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To:  
Brian Sheron

\*\*\* YELLOW \*\*\*

For Signature of:

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Case  
NRR Mailroom

Description:

Westinghouse Conclusions Regarding Recent CROSSFLOW Ultrasonic Flow  
Measurement System Performance Events

Assigned To:  
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Our ref: LTR-NRC-04-37  
18 June 2004

**Subject: Westinghouse Conclusions Regarding Recent CROSSFLOW Ultrasonic Flow Measurement System Performance Events**

- References:
1. CENPD-397-P-A, Rev. 01, "Improved Flow Measurement Accuracy Using CROSSFLOW Ultrasonic Flow Measurement Technology," May 2000
  2. Letter, S. A. Richards (NRC) to I. C. Rickard (ABB-CE), "Acceptance for Referencing of CENPD-397-P, Rev. 01-P, 'Improved Flow Measurement Accuracy Using Crossflow Ultrasonic Flow Measurement Technology' (TAC No. MA6452)," March 20, 2000
  3. WCAP-15689-P, Revision 1, "Evaluation of Transit-Time and Cross-Correlation Ultrasonic Flow Measurement Experience with Nuclear Plant Feedwater Flow Measurement," December, 2002
  - 4) Letter, F. P. Schiffler (WOG) to G. Shukla (NRC), "Westinghouse Owners Group, CROSSFLOW Task Force: Feedback Regarding Westinghouse Technical Bulletin, TB-04-4," WOG-04-310, June 8, 2004

Dear Dr. Sheron:

The purpose of this letter is to transmit to the Nuclear Regulatory Commission (NRC), the conclusions of Westinghouse Electric Company LLC (Westinghouse) and our CROSSFLOW partner, the Advanced Measurement and Analysis Group, Inc. (AMAG), regarding recent events associated with the CROSSFLOW Ultrasonic Flow Measurement System. Westinghouse also wants to inform the NRC of the efforts that are planned for further improvements in the installation and operation of CROSSFLOW for its use in both power recovery and Measurement Uncertainty Recapture (MUR) applications.

The recent events referred to above are: 1) the discovery of signal contamination at Byron and Braidwood Units 1 & 2 in 2003 and 2) plant configuration issues that affected CROSSFLOW performance in those plants and at Ft. Calhoun in 2004. Westinghouse/AMAG have evaluated the potential impact of these performance observations and have concluded that they do not represent a significant safety concern even in a situation where they may have led to an overpower condition. This is the case because of the amount of margin typically available in various safety analyses. CROSSFLOW only provides a control grade signal for use in determining a venturi flow correction factor,  $C_f$ , which is then used to obtain a more accurate venturi measured feedwater flow rate. The venturi determined feedwater flow rate is in turn used as part of a calorimetric power calculation that is subsequently used to make manual adjustments of plant power level, if appropriate. As an externally mounted instrument, CROSSFLOW does not compromise the feedwater system pressure boundary, nor does CROSSFLOW initiate any safety-related plant trips, actuate any emergency safety features systems for accident mitigation, or provide the operators with any information needed for post-accident emergency procedure implementation. Furthermore, CROSSFLOW does not perform any plant thermal power calorimetric/heat balance calculations. When used in the continuous operating mode, the CROSSFLOW system will indicate if a degradation in data

acquisition occurs indicating a potential performance issue that should be investigated. If CROSSFLOW is linked to the plant computer (as is the case for all Appendix K MUR power uprates) not only is the local CROSSFLOW operator alerted but operators in the plant Control Room are alerted as well. Even if CROSSFLOW failed to alert the operator, additional performance checks are available through use of existing plant operating parameters. For example, prior to manually adjusting power level based on this calculation, the thermal performance engineer can corroborate an indication that plant power level can be increased (or decreased) based on the CROSSFLOW derived  $C_f$  and the potential power change against other plant parameters (e.g., thermal kit, 1<sup>st</sup> stage turbine pressure, changes in steam flow and reactor coolant delta-T) and continue to trend performance to assure compliance with the plant's licensed power level.

Westinghouse/AMAG continues to stand firmly behind the CROSSFLOW technology to perform its intended function(s). The CROSSFLOW system is fully capable of delivering its intended design function of providing accurate feedwater flow measurement when properly installed and operated by qualified staff. The underlying CROSSFLOW technology has a well founded theoretical basis supported by confirmatory laboratory test and in-plant data. This data ranges from low Reynolds Numbers typical of testing laboratory capabilities to high Reynolds Numbers in the range of those found in typical plant feedwater systems. The majority of this information was provided to the NRC in support of the review and approval of the CROSSFLOW ultrasonic flow measurement technology and methodology documented in licensing topical report CENPD-397-P-A, Rev. 01 (Reference 1) which was approved by the NRC on March 20, 2000 (Reference 2). The topical report and NRC Safety Evaluation (SE) form the basis by which licensees implement requests for Appendix K MUR power uprate license amendments.

Westinghouse/AMAG have also assessed the information that was previously provided to the NRC in support of the staff review of the topical report (Reference 1), including the submittals associated with the response to additional RAIs (Reference 3). Based on our evaluations of the noted recent events, we have concluded that the information previously submitted remains valid for those conditions in which the CROSSFLOW meter was designed to function.

In the process of assessing these events and reaching the above conclusions, Westinghouse issued several vendor notices:

1. Technical Bulletin, TB-03-6, "CROSSFLOW Ultrasonic Measurement System Signal Issues," September 5, 2003
2. Nuclear Safety Advisory Letter, NSAL-03-12, "CROSSFLOW Ultrasonic Flow Measurement System Flow Signal Interference Issues," December 5, 2003
3. Technical Bulletin, TB-04-4, "Information Regarding Recent CROSSFLOW Ultrasonic Flow Measurement System Performance Observations," February 12, 2004

These documents were issued to all CROSSFLOW users and information copies were provided to the NRC.

These actions taken by Westinghouse/AMAG were taken proactively and conservatively to provide CROSSFLOW users and the NRC with early notification of performance observations at the two noted utilities via Technical Bulletin TB-04-4. Since, at the time of its issuance, it was not possible to completely rule out the potential for generic applicability, the Technical Bulletin was viewed as the best vehicle available to Westinghouse for promptly providing conservative recommendations that could be followed by all CROSSFLOW users to obtain reasonable assurance that a specific installation was still operating in conformance with the topical report and the NRC-approved Safety Evaluation. Westinghouse considers timely generic notification to its customers of potential issues to be prudent, even if, at the time of notification issuance, all aspects and causes have not been fully investigated.

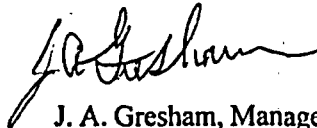
It is worth noting that in a recent letter (Reference 4) to the NRC regarding TB-04-4, the Westinghouse Owners Group (WOG) CROSSFLOW Task Force participants confirmed that they have "...evaluated the recommendations [contained in the TB] and confirmed that their current operating [CROSSFLOW] installations are performing within the acceptable limits and would be alerted, via system inherent diagnostics, if out of limit conditions are experienced."

Since issuing TB-04-4, Westinghouse/AMAG have investigated the performance observations from the above noted events and have concluded that they represent plant specific rather than generic installation issues. Nonetheless, Westinghouse/AMAG also have identified a number of lessons learned that can be applied to the benefit of all CROSSFLOW users. Some of these lessons have already resulted in CROSSFLOW procedural changes that will help CROSSFLOW users to avoid experiencing similar occurrences.

Although Westinghouse/AMAG are confident that reasonable assurance exists that current CROSSFLOW installations are performing properly, safely and within the licensing basis, we plan to assess these installations against the lessons learned. Plans call for these assessments to be conducted in two stages. First, CROSSFLOW applications supporting an Appendix K MUR power uprate will be completed by the end of August, 2004. CROSSFLOW applications supporting power recovery only will be completed by the end of September, 2004. Westinghouse/AMAG believes that these are prudent and conservative actions that will aid significantly to alleviate any remaining questions regarding the non-generic applicability of the noted events and associated performance observations and provide acceptable assurances of the soundness of the current installations.

As it has done since the onset of the subject performance observations, Westinghouse/AMAG will continue to keep its CROSSFLOW users, as well as the NRC, informed regarding ongoing progress and the ultimate conclusions drawn once all investigations and evaluations are completed. In the interim, please feel free to contact me regarding any questions that you may have regarding this matter.

Very truly yours,



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

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