

**Short abstract. 18th International Conference on  
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***Abstract title: Computational Fluid Dynamics (CFD) modelling of atmospheric dispersion for land-use planning around major hazards sites in the UK***

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*Preferred way of presentation:* oral

*Preferred topic:*

1. Model evaluation and quality assurance – model validation, model intercomparisons, model uncertainties and model sensitivities.

### **Abstract text**

This paper discusses the challenges facing the use of CFD models to simulate the atmospheric dispersion of toxic and flammable substances around major hazards sites in the UK, for the purpose of providing hazardous substance consent and advice to planning authorities on individual and societal risks. Currently, the Health and Safety Executive (HSE) uses the integral dispersion model DRIFT for this purpose, but it is increasingly facing pressure to accept results from CFD models. The perceived benefit of CFD models is principally that they can take into account the presence of terrain and complex obstructions, whereas integral models such as DRIFT assume flat terrain and account for obstacles as a uniform roughness.

There are a number of known unresolved issues with CFD models relating to:

1. Problems in sustaining realistic atmospheric boundary layers
2. Interpretation of averaging times in model results
3. Lack of validation, particularly for relevant scenarios involving terrain and obstructions
4. Uncertainty in source models for complex release scenarios, such as catastrophic vessel failures
5. Grid resolution, especially for complex sources and dense gas clouds in large spatial domains
6. Variability in model results due to user-effects
7. Model complexity and issues with best practice and regulatory oversight

8. High costs and long computing times, which may limit the number of sensitivity tests that can be performed.

Items 1 and 2 in this list are mainly problematic for CFD models solving the Reynolds-Averaged Navier-Stokes (RANS) equations, which includes the majority of commercial CFD codes.

These issues do not preclude the use of CFD for certain applications. Indeed, CFD has proven to be an invaluable tool to help understand flow behaviour in some situations. However, for HSE to have confidence in the use of CFD for the assessment of public safety risk in the context of land-use planning, these issues need to be comprehensively addressed. The paper describes in more detail the above points and identifies areas where further research would be beneficial.

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### **Motivation**

The Health and Safety Executive (HSE) is the UK's primary regulator for implementing the Seveso Directives. HSE is committed to ensuring that dispersion modelling carried out for both Safety Report assessments and for land-use planning purposes is fit for purpose. The motivation for this paper is to promote good practice in modelling methodologies.