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LTR-NRC-18-48

July 10, 2018

Subject: RAI-19 Revision 1 for WCAP-17203-P/WCAP-17203-NP, Revision 0-2, "Fast Transient and ATWS Methodology" (Non-Proprietary)

Attached is RAI-19 Revision 1 for WCAP-17203-P/WCAP-17203-NP, Revision 0-2, "Fast Transient and ATWS Methodology." This information is being submitted by Westinghouse in response to a telecon discussion with the NRC Staff to resolve the remaining issue regarding the Draft Safety Evaluation for WCAP-17203-P/WCAP-17203-NP, Revision 0-2.

The attached response is non-proprietary.

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Enclosures

cc: Ekaterina Lenning
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RAI-19 Revision 1 for WCAP 17203-P/WCAP-17203-NP, Revision 0-2, "Fast Transient and ATWS Methodology"

(Non-Proprietary)

July 2018

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RAI-19 Revision 1

In WCAP-17203-P, Section 7, Uncertainty Analysis, the applicant states the intent is to "predict a best estimate value accounting for uncertainties and biases of the relevant input." and seeks approval of a method to estimate operating limits and safety margins to acceptance criteria for Anticipated Operational Occurrences and ATWS events. The resulting uncertainties and biases arise from selection of input and modeling parameters and are evaluated using a Monte Carlo based method. However, SRP Chapter 15, which provides guidance on the evaluation of transients and accidents, only discusses the use of best estimate methods for the evaluation of loss-of-coolant-accidents as an alternative to Appendix K conservative deterministic methods. The only mention in Chapter 15 of the use of 95 percent probability/ 95 percent confidence calculations (for BWRs) is with respect to critical power ratio remaining above the minimum critical power ratio.

a) **Explain what precedent exists for use of best estimate methods to evaluate fast transients and ATWS events.**
b) **In CEND-300-P-A, the applicant proposed and the NRC accepted Approach A (conservative deterministic methods) to evaluate fast and slow transients for boiling water reactor reload fuel. In its evaluation of the submittal, the NRC rejected the applicant's proposed use of statistical techniques stating the "uncertainty analysis approach is not generically acceptable since the acceptability is highly application dependent." The reviewing contractor recommended that the applicant justify the following for the parameters selected for statistical treatment: (1) that those parameters selected are statistically independent and uniformly distributed; (2) that the range of applicability of the parameter is not violated by the distribution chosen by the applicant; (3) that each selected probability function is adequately conservative and well supported by actual applicable data; and (4) that the database used for the parameters is statistically significant. Address the NRC's prior rejection of the use of analysis uncertainty in CEND-300-P-A, including an explanation of the areas recommended for additional discussion and justification.**

Revised Response to RAI-19

South Texas Project Nuclear Operating Company (STPNOC) provided the initial response to RAI-19 on February 17, 2011 in letter U7-C-NINA-NRC-110022. Subsequent discussion with NRC staff on July 2, 2018 provided clarification to the methodology application, resulting in an update to this RAI response. The changes from the initial response are indicated with revision bars in the margin.

Part A:

Section 4.4 of SRP requires the applicant to treat uncertainties in the values of process parameters, core design parameters and in calculational methods (modeling parameters) with at least a 95-percent probability at the 95-percent confidence level when evaluating thermal margins during normal reactor operation and AOOs. This section further requires providing the methodology used to combine these uncertainties in input and modeling parameters.

For the Anticipated Operational Occurrences (AOOs) Westinghouse intends to use the best estimate method (95/95 calculations) with respect to critical power ratio remaining above the minimum critical power ratio consistently with the requirements of SRP Chapter 15 and Chapter 4.4.

For the ATWS events, Chapter 15.8 of the SRP does not refer specifically to the use of 95 percent probability/ 95 percent confidence calculations. Section 15.8.II refers instead to 10 CFR 50.46 as it relates to fuel integrity acceptance criteria. Considering the low frequency of occurrence for an ATWS event and application of 10 CFR 50.46, postulated loss-of-coolant accident best estimate uncertainty evaluation methods are applied for ATWS when evaluating the fuel integrity acceptance criteria. An approach consistent with the fuel integrity evaluation is applied also for other ATWS acceptance criteria.

The best estimate approach, consistent with the approach presented in this LTR, was applied earlier by Westinghouse in, for example, the NRC approved Realistic Large-Break LOCA Evaluation Methodology (Reference 1) and, is applied by other vendors in for instance (Reference 2) for AOO analysis.

Part B:

(1) Method B in CENPD-300 is based on the assumption of normally distributed input parameters. Westinghouse has no intention of applying this method to determine the thermal margins. Instead a new method to treat uncertainties is presented in the LTR, which has no requirements on the shape of the distribution function of these parameters.
Statistical independence of the input parameters to the uncertainty analysis is achieved by the selection process described in this topical report, based on the division of the events to different groups and selection process where only the relevant input and modeling parameters are considered in the analysis.

(2) The range of the applicability of the parameter is not violated by the chosen distribution function. Westinghouse considers three different shapes of distribution functions for the input and modeling parameters. Normal, log-normal and uniform distribution functions. The first two shapes are verified using the normality tests. If the normality test fails, a uniform distribution is assumed as this distribution type represents the maximum ignorance about the distribution and leads to conservative uncertainty estimates.

(3) Adequacy and quality of selected probability functions are addressed in Section 7.3.3 and Section 7.3.4 of this topical report.

(4) Statistical significance of the database used for the parameters is captured by the data uncertainty assessment process, described in the report. If the database is not statistically significant, the parameter is then excluded from the uncertainty evaluation and set to its conservative bounding value according to analysis methodology described in Section 6 of this LTR.

References:

1. WCAP-16009-P-A, Rev.0, “Realistic Large-Break LOCA Evaluation Methodology Using the Automated Statistical Treatment Of Uncertainty Method (ASTRUM)”, January 2005
2. NEDO-32906-A, Rev.3,Class I, Non-Proprietary, “TRACG Application for Anticipated Operational Occurrences (AOO) Transient Analyses”, September 2006