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Letter to the Editor

Comment on:

"Evaluation of Vapour Cloud Explosions by Damage Analysis"

by: H. Giesbrecht, J. Hazardous Materials, 17 (1988) 247–257.

It was very instructive to read Dr. Giesbrecht's paper: "Evaluation of Vapour Cloud Explosions by Damage Analysis" [1]. In this paper Dr. Giesbrecht analysed a vapour cloud explosion which happened at the "Rheinische Olefinwerke Wesseling" (ROW) on January 18th, 1985. As part of this analysis he tried to deduce the total amount of hydrocarbons involved in the combustion of the vapour cloud in this incident from observed blast damage. Several methods were used but where TNO's Multi-Energy method [2] was applied for this purpose I feel inclined to comment because its basic concept was violated.

The basic idea behind the Multi-Energy method is the absence of a direct relation between the total amount of fuel present in a vapour cloud and its blast upon ignition. This seems to be confirmed by reviews of major accidents [3,4]. According to the Multi-Energy concept blast effects are only related to the amount of fuel present in the partially confined parts of the cloud. In the ROW incident a part of the gas was trapped between the platforms, pipe racks and columns according to Dr. Giesbrecht's paper [1]. Following the Multi-Energy method the correct conclusion from the graphical reconstruction of the blast in [1] (Fig. 14) should have been, therefore, that between 0.5 and 3 tons of hydrocarbons must have been involved in the explosive combustion of the gas mixture present within the partially confined parts of the cloud.

Although inaccuracies inherent to the relations between damage, blast and energy prevent firm conclusions, this very analysis constitutes another indication for the correctness of the Multi-Energy concept. The concept is expected to hold for deflagrative explosion of vapour clouds, which are the result of a spill of fuel and atmospheric dispersion, and is more supported by experimental data [e.g. 5–7] today.

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6 A.J. Harrison and J.A. Eyre, The effect of obstacle arrays on the combustion of large premixed gas/air clouds. Combust. Sci. Technol., 52 (1987) 121–137.
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Reply to the comment of Dr. A.C. van den Berg

Damage analysis has many uncertainties. Knowing that, I used the word "involved" with respect to the mass of hydrocarbons generating an explosion pressure wave. I hoped it had the same blurred meaning as the German word "involviert". Dr. van den Berg is certainly right to relate the pressure wave only to the portion of the gas where high flame speeds can be generated.

In the case of an exploding vessel the old BASF investigations show that only 35% of the contents are micromixed with air at the instant of optimum mixture. Since this is a constant ratio we related the strength of the pressure to the inventory of the vessel. By applying this relation to the ROW explosion, which was not a vessel rupture I should have spoken as well of the "well-mixed mass of propylene", which I didn't. I used again the word "involved".

As I said in my conclusions, damage analysis gives one a better knowledge about the spectrum of explosion accidents; I should have said "feeling". This is rarely the case in occurred accidents and nearly impossible in assumed accidents for authority considerations – a well known problem for many of my colleagues.

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