

Cold comfort

EU hygiene requirements and action on climate change have led to a raft of new legislation governing refrigeration in meat plants. *Carina Perkins* tells you how to make sure your factory doesn't get left out in the cold



Refrigeration is hailed as one of the greatest inventions of modern times. It has revolutionised farming, aided the rapid development of a global food trade and allowed the meat industry to develop into what it is today.

But its impact on the environment means that refrigeration has come under increasing critical scrutiny. Today's technology pollutes on two levels: it releases greenhouse gases and consumes an estimated 15% of the total energy used worldwide. As a result, refrigeration has become the focus for a maelstrom of conflicting goals, with abattoirs and processing plants striving to meet hygiene standards and improve revenue while reducing their impact on climate change.

KEEP IT CLEAN

Hygiene legislation is the first consideration for a meat plant operator when it comes to refrigeration. EU requirements for carcase

chilling stipulate that beef and sheep carcasses must leave the chilling rooms at a temperature no higher than 7°C and pig carcasses 4°C.

"There are clear legal requirements for the chilling and chilled storage of meats," says Kim Matthews, MLC meat scientist.

"Effective chilling is important to prevent bacterial growth. Chilling should be as rapid as possible."

In order to avoid cold shortening – a muscle contraction which occurs when carcasses are chilled too rapidly, resulting in toughened meat – abattoirs must ensure that no part of any muscle falls below 10°C in the first 10 hours of chilling (or three hours for pigs). Electrical stimulation can be used to avoid cold shortening and improve tenderness, but care must be taken to ensure that heat shortening is avoided. "There should be a system of monitoring temperatures and pH post-slaughter on a regular basis," Matthews says.

Research carried out by FJB Systems, a refrigeration consultancy company that specialises in meat refrigeration, has revealed that chilling rates and performance vary significantly from plant to plant, and not all plants are meeting the deep leg temperatures necessary to comply with EU regulations, particularly in beef carcasses.

This is attributed to the fact that older plants were designed to chill carcasses over a 48-hour period and are therefore not capable of adequately chilling beef carcasses in a one-day time frame.

As legislation becomes more tightly controlled, and UK meat plants win contracts with EU processing companies, the issue of deep bone temperature will become more prominent. It is essential, therefore, that plant operators ensure refrigeration systems can cope with chilling carcase loads sufficiently.

New plants can also pose a problem when it comes to refrigeration. The sensitive nature



Pointing to a green future. The meat industry needs to stay on top of refrigeration issues

of meat chilling means that systems installed by refrigeration companies are often not adequate for abattoir requirements.

“A problem can be that plant operators go to local fridge sellers, who do not understand meat chilling properly,” explains Edwin Bowater of FJB Systems. “It is a skill that is lacking in the UK and we have been involved in a number of court cases, with abattoirs suing fridge companies that have put in totally inadequate systems. When considering the installation of new equipment, it is vital that operators get the advice of someone who has a lot of experience in meat refrigeration.”

CFC BAN

A second set of legislation relates to the type of refrigerant used in a refrigeration system. Chlorofluorocarbon (CFC) refrigerants were banned via the Montreal Protocol, an international environmental agreement signed by most CFC-producing countries in September

1987, after it was discovered that CFCs were 100% ozone-depleting. CFCs were replaced by hydrochlorofluorocarbons (HCFCs), which are less damaging, but still have ozone-depleting potential.

More recent EC legislation means that HCFCs now are being phased out, a process which is likely to affect the industry because the large majority of meat plants use the HCFC R-22 as a refrigerant. R-22 has been banned in new plants since 2001 and EU regulations have decreed that plants will not be able to buy virgin R-22 from 2010 onwards.

“An awful lot of abattoirs around the UK will have an R-22 plant or refrigeration that has a component of R-22 in it,” explains Bowater. “The total ban on R-22 is scheduled for 2015, but the EU is always looking to move that date forward, so plants need to start thinking about replacement strategies.”

Chemical companies are trying to devise replacements that can be easily swapped over

with R-22, but the process is not straightforward and can result in less efficient refrigeration. “A lot of people think they can get away with just replacing it and don’t understand the problems they are going to have in the future,” says Bowater. “Unfortunately, there is no wonderful replacement for R-22, which is a very effective single-component refrigerant. All the alternatives are blends of components, which cause problems if they leak because they leak at different rates.”

COST IMPACT

The replacements for HCFCs are hydrofluorocarbons (HFCs), which also cost considerably more. R-22 generally costs around £2/kg, whereas the HFC replacements cost as much as £5-£7/kg. Although not ozone-depleting, HFCs still have a fairly high global warming potential because they act as a very powerful greenhouse gas – 1kg of HFC refrigerant will have the same effect on global warming as 2,500-3,000kg of carbon dioxide.

As a result, the government has introduced F-gas regulations, which are designed to contain, prevent and reduce emissions of HFCs into the atmosphere. The regulations cover the containment and recovery of the refrigerants and lay down stringent leakage checks and recovery obligations. All people handling HFCs must be qualified to do so.

“Many plants will be unaware of the new refrigerant legislation and there is a tendency for operators to bury their heads in the sand over the issue,” says Bowater. “But the laws will come into force and it might be a convenient time for operators to think about scrapping their old inefficient equipment and putting in something more efficient on the basis of long-term payback.”

One alternative to HFC systems for larger-scale operators is the installation of an ammonia plant. Although initially expensive, these are very efficient and allow rapid cooling with minimum weight loss.

“Ammonia is also an environmentally friendly alternative. It won’t be phased out, because it has zero global warming and ozone depletion potential,” Bowater adds.

CLIMATE CHANGE LEVY

Legislation governing energy use is the third major consideration for meat plants. Recent climate change targets laid down in the Climate Change Bill have resulted in the Climate Change Levy (CCL), which is a tax on energy use. Restrictions on energy are likely to become more stringent as the government strives to reduce its overall energy use, and refrigeration has been identified as one of the key areas in which to make a change. Refrigeration often accounts for 50% of a meat plant’s energy and, as energy prices rise, efficiency is essential to keep running costs low.

Improving the energy-efficiency of a plant will enable businesses to stay ahead of any

future environmental legislation, as well as reducing the high energy bills that result from inefficient refrigeration equipment. There is an abundance of energy-efficient equipment available on the market, from liquid pressure amplification (LPA) systems, which allow refrigeration to operate at low condensing pressures, to evaporative condensers, which use a combination of water and air to condense the refrigerant.

When purchasing such equipment, there are several government schemes to consider. Small to medium-sized operators (SMEs) can apply for interest-free Energy-Efficiency Loans and larger companies can buy equipment listed under the Enhanced Capital Allowances Scheme (ECA), which enables businesses to write off the total cost of their energy-efficient equipment against their taxable profits in the first year.

There is a wide range of technology available on the market and if a plant is considering large-scale investment, it might be worth hiring an independent refrigeration consultancy firm to oversee the purchase and installation of equipment. Consultants will carry out energy audits and draw up maintenance contracts to ensure equipment is

looked after in the future. "We advise on methods to improve efficiency, which could involve a low-cost solution, such as different control settings," explains Alan Jackson, director of BJA Refrigeration Consulting Engineers. "It might also involve saying the plant is old, out of date and inefficient and we would then advise on the best replacement."

MANAGEMENT CHANGES

Even if large-scale investment is not necessary or viable, simple management changes can often lead to substantial energy savings. "Making savings is not necessarily about expensive new equipment, but the way in which existing equipment is used and managed," explains Dr Steve James of Bristol University's Food Refrigeration and Process Engineering Research Centre (FRPERC). "Simple things often lead to inefficiency, such as doors left open or refrigeration turned on when there are no carcasses in the room."

Maintenance and cleaning is also vital, as evaporator coils can get blocked and become less effective as a result. Refrigeration systems should be carefully monitored to ensure they are



Above: Carcase refrigeration is subject to strict temperature regulations

performing correctly. "Fans get less and less effective as time goes on, but as long as the meat comes out cold, this is rarely addressed," says James. "A lot of excess energy is lost as a result."

ALL-ROUND ACTION

Although hygiene, energy efficiency and pollution control may seem like conflicting requirements, action to tackle one of these problem areas can often give results across the board.

Old, inefficient equipment will not be able to chill carcasses to the required temperature, will use excess energy and will most likely rely on a refrigerant with global warming potential. Investment in more efficient technology and simple changes in management to ensure all refrigeration equipment is running properly, without leaks or blockages, will reduce the risk of greenhouse emissions, save considerable amounts of energy and allow carcasses to be cooled quickly and efficiently. If meat plant operators stay ahead of the current legislation governing refrigeration now, they will ensure good profits and a more efficient business in years to come. Those that bury their heads in the sand risk being caught out as the pressure for change gathers momentum. ●

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