Title	Explosion Hazards Assessment – A study of the feasibility and benefits of extending current HSE methodology to take account of blast sheltering
Publisher/Author	HSE
Publication Date	2001
Executive Summary	**Objectives / Background** This study concerns the methodology used by MSDU, HSE in assessing Land Use Planning cases (LUP) near Hazardous Installations storing LPG and presenting a Vapour Cloud Explosion (VCE) hazard. The work is also relevant to all risk assessment and consequence models that are used to assess the hazard posed by blast. The methodology currently used by MSDU assumes that the blast propagates without interaction with any buildings or terrain features that may lie between the explosion source and the proposed site. Thus the estimate of the incident peak positive overpressure is likely to be conservative. The probability of fatality is then inferred from the peak positive overpressure using war-time data. This allows the vulnerability of the public to be assessed from which consultation distance and hazard zone boundaries are determined. The leading shock wave is the highest frequency component of the blast wave and will, therefore, be the most affected by interaction with obstacles. A revised methodology which takes account of obstacle interaction will, therefore, exhibit sheltering effects. Thus there are situations where buildings that lie between the explosion source and the proposed site will provide substantial sheltering in the region of the proposed construction. In such situations it is conceivable that the existing methodology places the hazard zone boundaries at substantially larger distances than is required to maintain an acceptable probability of fatality. A revised methodology, therefore, which takes sheltering into account could potentially free-up substantial areas of land around existing and future hazardous installations. **Main Findings** Predictions of Computational Fluid Dynamic (CFD) simulations have been compared against a limited number of field-scale experiments which investigate the effects on the blast overpressure of the intervening obstacles. This has established that sufficient accuracy can be obtained using CFD methods without a prohibitive requirement of staff or computing resources. It has been shown that for simple linear rows of square cross-section buildings that three-dimensional CFD simulations provide a very accurate predictive method but require substantial computing and staff-time resources. However the application of a two-dimensional axi-symmetric approximation can also be used in the computations to yield adequate accuracy using contemporary workstations and a simulation turnover of less than a day. This has enabled the two-dimensional CFD to be used to simulate a range of cases for different building layouts and sizes. The peak positive overpressures determined from these simulations have provided sufficient data with which to propose a preliminary methodology for incorporating the effects of sheltering into existing explosion hazard assessment models. The methodology amounts simply to determining the TNT mass-scaled height of the buildings, and their intervening distances, and referring to look up tables to determine the relevant sheltering factors. These can then be used to determine the inward shifts of the hard zone boundaries. The preliminary methodology has been applied to two representative scenarios, the larger being on the scale of the Flixborough disaster, and has shown that the outer and inner boundaries of the Outer Zone can be moved in by as much as 80 m and 50 m respectively. These distances represent substantial free-up of land and therefore suggest that a revised methodology could significantly increase the land available for development

	around a major hazard site and/or lead to less restraints on the site owner. **Main Recommendations** A preliminary methodology for incorporating the effects of sheltering into existing explosion hazard assessment models has been proposed. MSDU can now decide on the appropriateness of including the sheltering effects of buildings in their assessment of LUP cases. This will crucially depend on the fact that intervening buildings are not necessarily permanent and their removal will change the consultation distance. The further development of the methodology described in this report will lead to a useful tool that could be used in the preparation or assessment of COMAH safety reports where blast is a significant hazard. The development of the methodology should be based on a programme of two and three dimensional CFD simulations validated against further blast experiments.
Table of Contents	