Brown & Root, Inc. Post Office Box Three, Houston, Texas 77001

79-NL-203

August 1, 1979

Mr. L. G. Hulman
Chief of Hydrology & Meteorology Section
Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Hulman:

We have a copy of "GENERIC EMERGENCY COOLING POND ANALYSIS" by J. E. Edinger, et al. prepared for the Commission under contract no. AT (11-1)-2224.

We have found that the friction factor as defined in the equations (4.7) and (4.8b) of the manual are incorrect. Since, there were no references for the section titled "The Friction Factor, f" (pg. 42 of the manual), we are attaching a derivation of the friction factor as defined in "OPEN CHANNEL HYDRAULICS" by V. T. Chow, Ph.D. (McGraw Hill - 1959).

The friction factor is an input to the Metmin code to estimate thermal transport diffusivity parameter for use in the Hyeta code. We made computer runs using Metmin. The friction factors were varied to assess the impact on the Metmin results. The results indicated no change except for the thermal transport diffusivity parameter.

If you have any questions, please contact S. P. N. Singh, phone (713) - 676-7818.

Very truly yours,

BROWN & ROOT, INC.

A. H. Geisler

A. H. Geisler, Manager
Nuclear Licensing

AHG/SPNS/vh

cc: M. J. Meyer
P. S. Jordan
F. H. Pomes
G. S. Millas

Attachment I

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ATTACHMENT I

The Friction Factor, f:

(Ref. OPEN CHANNEL HYDRAULICS, V. T. Chow, Ph.D.
McGraw Hill Book Company - 1959)

The equation for the friction factor is written as

$$f = \frac{8gRS}{V^2}$$

where

R = hydraulic radius (ft)
S = energy gradient (h_f/L)
V = velocity (ft/sec)
g = gravitational const (ft/sec^2)

The well known Manning Formula is written as

$$V = \frac{1.49}{n} R^{2/3} S^{1/2}$$

where n = coefficient of roughness (Manning's)

The Chézy Formula is usually expressed as follows:

$$V = C_h \sqrt{RS}$$

C_h = factor of flow resistance, called Chezy's C

Comparing the Chézy Formula with Manning's Formula

$$C_h = \frac{1.49}{n} R^{1/6}$$

This equation provides a relationship between Chézy's C and Manning's n.

From Chézy's Formula

$$C_h^2 = \frac{V^2}{RS}$$

The friction factor f can now be written in terms of C_h

$$f = \frac{8g}{C_h^2}$$

Relationship of C_h and n provides another relationship of

$$f = \frac{8g \quad n^2}{(1.49)^2 \; R^{1/3}}$$

where R = D/4 (D = hydraulic diameter)

$$f = \frac{8x(4)^{1/3} \; n^2}{(1.49)^2 \; D^{1/3}}$$