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Subject: "Response to NRC Request for Additional Information on Analyzed Break Spectrum for the Small Break Loss of Coolant Accident Evaluation Model NOTRUMP" (Non-Proprietary)

Enclosed is "Response to NRC Request for Additional Information on Analyzed Break Spectrum for the Small Break Loss of Coolant Accident Evaluation Model NOTRUMP." This material is provided in response to an NRC Staff request for additional information. The enclosed material does not contain proprietary information.

Any questions regarding this document should be addressed to B. F. Maurer, Acting Manager, Regulatory Compliance and Plant Licensing, Westinghouse Electric Company LLC, P.O. Box 355, Pittsburgh, Pennsylvania 15230-0355.

Very truly yours,

A handwritten signature in black ink that reads 'B. F. Maurer'.

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

Enclosure

cc: B. J. Benney/NRR
L. Feizollahi/NRR

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**Response to NRC Request for Additional Information on
Analyzed Break Spectrum for the Small Break Loss of
Coolant Accident Evaluation Model NOTRUMP**

September 2005

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Background

During review of several small break loss of coolant accident (SBLOCA) analyses performed for extended power uprates and replacement steam generators, the NRC Staff generated several requests for additional information (RAI's). Included in the RAI's was a concern that the break spectrum analyzed in the NOTRUMP evaluation model (EM) might be too coarse and that further refinement should be considered. Specifically, the Staff questioned if the resolution of the break spectrum used in the NOTRUMP EM (1.5, 2, 3, 4 and 6 inch cases) was fine enough to capture the limiting peak clad temperature as per 10 CFR 50.46. In addition, results from Staff audit calculations using RELAP5 indicated that calculated peak clad temperatures for certain break sizes might exceed the 50.46 acceptance criteria for one of the plant types under review. In subsequent conversations and meetings with the Staff, Westinghouse agreed to investigate the concern generically with the NOTRUMP EM.

Assessment

After review of the Staff's analytic conclusions, Westinghouse performed a study to see if the same behavior was exhibited by the NOTRUMP EM. Preliminary work showed that in some cases, more limiting results could be obtained by executing non-integer break sizes, however, the magnitude of the effect was less severe than the possible impact indicated by the Staff. Nevertheless, Westinghouse performed evaluations to determine the safety significance of the issue and to determine if there were any impact on compliance with the 50.46 acceptance criteria. To accomplish this, a plan was implemented to address the issue for operating plants. The first step was to identify those plants whose maximum reported SBLOCA peak clad temperature (PCT) is greater than 1,700°F and to explicitly analyze those plants to determine the potential effect of using a finer break spectrum. This number was chosen because it provides significant margin to the 50.46 PCT limit and because fuel rods exposed to this temperature or less do not experience significant metal-water reaction even when moderate variations in time exist.

These explicit analyses for the plants which had the highest predicted SBLOCA PCT's demonstrate continued 50.46 compliance. This finding also supports the Westinghouse belief that there is adequate margin to conclude that additional explicit analyses do not need to be performed at this time for those plants whose current SBLOCA PCT is less than 1,700°F.

Safety Significance

Given the magnitude of the variations noted for the explicit cases analyzed in assessing this matter, the break mesh size is judged not to be a safety significant issue. This is because the magnitude of the impact is small in comparison to the actual margins that are built into the NOTRUMP EM both by design and by Appendix K requirements. Some of the available margins include:

- ANS 5.1 – 1971 + 20% decay heat
- Cathcart-Pawel zirconium reaction model
- Condensation of Safety Injection (COSI) model low pressure limit is artificially restricted

- **Power shape occurrence** (The top skewed power shape assumed in the analysis has the potential to occur for only a small fraction of time during the cycle).
- **Power shape and decay heat shape are not the same** (The power shape assumes an instantaneous decay heat burn-in, but that is not the actual response).
- **MSSV setpoint uncertainty** (Only one MSSV needed at nominal set pressure to drive down the RCS equilibrium pressure)
- **Safety grade SG-PORV's typically not modeled** (Drives down the RCS equilibrium pressure)
- **Non-safety grade PORV's or steam dumps not modeled** (Drives down the RCS equilibrium pressure)
- **Single Failure (App K req)**
- **Minimum ECCS performance**
- **Operator Cooldown per ES-1.2 not modeled**
- **Rapid Cooldown per FR-C.1 not modeled**
- **Break Location**
- **No mixture surface entrainment accounted for in the core**
- **Core average velocity used in SBLOCTA in lieu of HA steam flow**
- **Enhanced condensation from the accumulators not modeled as it is for pumped SI**
- **Zaloudek sub-cooled break flow model**
- **Moody two-phase break flow model (App K req)**
- **No grids in SBLOCTA**
- **Hot leg nozzle gap not modeled**

Screening

A review of all domestic AOR's performed by Westinghouse shows that 6 units utilizing the NOTRUMP EM have a SBLOCA analysis of record (AOR) PCT (with assessments) above 1,700°F. As such, these units were specifically investigated with regard to potential impacts on the 10 CFR 50.46 acceptance criteria with a refined break spectrum. Instead of the typical 1 inch equivalent size variations, 0.25 inch variations in break size were investigated in the size range where SBLOCA PCT's for these plant types occur. This break size interval showed a good characteristic behavior and that no extreme outliers likely existed within the range considered. Given this and the overall conservatism within the model, the 0.25 inch size interval is considered adequate.

Results

The specific analyses for the plants discussed above showed that either the limiting break had been captured in the original analysis and/or continued compliance with the requirements of 10 CFR 50.46 with regard to peak clad temperature is assured. In order to properly assess the effects of pre-transient oxidation for these additional calculations, some plant specific data was required to be generated. As such,

demonstration for oxidation compliance for a subset of the plants which did not screen out is still on going. This work is expected to be completed by the middle of October 2005. Westinghouse is also in the process of preparing 50.46 notifications to plants affected by this issue for potential reportability. This only applies to the plants that did not screen out and that experienced a PCT impact. For plants within the screening criteria, no PCT impact is applied.

Summary

The analysis work performed for this issue demonstrates that there is no safety significance associated with this issue and that all plants are expected to remain in compliance with 10 CFR 50.46 SBLOCA criteria.

Forward Fit Application

For the plants which have SBLOCA PCT's that exceed the screening criteria, the calculated impacts will become part of the analysis basis. For plants that do not exceed the screening criteria, no further action is considered necessary at this time. Westinghouse would welcome the opportunity to discuss the forward fit applicability of this issue with the Staff in up-coming meetings on the NOTRUMP EM.