MEAT TECHNOLOGY – INFORMATION SHEET

Cutting edge technology for the meat processing industry

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Environmental Control in the Rendering Industry

Rendering produces two major environmental impacts which are serious, costly issues for the industry:

- Process odour emissions.
- Waste water treatment and disposal.

A third environmental impact in some circumstances is noise.

Plants should adopt four principles when dealing with environmental issues:

- Prevention is better than cure.
- Adequate buffer distances must be present between a plant and its neighbours.
- Management should closely monitor nearby land development planning issues.
- Control equipment must be of adequate capacity and be subject to similar standards of operation and maintenance as those of the processing plant.

Environmental Protection Authorities (EPAs) Requirements

EPAs react to complaints by neighbours. If rendering plants have effective odour and wastewater management and get on well with their neighbours, then fewer problems with their local EPA tend to crop up.

Basic EPA requirements include:

- A sufficient buffer distance from neighbours must be in place and plants must have control over odour emissions to avoid complaints.
- Wastewater and stormwater should be captured, and treated as necessary, to avoid harm to the environment.
- Noise or dust should not be a nuisance.
- A plant must have a program of continuous improvement in environmental performance, with environmental controls designed to meet future standards.

EPA Requirements and the Production of Hygienic Meat Meal

One of the challenges for the rendering industry is to manage odour emissions

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without compromising the quality of the rendered products produced.

Adequate ventilation to equipment handling and storing meat meal must be provided to avoid conditions which favour condensation and the growth of micro-organisms. Ventilation in processing areas should be at least 20-30 air changes/hour to ensure satisfactory working conditions.

Figure 1 shows an arrangement for ventilating the hot processing are using air from the raw material and meat meal areas. The entire building should be under negative pressure.

Methods of Odour Control

Five methods are commonly applied:

- Prevention
- Biofiltration
- Wet chemical scrubbing
- Thermal oxidation (as in an afterburner)
- Activated carbon

Prevention

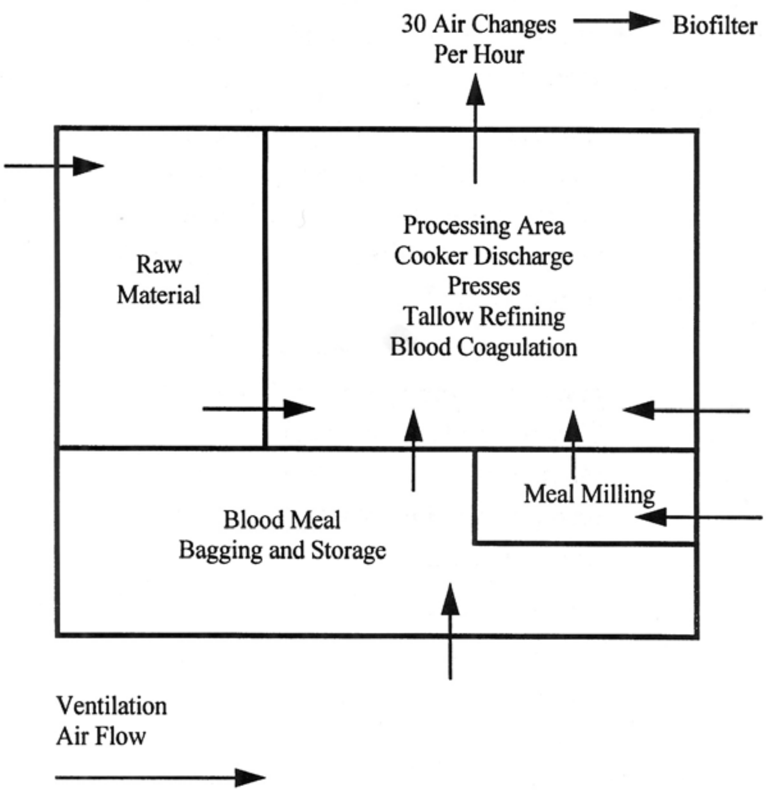
Prevention is always better than cure and is the best strategy if it can be implemented. Fresh, raw materials mean low odour emissions throughout the entire rendering process—from raw material through to finished product, tallow and meat meal. This is not achievable, however, for a contract rendering plant collecting and transporting raw materials over long distances.

Design and operational principles to consider:

- Ensure the cooking or heating capacity is adequate to process all raw materials as they are produced. Raw material storage is eliminated which results in two benefits: raw material odours are abolished and seepage from the raw material bins is eradicated.
- Restrict the pressure applied at the screw press. This limits the most pungent emission associated with rendering.

Plant layout should be designed to limit the surface area and temperature of the exposed product. High odour emissions can be traced

FIGURE 1 Rendering Plant Layout and Ventilation



to large, exposed surface areas (such as percolators, screw conveyors) with high temperatures and highly odorous material.

Biofiltration

Biofiltration is a widely used form of odour control and a simple, easily-managed process.

Biofilters can readily be constructed on a “do-it-yourself” basis, providing a few simple rules are followed. The bed residence (contact) time should be about 30 seconds, with the bed depth about one metre. Many commonly available organic materials can be used—rice hulls, well matured compost, wood chips, sawdust, etc – and they must be kept damp.

The air stream should be humidified to 100% RH with a maximum temperature of 40°C. Concentrated odour sources such as non-condensable cooking odours must be diluted with air by a ratio of about 4:1 air:odour. (Biofilters are an aerobic bacterial process,) Precaution should be taken to eliminate short circuits or leaks, e.g. at sharp corners.

Advantages of this method of odour control include low operating costs, medium capital cost and a five-year medium life. The method’s key disadvantage is that it requires a large ground area.

Wet Chemical Scrubbing

Wet chemical scrubbing uses oxidising chemicals such as sodium hypochlorite to react with the organics in a vapour stream. Often two- and three-stage systems are used to achieve the degree of treatment required.

A new process developed by ICI, “Odorgard™”, has been used for treating ventilation air and fugitive odour emissions in the UK.

The main application for chemical scrubbing is where land area available for the construction of biofilters is limited and where the biofilters would be close enough to housing to cause residual emissions to impact on residents.

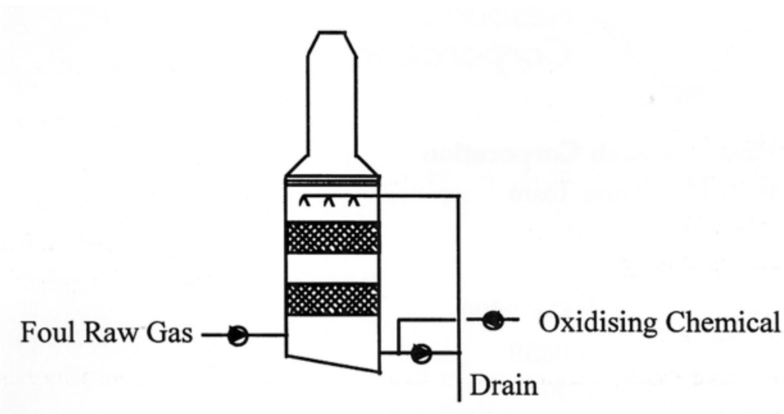
Chemical scrubbing transfers the odour problem to the effluent system. A major concern where chemical scrubbing is to be used in rural areas is the potential impact of increased sodium and chloride levels in the rendering effluent originating from the use of sodium hypochlorite, which is a low-cost and familiar chemical commonly used in the meat processing industry.

Capital and operating costs of chemical scrubbing are higher than those of biofilters.

Thermal Oxidation

Thermal Oxidation (incineration) was the first method used by the rendering industry for odour control. This method was successfully used to treat concentrated odours where there was minimal air entrainment. High operating costs for fuel limit the application of this technique to the treatment of non-condensable cooking vapours and meat meal press vapours. All other emissions in rendering plants are too dilute for this technique to be seriously considered. A residence time of 0.5 sec at 760°C is often specified by EPAs. Some

FIGURE 2 Gas Scrubber



renderers successfully incinerate non-condensable cooking vapours in their boiler plants.

Operating costs of incineration can be controlled or reduced. Sub-cooling the residual, odorous vapour to 40°C minimises the water vapour content. At additional cost, a heat exchanger to recover waste heat for preheating the vapour to be treated can be installed.

Activated Carbon

The activated carbon method is not known to be used in the Australian rendering industry. This method has high capital and operating costs.

Dispersion

In some cases, ventilation air can be discharged to the atmosphere via a tall stack without treatment. This method relies on sufficient mixing with the atmosphere so odour is not detectable at ground level.

While dispersion has some successful installations, this method is not popular with EPAs. Some EPAs have introduced a scale-of-fees based on the total number of odour units discharged by a plant. Fees calculated on this basis disadvantage this system.

On the positive side, however, dispersion offers the lowest capital and operating costs, subject to the scale of fees imposed by the EPA.

Wastewater Treatment and Disposal

Low-temperature and high-temperature rendering processes produce high-strength wastewater. Where a rendering plant is on the same site as the abattoir, the rendering plant commonly produces less than 25% of the effluent volume, but contributes more than 50% of the organic and nutrient loads.

A major challenge facing the rendering industry is to understand the various effluent streams and consider the source and prevention of contaminants. Much of the protein and fat in rendering effluent can be either prevented or captured at source and reprocessed.

Whether a rendering plant discharges effluent to a sewage treatment authority or treats its own effluent for discharge to land by irrigation, higher standards of treatment will be required in the future.

Sewage authorities usually impose limits on key components in rendering effluent, particularly suspended solids (SS), Biochemical or Chemical Oxygen Demand (BOD,COD) and nitrogen – particularly nitrogen in the ammonia form. The ammonia content of the effluent discharged to trade waste is commonly limited to 50-100 mg/L.

As with odour emissions, prevention is better than cure.

Effluent Source – Typical Range of Pollutants (mg/L)

	Total Suspended Solids	Phosphorus	Nitrogen	COD	Oil & Grease
Raw material bin drainage	6,000—14,500	300—700	3,000—5,500	40,000—65,000	up to 100,000
Tallow processing	20,000—35,000	70—120	250—400	50,000—70,000	Up to 50,000
Blood processing	2,000—20,000	75—150	1,200—8,500	15,000—100,000	Up to 500
Cooker condenstate - HT rendering	<200	<25	200—400	700—3,600	<100

Components of Rendering Effluent

Stickwater from low-temperature wet rendering is commonly 4%-7% fat and other solids.

The loss of protein and fat represented is significant. Rendering plants need to evaluate the cost and value of recovery, or prevention at source versus “end-of-pipe treatment”. Recovery is usually more easily accomplished from concentrated effluent streams than from a dilute mixture.

The Impact of Raw Materials

The problems of contaminants entering the waste stream start with the raw material. Fresh raw materials reduce odour emissions throughout the entire rendering process, produce the highest quality and value of tallow, and minimise the ammonia content of the condensate from high temperature rendering systems.

Materials should be delivered to the raw material bin before size reduction. Size reduction should only occur immediately prior to feeding the material to the cooker or preheater.

Hasher Washer systems in conjunction with pneumatic conveying should be avoided. This method of raw material preparation maximises the rate of degradation of the material and the volume of effluent lost from raw materials.

Either of two techniques may be used for slowing the degradation of raw materials: acid stabilisation or refrigerated storage.

Methods of Effluent Treatment

Effluent treatment should be designed to maximise the recovery of fat and protein which may be returned for reprocessing and to start with the physical separation of fat and solids by screening or dissolved air flotation (DAF).

Secondary treatment can include pond systems, chemical dosing and activated sludge systems. Chemical dosing and activated sludge systems can result in large quantities of sludge. Where chemical dosing is adopted, the sludge recovered may not be suitable for reprocessing in the rendering plant due to the presence of chemical residues. In the case of activated sludge systems, the process may be designed to produce a high-protein content sludge, or nitrify/denitrify the effluent.

Solids and sludge recovered from waste water treatment may vary in water content from 90% to 98%. Methods such as centrifuging or vacuum filtration remove excess water which, in turn, reduces the cost of drying or reprocessing. In many cases, the value of protein and fat recovered and reprocessed to finished product will be significant and should be considered as an alternative to either off-site disposal or payment to a sewage treatment authority.

DAF systems rarely deliver sludge higher than 7.5% solids content. Therefore, rather than allowing concentrated effluent such as raw material seepage or LT rendering stickwater to directly enter the effluent system, processors should consider either another method for concentration – such as a centrifuge or vacuum filter – or direct capture and return to the raw material feed. Waste heat from the rendering plant can also be used to concentrate sludges before reprocessing.