Results for today; Ideas for tomorrow

Meat Technology Update

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Odour Management

Although odours generated from meatworks or rendering operations do not directly create environmental damage, they are responsible for the largest number of complaints from the public. Licenses issued by environmental authorities usually specify that no detectable noxious or offensive odours are permitted beyond the boundaries of the plant. Unpleasant odours can arise from several areas of a meat plant and if they are not adequately controlled or treated can give rise to complaints from nearby residents and environmental regulators.

This newsletter gives an overview of sources of odours, odour minimisation strategies and odour treatments. More detailed technical information can be obtained from the publications, 'Odour Minimisation Manual for the Meat Processing Industry', available from Meat and Livestock Australia, and 'Abattoir Waste Water & Odour Management', available from Food Science Australia.

Odour Control

Regulations relating to odour emissions are the responsibility of state authorities. The authorities set odour performance criteria that should be used for the design of new facilities and for setting point source emission limits. These odour performance criteria are also used for odour dispersion modelling purposes where they are applied at the nearest off-site sensitive receptor or likely future sensitive receptors.

Perception of odours depends partly on how odorous gases are dispersed before they arrive at a point where they may be considered to be a nuisance. Odour dispersion modelling is used to predict mean ground level concentrations in the vicinity of an odour source. The odour source may be a single point such as a stack or an area such as a pond. The main model used in Australia is computer program, AUSPLUME, developed and marketed by the Victorian Environmental Protection Authority.

Figure 1. Packed tower scrubber.

Proper land use planning is one of the most important tools in odour management. Many odour problems can be avoided by the appropriate siting of new facilities. Affected areas around a facility should be identified and a buffer zone established to help minimise odour complaints. Odour dispersion modelling is a useful tool in siting odour-generating processes and in selection of odour treatment

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equipment. It is also important to maintain lines of communication between plant management and the surrounding community so that neighbours will better understand your business and problems.

Odour control takes two main forms, the minimisation of odour generation and the treatment of generated odours.

Minimisation Strategies

All potential sources on a site must be considered when approaching the task of minimising odour. The main sources of odour generation are outlined below, along with the processes that may have a significant influence on the amount of odour generated.

Livestock & Yards

- Seal roadways to reduce dust.
- Ensure yards and trucks are clean.
- Ensure that yards and pens are sealed and well drained.
- Design shade structure in feed yards to allow drying and cleaning.
- Visually screen yards, possibly with trees, to confine dust.

Rendering Plant

- Generally continuous wet rendering generates less odour than dry rendering.
- Plant should be designed for ease of cleaning:
  - Building structure should be corrosion resistant with smooth walls and no ledges;
  - Floors should slope (min 1:100) to drains with accessible solids traps;
  - There should be access for cleaning raw material handling equipment on a daily basis or the equipment should be fitted with clean-in-place facilities;
  - All equipment should be free of areas where material can lodge and degrade.
- Only fresh material should be processed if possible but if it is necessary to process old material, additional precautions should be taken such as use of a chemical odour control agent (listed in Odour Minimisation Manual).
- Blood should be processed fresh or preserved with sodium metabisulphite (up to 0.15%w/v).

Effluent Treatment

- Keep areas around savealls and flotation tanks clean and do not allow buildup of odorous material.
- Maintain a crust on anaerobic ponds (Note that authorities may requires a cover on new installations.)
- Ensure aerobic and aerated lagoons are not overloaded to avoid them becoming anaerobic.
- Irrigate only stabilised, fully treated effluent and limit application to avoid ponding.

Solid Waste Handling

- Locate composting and solid waste handling operations at least 100 m away from the property boundary.
- Turn compost regularly so that it does not become anaerobic.
- Suppress dust by spraying roadways and compost piles.
- Ensure compost is mature before screening.
- Only undertake compost turning and screening operations when weather conditions are favourable.
- Cover odorous compost piles with a layer of bark or finished compost.

There may be times when the release of offensive odours is necessary as part of the normal plant operation or an exceptional circumstance such as periodic maintenance on an anaerobic pond. In order to avoid nuisance to the public, odour should not be released:

- When winds are blowing towards sensitive areas;
- On weekends and public holidays when people are engaged in recreational activities;
- Late in the afternoon when an evening inversion layer is forming;
- On heavy overcast days or when rain is forecast.

Odour Treatment

Some of the odour treatment technologies that are suitable for meat industry odours, particularly rendering odours are dispersion stacks, incineration, scrubbing, biofiltration, activated carbon, and UV and ozone.

Dispersion Stacks

Odour dispersion relies on ejecting the odorous gases into the atmosphere such that sufficient mixing and dilution takes place so that the ground level concentration is below the level of detection. This system may be applicable to the disposal of building ventilation air from rendering plants and other processing facilities. The stack height should be determined using odour dispersion modelling based on the local meteorological data.

Buildings such as rendering plants should be ventilated with at least 30 air changes per hour to maintain comfortable working conditions. Stack velocities should generally not exceed 10 m/s.

With odour dispersion, there is no treatment or reduction of the emissions, therefore it should only be considered in consultation with the state environmental regulators and may not be suited to many applications. Operating costs of the dispersion stack are low as power is required only for the fan.

Incineration

Incineration is the thermal oxidation of the odorous compounds by combustion with fuel and air. It is a highly effective means of destroying concentrated odorous gases such as the non-condensable gases remaining after the condensation of rendering cooker vapours in heat recovery systems. Temperatures of greater than 600ºC are required. It is generally accepted that 760ºC for 0.5 seconds will destroy odours in the non-condensable gas fraction of rendering vapours.

Incinerators can be fitted with heat recovery systems to pre-heat the combustion air to improve efficiency. The incinerator should also have a temperature indicator-controller and alarms to ensure that it is operating in the required temperature range.

A boiler or furnace may also be used to incinerate odorous gases and can be the most economic option. However a liquid or gas-fired boiler may not be suitable - if it is on low fire for extended periods - as the time/temperature may be inadequate. A coal-fired boiler is suitable as an afterburner as it will normally provide a long residence time for the odorous gases. They are normally introduced to a coal-fired boiler below the grate as under-fire air.

Liquid Scrubbers

Scrubbing brings the odorous gases into intimate contact with a liquid in which they have a high solubility. In most cases this is water with or without chemical additives, usually oxidising agents such as sodium hypochlorite or hydrogen peroxide. The particular scrubbing solvent to be used should be determined by the specific nature of the nuisance compounds to be removed. When treating non-condensable rendering gases, a two-stage system is the most appropriate with the first stage being an alkaline treatment and the second an oxidising treatment.

The most common types of scrubbers are venturi scrubbers, packed towers and horizontal scrubbers. In venturi scrubbers, the liquor is sprayed into the throat of a venturi through which the gas is drawn and the turbulence generated ensures vigorous contact between the liquor spray and the odorous gas. The liquid is separated from the gas stream in a cyclone and recirculated back to the venturi spray.

A packed tower is commonly a tall cylinder comprising a liquor recirculation tank and a packed section, which is continually wetted by overhead sprays (Figure 1). The tower is packed with lightweight plastic shapes having a large surface area. Contact is counter current with the liquor falling down through the packing and the gas passing up and through a mist eliminator to atmosphere.

In horizontal or cross-flow scrubbers, the gas stream flows horizontally through a falling stream of the solvent or through contact screens that are sprayed with the absorbent liquor.

Liquid scrubbing becomes economically attractive, compared with some other technologies such as incineration, when the volume of odorous gas is greater than 5,000 cubic metres per hour.

Biofilters

Biofilters were first used in Europe in the early 1960s and have been used in Australia since the late 1980s. They have become popular in Australia and New Zealand for the treatment of rendering odours. A biofilter consists of an air distribution system below a moist medium capable of supporting a population of microorganisms that have the ability to break down a wide variety of odorous compounds. The basic odour removal mechanism in the biofilter is thought to be adsorption or a combination of absorption and biooxidation.

Biofilters may be constructed above ground or in-ground. An in-ground biofilter will normally use a network of perforated pipes to distribute the air evenly whereas an above ground unit will normally have a plenum chamber below the biomass. In both design, there should be facilities for collecting the leachate from the filter medium and directing it to the plant effluent treatment system.

A variety of materials have been used for the filter media. The main criteria are that they should remain moist, be of an open structure with a high surface area and support microorganisms. Biofilters have used soil, peat moss or compost singly or in combination with bark, woodchips or other coarse material to provide an open structure. Other suitable materials are rice hulls, porous gravels, plastic foams and crushed bark. Graded crushed pine bark is one of the most successful materials used in biofilter media. The cost and availability are important considerations in the selection of the biomass.

The biofilter media must remain moist (in the range 50 – 70%) and, ideally, at a temperature around 35ºC in order to operate efficiently. This is achieved by humidifying the air through a spray chamber and by irrigating the bed from above. The conditioning chamber should also remove fat and other fine particulates from the air as these may block the filter and lead to a need for premature replacement.

Biofilters have been built with a wide range of volumetric loading rates. A low loading rate would provide a longer retention time, which should result in a higher removal efficiency but also a larger land area. Design loading rates in the range of 2 to 4 m^3/min per m^2 of bed area (at a bed depth of 1 m) are commonly used in treating rendering building ventilation air. Lower loading rates may be necessary for more odorous air such as non-condensable gases from dry rendering cookers.

The pressure drop through the biofilter should be monitored using a U-tube manometer or a pressure gauge. The pressure differential will be a function of the gas flow rate and porosity of the medium and the recommended design range is 500 to 1000 Pa (approx. 50 – 100 mm w.g.). Higher pressures are tolerable but will result in higher fan power requirements. Increases in pressure may indicate compaction or clogging of the filter whereas decreases could indicate excessive drying and short-circuiting.

Odour removal efficiencies of 95 to 98% have been reported with reductions from 9000 odour units per m^3 to less than 400 OU/m^3 at the surface in rendering plant ventilation applications.

Biofiltration offers a relatively simple method of treating odours with a low operating cost but a relatively large land area is required and any remaining odours are discharged at ground level making it difficult to achieve adequate dispersion.

Activated Carbon

Activated carbon is available in powder or granular form for adsorption of odours. It is suitable for treating organic odours and to be effective the air stream must be free of dust or water vapour which might lead to clogging of the carbon particles. The powdered form is less expensive than the granules but cannot be regenerated. This technology is most applicable as an auxiliary treatment for exhaust streams from other abatement equipment during peak loading periods.

UV and Ozone

Systems are available to treat odorous vapours using a combination UV-C light and ozone. UV-C is at the shorter wavelength (100 – 280nm) section of the UV. Ozone production from UV lamps is optimised at wavelengths in the region of 185nm. Ozone chemically oxidises odour-causing compounds resulting in better than 90% reduction in OU/m^3.

The air temperature should be below 45ºC and some pre-treatment may be required to filter fine dust (such as meat meal) from the air to be treated. The system has a similar cost and performance to a biofilters but requires little land space and offers single point dispersion of any remaining odours.

The technology has been used in combination with an activated carbon filter to treat exhaust air collected from point sources in an Australian rendering plant (Figure 2).

Figure 2. UV-C and Ozone treatment plant

Further reading

AS/NZS 4323:3:2001 Sep 2001, Stationary source emissions: Determination of odour concentration by dynamic olfactometry.

Meat Research Corporation c. 1991, *Abattoir Waste Water & Odour Management,* CSIRO Division of Food Processing and University of Queensland.

Meat Research Corporation 1997, *Odour Minimisation Manual for the Meat Processing Industry*.

NSW EPA 2001, Technical notes draft policy: Assessment and management of odour from stationary sources in NSW.

http://www.epa.nsw.gov.au/air/odour.htm

http://www.epa.vic.gov.au/Air/

For more information. contact one of the Meat Industrv Services staff listed below.

Food Science Australia Meat Industry Services Section

The Meat Industry Services (MIS) Section of Food Science Australia is an initiative supported by Meat and Livestock Australia (MLA) and the Australian Meat Processor Corporation (AMPC) to facilitate market access for, and support world-class practices in, Australia 's meat industry.

Need additional information help, information or advice?

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