



8 March, 2000  
LD-2000-0017

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U. S. Nuclear Regulatory Commission  
Attn: Document Control Desk  
Washington, D.C. 20555

**SUBJECT: RESPONSE TO VERBAL REQUEST FOR ADDITIONAL INFORMATION  
REGARDING NRC REVIEW OF CENPD-397, REV. 1  
{CONTAINS PROPRIETARY INFORMATION}**

References: Letter I. C. Rickard (ABB CENP) to USNRC Document Control Desk, "Submittal of CENPD-397-P, Rev. 01 - Improved Flow Measurement Accuracy Using CROSSFLOW Ultrasonic Flow Measurement Technology", LD-2000-0002, January 6, 2000 {Contains Proprietary Information}

Messrs. John Donoghue and Iqbal Ahmed, both of the Nuclear Regulatory Commission (NRC), contacted Mr. Charles French of ABB C-E Nuclear Nuclear Power, Inc. (ABB CENP) regarding their review of CENPD-397, Rev. 01, "Improved Flow Measurement Accuracy Using CROSSFLOW Ultrasonic Flow Measurement Technology". CENPD-397, Rev. 01 was submitted to the NRC on January 2, 2000 via the referenced ABB CENP letter. Specifically, three (3) questions were asked during a telephone conference call on March 2, 2000. Although the questions have already been responded to verbally, this letter transmits ABB CENP's formal response.

Enclosure 1-P contains the three questions and ABB CENP's responses. ABB-CE has determined that Enclosure 1-P contains information that is PROPRIETARY in nature. Consequently, it is requested that Enclosure 1-P be withheld from public disclosure in accordance with the provisions of 10 CFR 2.790 and that these copies be appropriately safeguarded. The reasons for the classification of this information as PROPRIETARY are delineated in the affidavit provided in Enclosure 2. Enclosure 3 provides a NON-PROPRIETARY copy of ABB CENP's response.

Information in this record was deleted in accordance with the Freedom of Information Act Exemptions  
FOIA/PA 2008-0046

**ABB C-E NUCLEAR POWER, INC.**

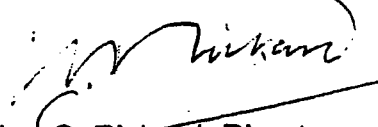
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If you have any questions concerning this matter, please do not hesitate to call me or Chuck Molnar of my staff at (860) 285-5205.

Very truly yours,  
ABB C-E NUCLEAR-POWER, INC.



Ian C. Rickard, Director  
Nuclear Licensing

Enclosure: As stated

xc: I. Ahmed (NRC)  
J. S. Cushing (NRC)  
J. E. Donoghue (NRC)

**ABB C-E Nuclear Power, Inc.**

**NON-PROPRIETARY RESPONSE  
TO VERBAL REQUEST FOR ADDITIONAL INFORMATION REGARDING  
NRC REVIEW OF CENPD-397, REV. 1**

**NON-PROPRIETARY RESPONSE TO VERBAL REQUEST FOR ADDITIONAL INFORMATION  
REGARDING NRC REVIEW OF CENPD-397, REV. 1**

Messrs. John Donoghue and Iqbal Ahmed, both of the Nuclear Regulatory Commission (NRC), contacted Mr. Charles French of ABB C-E Nuclear Power, Inc. (ABB CENP) regarding their review of CENPD-397, Rev. 01, "Improved Flow Measurement Accuracy Using CROSSFLOW Ultrasonic Flow Measurement Technology". ABB CENP's responses to the three (3) questions follows:

**Question 1:**

[ ~~Ex 4~~ ]

] ~~Ex 4~~

**Response:**

[ ~~Ex 4~~ ]

~~Ex 4~~ ]

**Question 2:**

What are the bases for Equation 5-24 in CENPD-397-P Rev. 01?

**Response:**

[ Ex 4 ]

Ex 4 ]

Original paragraph Section 5.6: [ Ex 4 ]

Ex 4 ]

Modified paragraphs, Section 5.6: [ Ex 4 ]

Ex 4 ]

[~~4~~ 4

4 ]

**Question 3:**

[ *Ex 4* ]

*Ex 4* ]

**Response:**

The Alden Calibration curve for the CROSSFLOW meter has an uncertainty of +0.25%. Thus, a specific data point can fall above or below this curve by as much as 0.25% and still be acceptable. This criterion for acceptability is consistent with Nuclear Industry practice for venturis. Each venturi is calibrated at a hydraulic laboratory under low Reynolds number conditions and is assigned an uncertainty equal to the uncertainty of the calibrating instrument - for the Alden Research laboratory, this value is +0.25%. The venturis are then operated at much higher Reynolds numbers with no additional compensation for a higher uncertainty.

To help clarify these differences in the Topical Report Sections 4.3 and 5.6.2 will be modified as follows:

**Original paragraph, Section 4.3:** An accurate curve has been developed for the VPCF that is only a function of Reynolds Number. This curve assumes that the velocity profile is fully developed and that pipe wall friction is small. The use of plastic piping for the calibration provides a limiting condition that assures that the velocity measured by the CROSSFLOW cross-correlation meter will be equal to or greater than the actual velocity of the fluid. This in turn assures that the mass flow and, hence, the thermal power will be equal to or greater than the actual output of the reactor - a conservative condition.

Moreover, the high Reynolds Number tests confirmed that the calibration curve, which was developed at low Reynolds Numbers, is also applicable at higher values which includes those conditions that would be encountered in operating nuclear power plant feedwater systems.

**Modified paragraph, Section 4.3:** An accurate curve has been developed for the velocity profile correction factor that is only a function of Reynolds number. This curve assumes that the velocity profile is fully developed and that the pipe wall friction is small. The use of plastic piping for the calibration provides a limiting condition that maximizes the velocity measured by the CROSSFLOW meter.

To demonstrate the accuracy of the Alden Calibration curve, which has been extrapolated from a Reynolds number of 7 million to nearly 30 million in Figure 4-2, two plant data points have been superimposed on the curve. These points help to confirm that the calibration curve, which was developed using Reynolds Numbers below 7 million, is also applicable at higher Reynolds numbers that would be encountered in the feedwater systems of operating nuclear power plants.

It will be observed that the two data points do not lie on the curve but are slightly above and below it. This does not create a concern, because the Alden Calibration curve for the CROSSFLOW meter has an uncertainty of +0.25%. Thus, a specific data point can fall above or below this curve by as much as 0.25% and still be acceptable. This criterion for acceptability is consistent with Nuclear Industry practice for venturis. Each venturi is calibrated at a hydraulic laboratory under low Reynolds number conditions and is assigned an uncertainty equal to the uncertainty of the calibrating instrument - for the Alden Research laboratory, this value is +0.25%. The venturis are then operated at much higher Reynolds numbers with no additional compensation for a higher uncertainty.

Original paragraph, Section 5.6.2: [ *Ex 4* ]

*Ex 4* ]

Modified paragraph, Section 5.6.2: [ *Ex 4* ]

*Ex 4* ]