MEAT TECHNOLOGY UPDATE
Cutting edge technology for the meat processing industry

Meat technology update

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Solid Waste Management

- Waste avoidance and minimisation are the preferred options in the cleaner production hierarchy.
- The commitment of senior management is critical to the success of waste minimisation strategies.
- Good housekeeping can assist in minimising waste.
- Recycle as much solid waste as possible and minimise the quantity sent to landfill.
- Remember the 3 Rs: Reduce, Reuse, Recycle.

Waste is defined as 'a substance or object that is proposed to be disposed of; or is disposed of; or is required by law to be disposed of'. Meat processing results in the production of a range of wastes, both liquid and solid. Some wastes, particularly solid wastes, are not strictly wastes, but a raw material for a further process. The storage, processing and disposal of solid wastes have the potential to lead to environmental degradation if not done in a proper manner.

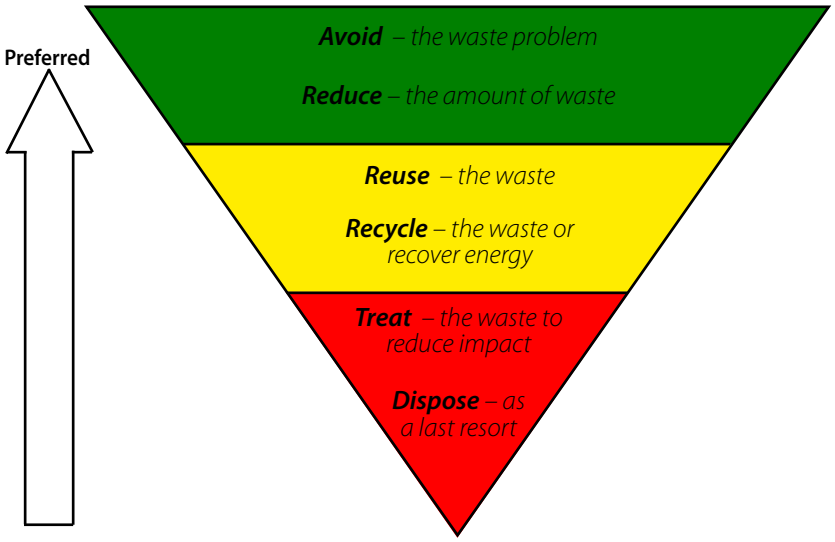

Figure 1: The waste heirarchy.

Overview

Australian state governments have policies regarding wastes which encourage waste minimisation ahead of disposal. This follows the cleaner production, or waste hierarchy, shown in Figure 1. Priority should be given to avoiding the production of the waste ahead of reuse or recycling, with the least preferred being treatment and disposal as a last resort.

The environmental management system for an organisation should include a waste management plan that identifies all solid wastes. The plan should provide for minimising the production of wastes and include methods of dealing with the waste issues. The ISO 14000 series provides guidance for the implementation of environmental management systems. ISO 14001, 'Environmental management systems—requirements with guidance for use', is based on the Plan-Do-Check-Act (PDCA) methodology which can be briefly described as:

- **Plan**: establish the objectives and processes necessary to deliver results in accordance with the organisation's environmental policy;
- **Do**: implement the processes;
- **Check**: monitor and measure processes against environmental policy, objectives, targets, legal and other requirements, and report results;
- **Act**: take actions to continually improve performance of the environmental management system.

The commitment of top management to environmental issues is critical to the minimisation of waste; however, many sound suggestions can come from employees and these should be rewarded. A company's environmental policy should include statements regarding waste minimisation. Although recycling is the solution normally embraced by those concerned about waste, minimisation is a superior approach as it aims to eliminate or reduce the quantity or toxicity of wastes.

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Waste avoidance

In an ideal production environment, very little waste would be generated. Although this is not generally possible in practice, initiatives can be taken to avoid the generation of some types of solid wastes. This can be one of the simplest and most cost-effective steps. Waste avoidance strategies are readily distinguished from reuse and recycling, which arise after consumption of a product.

Avoiding waste will often commence with implementation of eco-efficient purchasing policies. This can include:

- buying from suppliers who use less packaging, or packaging that can be recycled;
- considering life-cycle issues—purchase items that can be recycled rather than dumped.

Also, some processes can be altered to avoid production of a waste material. Some examples of this are:

- the use of carton glueing—rather than strapping—which eliminates the waste strapping that can be difficult to recycle;
- recyclable liner-less cartons for manufacturing meat eliminate polythene liners which are difficult to recycle after being in contact with meat;
- the use of tubestock (for vacuum bags) that is cut to size for each cut, eliminating the waste bag trim that can be up to 20% for pre-sized bags;
- automated bagging of cuts, where bag selection is automated, can eliminate use of oversize vacuum bags, thus reducing waste;
- freezing of naked blocks for pet food;
- automated carton construction can generate up to 50% less packaging waste than manual construction, due to reduced rejects.

Steps can be taken in offices to reduce paper usage. These include:

- double-sided printing and photocopying;
- reduced-size photocopying;
- printing only when necessary—edit on screen;
- avoiding paper wastage which, in turn, reduces consumption of toner and printer ink.

If surplus product that is still edible has been produced, consideration can be given to donating it to a charitable organisation, such as Foodbank, instead of dumping it.

Case study: Robotic bagging & semi-automatic bag makers

An export boning room producing 1,000 cartons of vacuum-packaged beef per day, converted from manual bagging of primal cuts to robotic bag selection and packing.

For ease of getting the bag over the cut, manual operators will often select a bag size that is too large. Automatic bag selection based on the measured dimensions of the primal cuts resulted in savings in the quantity of film used of 9,000 kg per annum with robotic selection and bagging.

Waste reduction

Due to the nature of the process, it is impossible to completely eliminate the production of many waste solids; however, steps can be taken to reduce the quantities of material that enter drains or are converted to waste. Good housekeeping is at the top of the list of waste minimisation strategies. The objective of good housekeeping is to minimise material losses and prevent unnecessary waste generation. Good housekeeping practices are not restricted to processing areas but can be applied to most aspects of a business including purchasing, inventory control, storage, maintenance, etc.

Consider these suggestions for reducing waste.

Purchasing

- Buy materials in containers of a size and type that minimises material wastage, and in containers that can be readily handled and easily re-used or recycled. Consider buying in the largest packaged units practicable to reduce the number of empty containers to be handled.
- If using coal-fired boilers, buy a suitable coal with the lowest ash content to minimise ash disposal costs.
- Purchase animals that require the minimum of cleaning. Washing cattle consumes resources and deposits additional solids in the system. Minimise the time animals are held on site to reduce the amount of manure deposited.
- Select vacuum bags of the minimum gauge necessary to ensure integrity in order to reduce the quantity of raw material used and waste generated.

Inventory control

- Minimise inventory, especially of perishable supplies.
- Use a 'first in—first out' policy for raw materials.
- Have a computerised tracking system for stores.
- Maintain suitable temperature and humidity for supplies and raw materials.

Processing

- Keep animals off feed before processing to reduce gut fill.
- If washing carcases, use low pressure water to reduce the loss of fat to the drain.
- Dry dump cattle paunches.
- Dry clean floors before hosing.
- Ensure solids collected by in-drain screens or traps are recovered.
- Don't wash gut material unless it has to be done for rendering.

Storage

- Keep stores clean and well lit and aisles free of obstructions for easier access and less likelihood of product damage.
- Minimise damage to packaged product to reduce re-packaging and product wastage.
- Monitor and alarm storage temperatures to control product loss in case of breakdown.

Figure 2: Cardboard and paper are readily recyclable.

Re-use/recycle

The majority of the organic wastes from meat processing are a resource for other processes, particularly rendering. This is an attractive way to recycle wastes as it is normally a profitable operation. Some other recycling or energy-recovery operations may not be as financially attractive, but may be essential from the environmental aspect.

Reuse applications in the meat industry are quite limited due to food safety considerations; however, there are some exceptions such as reusable food-standard bulk containers for storage and transport of chilled meat in place of cartons. As well as being a more efficient handling method, it also saves a significant amount of cardboard. Some other packaging, such as drums, may be reused on site for similar or other purposes.

Case study: Use of bulk bins instead of cartons

A processor manufacturing product for the domestic market moved from packing manufacturing beef in cartons to packing in bulk bins. By packing 10 bins per day, it was estimated that over 400 fibreboard cartons were saved per day, along with the associated liners and strapping. This represented a saving in resources and waste disposal for the customer.

Recycling opportunities for waste are almost limitless and are routinely applied in most plants. Most of the organic wastes produced during meat processing have properties that make them suitable for biological treatment processes such as composting. They are normally very wet (>85% moisture), readily biodegradable and low in toxic compounds and heavy metals, with reasonable levels of nutrients such as nitrogen and phosphorus; however, they may also contain high levels of micro-organisms, some of which may be pathogenic. Most organic wastes that cannot be rendered to produce meat meal and tallow are able to be composted.

These wastes include:

- animal manure;
- paunch contents;
- effluent primary treatment screenings and dissolved air flotation solids;
- waste sludge from secondary wastewater treatment.

Some other wastes such as dead stock and NCV sheepskins can also be composted, but more care needs to be taken with them to ensure that an odour nuisance is not created.

Due to their high moisture content, the composting process for abattoir waste benefits from the addition of a bulking agent to aid aeration and control odours. It may be possible to include other material from the site such as ash from coal-fired boilers and some paper waste as a bulking agent. The finished compost may be used directly as a soil amendment or as an ingredient in landscaping products or potting mixes.

The quantities of some of the wastes available from red-meat processing are given in Table 1.

Table 1: Typical quantities of organic solid wastes

Waste type	Typical daily quantity (kg/t HSCW)	Daily range (kg/t HSCW)
Manure (cattle) Manure (sheep) Manure (lambs) Manure (truck wash)	10 9 5 2	4–13 5–12 3–7 1–5
Paunch contents	45	25–70
Gut contents	20	15–30
Solids from primary effluent treatment	170	150–200
Biological sludges from wastewater treatment	135	70–200

Composting benefits from having all the waste ingredients mixed together well, which is in contrast to most recycling schemes where wastes are best segregated at source. Source segregation should be practiced for packaging and office wastes for materials such as paper and cardboard, plastics and metal.

Waste to energy

Production of energy from agricultural wastes is widely practised in Europe with over 3,500 biogas plants in Germany alone. In Germany biogas is used to power gas engines for production of electricity with total electricity production equivalent to the output of a 1200 MW power station. In some other European countries the gas is used to run city buses.

There are particular drivers in Europe that can make biogas production more attractive than in Australia. These include:

- government subsidies for renewable energy;
- the presence of BSE and hence restricted outlet for meat and bone meal;
- both lack of domestic coal and an anti-nuclear power stance;
- a ban on depositing organic waste in landfill.

Wastes from animal processing that would be rendered in Australia can be used to produce biogas from anaerobic digestion. Gas production is higher than would be achieved from anaerobic effluent treatment with output in the region of 600 m^3/tonne of volatile solids.

The high moisture content of meat processing wastes limits the applicability of other waste to energy technologies. A review of waste to energy technologies conducted for MLA identified two new technologies not fully commercialised, that appeared to be applicable to wet meat wastes. They were thermal pressure hydrolysis and thermal depolymerisation and chemical reforming. A high biogas output is obtained from thermal pressure hydrolysis; and oils and gases are produced from thermal depolymerisation.

Treatment/disposal

Disposal of waste to landfill should be a last resort and used only for materials that cannot be recycled. Therefore it is essential that readily recyclable wastes are separated from those destined for landfill.

Some wastes may not be able to be recycled because they are contaminated, they are are non-recyclable—such as certain types of plastics or items from a mix of materials—or recycling facilities are not available locally. Landfill is then the appropriate destination for these wastes.

The amount of waste recycled and the quantity sent to landfill should be recorded to assess whether the plant is in line with industry benchmarks and whether improvements are being made. An industry environmental performance review conducted for MLA in 2003 showed that the amount of solid waste to landfill had increased significantly since the previous review in 1998, but figures for both reviews were considered to be potentially inaccurate and overestimates. The key performance indicator for solid waste to landfill in MLA's 2003 review was 15.6 kg/tHSCW.

An industry benchmark for the amount of packaging waste generated is not currently available, but in-plant records should be kept to indicate any trend. Reliable figures on quantities of solid wastes are not always easy to obtain as bins may not be 100% full and the density of the waste can vary. A standard recording procedure should be devised and the results reported in a form such as kg/tHSCW. Measuring and reporting the amount of waste is a fundamental step towards improving environmental performance.

Summary

There will be a continuing trend through public and legislative pressure for industry to reduce its amount of waste. Technology that allows meat processors to use less resources and produce less waste, is now available. Most plants also have access to waste disposal and recycling programs that provide a large range of options for dealing with their waste.
Remember the 3 Rs:

Reduce... Reuse... Recycle.

Further reading

Environmental best practice guidelines for the red meat processing industry. Meat & Livestock Australia Ltd, 2007.

Eco-efficiency manual for meat processing. Meat & Livestock Australia Ltd, 2002.

Industry environmental performance review. Integrated meat processing plants. Meat & Livestock Australia Ltd, 2005.

Contact us for additional information

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