Meat technology update

97/6 – October 1997
Reprinted November 2006

Noise Control in Processing Areas

MEAT TECHNOLOGY UPDATE
Cutting edge technology for the meat processing industry

Sound consists of a series of compression waves derived from a vibrating source and transmitted by solids, liquids and gases. These pulsations consist of minute fluctuations in air pressure. The frequency of a sound is the rate at which the variation in pressure occurs and is expressed in cycles per second or hertz (Hz).

The sound pressure level is a measure of the extent of the variations in pressure. The ear is sensitive to a wide range of pressures, from the low end, i.e. threshold of audibility (the level of the weakest sound that a person with very good hearing can detect in an extremely quiet location), to the threshold of pain. As this range is too large to work with conveniently, a logarithm of the ratio of actual sound pressure to a reference pressure is used. This number is called a decibel (dB). Zero on the decibel scale corresponds to the threshold of audibility. The threshold of pain occurs at about 120 dB. Decibel levels from multiple sources may not be added to give the overall sound level.

The human ear does not respond uniformly to sound pressure over the whole frequency range. For example, the ear would perceive a 70 dB sound at 1,0000 Hz to be as 'loud' as a 100 dB sound at 50 Hz. Owing to the way in which ear sensitivity varies with frequency, an overall decibel reading is not usually sufficient for evaluating noise.

The National Standard for the exposure to noise in the occupational environment is expressed as:

- Maximum allowable eight hours' continuous exposure level of 85 dB(A).
- Peak noise level should never exceed 140 dB(lin).

These levels as specified in the National Standard are the maximum acceptable exposure levels for noise in the workplace. However, over long periods, repeated noise exposure at between 75 dB(A) and 85 dB(A) may present small risks to some people. With progressively increasing levels, the risk becomes greater. Workplace noise levels lower than 85 dB(A) are therefore desirable, if practicable. Some key definitions include:

- Decibel (dB) - the measure of how much noise (or sound pressure level). It is a logarithmic scale and each increase in 3dB is equivalent to doubling the energy of the noise in an area.

FOOD SCIENCE AUSTRALIA
A joint venture of CSIRO & the Victorian Government

AMPC

mla
MEAT & LIVESTOCK AUSTRALIA

- dB(A) - noise levels are commonly expressed in dB(A). The sound signal to be measured is passed through a series of notch filters and each frequency band is weighted according to the response of the human ear. This is known as the "A" weighting and is denoted dB(A). It enables the intensity of noise with different frequency characteristics to be compared, i.e. it is essentially a measure of the 'loudness' of a sound and gives a response to frequency similar to that of the ear.
- dB (lin) - means unweighted decibel. Unweighted means sound pressure levels or similar quantities that are measured using an instrument that responds equally to all frequencies, i.e. it has a flat or linear frequency response.
- Leq - the equivalent noise level is the continuous steady state noise level which would contain the same energy as the time-varying noise for hearing conservation purposes. This value is obtained over a period of 8 hours.
- $L_{Aeq\ 8\ hr}$ - the "A" weighted equivalent noise level measured over an 8-hour period.
- $L_{Aeq\ (Lin)}$ - the peak noise level measured over a certain time period using a linear frequency response.

Noise exposure may be controlled by:

1. Redesigning to eliminate the noise source.
2. Modifying the noise source to reduce the noise output, and/or altering or blocking the transmission path of the noise to reduce the noise levels reaching the receiver. *(Engineering controls.)*
3. Removing or limiting the receiver from the area. *(Administrative controls.)*
4. Preventing the exposure of the receiver. *(Personal protective equipment.)*

Administration controls, hearing protectors or earplugs should only be considered as a temporary or last resort option once a noise problem is identified in your abattoir as these methods are the least reliable ways of reducing hearing damage.

Engineering controls at the source

Noise control solutions that may be applicable at the noise source include:

- **The purchase of new** plant, the design of the area in which it is to be installed and the design of new workplaces generally, provide an opportunity for cost-effective noise control measures. All new plant and equipment should specify maximum noise emission data, and this should be a consideration in future purchases. Although many abattoirs rarely enjoy new plant opportunities, when these do arise, the issue of noise generation should be part of the design brief.
- **Eliminate or replace the plant** or its operation by a quieter operation, with equal or better efficiency, (e.g. replace rivets with welds, replace reciprocating compressor with screw).
- Make minor design changes to **reduce specific noise sources**, e.g. avoid metal-to-metal contact with the use of nylon or polyurethane bumpers, improved gearing etc.
- Correct the **specific machine elements** causing the noise by a local source approach, rather than by consideration of the entire machine as a *noise source*, e.g. by the addition of vibration isolating mountings, mufflers or silencers for air and gas flows; reduce air velocity of free jets etc.
- **Maintain plant** properly by replacing worn bearings and gears, improving lubrication, tightening loose parts (especially guards), tensioning slapping belts, balancing all rotating parts and preventing air or steam leaks.
- **Isolate** the vibrating machine parts

to reduce noise from vibrating panels or guards.

- **Materials handling** processes, in particular, can be modified to ensure that the impact and shock during handling and transport are minimised as far as possible. This may be achieved by:
  - minimising the fall height of items onto hard surfaces;
  - fixing damping materials to or stiffening tables, panels or containers where they are struck by materials or items during processing;
  - absorbing shock through the provision of wear-resistant rubber or plastic coatings;
  - using conveyors instead of rollers, which are more likely to rattle;
  - controlling the speed to better match the production flow, thereby reducing the noise generation due to stop-start impact noise.

The MRC Report 'Noise Control for Abattoirs' contains a range of engineering-based suggestions which are provided as practical solutions to common noise problems in abattoirs. Examples are shown in Figures 1, 2 and 3.

Engineering controls of the noise transmission path

If it is not possible to change or modify the noise generation at the source, engineering solutions which interfere with the path of transmission between the *source* and the receiver *should* be investigated. This may include:

i. **isolating noise emitting equipment** (the noisy elements that are not an integrated part of the basic plant such as pumps, air compressors, fans) away from the general work areas and the majority of the work population;

ii. **isolating the noise source or the employees** in an acoustic enclosure.

A system should be established to ensure regular inspection and maintenance of vibration mountings, impact absorbers, gaskets, seals, silencers, barriers, absorptive materials and other equipment used to control noise.

Figure 1:

AREA:

Knocking

NOISE SOURCE:

Impact Noise

- animal against knocking box
- knocking box mechanisms

CONTROL OPTIONS:

- More rigid knocking box with solid panels to minimise vibration
- Secure beast to prevent thrashing about e.g. head secured, sides secured
- Rotating knocking box to reduce impact noise when beast falls onto conveyor/floor
- Nylon guides in door mechanism to dampen the impact of the door against the frame
  - Modification of the gate closure by either:
  - Slowing down air cylinders towards the end of the stroke
  - Noise damping to stop gate closure impact noise
  - Stop gate short of end closure to stop end impact.

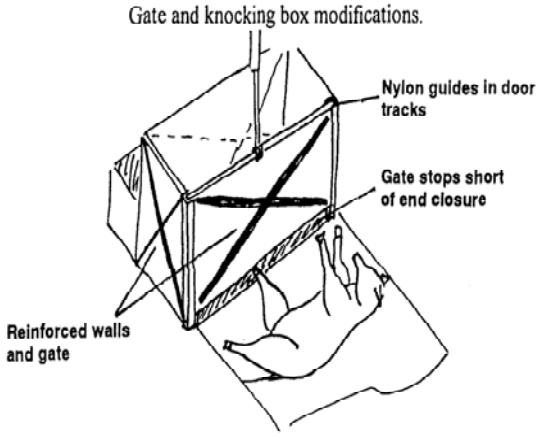


Figure 2:

AREA:

Boning Room/Offal Rooms

NOISE SOURCE:

Prebreaker and breaker machines
$L_{Aeq\ 8\ hr}$ 96 dB(A)

CONTROL OPTIONS:

- Damping of chutes and metal casings with double skin interspersed with a heavy material (e.g. concrete, sandwich, etc) or acoustic attenuating materials, e.g. 'noisless' steel - a laminated material.
- Isolate breakers from general work areas.
- Installation of lids and flaps to reduce the speed of bone entry and block noise transmission.

Diagram of cross-section of double-skinned chute

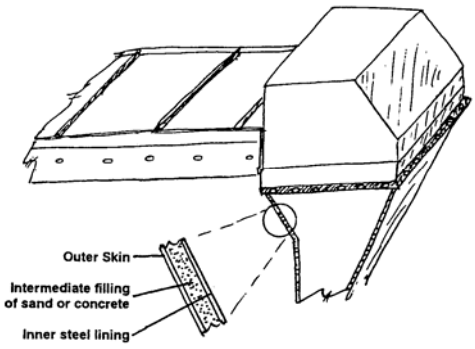


Figure 3:

AREA:

Chillers/Freezers

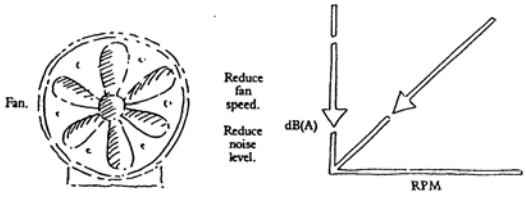
NOISE SOURCE:

Overhead fans (chiller fans)
$L_{Aeq\ 8\ hr}$ 95 dB(A)

CONTROL OPTIONS:

- Manually control or use door interlocked variable speed control units, e.g. when door is open fan slows to reduce noise; when door is closed high speed is engaged (use timer to re-activate high speed after nominated time to reduce chance of interlock failure).
- Reduce fan tip speed to reduce the noise generation (in consultation with the manufacturers).
- Use multi-blade, low noise fans instead of 6-blade fans as are in the older units.
- Run fans at lower speed during loading and high speed during chilling phase. Restrict entry during chilling.
- Fit sound attenuators to fans.

Lower the speed of fan, lower the noise



Contact us for additional information

Meat Industry Services is supported by the Australian Meat Processor Corporation (AMPC) and Meat & Livestock Australia (MLA).

Brisbane:
Food Science Australia
PO Box 3312
Tingalpa DC QLD 4173

Sydney:
Bill Spooncer
PO Box 181
KURMOND NSW 2757

Adelaide:
Chris Sentance
PO Box 178
FLAGSTAFF HILL SA 5159

Ian Eustace
T +61 7 3214 2117
F +61 7 3214 2103
M 0414 336 724

Neil McPhail
T +61 7 3214 211
F +61 7 3214 2103
M 0414 336 907

Alison Small
T +61 7 3214 2109
F +61 7 3214 2103
M 0409 819 998

T +61 2 4567 7952
F +61 2 4567 8952
M 0414 648 387

T +61 8 370 7466
F +61 8 8370 7566
M 0419 944 022

MEAT TECHNOLOGY UPDATE
Cutting edge technology for the meat processing industry