Letter to the Editor

Dear Sir,

I note in the recent review in the Journal of Keith Gugan's book "Unconfined Vapour Cloud Explosions"*, your reviewer referred to my mortality index. This has the form:

$$M_I = 4 \times \text{(tonnes of explosives)}^{-\frac{1}{2}}$$

The index comes from my paper "How lethal are explosions and toxic excapes?" [1] and I would like to pass further comment on it.

The paper pointed out that the exponent of $-\frac{1}{2}$ probably reflected the under-reporting of non-fatal incidents involving small quantities, e.g. less than 1 tonne. In consequence the slope of this line would thereby be steepened. In a later paper "Physical implications of major hazards" [2] I refined this index so that it became:

$$M_I = P_D M^{-1/3}$$

where P_D = population density in thousands per sq. kilometre and M = mass of explosive in tonnes.

Assuming that the two equations are compatible the figure 4 in the first equation would imply that the mean population density in the region of the accidental explosions studied in order to derive this equation, was 4,000 per square kilometer. This figure corresponds to low density suburban housing; it coincides in fact with the population density which was assumed for Canvey Island by the team which produced the UK Canvey Island Report.

Dr. Gugan points out in his book that my estimate of the mortality index for vapour clouds gives similar values to the mortality index for dense explosives even though vapour cloud explosions are seldom equivalent tonne for tonne to an equal mass of TNT. (On the average one tonne of flammable vapour gives a yield of around ½ a tonne of TNT.)

I agree with Dr. Gugan in believing that the mortality index for unconfined vapour cloud explosions is higher than would arise from their equivalent in TNT, because of the additional deaths caused by fire.

In saying this I am conscious of the limitations of the TNT model as a basis for estimating the yield of vapour cloud explosions. However, it has to be conceded that we are dealing here with very approximate figures.

Your reviewer suggests that how people meet their end in such events is an academic matter but I do not agree with him. The application of this knowledge may reduce the number of deaths in future disasters.

V.C. MARSHALL
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References

1 The Chemical Engineer, August 1977.
2 Proceedings of the Seminar on Major Chemical Hazards, April 1978, published by Harwell, Oxon.