Assessment of chlorine leak dispersion around Gebeng industrial area and potential evacuation route

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ABSTRACT

This paper evaluates the effect of topographical and wind condition on the dispersion of chlorine leaks around Gebeng industrial area Malaysia using a computational fluid dynamics (CFD). The actual data on wind speed and direction was obtained from a local weather station. The turbulent flow was resolved using a scale-adaptive simulation (SAS) model, whereas the chlorine dispersion was modelled using the species transport equation and compared with the area location of hazardous atmosphere (ALOHA) model. The simulation was compared with the laser doppler anemometry (LDA) measurement on a scaled-down terrain model. A good agreement between the CFD prediction and LDA measurement was obtained. The finding showed that the terrain surface, wind direction and wind speed have a combined effect on the dispersion of chlorine. Residential areas R1 and R2 are affected by the chlorine leak during June to September and November to January, respectively. The plume reached the residential area rapidly under the wind speed above 7.2 m/s but the hazard zone is reduced about 50%. CFD prediction agrees with that of ALOHA in the case of flat terrain, whereas CFD provide a better prediction for the case involving complex terrain. The finding in this work may provide a useful guide to estimate the risk zone from a hypothetical chlorine leak which can be used to plan the safety evacuation procedure.

KEYWORDS: Gebeng industrial area; Chlorine leak; Heavy gas dispersion; Computational fluid dynamics; Laser doppler anemometry

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