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January 18, 2002  
LTR-NRC-02-3

*Proj 692*

U.S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
One White Flint North  
11555 Rockville Pike  
Rockville, Maryland 20852-2738

**SUBJECT: DESCRIPTION OF CROSSFLOW<sup>XT</sup> ULTRASONIC FLOW MEASUREMENT SYSTEM  
[Enclosure 1-P Contains Westinghouse Proprietary Class 2 Material]**

- 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, Revision-01-P, 'Improved Flow Measurement Accuracy Using CROSSFLOW Ultrasonic Flow Measurement Technology' (TAC No. MA6452)", March 20, 2000

Westinghouse Electric Company LLC (WEC) in conjunction with Advanced Measurement and Analysis Group, Inc. (AMAG) has developed an enhanced version of its CROSSFLOW ultrasonic flow measurement system (Reference 1). CROSSFLOW was approved by the Nuclear Regulatory Commission (NRC) on March 20, 2000 (Reference 2) for use in support of Appendix K power uprates. Enclosure 1-P describes the enhanced version of CROSSFLOW which is called CROSSFLOW<sup>XT</sup>. CROSSFLOW<sup>XT</sup> provides increased operational reliability along with improved flow measurement accuracy without significant change to the base hardware package described in CENPD-397-P-A, Rev. 01. At this time, installations of CROSSFLOW<sup>XT</sup> units in domestic nuclear power plants are pending, therefore, the enclosed description is for information purposes in order to keep the NRC apprised of ongoing product enhancements. CROSSFLOW<sup>XT</sup> is, therefore, not currently part of any Appendix K uprate application currently under review by the NRC. It should be noted that all modifications are based on technologies and well established statistical methodologies that have been previously reviewed and approved by the NRC. Therefore, we believe that the CROSSFLOW<sup>XT</sup> meter continues to comply with the requirements of the SER, Reference 2.

WEC has determined that the information contained in Enclosure 1-P is proprietary in nature. Consequently, it is requested that the information contained therein be withheld from public disclosure in accordance with the provisions of 10 CFR 2.790 and that copies provided herewith be appropriately safeguarded. The reasons for the classification of this information as

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proprietary are delineated in the affidavit provided in Enclosure 2. Enclosure 3 provides a non-proprietary version of the information.

If you have any questions regarding this matter, please do not hesitate to call Chuck Molnar of my staff at (860) 731-6286 or Chip French of our technical staff at (860) 731-6711.

Very truly yours,  
Westinghouse Electric Company LLC

A handwritten signature in black ink, appearing to read 'Philip W. Richardson', is written over the typed name and title.

Philip W. Richardson  
Licensing Project Manager  
Windsor Nuclear Licensing

Enclosure(s): As stated

xc: w/Enclosures

I. Ahmed (NRC)

J. S. Cushing (NRC)

E. C. Marinos (NRC)

# **WESTINGHOUSE ELECTRIC COMPANY LLC**

## **NON-PROPRIETARY DESCRIPTION OF CROSSFLOW<sup>XT</sup> ULTRASONIC FLOW MEASUREMENT SYSTEM**

**JANUARY, 2002**

## DESCRIPTION OF CROSSFLOW<sup>XT</sup> ULTRASONIC FLOW MEASUREMENT SYSTEM

### 1.0 Introduction

The purpose of this description is to keep the Nuclear Regulatory Commission (NRC) apprised of ongoing activities by Westinghouse Electric Company LLC (WEC) and Advanced Measurement and Analysis Group, Inc. (AMAG) to further enhance both the reliability and the accuracy of the CROSSFLOW ultrasonic flow meter. The CROSSFLOW system technology and methodology was documented in CENPD-397-P-A, Rev. 01, "Improved Flow Measurement Accuracy Using CROSSFLOW Ultrasonic Flow Measurement Technology", (Reference 6.1) and approved by the NRC on March 20, 2000 (Reference 6.2), for improved feedwater flow measurement accuracy for use in support of Appendix K power uprates. By employing CROSSFLOW ultrasonic flow measurement technology a utility can, subject to NRC approval, increase the thermal output of a nuclear power plant by taking credit for the reduction in the uncertainty of the secondary heat balance measurement.

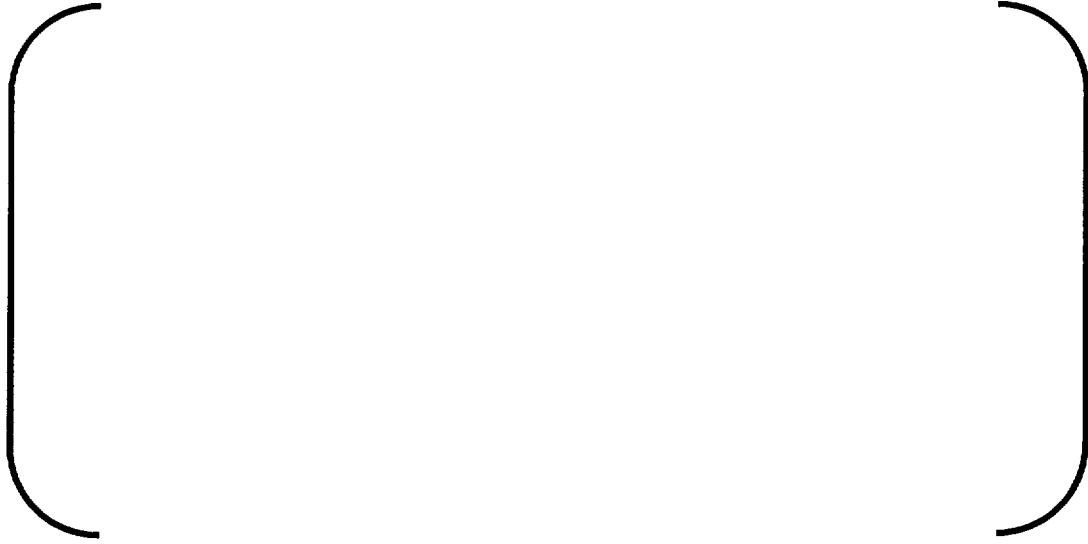
WEC and AMAG continuously strive to improve the CROSSFLOW system to further enhance its inherent reliability and accuracy and make it more user friendly for utility personnel. The next evolution for an enhanced CROSSFLOW system is called CROSSFLOW<sup>XT</sup>. The CROSSFLOW<sup>XT</sup> improvements in reliability and accuracy are achieved predominantly through statistical methods. There are no significant changes to the fundamental design or to the methods of implementation already approved by the NRC. [

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### 2.0 Modified M/TSF Design

Section 3.1.1.2 of CENPD-397-P-A, Rev. 1 describes the current saddle-type M/TSF design. Figure 3-3 of the same reference contains a picture the M/STF. The modified design contains [

] construction used on the original CROSSFLOW design as shown below:



### 3.0 Modified Signal Conditioning Unit

Section 3.1.4 of CENPD-397-P-A, Rev. 1 describes the SCU that generates the ultrasonic signal that is passed through the fluid to measure the fluid velocity. 【

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### 4.0 Implementation of the Ultrasonic Meter Upgrades

The improvements in reliability and accuracy for CROSSFLOW<sup>XT</sup> are achieved by performing multiple simultaneous independent flow measurements using the same methodology described in CENPD-397-P-A, Rev. 1.

Referring to Section 5.1 of CENPD-397-P-A, Rev. 1, the flow equation for the CROSSFLOW meter is defined as:

$$W_{\text{feedwater}} = C_f \frac{\rho A L}{t_{\text{delay}}}$$

WESTINGHOUSE NON-PROPRIETARY CLASS 3

where:  $W_{feedwater}$  = feedwater flow

$C_f$  = velocity profile correction factor

$\rho$  = density of the feedwater

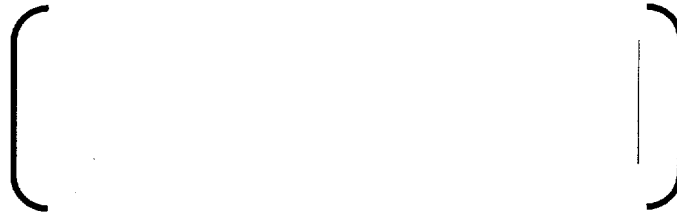
$A$  = cross-sectional flow area of the pipe

$L$  = spacing between the upstream and downstream transducers stations

$t_{delay}$  = time that it takes for the eddies within the flow to pass between the two transducers stations

[

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4.1 [

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[

]. This approach conforms to the methods of inside pipe diameter measurement, thus it also meets the requirements of the SER, Reference 6.2.

4.2 [

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4.3 Uncertainty Analysis

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#### 4.4 Implementation

Section 5.6.1 of CENPD-397-P-A, Rev. 1 outlines the requirements for determining the VPCF. These same requirements apply to the CROSSFLOW<sup>XT</sup> meter. [

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#### 5.0 Conclusions

In conclusion, the above information describes the enhanced CROSSFLOW<sup>XT</sup> meter and how it achieves a higher level of reliability and flow measurement accuracy simply by modifying the previously approved CROSSFLOW meter to [

]. Moreover, all modifications are based on technologies and well established statistical methodologies that have been previously reviewed and approved by the NRC. Therefore, we believe that the CROSSFLOW<sup>XT</sup> meter continues to comply with the requirements of the SER, Reference 6.2.

#### 6.0 References

- 6.1 CENPD-397-P-A, Revision 1, "Improved Flow Measurement Accuracy Using CROSSFLOW Ultrasonic Flow Measurement Technology", May 2000
- 6.2 Transmittal Letter to Ian Rickard (ABB-CE) from Stuart Richards (NRC), "Acceptance for Referencing of CENPD-397-P, Revision-01-P, 'Improved Flow Measurement Accuracy Using CROSSFLOW Ultrasonic Flow Measurement Technology' (TAC No. MA6452)", March 20, 2000



## **Westinghouse Electric Company LLC**

### **Copyright Notice**

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**WESTINGHOUSE ELECTRIC COMPANY LLC**

**PROPRIETARY AFFIDAVIT**

**FOR**

**DESCRIPTION OF CROSSFLOW<sup>XT</sup>**

**ULTRASONIC FLOW MEASUREMENT SYSTEM**

**Proprietary Affidavit**

I, Philip W. Richardson, depose and say that I am the Licensing Project Manager, Windsor Nuclear Licensing, of Westinghouse Electric Company LLC (WEC), duly authorized to make this affidavit, and have reviewed or caused to have reviewed the information which is identified as proprietary and described below.

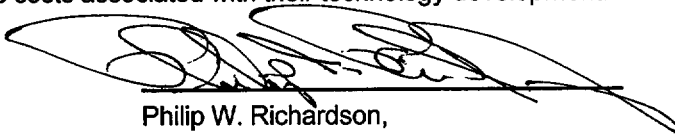
I am submitting this affidavit in conformance with the provisions of 10 CFR 2.790 of the Commission's regulations for withholding this information. I have personal knowledge of the criteria and procedures utilized by WEC in designating information as a trade secret, privileged, or as confidential commercial or financial information.

The information for which proprietary treatment is sought, and which documents have been appropriately designated as proprietary, is contained in the following:

Enclosure 1-P to LTR-02-3, "Description of CROSSFLOW<sup>XT</sup> Ultrasonic Flow Measurement System",  
January 18, 2002, LTR-02-3

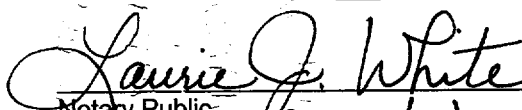
Pursuant to the provisions of Section 2.790(b)(4) of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information included in the documents listed above should be withheld from public disclosure.

- i. The information sought to be withheld from public disclosure is owned and has been held in confidence by WEC. It consists of information concerning implementation of the CROSSFLOW<sup>XT</sup> ultrasonic flow measurement system.
- ii. The information consists of test data or other similar data for the design, development and implementation of the CROSSFLOW<sup>XT</sup> ultrasonic flow measurement system, the application of which results in substantial competitive advantage to WEC.
- iii. The information is of a type customarily held in confidence by WEC and not customarily disclosed to the public.
- iv. The information is being transmitted to the Commission in confidence under the provisions of 10 CFR 2.790 with the understanding that it is to be received in confidence by the Commission.
- v. The information, to the best of my knowledge and belief, is not available in public sources, and any disclosure to third parties has been made pursuant to regulatory provisions or proprietary agreements that provide for maintenance of the information in confidence.
- vi. Public disclosure of the information is likely to cause substantial harm to the competitive position of WEC because:
  - a. A similar product is manufactured and sold by major competitors of WEC.
  - b. WEC invested substantial funds and engineering resources in the development of this information. A competitor would have to undergo similar expense in generating equivalent information.
  - c. The information consists of implementation plans for the use of the CROSSFLOW<sup>XT</sup> ultrasonic flow measurement system, the application of which provides a competitive economic advantage. The availability of such information to competitors would enable them to design their product to better compete with WEC, take marketing or other actions to improve their product's position or impair the position of WEC's product, and avoid developing similar technical analysis in support of their processes, methods or apparatus.
  - d. In pricing WEC's products and services, significant research, development, engineering, analytical, manufacturing, licensing, quality assurance and other costs and expenses must be included. The ability of WEC's competitors to utilize such information without similar expenditure of resources may enable them to sell at prices reflecting significantly lower costs.
  - e. Use of the information by competitors in the international marketplace would increase their ability to market a competing product, reducing the costs associated with their technology development.



Philip W. Richardson,  
Licensing Project Manager  
Westinghouse Electric Company LLC

Sworn to before me this 18<sup>th</sup> day of January, 2002

  
Notary Public  
My commission expires: 8/31/04