel type.

3.4 Application of the Correlation over the Intended Range

Because the functional form of WNG-1 correlations is empirical and was based on experimental observations of the relationship between the measured DNB and the correlation variables, the entire intended range of the correlation must be bounded by the test data. However, the WNG-1 correlation is also made up of test data from three separate fuel types and there were questions raised by the NRC staff requesting that Westinghouse justify the use of one correlation range for all the fuels when a correlation range for each of the three fuels could be more appropriate.

In their response to RAI #5 and #7 (Reference 4) and response to further clarification on RAI #5 b, c and #7 a, c (Reference 6), Westinghouse noted that the designs were similar according to key parameters (defined in Reference 9) and the data demonstrated similar performance over each of the three fuel types.

Specifically with reference to Westinghouse's response to further clarification on RAI #7c (Reference 6) about 16x16 NGF fuel, the NRC staff agrees with Westinghouse that the WNG-1 correlation is applicable over the entire mass flow range, even though there is a small portion of the range for which no 16x16 NGF data was available. The NRC staff agrees that the behavior of the 16x16 NGF fuel over this range will be conservatively bounded by the 17x17 NGF and 17x17 RFA fuel given the similarities between the key parameters of the fuel designs (defined in

Reference 9) and the small size of the portions of the range for which there was no 16x16 NGF data.

Specifically with reference to Westinghouse's response to RAI #5 (Reference 4) and further clarification on RAI #5 b, c (Reference 6) about quality, the NRC staff agrees with Westinghouse that the WNG-1 correlation behaves conservatively in this range and also has a conservative trend with respect to available test data (both at CHF and non-CHF conditions). The NRC staff agrees that the WNG-1 correlation will accurately predict the CHF in this quality range.

The NRC staff reviewed the intended range of the correlation and finds that the behavior of the correlation is consistent among the fuel designs and supports one bounding range for all three fuels (given in Table 1).

3.5 Statistical Evaluation of DNBR

The following topics were considered by Westinghouse for the statistical treatment of the database: outliers, normal distribution, comparison of the various data groups, the homogeneity of variance, and the 95/95 DNBR limit. The means and standard deviations for the homogeneity of variance for the ratio of M/P CHF were given for the total correlation database, for the individual tests in the data set, for the total validation database, for the individual tests in the validation data set, and for the total combined database.

Standard statistical tests were used including the W-test for normality at the 95 percent confidence level for groups with less than 50 data points, the D' test for normality at the 95 percent confidence level for groups with more than 50 data points, and the Bartlett test for homogeneity of variance. The F-test analysis of variance (ANOVA) was applied to test for equality of means and Owen's method was applied to determine a one-sided 95/95 limit. For groups that did not pass the normality test, the Kruskal-Wallis One-Way Analysis of Variance by Ranks test was applied to check equality of the medians and the Summerville non-parametric one-sided 95/95 DNBR limit was determined.

Due to questions about the results of the poolability determination, in RAI #7 (Reference 3) the NRC staff requested that a 95/95 DNBR value be determined for each fuel type and the NRC staff requested Westinghouse provide justification for using the combined data from all fuel types to determine one 95/95 DNBR limit when it may be more appropriate to use the data from each fuel type to determine a 95/95 DNBR limit for that specific fuel type. This would result in three DNBR limits, one for each fuel type as outlined in the clarification to RAI #7a, d (Reference 5).

According to the Westinghouse Fuel Criteria Evaluation Process (FCEP) Section J (Reference 9), the ratios of the M/P critical heat fluxes are subject to the three aforementioned statistical tests to determine if they are from the same population (commonly referred to as poolability). Each CHF point represented one test run. All of the runs taken on a specific bundle represented a complete test; thus, in the development of the correlation there are nineteen tests corresponding to the nineteen bundles. Westinghouse combined the tests into groups and performed the three statistical tests comparing the groups to each other and determined the groups were poolable. The NRC requested that Westinghouse provide analysis to determine that the tests were poolable into the groups, acknowledging that if they were then the groups were poolable with each other in clarification to RAI #7e (Reference 5). Westinghouse's response (Reference 6) indicated that if the tests were separated into groups which would pass the poolability requirements of the FCEP, the limiting group would have a conservative DNBR limit of 1.15.

The DNBR limit which meets the 95/95 acceptance criterion was determined using Owen's onesided tolerance limit method (Reference 10). Use of this method was approved by the NRC (Reference 9). The general equation for Owen's method is as follows:

$$95/95 \text{ DNBR limit} = \frac{1}{\overline{\frac{M}{P}} - K_{95/95} \cdot \sigma}$$

Where

$\overline{\frac{M}{P}}$ is the test population mean of measured to predicted CHF ratios.

σ is the effective standard deviation of all the M/P data.

$K_{95/95}$ is a tolerance multiplier which provides the 95/95 probability/confidence limit.

The constant $K_{95/95}$ is a function of the effective degrees of freedom in the test series.

Consistent with previous CHF correlations (Reference 11, 12) the standard deviation, shall be calculated from combined variance of the variance within the test series and the variance among the test series. The effective degrees of freedom shall also be calculated in a like manner.

Therefore, the NRC staff finds that with a DNBR limit of 1.15 the WNG-1 CHF correlation will conservatively predict the CHF behavior of the fuel designs described herein.

4.0 CONDITIONS AND LIMITATIONS

Based on the forgoing considerations, the NRC staff concludes that the use of the WNG-1 correlation with a DNBR limit of 1.15 is acceptable for plant safety analyses provided that the following conditions are met:

1. Because the WNG-1 correlation was developed from test assemblies designed to simulate 16x16 NGF, 17x17 RFA, and 17x17 NGF with split vane grids as described in the TR, the correlation may only be used to perform evaluations for those fuel designs without further justification. The WNG-1 correlation's range is limited to those parameter values found in these three fuel designs.

2. The WNG-1 correlation shall be used with a DNBR limit of 1.15 with the Westinghouse VIPRE-01 computer code. WNG-1 is dependent on calculated local fluid properties that shall be calculated by the Westinghouse version of

VIPRE-01 computer code which has been reviewed and approved by the NRC staff for that purpose.

3. The WNG-1 correlation can be used for PWR plant analyses of steady state and reactor transients other than loss of coolant accidents. The WNG-1 CHF correlation shall not be used for loss of coolant accident analysis unless additional justification is provided to the NRC which demonstrates that the applicable regulations are met and the computer code used to calculate local fuel element thermal/hydraulic properties has been approved for that purpose.

4. The correlation shall not be used outside its range of applicability defined by the range of the test data from which it was developed. This range is listed in Table 1.

Table 1: WNG-1 Applicability Range

Parameter	WNG-1 Applicability Range
Pressure (psia)	**1405 to 2495**
Local mass velocity (Mlbm/hr-ft2)	**0.79 to 3.72**
Local quality (fraction)	**≤ 0.43**
Heat length, inlet to CHF location (inches)	**48* to 168**
Grid spacing (inches)	**6.4 to 26**
Heated hydraulic diameter ratio	**0.85 to 1.00**
Matrix heated hydraulic diameter (inches)	**0.46 to 0.50**
Grid Spacing Term	**≥ 26.5**

* Set as minimum Heat length, applied at all elevations below 48 inches.

5. Modifications to the WNG-1 CHF correlation or modifications to the associated DNBR limit of 1.15 for the three associated fuel types (16x16 NGF, 17x17 NGF, and 17x17 RFA), would require additional NRC review and approval.

6. Use of the WNG-1 CHF correlation for fuel types other than those specified in this SE (16x16 NGF, 17x17 NGF, and 17x17 RFA) are considered by the NRC staff to constitute a departure from a method of evaluation in the safety analysis. Justification for a departure shall be provided to the NRC for review.

The NRC staff will require licensees referencing this TR in licensing applications to document how these conditions are met.

5.0 CONCLUSION

When exercised appropriately, the NRC staff has reasonable assurance that the use of the WNG-1 CHF Correlation, as documented in Reference 1, is acceptable in calculating the CHF for the specified fuel types. The NRC staff has reviewed the WNG-1 CHF Correlation, and does not intend to review the associated TR when referenced in licensing evaluations, but only finds the methods applicable when exercised in accordance with the conditions and limitations described in Section 4.0 of this SE.

If the NRC's criteria or regulations change so that its conclusions about the acceptability of the thermal-hydraulic methods or statistical analyses are invalidated, the licensee referencing the report (Reference 1) will be expected to revise and resubmit its respective documentation, or submit justification for the continued effective applicability of these methodologies without revision of the respective documentation.

6.0 REFERENCES

1. J.A. Gresham, Westinghouse Electric Company, letter to U.S. Nuclear Regulatory Commission (NRC), LTR-NRC-07-57, "Submittal of TR WCAP-16766-P, 'Westinghouse Next Generation Correlation (WNG-1) for Predicting Critical Heat Flux in Rod Bundles with Split Vane Mixing Grids'", October 26, 2007 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML073050397 (letter) / ML073050399 / ML073050398 (Proprietary / Non-Proprietary)).

2. WCAP-14565-P-A, "VIPRE-01 Modeling and Qualification for Pressurized Water Reactor Non-LOCA Thermal-Hydraulic Safety Analysis", October 1999 (ADAMS Accession No. ML993160153 / ML993160096 (Proprietary / Non-Proprietary)).

3. J. H. Thompson, U.S. NRC, letter to J. A. Gresham (Westinghouse) "Request for Additional Information Re: Westinghouse Electric Company (Westinghouse) Topical Report (TR) WCAP-16766-P 'Westinghouse Next Generation Correlation (WNG-1) for Predicting Critical Heat Flux in Rod Bundles with Split Vane Mixing Grids (TAC No. MD7230)'" dated May 6, 2008. (ADAMS Accession No. ML081200886 / ML081200872 (Proprietary / Non-Proprietary)).

4. J.A. Gresham, Westinghouse Electric Company, letter to U.S. NRC, LTR-NRC-08-37 "Response to NRC Request for Additional Information by the Office of Nuclear Reactor Regulation for Topical Report (TR) WCAP-16766-P, 'Westinghouse Next Generation Correlation (WNG-1) for Predicting Critical Heat Flux in Rod Bundles with Split Vane

Mixing Grids. (TAC No. MD7230)'" dated July 25, 2008. (ADAMS Accession No. ML082180031 / ML082180030 (Proprietary / Non-Proprietary)).

5. G. Bacuta, U.S. NRC, letter to James A. Gresham (Westinghouse) "Request for Additional Information Re: Westinghouse Electric Company (Westinghouse) Topical Report (TR) WCAP-16766-P 'Westinghouse Next Generation Correlation (WNG-1) for Predicting Critical Heat Flux in Rod Bundles with Split Vane Mixing Grids (TAC No. MD7230)'" dated November 25, 2008. (ADAMS Accession No. ML082971069 / ML082970996 (Proprietary / Non-Proprietary)).

6. J.A. Gresham, Westinghouse Electric Company, letter to U.S. NRC, LTR-NRC-09-11, "Further Clarifications on RAIs for Topical Report (TR) WCAP-16766-P, 'Westinghouse Next Generation Correlation (WNG-1) for Predicting Critical Heat Flux in Rod Bundles with Split Vane Mixing Grids.'" dated February 12, 2009. (ADAMS Accession No. ML090570514 / ML090570513 (Proprietary / Non-Proprietary)).

7. L.S. Tong, "Boiling Crisis and Critical Heat Flux," TID-25687, 1972.

8. WCAP-16523-P-A, "Westinghouse Correlation WSSV and WSSV-T for Predicting Critical Heat Flux in Rod Bundles with Side-Supported Mixing Vanes", August 2007 (ADAMS Accession No. ML072570633 / ML072570327 (Proprietary / Non-Proprietary)).

9. WCAP-12488-A, "Westinghouse Fuel Criteria Evaluation Process", October 1994 (ADAMS Accession No. ML020430107 (Proprietary)).

10. Owen, D.B. "Factors for One-Sided Tolerance Limits and for Variable Sampling Plans," SC-R-607, Sandia Corporation, March 1963.

11. WCAP-10444-P-A, "Vantage 5 Fuel Assembly", September 1985 (ADAMS Accession No. ML080650257 (Proprietary)).

12. WCAP-15025-P-A, "Modified WRB-2 Correlation, WRB-2M, for Predicting Critical Heat Flux in 17x17 Rod Bundles with Modified LPD Mixing Vane Grids", April 1999 (ADAMS Accession No. ML081610106 (Proprietary)).

Principal Contributors: A. Attard
J. Kaizer

Date: June 22, 2009

RESOLUTION OF WESTINGHOUSE ELECTRIC COMPANY (WESTINGHOUSE)

COMMENTS ON DRAFT SAFETY EVALUATION FOR TOPICAL REPORT (TR)

WCAP-16766-P, "WESTINGHOUSE NEXT GENERATION CORRELATION (WNG-1)

FOR PREDICTING CRITICAL HEAT FLUX IN ROD BUNDLES WITH

SPLIT VANE MIXING GRIDS"

By e-mail dated May 19, 2009 (ADAMS Accession No. ML091400076), Westinghouse provided two (2) minor grammatical corrections on the draft safety evaluation (SE) for TR WCAP-16766-P, "Westinghouse Next Generation Correlation (WNG-1) for Predicting Critical Heat Flux in Rod Bundles with Split Vane Mixing Grids" to the U.S. Nuclear Regulatory Commission (NRC) staff for review and approval. In the same e-mail, Westinghouse also indicated that there is no Westinghouse Proprietary information included in the draft SE; therefore, the draft of this SE will be made publicly available. The following are the NRC staff's resolution of these comments:

Draft SE comments for TR WCAP-16766-P:

1. Page 2, Line 33: replace the word "flow" with the word "coolant", more accurante statement.

   NRC Resolution for Comment 1 on Draft SE:

   The staff reviewed the Westinghouse recommendation and found it acceptable because the change is a grammatical correction.

   On Page 2, Line 33 is changed to read "coolant conditions".

2. Page 7, Table 1: Matrix heated hydraulic diameter, should include the units (i.e., (inches)).

   NRC Resolution for Comment 2 on Draft SE:

   The staff has reviewed the Westinghouse suggestion and found it acceptable to include the units in inches.

   On Page 7, Row 8 of Table 1 is changed to read "Matrix heated hydraulic diameter (inches)".

ATTACHMENT