Uncertainties arising from Combined Effects of Buildings and Terrain on Plume Dispersion.

Odour dispersion modelling was conducted for two new stacks for an industrial process with an assumed odour emission concentration of 1,500 OU_E/m^3. The process included a complex of buildings up to 8m high, located near the crest of the upper slopes of a river valley, with slopes of less than 30°. The nearest odour sensitive receptors were within 200m of the proposed release.

Odour impacts were predicted using the dispersion model ADMS 3.2. This included 5 years of recent hourly sequential meteorological data from a UK Meteorological Office station less than 10km from the site, a detailed building and site topography survey, and Ordnance Survey ground heights. A model sensitivity analysis was conducted for the worst case 1 year in 5 and other factors such as building effect, terrain effects and surface roughness. Stack heights up to 40m in height were considered.

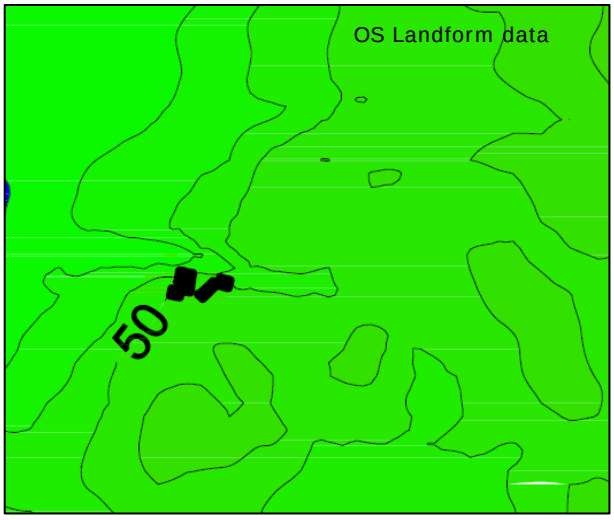
The process operator wished to keep stacks as low as possible to minimise potential visual intrusion. The results from the model indicated that 15m stacks would ensure effective dispersion of residual emissions where process odours would be less than 1.5 OU_E/m^3 98%ile at the nearest receptor.

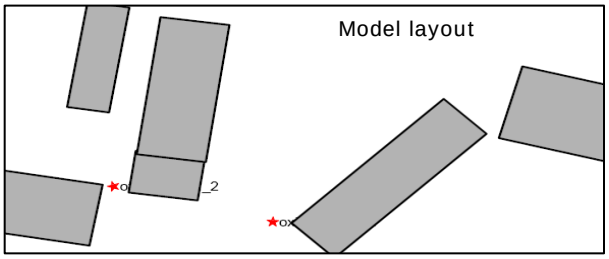
Once operational, the new process provoked persistent odour complaints, with visible plume grounding occurring within 200m of the release. Compliance monitoring indicated that odour emission concentrations were up to 8,000 OU_E/m^3. Further dispersion modelling using ADMS 3.3 indicated that two 27m stacks would be required to achieve 1.5 OU_E/m^3 98% ile at the nearest receptors and that this would minimise plume entrainment under most wind speeds.

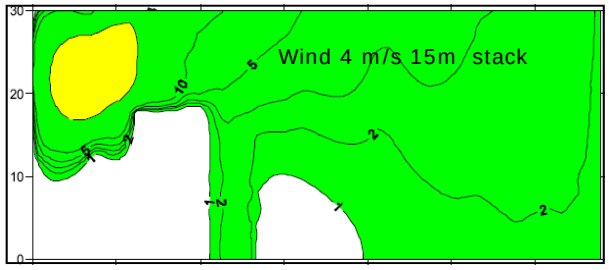
However plume grounding near the stack and odour complaints persisted after the stack height was increased to 30m, although this was not predicted by ADMS.

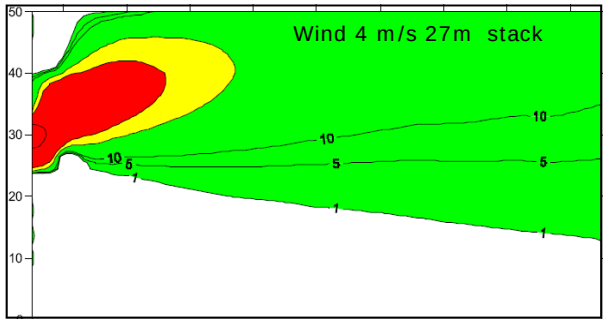
Subsequent dispersion modelling was conducted using CFD to investigate this in more detail. The CFD model (Ansys 11.0) provided better agreement with observed plume behaviour. The CFD model results suggested that plume entrainment would be likely to continue with a 30m stack, when the combined effects of terrain and buildings were considered.

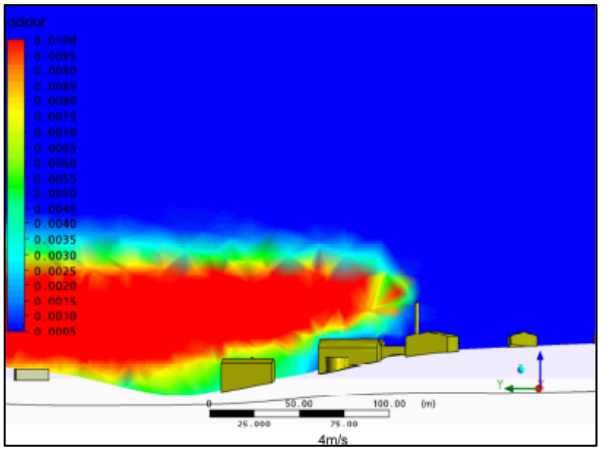
The CFD model results indicated that a 50m stack would be required to achieve acceptable odour and prevent plume grounding within 500m of the process. The results suggest that ADMS may underpredict impacts in some cases where flows are affected by both complex buildings and terrain.











The Airshed

The Airshed Ltd 5 Lauder Place, East Linton EH40 3DB. Tel; 01620 860 529 Fax 0870 762 0018
email mail@theairshed.com