

Title	Review of flash fire modelling																
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Executive Summary	<p>There are many industrial sites within the UK which handle or store hazardous materials in sufficient quantities that they may be considered to pose a risk to off-site personnel. Land use planning legislation requires that HSE is consulted concerning potential developments near such sites, and their advice would generally be supported by some form of quantification. The resulting requirement for some form of safety report for these sites will mean that not only should hazardous scenarios be identified, but that consequences should also be assessed. This will typically include source term calculations, gas dispersion modelling and an assessment of toxic or flammable effects.</p> <p>When a dispersing cloud of flammable vapour is ignited, it can burn in a number of different ways. A flash fire or cloud fire occurs if ignition takes place within the flammable region of a gas cloud, generally at a point remote from the source. In circumstances where a cloud extends back to its original point of release, burn-back to the release source may occur, normally resulting in a jet or pool fire depending upon the scenario; the effects of such escalation may be more severe than the flash fire itself, e.g. a BLEVE may result. In the presence of sufficient obstructions, the flame may accelerate such that significant overpressures are produced, giving an unconfined vapour cloud explosion.</p> <p>Flash fire models used for the purpose of risk assessment are usually based on gas dispersion modelling combined with the probability of ignition (e.g. Considine et al 1982, Clay et al 1988) The boundary of the fire is defined by the gas cloud's downwind and crosswind dimensions. It is generally assumed that personnel caught within the fire boundary are fatalities and that those outside are not seriously injured. This approach predicts the extent of potential flash fires and provides generally conservative estimates of fatalities. More detailed modelling has been undertaken (e.g. Raj &amp; Emmons (1975), Rodean et al (1984)), incorporating a flame propagation rate and using standard view factor techniques to calculate thermal radiation external to the fire.</p> <p>Unfortunately, this requires knowledge of the physical and chemical processes that take place during wind/flame interaction, which are currently not well understood. The wind/flame interaction could cause the flame propagation process to speed up, slow down or cease, dependent on the wind conditions, dispersed cloud characteristics, ignition location, surrounding topography, etc. The relationships between different wind regimes and flame propagation rates may be obtained from experimental data, theoretical studies or both. The flame propagation is dependent on the thermophysical and chemical-kinetic properties of the gas cloud, turbulence and buoyancy of the gases, and is mainly controlled by the turbulent mixing in the field. Significant advances in the understanding and modelling of these processes have recently been gained.</p> <p>This report discusses the present understanding and modelling of flash fires and presents a proposed framework for the modelling of flame propagation within flash fires. The purpose of this framework is to allow improved prediction of the effects of flash fires; both in terms of their direct effect on personnel and their contribution to escalation that may lead to more severe events.</p>																
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