National Commission on Air Quality

July 10, 1980

Mr. Walt Pasciak
Radiological Assessment Branch
Division of Systems Integration
U. S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Walt:

I have reviewed the comments on "A Method for Calculating Doses to the Population from ^{133}Xe Releases During the Three Mile Island Accident" that were provided with your 9 June 1980 letter.

The reviewer comments on the derivation of the $^{X}/_{Q}$ values in Table 1 do not seem warranted. The atmospheric dispersion model is properly referenced and the modifications to the model and the uncertainties associated with its application are discussed on pages 10 and 11.

The reviewer comment on use of the assumption of concentration decreasing as distance to the 1.5 power is interesting, particularly in the assertion that the assumption is "not valid for sustained gound level releases (or at distances where such may be assumed.)" If this assumption is valid anytime, it is for ground level releases. A few quick calculations from Turner's "Workbook of Atmospheric Dispersion Estimates" may illustrate the point. Most of the releases at Three Mile Island were made during slightly stable ("E" stability) conditions. I've enclosed a copy of Figure 3.5E from Turner's Workbook to illustrate the decrease of downwind centerline concentrations (as computed from the simple Gaussian straight-line model) for various release heights during E stability conditions. Note that only for a ground level release does concentration monotonically decrease with distance with a slope that approaches $-^{3}/_{2}$, particularly for distances greater than 1 km. Of course, building wake effects would distort the shape of the concentration curve close to the source and reduced mixing heights and reflection off the surface and inversions distort the shape of the curve at very long distances, approaching 100 km. However, the uncertainties of $^{X}/_{Q}$ at such long distances are probably more a function of the validity of assumed straight-line airflow and the representativeness of single-station meteorological data. Using the sector-spread model for E stability and an assumed ground level release also results in the slope of concentration versus downwind distance approximately $-^{3}/_{2}$. Using the sigma-Z curves of Turner (which probably vary slightly from those used by the NRC) for E stability relative concentrations can be easily calculated for a ground level release by the formula:

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$$X/Q = \frac{2.032}{\sigma_z u x}$$

X	σ_z	Xu/Q
100m	3.5m	5.8E-3
1000	21	9.7E-5
10000	70	2.9E-6
100000	200	1.0E-7

The slope of concentration with downwind distance is approximately $-3/2$, particularly for distances greater than 1 km.

For the specific reviewer comments on the text, I offer the following observations:

(1) P 10 Wind speed reduction factor footnote -- The assumption of a power law to represent a wind profile is <u>not</u> dependent on downwind distances, as the reviewer implies. The use of 30.4m level wind speed and direction measurements was believed to best represent airflow characteristics throughout the region of interest.

(2) P 10, L 8 -- The reviewer cannot make a case for either purely ground level or purely elevated releases. Some modifier should be used to indicate the uncertainty of the type of release.

(3) P 10, L 10 -- The model is not an "interpolation" model as the reviewer indicates; however, a straight-line assumption was made to interpolate X/Q values from Tables 2 and 3. Perhaps the reviewer was confused.

(4) P 12 Exclusion of more distant receptors -- If the basis for the reviewer's concern is the applicability of the $X^{-1.5}$ assumption, then the comment is not relevant given the previous discussion of this assumption.

Give me a call if you want to discuss my comments.

Sincerely,

James E. Fairobent

Enclosures

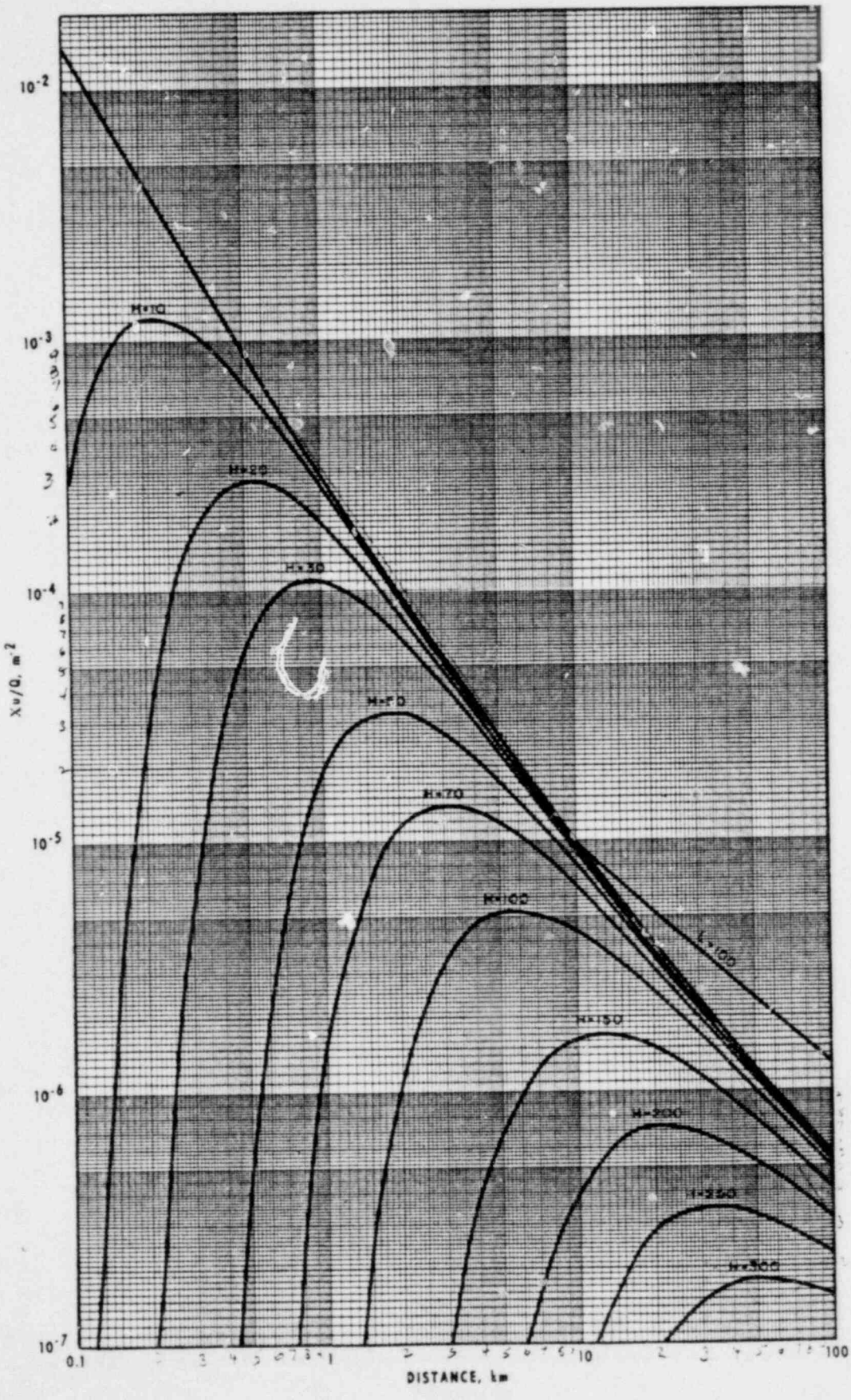

Figure 3-5E. xu/Q with distance for various heights of emission (H) and limits to vertical dispersion (L), E stability.