



Advanced Topics in Hazard Prediction

Development of a Model for Spills of Liquids on Porous Surfaces

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When predicting the potential environmental and health hazards posed from liquid chemical spills two questions are commonly asked: what is the downwind hazard; and how long does the hazard persist? Initial operational responses may rely on input data with high degrees of uncertainty and in order that the immediate (airborne) hazard may be estimated quickly, simplifications and assumptions are made to give a “reasonable worst-case” prediction. However, if the same model/assumptions are used, this can lead to an underestimate of the persistency. If a different model is used, though, then the predictions become incompatible. An approach is required that gives reasonable predictions for both questions and ensures modelling consistency. The UK Defence Science and Technology Laboratory (Dstl) commissioned the UK Health and Safety Executive Science and Research Centre to develop the model SLOPS (Spills of Liquid On Porous Surfaces) for the prediction of vapour source terms that can be used as an input to the Hazard Prediction and Assessment Capability (HPAC). The SLOPS tool simulates liquid spreading over flat ground, the vertical infiltration of liquid into the porous surface and evaporation from the pool during and after spreading. The model combines the GASP model (Webber, 1991) for pool spread and vaporisation, with the Green-Ampt model (1911) for infiltration and adapted water resource engineering models for subsurface evaporation. The coupling of these models applied to non-water substances has not been found in the literature and offers unique insights into the dynamics of a chemical hazard following release. SLOPS has been verified with analytical solutions and by comparison with GASP, where possible, and shows excellent agreement. Validation to date has been achieved indirectly through comparison with other models that have been validated elsewhere. Designed as a quick-running operational tool, SLOPS provides the analyst with a more detailed and confident prediction of persistency along with a source term for HPAC. SLOPS is pre-populated with referenced, standardised data for a range of surfaces and chemicals, meaning data demands and response times are minimised. This ensures detailed, high quality and consistent advice is provided in the event of a liquid chemical spill, keeping the warfighter and civilian populations safe.