Preventing Nuisance Odours from STPs
understanding problem & using relevant technology is critical

This case study examines the selection and implementation of the most appropriate technology to prevent and treat nuisance odours from sewage treatment plants. The study illustrates the selection criteria for assessing the most effective technology and the design solutions required to ensure minimum disruption to the works operations.

Odour is a pollutant as defined by Integrated Pollution Prevention and Control (IPPC) that specifies the use of Best Available Techniques (BAT) to control nuisance odours and increasingly identifies biotechnological solutions as appropriate technology.

The selection procedure for BAT must take into account the type of compounds in the air emission, the quantity and rate of emission, the temperature, location of current equipment, the space available for treatment technologies, economic considerations and a net present value assessment. Therefore, selecting BAT requires knowledge of relevant technologies and some applications experience.

Effective treatment of nuisance odours is dependent on understanding the source of the odour and identifying odorous compounds **in addition** to the Hydrogen Sulphide being produced from associated anaerobic conditions. While Hydrogen Sulphide continues to be the predominant performance indicator for odour removal in the waste water treatment industry, *Bord na Mona,* also recommend that odour is measured as olfactory units. This ensures that all potential odorous compounds are effectively controlled.

Understanding the treatment problem, together with an ability to apply relevant technology are critical to providing a solution. *Bord na Mona,* an Irish semi-state owned company with a turn over of £200 million, offer scientific expertise to deliver such bespoke solutions. They have developed intelligent design and state of the art technologies to effectively prevent nuisance odours from sewage treatment plants.

Background

This case study cxamines the approach taken to prevent nuisance odours at three sewage treatment plants – **Bridlington; Lundwood near Barnsley; and Minehead.** At each of these works, sludge is thickened prior to its disposal or reuse as material for the reclamation of land. This process can lead to the production of nuisance odours.

Sludge treatment facilities at **Lundwood** were refurbished in 1998. The works not only thickens and treats sludge from the site but an additional one and a half times this volume is imported to the site. Sludges are mixed in a day tank and then fed to a gravity belt thickener, producing a final thickened sludge. The gravity belt thickener is housed in a separate building but extracted to the same odour control plant.

Sludge at **Bridlington** is also dewatered and thickened in a dedicated sludge treatment building. Prior to thickening, digested sludge is stored in covered holding tanks. The headspace gases in these tanks also needed to be extracted and treated to prevent nuisance odours.

Similarly, at **Minehead,** sludge is thickened following storage in holding tanks. A centrifuge system is used and this is housed in a sludge treatment building adjacent to the sludge holding tanks.

Technology assessment

Yorkshire Water and Wessex Water were committed to ensuring that appropriate odour control technology was installed quickly and efficiently. *Bord na Mona's* technical experts worked closely with site project managers to understand the specific requirements for each site. These included identifying the potential source of odours, the expected Hydrogen Sulphide concentrations to be treated, relevant flow rates and the requirement for odour monitoring and dispersion modelling.

Three relevant technologies were identified for prevention of nuisance odours at each site. Chemical scrubbing, activated carbon and biofiltration. Wet scrubbing was rapidly eliminated as an appropriate technology due to the initial capital cost, high running costs and extra health and safety considerations.

Enhanced biofiltration was selected as the **Best Available Technique** and it also offered low capital and running costs. Enhanced biofiltration combines innovative media and an inherent scrubbing characteristic to enable continued abatement performance even at prolonged high loadings and significant fluctuations in odour concentration across its operational life. The media provides an optimum surface area for mass transfer, a stable environment for biological proliferation and a packing characteristic that assists gas flow through the biofilter with minimum pressure drop. MONASHELL™ provides the necessary inherent buffering capacity to allow the microbial population to adapt to extreme variations in loads that would cause other biofilters to fail.

Due to the sensitive location of coastal sites at **Bridlington** and **Minehead,** both Wessex Water and Yorkshire Water insisted on a high odour abatement performance where outlet airstreams from each odour control system were required to contain less than 100ppb Hydrogen Sulphide,

Technology used

At all three sites the fully enclosed enhanced biofilters are constructed from corrosion resistant Glass Reinforced Plastic (GRP) and are packed with *Bord na Mona's* patented MONASHELL™ media supported on a raised plenum floor to ensure uniform air flow through the media. Operating in a co-current configuration air is drawn through the MONASHELL™ media by a duty standby fan. The negative pressure design of the system allows better control of airflow through the unit and ensures total capture of all odorous gases. The biofilter is irrigated by a continuous irrigation water system that ensures continuous scrubbing of odours by optimising the mass transfer characteristics even at variable peak loadings. The buffering capacity of the MONASHELL™ media allows recirculation of the water, thereby minimising on water usage through its lifetime. The media is self supporting to a depth of 3m, reducing the foot print of the system.

At **Lundwood,** the design specification required treatment of an inlet concentration of 75 ppm Hydrogen Sulphide from a primary and imported sludge holding tank and an associated belt thickener. The total extraction rate was 850m^3 /h and a guaranteed removal efficiency of 98 per cent was required. Subsequently *Bord na Mona* have measured average Hydrogen Sulphide inlet concentrations between 150 and 250 ppm, yet the MONASHELL™ unit still reduces the Hydrogen Sulphide concentration to below 100 ppb (>99.9% removal). The unit not only treats a significantly higher load than was originally specified, but a higher flow rate by virtue of an increased extraction rate to reduce odour concentration within the thickener building. The odour removal performance of the MONASHELL™ unit is even maintained during weekends when the thickener is not in service.

Bridlington has two enhanced biofilters, each with secondary polishing units. The first MONASHELL™ unit treats headspace in the digested sludge storage tanks. These tanks each have a volume capacity of 25m^3 and give rise to a total airflow of 2502m^3/h. sources in the sludge treatment building. They are serviced by a biofilter 6.25m long, 5.03m wide and 2.51m high packed with MONASHELL™ media.

A second MONASHELL™ unit treats an airflow of 2946m^3 h from various sources in the sludge treatment building. Air from the biofilters is passed through a dedicated MONASORB™ activated carbon system for final polishing. Two MONASORB™ RAD9 units 1.27m in diameter and 2m high ensure near to 100 per cent removal of Hydrogen Sulphide is achieved from the digested sludge holding tanks while one unit is sufficient to polish air from the biofilter servicing the sludge treatment building.

The specified performance standard is currently being achieved solely by the MONASHELL™ , units thus prolonging the life of the MONASORB™ units. The biofilters are guaranteed to reduce Hydrogen Sulphide by 98% provided the inlet concentration does not exceed 750 ppm.

At the **Minehead** plant a single biofilter treats foul air from the four sludge storage tanks and the centrifuge room in the sludge treatment building. In total a flow of 8036 m^3/h is treated primarily by a MONASHELL™ biofilter with an additional MONASORB™ polishing system. Air from the biofilter is passed into a MONOSORB ™ reactor containing two concentric beds of MONASORB™ IGC3 type 2 impregnated media. This is configured to minimise the pressure drop across the media bed. The system is guaranteed to ensure that the maximum outlet concentration of 100ppb Hydrogen Sulphide is achieved.

As at Bridlington the MONASHELL™ unit achieves the specified performance standards as a stand alone unit.

These projects illustrate *Bord na Mona's* problem solving approach that is delivered as standard. Offering advice on a range of technologies for odour control; backed by a working knowledge of IPPC, each member of the project team has a 'hands on' attitude and is dedicated to providing a total solution. A customer focused project manager is available for the duration of installation providing the client with a focal point for discussing progress. This ensures that the design and installation of the system achieves the client's objectives. Regular meetings and comprehensive on site training for staff responsible for operating and maintaining the selected odour treatment system once it is commissioned is provided. A PC based training programme is an integral part of the commissioning process. The Company works to a quality system that meets ISO 9001 guidelines and provides opportunities for external audit by clients. With ten years experience it has been responsible for designing and bulding over 300 control systems, including the UK's biggest biofilters and also offers other treatment technologies where biotechnology solutions are not appropriate.

Summary

Enhanced biofiltration provides reliable cost effective control of nuisance odours from wastewater treatment plants. In the above case study, Yorkshire Water and Wessex Water demonstrate their commitment to ensuring that residents local to their wastewater treatment plants do not experience nuisance odours.

Operational reliability, significantly lower running costs compared to other technologies and low environmental impact were all factors that led them to select enhanced biofiltration as the most appropriate technology. ■

Note: *The Editor & Publishers thank Dr David O'Malley, Senior Scientist at Bord na Mona for preparing the above case study.*