NORTHEAST UTILITIES

THE CONNECTICUT LIGHT AND POWER COMPANY
WESTERN MASSACHUSETTS ELECTRIC COMPANY
HOLYOKE WATER POWER COMPANY
NORTHEAST UTILITIES SERVICE COMPANY
NORTHEAST NUCLEAR ENERGY COMPANY

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ED-RTH-92-231
January 6, 1993

Mr. Ted Stevenson
Coltec Industries
Fairbanks Morse Engine Division
701 Lawton Avenue
Beloit, WI 53511

References:

1. Coltec Engineering Report R-6.00-0260, dated 4/28/92: "Millstone Unit No. 1 Cooling Capacity Analysis - Performance of Heat Exchangers Under Various Operating Conditions".

2. Coltec Engineering Report R-6.00-0260, dated 1/10/92: "Millstone Unit No. 2 Heat Exchanger Performance - System Performance Under Cooling Water Flow Conditions Outside the Design Basis -Final Report".

3. Code of Federal Regulations, Title 10, Part 21

Dear Sir:

It is the opinion of Northeast Utilities Service Company (NUSCO) that the heat exchanger calculations performed by Coltec Industries/FMED for the Millstone Point Nuclear Power Station Units 1 and 2 Emergency Diesel Generators (EDG) are in error and that the actual cooling water flow requirements are greater than specified in the referenced Coltec Engineering Reports. Details of this error are described in the attachment to this letter.

As part of your responsibilities under 10CFR, Part 21, Coltec Industries should evaluate all heat transfer analyses performed for other NRC licensed or otherwise regulated nuclear facilities to determine if the NUSCO identified defects adversely effect the conclusions of engineering analysis supplied to other nuclear facilities. If the NUSCO identified defects are discovered to adversely effect engineering analysis supplied to other nuclear facilities, Coltec Industries should review 10CFR, Part 21 and any internal procedures used to implement the requirements of 10CFR, Part 21 to determine reporting and notification requirements for these facilities.

Please call Peter Tirinzoni at (203)665-3387 with specific technical questions or Tom Silko at (203)665-5241 with specific Licensing questions.

If you have any other questions, please do not hesitate to contact me.

Sincerely,

R. T. Harris

R. T. Harris, Director
Engineering Department

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c: L. J. Norrholm, NRC - Chief Vendor Inspection Branch

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Coltec Industries/Fairbanks Morse Engine Division has performed heat exchanger performance analysis to determine the minimum required cooling water flow to the Millstone Point Nuclear Power Station Units 1 and 2 Emergency Diesel Generators (EDG). This analysis was performed using a commercial heat exchanger analysis program called Shell and Tube Exchangers, developed by the Thermal Analysis Systems Company. This analysis program utilized the Kern correlation for establishing the shell-side film coefficient.

Northeast Utilities Service Company (NUSCO) has researched the Kern correlation and found that it was developed using test data from heat exchangers with a 25% baffle cut (baffle cut is defined as the fraction of a segmented baffle or support plate that is cut off to allow passage of the shell-side fluid, expressed as a percentage of the shell internal diameter). The Kern method agrees well with test data for these heat exchanger (i.e. 25% baffle cut), however it is limited in it's application since there are no correction factors to account for baffle cuts other than 25%. With all other characteristics remaining consistent, the efficiency of a heat exchanger will be reduced as the baffle cut increases, since less of the tube bundle will be in pure cross-flow.

The Millstone Point Units No. 1 and 2 EDG heat exchangers have baffle cuts of 35% and 45%. If a 25% baffle cut is assumed in analyzing the performance of these heat exchangers, then the shell-side film coefficient will be overpredicted, thus resulting in a non-conservative minimum required cooling water flowrate. For the case of the Millstone Unit No. 2 EDG heat exchangers, the Kern correlation predicted the shell-side film coefficients to be 25% greater than predicted by correlations that account for various baffle cuts. Correcting the shell-side film coefficient for the appropriate baffle cut increases the minimum required cooling water flowrate by 40% compared to that specified by Coltec in the reference 2 report.

NUSCO also detected an apparent non-conservatism in Coltec's implementation of the Kern correlation. The Kern correlation requires the viscosity be calculated at the bulk fluid temperature when determining the shell-side Reynolds number, however, it appears that Coltec calculated the fluid viscosity using the shell-side wall temperature. Although it is a common practice to neglect the viscosity correction term (the viscosity at the wall temperature divided by the viscosity at the bulk fluid temperature, raised to the .14 power), analyzing the fluid viscosity at the wrong temperature linearly impacts the calculated Reynolds number. Calculating a higher than expected Reynolds number will inflate the shell-side film coefficient, again resulting in a non-conservative minimum required cooling water flowrate.

Based upon these concerns, the Coltec Engineering Reports provided for the Emergency Diesel Generators at the Millstone Nuclear Power Station Unit No.s 1 and 2 are considered to be in error. This conclusion has been confirmed through an independent evaluation by a NUSCO consultant and by the Millstone 2 EDG heat exchanger manufacturer (BASCO), using the Heat Transfer Research Institute (HTRI) heat exchanger analysis computer code.

For the Emergency Diesel Generators at Millstone Units 1 and 2, NUSCO has performed subsequent heat exchanger analyses which account for the inefficiencies associated with the actual heat exchanger baffle cuts (35% or 45%, as appropriate). Although these calculations establish a required cooling water flowrate greater than that specified in the reference 1 and 2 Coltec Engineering reports, the cooling water flow predicted to be available under degraded conditions exceeds the required flowrate under the limiting system alignment for both Millstone Unit No.s 1 and 2.