

THE BABCOCK & WILCOX COMPANY
POWER GENERATION GROUP

(14)

to G. A. MEYER, MANAGER, T-H ENGINEERING UNIT

THE-79-194

from *sent for JAN*
J. A. WEIMER, T-H ENGINEERING UNIT, EXT. 3236

805 663.5

subject. TMI-2

File No.
or Ref.

subject. INCORE THERMOCOUPLE ERROR EVALUATION

Date
APRIL 10, 1979

This letter is cover one customer and one subject only.

AN ANALYSIS WAS DONE TO DETERMINE THE MAGNITUDE OF INCORE THERMOCOUPLE ERRORS FOR TMI-2 PRIOR TO MARCH 28, 1979. THIS ANALYSIS WAS BASED ON A TEMPERATURE AND POWER DISTRIBUTION AT 98% AND 16% FULL POWER. THIS WORK ASSUMES THAT THE INLET AND OUTLET RTD (RESISTANCE TEMPERATURE DETECTOR) TEMPERATURES AND POWER DISTRIBUTIONS WERE CORRECT, AND IN ADDITION, ASSUMED A CONSERVATIVE + 3°F DIFFERENCE BETWEEN THE CORE OUTLET AND VESSEL OUTLET TEMPERATURE AT 98% POWER. THIS RESULTS IN A 0.5°F DIFFERENCE AT 16% POWER. MORE REALISTIC TEMPERATURE DIFFERENCES (IE. 2°F AT 98% FP AND .2°F AT 16% FP) WOULD INCREASE THE PREDICTED T-C ERRORS SLIGHTLY.

THE METHOD USED FOR THIS ANALYSIS WAS BASED ON A KNOWN BUNDLE DELTA ENTHALPY, AND FLOW RATES (FROM ONLINE COMPUTER (OLC)) FOR AN AVERAGE POWER BUNDLE (RELATIVE POWER = 1.0). THE EQUATION USED FOR THIS ANALYSIS IS:

$$H_{OUT_2} = \frac{Q_2}{Q_1} \times \frac{W_1}{W_2} \times (H_{OUT_1} - H_{IN_1}) + H_{IN_1}$$

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WHERE

Q_2 = RELATIVE POWER OF BUNDLE FOR EACH CALCULATION (FROM OLC)

Q_1 = RELATIVE POWER OF BUNDLE FOR AN RPD OF 1.0

Q_1 = 1.0

W_1 = BUNDLE FLOW FOR AN RPD OF 1.0 (FROM OLC)

W_2 = BUNDLE FLOW OF BUNDLE FOR EACH CALCULATION (FROM OLC)

$H_{OUT_1} - H_{IN_1}$ = DELTA ENTHALPY FOR AN RPD OF 1.0

RPD = RELATIVE POWER DIFFERENCE (NORMALIZED TO AVERAGE ASSEMBLY POWER)

H_{OUT_2} = CALCULATED BUNDLE OUTLET ENTHALPY FOR EACH BUNDLE.

H_{OUT_2} IS THEN CONVERTED TO T_{OUT} AND COMPARED TO THE MEASURED T_{OUT} (T-C READING). THIS ANALYSIS (AT 98% AND 16% FP) WAS EXTRAPOLATED TO 1% FP.

ANY INHERENT ERRORS ON THE OLC FLOW AND RPD CALCULATIONS ARE ELIMINATED BY THIS RATIOING METHOD. THEREFORE, THE ONLY REAL UNCERTAINTY IS IN THE H_{OUT_1} AND H_{IN_1} MEASUREMENTS. THESE WERE ASSUMED CORRECT FOR THIS ANALYSIS.

THE RESULTS OF THIS ANALYSIS INDICATE AN AVERAGE + 7.94°F ERROR AT 98%, AND A + 5.59°F ERROR AT 16% POWER. THIS EXTRAPOLATES TO A + 5.16°F ERROR AT 1% POWER.

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ASSUMING NO DAMAGE OCCURRED TO THE T-C'S DURING THE TRANSIENT OF MARCH 23, 1979 AT TMI-2 THESE RESULTS WOULD APPLY TO THE PRESENT T-C READINGS, THUS IT IS POSSIBLE THAT THE INCORE THERMOCOUPLE READINGS PRESENTLY BEING OBTAINED ARE HIGH BY AN AVERAGE OF 5°F.

FINALLY, THE AVERAGE T-C ERRORS WERE CALCULATED AS A FUNCTION OF DIFFERENT POSITIONS IN THE CORE. THE RESULTS SHOW NO INHERENT CORE REGION DEPENDENCY.

JAW/SGH

CC: FE UNIT MANAGERS
J. S. TULENKO
CORE HOT SPOT TASK FORCE

QA: THE METHOD AND CALCULATIONS WERE REVIEWED AND FOUND TO BE CORRECT AND CONSISTENT WITH THE STATED ASSUMPTIONS.

Burns for RL Lane DATE *4/10/79*

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