UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

November 3, 1999

MEMORANDUM TO: Docket File

FROM: Jack Cushing, Project Manager, Section 2
Project Directorate IV & Decommissioning
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

SUBJECT: ABB COMBUSTION ENGINEERING - FACSIMILE TRANSMISSION REGARDING QUESTIONS CENPD-397-P (TAC NO. MA6452)

The attached questions were transmitted by fax on October 26, 1999, to Mr. Charles Molnar of ABB/CE to prepare him and others for an upcoming telephone call. This memorandum and the attachment do not convey a formal request for information or represent an NRC staff position.

Attachment: As stated

DF03

PDR To PECA.

REQUEST FOR ADDITIONAL INFORMATION REGARDING

TOPICAL REPORT CENPD-397-P, "IMPROVED FLOW MEASUREMENT ACCURACY

USING CROSSFLOW MEASUREMENT TECHNOLOGY."

1. Figure 2-2 compares the plot of the velocity profile correction factor (VPCF) vs. Reynolds number to experimental results. The topical report claim of high confidence in the extension of the VPCF to high Reynolds number is supported by only one data point. Provide additional data for high Reynolds numbers (i.e., above $15x10^6$) plotted in Figure 2-2, or provide additional basis for the topical report claim.

2. The topical report associates Equations 2-15 and 2-19 with Reference 2-1 (Schlichting), yet the equations do not appear in the same form in the Schlichting reference. Provide the basis for the equations using a derivation traceable to something in Schlichting or some other source.

3. Summarize the detailed analysis mentioned in Section 2.3 supporting Equation 2-22 or provide the reference(s) containing the supporting analysis.

4. Section 3.4.1 discusses the intended application of the Crossflow system. The Crossflow output is not to be directly used as input to the calorimetric calculation of thermal power, but to provide data to adjust the venturi flowmeter flow coefficient. What uncertainty components are introduced in the calibration of the venturi measurement from the Crossflow data? How are venturi-related uncertainties accounted for in power measurement in order to support a reduced (i.e. less than 2 percent) margin? Provide supporting details.

5. How were values of measured C_o given in table 4-1 determined (appears to be inverse of Equation 4-9)? What measurement or supporting experimental information is represented by V* in the table?

6. Equation 4-6 should be the inverse of Equation 4-3, but Equation 4-6 appears to be missing the V_a term. If the omission is confirmed, provide corrections to equations and other material in the topical report that follow from Equation 4-6.

7. Explain the apparent disparity among the curves and plant data depicted in Figures 2-2, 4-1, and 4-2.

8. Explain the basis of the accuracy claim for velocity profile correction factor (in Section 4.1) at high Reynolds number (Re above $15x10^6$).

9. Provide Reference 4-2.

10. What is the effect of corrosion products on the ultrasonic measurement of inside pipe diameter discussed in Section 5.4.1 of the topical report?

11. Explain why sensor angular orientation relative to the flow disturbance is not a factor in determining the pipe configuration correction factor (Equation 5-24)?

12. Error analysis and uncertainty calculation based on square root sum-of-the-squares methods discussed in Section 5 must use contributors that are random, normally

distributed, and independent. Explain how, for a specific installation, that each of the terms in Equation 5-34 can be assured to meet the randomness, distribution, and independence requirements. For example, explain how independence of the profile correction factor and feedwater density error terms is assured if each error involves measurement of feedwater temperature using the same instrumentation.

13. Explain the basis for the flow disturbance factor (ΔC) in Equation 5-24.

14. How does the internal time delay check mentioned in Sections 3.3.5 and 5.8 confirm the values input to Equation 5-29 (the time delay confidence interval)? Explain how the terms on the right side of Equation 5-29 are independent.

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