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U. S. Nuclear Regulatory Commission
10 CFR 50.46 Annual Notification and Reporting for 2006

Dear Mr. Wermiel,

The purpose of this letter is to report the impact of changes or errors in the emergency core cooling system (ECCS) evaluation models used by Westinghouse Electric Company. A description of the changes to the Westinghouse small break LOCA and large break LOCA ECCS evaluation models for 2006 is provided as an attachment. Westinghouse has categorized these changes or errors into two separate groups:

- Non-Discretionary Changes
- Discretionary Changes

This annual notification is being provided since it affects information previously submitted in Westinghouse Topical Reports. It is noted that plant-specific peak cladding temperature (PCT) variations are not addressed in this letter. These should be treated, as appropriate, on a plant-specific basis in accordance with the applicable sections of 10 CFR 50. Westinghouse has notified licensees utilizing these Westinghouse ECCS evaluation models in their plant-licensing basis of the appropriate reportable changes.

For future referencing convenience, the 2006 10 CFR 50.46 reportable changes provided in the attachment, together with the "2005 Formulation" offered in Reference 2 constitute the "2006 Formulation" of the Westinghouse ECCS evaluation models.

Reference 3 responded to a request for additional information regarding the mesh size used to determine the limiting break equivalent diameter in NOTRUMP-EM. This letter established the Westinghouse position on how this issue would be reported to affected plants. The 10 CFR 50.46 reporting for this issue is being completed, and generic reporting text will be included in the 2007 annual report.

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MRR

References:

1. ET-NRC-92-3755, "W Methodology for Implementation of 10 CFR 50.46 Reporting," N. J. Liparulo, Westinghouse to NRC Document Control Desk, October 30, 1992. (WCAP-13451)

2. LTR-NRC-06-8, "U.S. Nuclear Regulatory Commission, 10 CFR 50.46 Annual Notification and Reporting for 2005," B. F. Maurer, March 16, 2006.

3. LTR-NRC-06-44, "Transmittal of LTR-NRC-06-44 NP-Attachment, 'Response to NRC Request for Additional Information on the Analyzed Break Spectrum for the Small Break Loss of Coolant Accident (SBLOCA) NOTRUMP Evaluation Model (NOTRUMP EM), Revision 1' (Non-Proprietary)," J. A. Gresham, July 14, 2006.

Sincerely,

B. F. Maurer, Acting Manager
Regulatory Compliance and Plant Licensing Engineering

Attachment:

1. Standard Format Text for Changes and Enhancements to the Westinghouse Evaluation Models for 2006

cc:
D. Holland/NRR/OWFN/DRPW/PFDIV2 (Rockville, MD) 1L

Standard Format Text for Changes and Enhancements to the Westinghouse Evaluation Models for 2006

Non-Discretionary Changes

BASH Minimum and Maximum Time Step Sizes (BASH (1981))
PAD Version 4.0 Implementation (BASH (1981))
Revised Downcomer Gap Inputs (UPI (1999))
Upper Support Plate Modeling (CQD (1996))
Inconsistent Vertical Levels in Vessel (UPI (1999))
Wetted Perimeter Fraction for Entrained Droplet Deposition Calculation (ASTRUM (2004))
Vessel Model Section Elevation Definition (ASTRUM (2004))
Core Support Column Heat Slab Discrepancy in UPI BELOCA Analyses (SECY UPI, UPI (1999), ASTRUM (2004))
HGAP Correlation Input Error (BWR)

Discretionary Changes

General Code Maintenance (BASH (1981), NOTRUMP (1985))
Rod-To-Rod Radiation Enclosure Selection Process Improvement for the 1999 EM (CEFLASH-4A (1999))
General Code Maintenance (CQD (1996), UPI (1999), ASTRUM (2004))
Pellet Radial Power Profile Calculations (ASTRUM (2004))

BASH MINIMUM AND MAXIMUM TIME STEP SIZES (Non-Discretionary Change)

Background

A review of some recent BASH-EM sensitivity calculations led to a recommendation to reduce the minimum and maximum time step sizes in BASH during reflood. These changes are being recommended for generic application and have been evaluated for impact on existing analysis results. These changes represent a closely-related group of non-discretionary changes in accordance with Section 4.1.2 of WCAP-13451.

Affected Evaluation Model(s)

1981 Westinghouse large break LOCA evaluation model with BASH

Estimated Effect

Sensitivity calculations using BASH and SMUUTH show that reducing the minimum and maximum time step sizes in BASH during reflood results in either a negligible change or a modest increase in the integral flooding rate for most cases, leading to an estimated impact of 0°F for 10 CFR 50.46 reporting purposes. One case showed a decrease in the integral flooding rate late in reflood and was evaluated for 10 CFR 50.46 impact on a plant-specific basis.

PAD VERSION 4.0 IMPLEMENTATION
(Non-Discretionary Change)

Background
A recent BASH-EM evaluation predicted an increase in the peak cladding temperature (PCT) for IFBA fuel that was attributed primarily to the use of fuel rod initial conditions based on PAD Version 4.0. This result called into question the basis for forward-fit implementation of PAD Version 4.0, and existing IFBA analyses based on PAD Version 3.4 were reviewed to identify conditions that could lead to similar behavior. For each potentially-affected analysis, the estimated PCT impact due to PAD Version 4.0 implementation was assessed on a plant-specific basis. This change represents a non-ciscretionary change in accordance with Section 4.1.2 of WCAP-13451.

Affected Evaluation Model(s)
1981 Westinghouse large break LOCA evaluation model with BASH

Estimated Effect
The 10 CFR 50.46 assessments for this issue were determined on a plant-specific basis.

REVISED DOWNCOMER GAP INPUTS (Non-Discretionary Change)

Background

An error was identified during the course of a best estimate large break LOCA analysis. A factor of ½ had been missed from the downcomer nominal gap width (GAPN) calculations from several analyses, resulting in downcomer GAPN values twice as big as they should be. The error has been corrected, and a representative steady state and transient rerun was performed to quantify the effect on PCT. This change represents a non-discretionary change in accordance with Section 4.1.2 of WCAP-13451.

Affected Evaluation Model(s)

1999 Westinghouse best estimate large break LOCA evaluation model, application to PWRs with upper plenum injection

Estimated Effect

A representative reference transient was rerun using WCOBRA/TRAC to establish an estimated effect, and the PCT impact was assigned on a plant-specific basis.

UPPER SUPPORT PLATE MODELING
(Non-Discretionary Change)

Background
A discrepancy was identified during the course of a best estimate large break LOCA (BE LBLOCA) analysis whereby the upper support plate unheated conductor calculations are inconsistent with the analysis input guidelines. An assessment was performed to estimate the impact of these differences on the BE LBLOCA results for the affected plants. These changes represent a closely-related group of non-discretionary changes in accordance with Section 4.1.2 of WCAP-13451.

Affected Evaluation Model(s)
1996 Westinghouse best estimate large break LOCA evaluation model

Estimated Effect
An assessment was performed with consideration of all of the affected plants. This assessment concluded that there is no significant impact on the BE LBLOCA analysis results due to the modeling of the upper support plate unheated conductor, leading to an estimated PCT impact of 0°F.

INCONSISTENT VERTICAL LEVELS IN VESSEL (Non-Discretionary Change)

Background

A discrepancy was identified during the course of a best estimate large break LOCA (BE LBLOCA) analysis whereby the number of vertical levels in the vessel is inconsistent with the analysis input guidelines. An assessment was performed to estimate the impact of these differences on the BE LBLOCA results for the affected plants. These changes represent a closely-related group of non-discretionary changes in accordance with Section 4.1.2 of WCAP-13451.

Affected Evaluation Model(s)

1999 Westinghouse best estimate large break LOCA evaluation model, application to PWRs with upper plenum injection

Estimated Effect

An assessment was performed with consideration of all of the affected plants. This assessment concluded that there is no significant impact on the BE LBLOCA analysis results due to the inconsistent modeling of the vessel vertical levels, leading to an estimated PCT impact of 0°F.

WETTED PERIMETER FRACTION FOR ENTRAINED DROPLET DEPOSITION CALCULATION
(Non-Discretionary Change)

Background
An error was identified in the calculation of the fraction of wetted perimeter to be used for droplet deposition on the support columns in the periphery of the upper plenum in the R. E. Ginna WCOBRA/TRAC vessel model. A plant-specific evaluation was completed to estimate the effect of this modeling error on the large break LOCA ASTRUM analysis. This change represents a non-discretionary change in accordance with Section 4.1.2 of WCAP-13451.

Affected Evaluation Model(s)
2004 Westinghouse realistic large break LOCA evaluation model using ASTRUM

Estimated Effect
A plant-specific evaluation of the corrected values was performed to estimate the effect of this error. The evaluation determined that this error has a negligible effect on the R. E. Ginna large break LOCA analysis results, leading to an estimated PCT impact of 0°F for 10 CFR 50.46 reporting purposes.

VESSEL MODEL SECTION ELEVATION DEFINITION (Non-Discretionary Change)

Background

An error was identified in the definition of the first level elevation in vessel section 5 of the R. E. Ginna WCOBRA/TRAC vessel model (this level elevation defines the height of the first cell in each channel in vessel section 5). The modeled elevation was set at a different height than the elevation intended for the analysis. This resulted in an inconsistency in the support column gap (lateral flow path) calculations for the bottom two cells of vessel section 5. A plant-specific evaluation was completed to estimate the effect of this modeling error on the large break LOCA ASTRUM analysis. This change represents a non-discretionary change in accordance with Section 4.1.2 of WCAP-13451.

Affected Evaluation Model(s)

2004 Westinghouse realistic large break LOCA evaluation model using ASTRUM

Estimated Effect

A plant-specific evaluation was performed to estimate the effect of this error. The evaluation determined that this error has a negligible effect on the R. E. Ginna large break LOCA analysis results, leading to an estimated PCT impact of 0°F for 10 CFR 50.46 reporting purposes.

CORE SUPPORT COLUMN HEAT SLAB DISCREPANCY IN UPI BELOCA ANALYSES
(Non-Discretionary Change)

Background
An error was identified in the calculation of the core support column metal mass which results in a very small discrepancy in the total lower plenum heat slab metal mass for some two-loop plants (less than 0.1%). The corrected metal mass for the core support columns has been evaluated for impact on current licensing-basis analyses. This change represents a non-discretionary change in accordance with Section 4.1.2 of WCAP-13451.

Affected Evaluation Model(s)
SECY UPI WCOBRA/TRAC large break LOCA evaluation model
1999 Westinghouse best estimate large break LOCA evaluation model, application to PWRs with upper plenum injection
2004 Westinghouse realistic large break LOCA evaluation model using ASTRUM

Estimated Effect
The difference in the metal mass is very small and would be expected to produce a negligible effect on the large break LOCA analysis results, leading to an estimated PCT impact of 0°F for 10 CFR 50.46 reporting purposes.

HGAP CORRELATION INPUT ERROR (Non-Discretionary Change)

Background

The Westinghouse Fuel Rod and Thermal-Hydraulic Design group has informed LOCA Integrated Services I that the nominal HGAP calculations for STAV 7.2.18 have changed due to small differences in the power history / burnup calculations. This change represents a non-discretionary change in accordance with Section 4.1.2 of WCAP-13451.

Affected Evaluation Model(s)

Westinghouse BWR LOCA evaluation model, applicable to SVEA-96 Optima2 fuel

Estimated Effect

The BWR LOCA evaluation model uses a bounding lower HGAP limit for the evaluation model. The lower HGAP bound has been modeled conservatively with as-built uncertainties; the changes due to this error fall within the lower bounds of the as-built uncertainties. Therefore, the estimated PCT impact is 0°F for 10 CFR 50.46 reporting purposes.

GENERAL CODE MAINTENANCE
(Discretionary Change)

Background
Various changes in code input and output format have been made to enhance usability and help preclude errors in analyses. This includes both input changes (e.g., more relevant input variables defined and more common input values used as defaults) and input diagnostics designed to preclude unreasonable values from being used, as well as various changes to code output which have no effect on calculated results. In addition, various updates were made to eliminate inactive coding, improve active coding, and enhance commenting, both for enhanced usability and to facilitate code debugging when necessary. These changes represent discretionary changes that will be implemented on a forward-fit basis in accordance with Section 4.1.1 of WCAP-13451.

Affected Evaluation Model(s)
1981 Westinghouse large break LOCA evaluation model with BASH
1985 Westinghouse small break LOCA evaluation model with NOTRUMP

Estimated Effect
The nature of these changes leads to an estimated PCT impact of 0°F.

ROD-TO-ROD RADIATION ENCLOSURE SELECTION PROCESS IMPROVEMENT FOR THE 1999 EM
(Discretionary Change)

Background

The Appendix K ECCS Performance Analysis for LBLOCA for CE plants is performed with the 1999 evaluation model (1999 EM). The hot rod heat-up portion of this analysis contains a component model for rod-to-rod radiation, which utilizes an enclosure of fuel rods. In the Evaluation Model Topical Report, the rod-to-rod radiation methodology and a related SER limitation/constraint require that a bounding radiation enclosure will be used in the analysis. Search criteria are specified in the NRC-accepted Topical Report for ensuring that these conditions are met. The process for identifying candidate limiting enclosures for the rod-to-rod radiation model includes the use of an automated survey of the core on a pin-by-pin basis. The REX code is the utility code that executes the surveying process for identifying potentially limiting radiation enclosures for evaluation in the LBLOCA performance analysis.

In 2005, a problem developed with the REX code, in that inappropriate radiation enclosures for the rod-to-rod radiation model were being identified. This had the potential for adding considerable inefficiency to the reload analysis process, since all identified candidates must be dispositioned for the analysis. This problem coincided with the introduction of ZrB2 IFBA bearing cores, which have flatter power distributions. It was found that some candidate enclosures contained target hot rods operating below the power of the average rod of the hot assembly. This result produced candidate enclosures that fall outside the range of applicability of the rod-to-rod radiation methodology and therefore are inappropriate for the analysis. The REX utility code was modified to eliminate inappropriate enclosures derived from the survey process. This modification has no impact on the final limiting enclosure used in determining PCT. This change represents a discretionary change in accordance with Section 4.1.1 of WCAP-13451.

Affected Evaluation Model(s)

Appendix K LBLOCA evaluation model, 1999 EM

Estimated Effect

This process improvement has no impact on the licensed methodology or on the NRC-accepted search criteria and does not conflict with the SER limitation/constraint imposed on the radiation model. There is no impact on PCT for 10 CFR 50.46 reporting purposes.

GENERAL CODE MAINTENANCE
(Discretionary Change)

Background
A number of coding changes were made as part of normal code maintenance. Examples include additional information in code outputs, improved automation in the ASTRUM codes, increased WCOBRA/TRAC code dimensions, and general code cleanup. All of these changes are considered to be discretionary changes in accordance with Section 4.1.1 of WCAP-13451.

Affected Evaluation Model(s)
1996 Westinghouse best estimate large break LOCA evaluation model
1999 Westinghouse best estimate large break LOCA evaluation model, application to PWRs with upper plenum injection
2004 Westinghouse realistic large break LOCA evaluation model using ASTRUM

Estimated Effect
The nature of these changes leads to an estimated PCT impact of 0°F.

PELLET RADIAL POWER PROFILE CALCULATIONS (Discretionary Change)

Background

The pellet radial power profiles assumed in WCOBRA/TRAC and HOTSPOT are generally consistent with fresh fuel. For an ASTRUM analysis which has the potential for a large range of burnups, the initial fuel temperature and core stored energy in WCOBRA/TRAC and HOTSPOT may not converge to the steady state target values and tend to be over-estimated. As such, an option to calculate the pellet radial power profile as a function of burnup and enrichment based on PAD models has been added to ASTRUM. This change is considered a discretionary change in accordance with Section 4.1.1 of WCAP-13451 and will be implemented in a forward-fit manner.

Affected Evaluation Model(s)

2004 Westinghouse realistic large break LOCA evaluation model using ASTRUM

Estimated Effect

This change will be implemented in a forward-fit manner and has no effect on existing analyses.