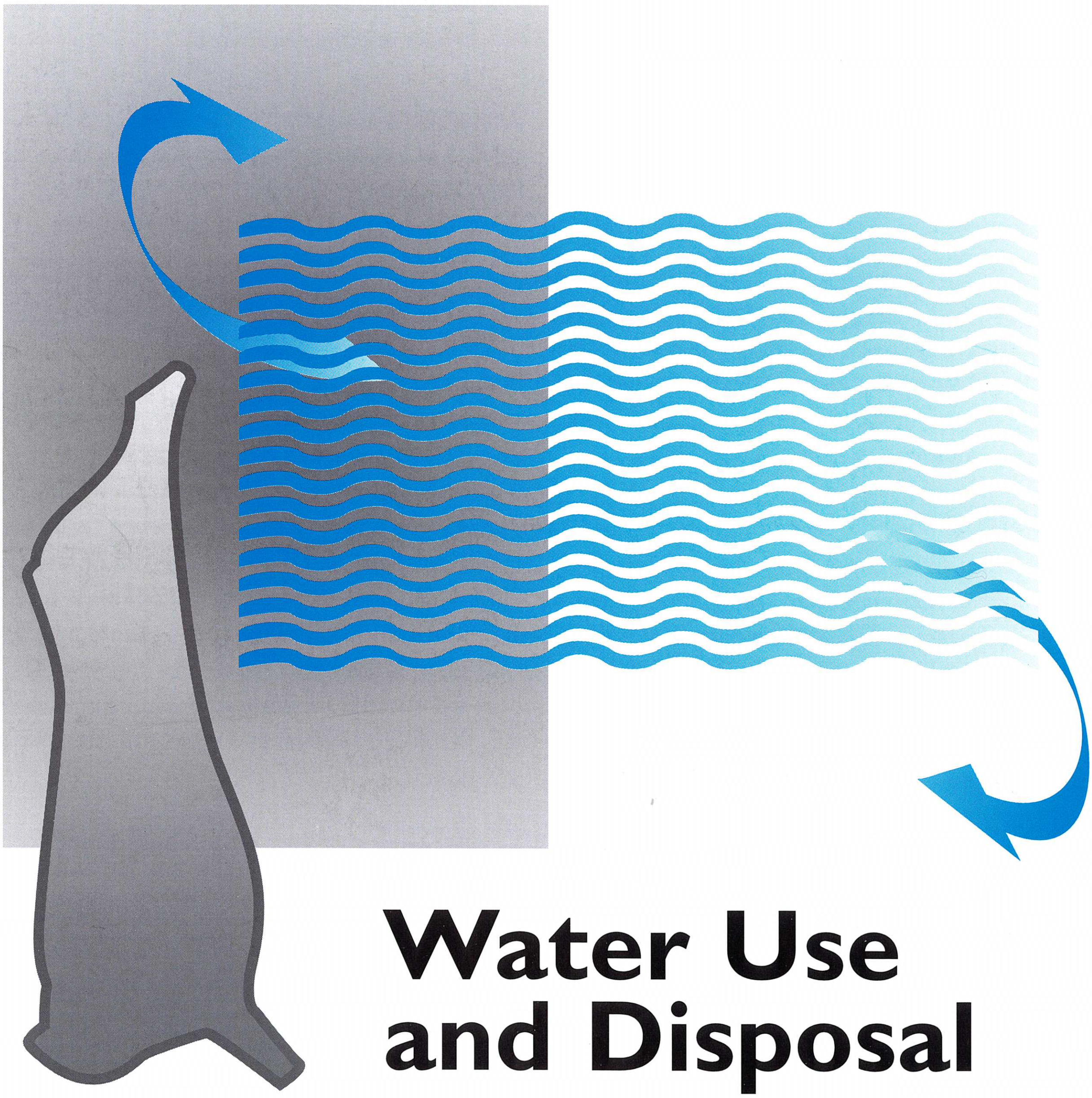


Water Use and Disposal

1997

Meat Research Corporation

AMT
AUSTRALIAN MEAT TECHNOLOGY

Large volumes of hot and warm water are used at meat plants. Hot water (82°C and above) is used for sterilising equipment including knives, hooks, viscera tables and halving saws. Warm water (approximately 43°C) is used mainly for hand and apron washing. Water at a temperature between that of hot and warm is used for washing carcases and edible meat products, including tripe.

Significant energy is required for heating hot and warm water, particularly for abattoirs with rendering plants that do not recover heat. Thus, minimising hot and warm water usage can substantially reduce energy consumption. This increases profits and reduces greenhouse emissions, primarily in the form of carbon dioxide.

Hot and warm water savings are possible for most plants, simply by tuning existing devices or by replacing older continuous overflow sterilisers with intermittent devices.

Typical Water Usage

Hot and warm water usage in an abattoir can vary considerably, depending on the species being killed and the equipment in use. Even more variability occurs between abattoirs due to different processing operations and numbers of animals being killed. Typical water consumption values measured in an Australian plant case study are given in Table 1.

Additional data on water usage and water minimisation techniques is provided in the manual Water and Waste Minimisation.

Potential for Water Minimisation

Techniques for minimising water usage fall into three main categories: point-of-use water reduction; water re-use; and non-water alternatives.

Point-of-use reduction

Point-of-use water reduction involves determining the proportion of hot and warm water used by various pieces of equipment and operations in the plant. These include knife sterilisers, hand and apron washing areas, product washing and plant washdown operations.

Ways to reduce water usage include:

- 'tuning' of existing devices to optimum flows;
- replacing older technologies with newer more efficient ones; and
- turning off continuous-flow devices during breaks in non-critical areas.

Tuning of existing devices can often provide major savings in water consumption. Table 1 illustrates large variation in flow between water-using devices, which is typical of many abattoirs. Adjustment and maintenance of valves to give optimum flow at each device will often provide substantial savings in hot and warm water use.

Water usage can be much greater with continuous overflow knife sterilisers than with intermittent devices. Large water savings are possible by replacing continuous devices with intermittent devices which are only actuated when required. However, these water savings are valid only when the frequency of intermittent operations is low. An alternative is to fit localised temperature and flow control on knife sterilisers so that hot water is only fed into the steriliser when the temperature falls below a preset value. Figure 1 illustrates this principle.

FIGURE 1 Double skin knife steriliser with temperature control (Walford et al., 1994)

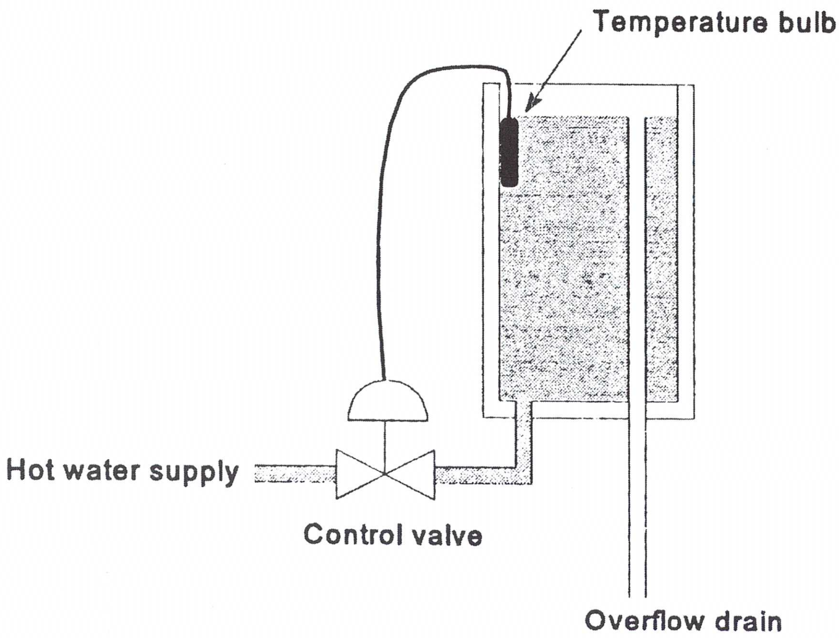


TABLE 1 Measured hot and warm water consumption in a case study plant (Amos, 1997)

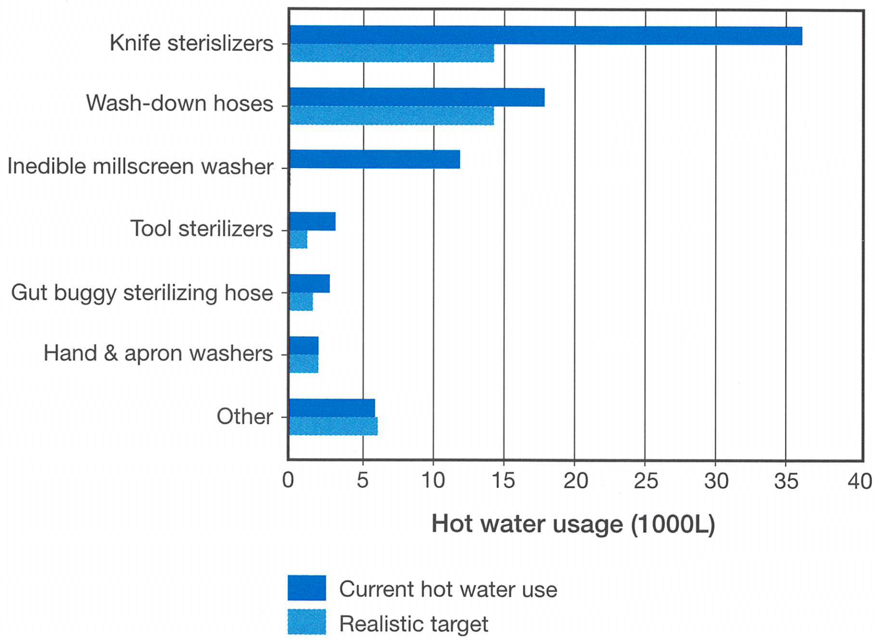
Device[1]			Instantaneous Flow (L/min)	Flow (L/beef carcase)
Warm Water (43°C)				
Intermittent	Knee-operated hand washers (65)	Avg.[2]	-	0.70
		Min.[3]	-	0.03
		Max.[4]	-	2.97
	Sensor-operated hand washers (5)	Avg.	-	0.04
		Min.	-	0.04
		Max.	-	0.04
Continuous	Hand washers (15)	Avg.	17.7	-
		Min.	4.8	-
		Max.	38.0	-
Hot Water (82°C)				
Intermittent	Gut barrow sterilisers	Avg.	-	16.0
Continuous	Knife sterilisers (73)	Avg.	4.7	-
		Min.	0.2	-
		Max.	19.2	-
	Horn saw steriliser (1)	Avg.	5.2	-
	Splitting saw sterilisers (4)	Avg.	6.0	-
	Rod sterilisers (2)	Avg.	4.2	-

[1] Figures in brackets signify the number of each device present in the measured plant.
[2] Average measured flow. [3] Minimum measured flow. [4] Maximum measured flow.

Replacing knee-operated intermittent devices with sensor-operated devices can lead to further savings.

Figure 2 illustrates hot water usage for a New Zealand beef-only plant with a daily kill of 143 animals, along with potential hot water savings.

FIGURE 2 Hot water usage in a beef processing plant (Walford *et al.*, 1994)



The potential hot water savings amount to 28% at no cost, simply by better management of water use, including knife steriliser flows and scheduling of water flow during processing and washdown operations.

Water re-use

Water re-use requires collection of used water prior to its re-use in the same process or for other approved purposes. Treatment of the water before recycling to ensure water quality, as well as re-heating or cooling of the water to maintain the correct temperature, may be required.

When the water is to be re-used on edible products, decontamination is also important. One example of this type of re-use option is the hot water decontamination cabinet and treatment system funded by the Meat Research Corporation (MRC) and developed by Australian Meat Technology Pty Ltd (AMT). In this process, hot water is sprayed onto carcases before chilling to reduce bacterial counts on the carcase. The hot water is then treated and re-heated before being recirculated to the spray cabinet. Fresh make-up water is required to keep the water quality within specified limits, although only a small amount of make-up water is used, which represents a large cost saving in water consumption and heating.

Non-water alternatives

Non-water alternatives involve changing operations that typically use water to operations which use no water, and therefore represent a direct saving in water usage as well as potential energy savings if the alternative technology is more energy-efficient. One example is the use of ultraviolet light to sterilise knives, instead of using steriliser water.

Consumption Relative to Production

To be an effective management tool, daily water consumption readings should be collated and related to the daily production levels, either on a hot carcase weight (HCW) or equivalent cattle weight (ECW) basis. If daily hot carcase weights are readily available, this is the preferred method, being expressed as either litres per kg, or cubic metres per tonne HCW. The ECW method requires that various species of small stock, including pigs and goats, be allocated a value equivalent to beef. This method does not allow for the substantial weight variation within species.

Reference

Walford, J., Lovatt, S.J. and Willix, J. 1994, 'Measurement and Modelling of Hot and Warm Water Usage in Meat Plants', *Meat Industry Research Institute of New Zealand (MIRINZ) Technical Report No. 944.*

Additional Information

More detailed information on this subject is provided in the following:

'Analysis of Rendering and Hot Water Heat Energy Use in Meat Plants' in *43rd ICOMST Congress Proceedings, Auckland, New Zealand,* 1997, pp. 2-7.

'Water and Waste Minimisation, Optimisation of Water Use and Control of Waste in Abattoirs', AMT/MRC Manual, 1995.

Additional information

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