environmental

The sweeter smell of odour control

Odours, like noise, are now a serious environmental issue, particularly in the food and chemical industries. MU asked Bob Maloney, an expert in odour control, to explain the issues and how they can be tackled effectively.

Earlier this year Environmental Permitting Regulations were introduced requiring operating sites to assess the emission of offensive odours. The nature, strength, persistence, frequency and likely areas affected need to be identified as well as the possible sources and the actions needed to tackle and monitor any such odours.

This assessment covers both normal and abnormal operating conditions. A dispersion model may well need to be produced to enable the site operators to have confidence that they are meeting imposed boundary conditions.

The options

A classic hierarchy of preferred options has been developed to minimise the financial and environmental burdens of odour emissions. At the top of this hierarchy is eliminating the odour source. This may be achieved through the use of alternative production materials or processes. An example of this is the advances made in inks which has enabled some printing applications to move from solvent-based (with their VOC/odour emissions) to odourless water-based inks. The opportunities for this option tend to be limited, as indeed does the second option of either recycling the air in a closed loop, or of sealed containment. An extension of this would be the use of an odourless gas (such as nitrogen) under positive pressure to prevent noxious gas release.

The third option aims to reduce the volume of odour to be treated. This is possible where different odour concentrations normally exist in separate sectors of the process plant. The potential may exist to “internally transfer” the low odour emissions through to the high odour areas before final emission, thus reducing the overall volumetric emission. The reduction may be as great as 50 per cent.

If further remedies to odour problems are required, dispersion would be considered. A good example of the potential savings from “disperse alone” treatment can be seen in the snack food industry where upwards of 500,000 m^3/hour of air was being abstracted. By assessment of odour emissions (and elimination of fugitive emissions) it proved possible to comply with local authority requirements, regarding boundary levels and beyond, by installing a stack without the need for a treatment system which could cost well in excess of £1m.

If all options have been considered and shown not to be practical or effective in addressing the odour issue then the site is faced with the prospect of an abatement system.

At this point the possible treatment options become extensive and selection is subject to various considerations. These include the average/maximum odour emitted and by what degree it must be reduced?

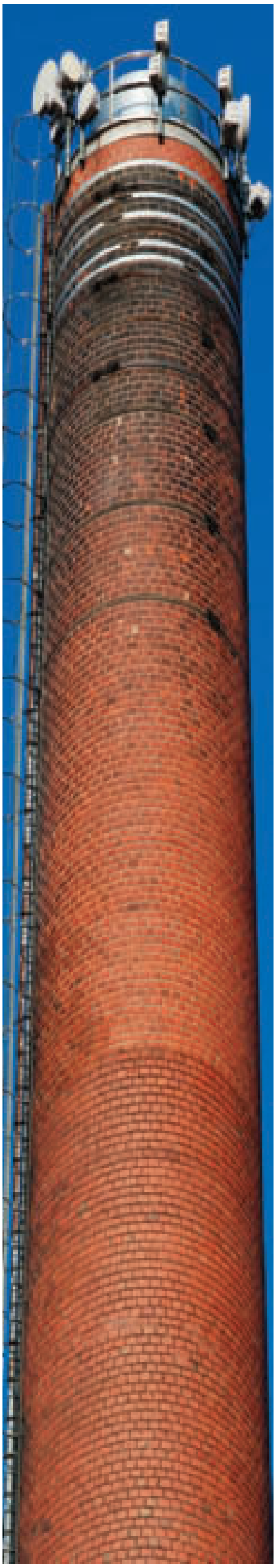
An understanding of the terminology is helpful:

Odour is defined in odour units/m^3 where 1 odour unit is that quantity of a gas/mixture which, distributed in odour free air, can be distinguished by half a panel of observers from odour free air. The concentration is therefore equivalent to the number of times the air sample must be diluted to reach that distinguishing level. Different gases have markedly different concentrations at which this 1 odour unit, (referred to as the odour threshold), is registered. For instance, the Hydrogen Sulphide threshold level of 18ppb contrasts with DiMethyl-Sulphide level of 2ppb, highlighting the importance of analysing gas concentrations in determining removal requirements.

Adequate definition of the extent of the odour problem is critical to enable the treatment

continued on page 72

environmental



continued from page 71
requirement to be correctly specified. Parameters to be considered include identifying all odour sources; determining the contaminants present and their concentrations, understanding the prevailing conditions in terms of temperature, humidity and wind effects; identifying the frequency of emissions and the variance; and finally identifying issues of space, access, topography and local amenity influences.

These combined factors will influence the selection of suitable abatement equipment, as will the overall removal efficiency required to meet the imposed boundary/receptors odour levels.

Abatement processes

Four main types of abatement processes are available, although there are some emerging technologies with niche applications. Sometimes a combination of technologies will be favoured.

The main types are:

- **dry scrubbing,**
- **wet scrubbing, biofiltration**
- **bioscrubbing**
- **thermal catalytic oxidation**.

Dry scrubbing generally uses activated carbon relying on the physisorption (physical adsorption is a type of adsorption in which the adsorbate adheres to the surface) of contaminant molecules onto the activated carbon having an extremely high internal surface area and network of pores. Removal efficiencies are high and it is particularly suited to low concentration intermittent odour emissions. Activated carbon is an expensive media to purchase and replace, leading to high running costs in circumstances where the quantity of media required is high or the life is short.

Wet scrubbing uses a different mechanism through which water soluble oxidising compounds (selected for specific odour components) pass through one or more packed bed columns in which the water and air contact each other. These systems have a small footprint with normally low maintenance costs and can achieve good removal efficiencies provided the dosing and control systems are properly maintained. High capital and running costs may limit the application of this process if other processes prove acceptable.

Biofiltration/bioscrubbing processes achieve odour abatement by the aerobic conversion of odorous components using specific micro organisms supported on a carrier media. For the majority of applications, which involve substantial frequent or continuous odour emissions, this process would have the lowest running cost with removal efficiencies typically between 95 per cent and 99 per cent. The main disadvantage is probably the footprint – though this has been addressed by the use of more robust medias (capable of greater bed depth and hence smaller footprint) and, in some instances, multi-stacked units.

Thermal and catalytic oxidisers convert odourous compounds to carbon dioxide and water through the application of high temperature (with heat recovery). The use of a catalyst enables this type of oxidiser to operate at lower temperatures. Although oxidizers have a small footprint and high odour removal efficiency, they are high on capital cost and very high on running costs in virtually all odour applications.

Common issues

For a particular application a matrix is established for the processes identifying common issues and individual parameters to enable a cost comparison to be identified. If either activated carbon or biofiltration/scrubbing is the preferred route then pilot trials can be undertaken to confirm the efficiency of the process.

Instances often arise during the course of these trials highlighting manufacturing operational issues impacting on odour emissions. Trials also allow the opportunity to alter the design loadings for the main plant which can lead to significant changes in plant costings.

Inappropriate technology or undersized systems that cannot adequately cope can lead to renewed odour complaints and the imposition of stringent measures by the local authority. Choosing a process contractor with design knowledge, application experience and the financial support of a group plc can provide that reassurance of the sweeter smell of odour control across the manufacturing sector.

FURTHER INFORMATION

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