CLEANING UP

Effective cleaning of the milking machine and yards is extremely important if milk quality is to be maintained. While cleaning is not a job where shortcuts can be taken, it need not take a long time. Cleaning up is a routine job that can be almost fully automated, so the potential for time saving is great.

Many farmers spend between 30 and 60 minutes cleaning the milking machines and yards at each milking. Extra time may also be spent washing out the vat. Careful thought given to work routines and the strategic use of automation can make significant efficiency gains. The benefits include:

- harvesting premium-quality milk;
- receiving premium prices; and
- minimising labour costs.

This chapter contains ideas to consider on the following areas:

Information in this chapter will assist in planning efficient cleaning systems for milking machines and holding yards.

Key principles to keep in mind ...

The ultimate quality of a farm's milk is determined in large part by the cleanliness of the milking machine and the whole dairy environment. A clean milking machine ensures that microbial contamination of the milk is minimised. Clean yards and surroundings reduce other sources of contamination.

Effective cleaning — essential elements

Some things are cleaned more easily than others. Sometimes cleaning can be accomplished by flushing or rinsing with the right quantity of water. In other circumstances, some sort of chemical assistance is required and no amount of flushing will produce an effective clean.

There are four elements that combine when a milking machine is cleaned. If one of these elements is lacking, the other elements must work harder to compensate. The essential elements are:

- thermal energy – water temperature;
- chemical energy – detergent (acid or alkali);
- kinetic energy – turbulence; and
- time – sufficient time to get the job done.

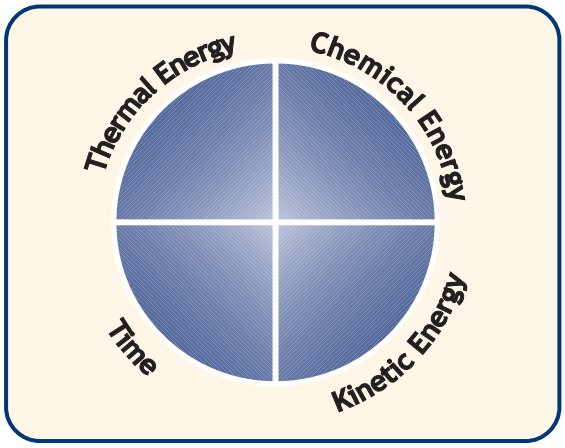

Figure 6.1: The essential elements for effective machine cleaning.
Source: National Milk Harvesting Centre.

The essential element when cleaning a holding yard is kinetic energy.

- Large volumes of water provide a flushing effect to lift the manure – kinetic energy.

Water

Water plays a crucial role in the cleaning of both the milking machine and the yards.

- Water transports the heat energy and cleaning chemicals used in milking machine cleaning.
- Water volume and flow rate creates turbulence – a 'scrubbing' action or a lifting force.
- Water carries away the milk residue or yard debris.

Water is the medium that brings all the elements of cleaning together to change something from dirty to clean.

Water — machine cleaning

The quality and quantity of the water used for cleaning the milking machine has a significant impact on cleaning efficiency.

- Poor water quality can affect the performance of cleaning chemicals.

There are a number of farms where the detergent wash water is being recycled. This is one way of getting good-quality wash water in areas of poor water quality. Other benefits include:

- Recycling detergent wash water saves on detergent and energy costs for heating water. Some water and additional chemical is added as needed.
- Recycling reduces the amount of detergent entering the farm effluent system.
- Catching the final hot water rinse and using as the first warm rinse at the next milking reduces water and energy usage.

Water — yard cleaning

The water used for yard cleaning does not have to be high quality, but large quantities of water are usually required.

- Yards can be flushed with recycled water from the effluent pond.
- Pumping water back to a holding tank does cost, but the amount of water used is significantly reduced.
- Recycling yard wash water can lead to a salt build up in the effluent water – this may need to be monitored over time.

The main hazards associated with this part of the milk harvesting process include:

- hot water – milkers can be splashed and burnt, particularly if carrying buckets;
- chemical – acid and caustic chemicals can burn even after a thorough rinse;
- hot water piping – exposed or uncovered pipes can be a burn hazard;
- slipping – cows and milkers can slip on wet surfaces in the milking area and yards; and
- tripping – long or poorly sited hoses create a tripping hazard.

Milking machine cleaning

Machine cleaning systems

The aim of any system should be to achieve high levels of cleanliness with the least input in terms of labour time.

There are a number of cleaning system options:

- bucket or flush cleaning;
- reverse flow cleaning; and
- jetter systems – also called third line cleaning, clean-in-place (CIP).

Bucket cleaning

Bucket cleaning is being phased out of the industry.

- Bucket or flush cleaning is very time consuming and labour intensive.
- Carrying around buckets of hot water and chemicals is a potential hazard.

Bucket cleaning is not a good choice from an OH&S point of view.

Avoid carrying buckets of hot water. Use a trolley instead.

Reverse flow cleaning

In a reverse flow type of cleaning system, water is pumped through the milking machine via the receival can and then the water exits at the cluster.

- A high flow rate and large volumes of water are required for this system – this can be a major disadvantage.
- Installation expenses are often high, as additional water-heating capacity is usually needed.

While reverse flow cleaning requires less labour time than jetters, the system uses more water and chemicals than a recirculating jetter system.

Jetter cleaning

A jetter system uses a third line plumbed to drums containing the cleaning solution. An air injector may also be fitted to the end of the milkline to ensure better cleaning through the turbulence it creates down the milkline. Jetters can be fixed to either lowline, midline or highline configurations.

- Jetter cleaning systems are cheaper to run than reverse flow cleaning and a lot safer than the bucket cleaning system.

- Jetters provide a consistent clean every time – they reduce the chances of mistakes being made by new or distracted milkers.
- The majority of farm dairies have this type of system.

In terms of work routine efficiency, most time is spent attaching clusters to the jetters. In some systems, clusters should also be removed from the jetters after washing to prevent distortion, a step that adds time to the work routine.

An efficient jetter system should have the following features:

- Adequately sized and configured washline.
- Minimum flow rate of 3 litres per minute, per cluster.
- Flow rate through the first jetter should not greatly exceed the last.
- A secure plugging device at the end of the milkline. If the milkline is looped, this sectioning off is done closest to the receival can on one of the lines.
- Be self-draining.
- Cause minimal liner stretch and distortion.
- A high flow, rapid-dump hot water service – this saves time filling drums.

Make sure all joints and pipes in the third line are secure, to avoid leaks during the cleaning cycle.

Wash drums

Usually one drum is used for the warm and hot rinses, and another for the hot detergent wash.

- Each drum needs to hold at least 5 litres per set of clusters to give the required flow rate at the cluster.
- A container that measures the exact amount of liquid or powder saves time every milking.
- Measure volumes accurately to ensure the correct detergent concentrations – mark the fill mark on the side of the drum.
- Consider hooking up automatic shut-off valves to water drums – this avoids having to wait around while they fill.
- It must be possible to control these auto shut-off valves when the machine is actually washing.

Jetter set-up

The job of putting clusters on jetters will always involve a labour input.

- Rub the outside of the clusters before they are attached to jetters to remove any manure or dirt.
- Some liners and jetters are not compatible – check compatibility.
- Clusters on some styles of jetters may need to be removed from jetters after cleaning to avoid liner distortion.

Figure 6.2: Jetter cleaning system.
Source: National Milk Harvesting Centre.

Automated jetter systems

It is possible to automate the entire cleaning process once the clusters are attached to the jetters. These systems are worth considering, as they free up labour to do more productive tasks.

- These systems give a consistent clean after every milking.
- The correct amount of chemical is automatically added each time.
- Water circulates at the appropriate temperature for exactly the right time.
- There is no need for humans to contact chemicals.
- A daily check of chemical usage and water flow through each of the clusters ensures the system is working well.

Figure 6.3: Automatic plant cleaning system.
Source: National Milk Harvesting Centre.

Use the personal protective gear recommended on the chemical product's label when handling cleaning chemicals.

Ensure a wash station and chemical spill equipment is close to chemical use areas.

In-dairy washdown systems

An easy-to-operate method of cleaning the pit and milking platform is essential.

- Use high volumes of water at low pressure in the dairy – too much pressure splatters manure everywhere.
- Very long hoses are difficult to handle and get caught easily.
- Hoses that are too narrow dramatically increase clean-up time.

Some larger dairies are installing automatic washing systems on their milking platforms. This is especially useful if the dairy is used for more than an hour at a time.

- Platform washing systems speed up dairy cleaning time and clean the platform between a run of cows if dunging is a problem – dunging should not be a problem in a modern, well-operated dairy.
- Platform washing systems are especially useful in rapid exit dairies because of the increased area to be cleaned in the dairy itself.
- Splash guards and a manure channel mounted on the pit frame behind the cows can reduce the need to clean the milking platform.

See Chapter 9 – Design considerations.

Hoses used to clean up the milking platform should be located out of traffic zones.

Yard cleaning

Yard cleaning is a tedious and time-consuming job. Reducing the time spent washing yards requires efficient work routines and careful design of the holding yards.

If the work routine for cleaning up currently takes too long, it might be necessary to redesign the yard system to make yard cleaning easier and more efficient.

The amount of manure deposited in the yard is directly related to the time the cows spend in there.

Volume & pressure

The amount of water and the pressure at which it is delivered are two factors that affect yard cleaning efficiency. The volume of water acts as a carrying agent that transports the manure away, while the pressure provides the mechanical energy – a lifting and moving force.

In general, high-volume, low-pressure systems are better at moving manure.

High-pressure water is dangerous when directed at people.

Pre-wetting yard surface

It is worth considering keeping the surface of the yard wet while cows are in the yards. This saves time and effort during the final cleaning stage. Yard wetting options include:

- Overhead sprinklers, garden sprinklers, automatic sprays – all can help reduce fly irritation, keep cows cool in summer and ensure that the yard remains damp enough for easy washing.
- Polypipe (with holes to let the water dribble out) which is placed at the top of the slope, keeps the surface wet without wetting the cows.
- Tipping drums that periodically empty onto the yard – these wet the surface and do some flushing as well.
- Risers can be used to wet the yard surface.

Take care to minimise obstructions to water flowing over the surface. Each obstruction will require more effort or water to clean around.

Yard slope & drainage

Single slope yards rising up to the dairy promote good cow-flow and can be cleaned effectively using all cleaning system options – the difference is in the time it takes.

- Single slope yards usually have the main drain at the rear of the yard. Cleaning starts at the dairy end.

Yards with twin slopes or cross slopes can be cleaned by hose or hydrant systems, but are not suitable for flood wash systems. There may also be problems with using backing gate cleaning systems on twin slopes.

- Twin slope yards usually have the main drain near the dairy entry – most manure is deposited here, so the area can be cleaned quickly.

Chapter 4 – Dairy entry.

Cover large drains with secured grates.

Yard surface

The surface of the yard impacts on the ease of cleaning.

- Excessively rough and cracked concrete surfaces affect the ease of cleaning and increase the time spent hosing these areas – consider resurfacing.
- Large grooves running across the slope can slow water flow and trap sand particles.
- Grooves running down slope do not cause as much restriction and enable sand to be flushed away.
- Concrete should not be over finished, as it can become slippery and can bring fine material to the surface that breaks down under continual washing.

Chapter 4 – Dairy entry.

Broken areas of yard are a tripping hazard.

Manual cleaning systems

Manual systems involve a higher labour input but, depending on the system used, the potential for saving time is large.

- Using high-volume and low-pressure systems saves time.
- Removing obstructions also helps with the cleaning time.

The options for manual yard cleaning systems are:

- hose systems; and
- hydrant systems.

Hose system

Hose cleaning systems can handle any slope, but are costly in terms of time. The greater the area to be cleaned, the longer it will take. Increasing the pressure may make the hose difficult to handle.

Table 6.1: Volume and pressure.

Options	Volume – litres per minute	Pressure – kPa
High-volume, Low-pressure	220 – 400	100 – 140
Low-volume, High-pressure	54 – 145	180 – 262

Source: National Milk Harvesting Centre.

Pumps

Place water pumps close to the storage tank – this reduces the distance water has to be 'dragged' and is less effort for the pump.

- Pump suction and discharge have a large effect on the amount of water a pump can output.
- The delivery to the pump is best from above, but if suction is necessary, the lift should be as short as possible.
- The delivery pipe diameter should be at least 51 mm ID.

Hoses

Hoses should be located at the top of slopes to work effluent towards drains.

- Hose swivels reduce kinking and hose wear, and makes using them easier.
- In round yards, a swivelled overhead boom can reduce the amount of hose dragging required.
- In rectangular yards, top rails can incorporate the water delivery line – connection points can spaced along the length of the rail.
- A piece of partially flattened 38 mm stainless steel can serve as a nozzle – this simple device increases pressure but does not restrict water flow too much.

Figure 6.4: Flattened pipe making a simple nozzle on a yard cleaning hose.
Source: National Milk Harvesting Centre.

Short hoses, located at convenient positions avoid the need to drag a single, long hose across clean areas to reach unwashed areas.

Scrapers

Scrapers are useful where water shortage is a problem.

- Wooden or rubber scrapers with wheels are used for breaking up large dung pads and help shift heavier solids from the yard.
- Using scrapers on hot days may cause the manure left behind to dry quickly on the yard.

Keeping the yard wet, breaking up the pats, plus pre-wetting before hosing down, ensures time and water usage are kept to a minimum. Using a mechanically operated backing gate to do this can cut cleaning times significantly.

Use mechanical hose supports such as booms to save dragging long hoses.

Short hoses are easier and safer to handle.

Hydrant washing

Hydrant washing systems are becoming very popular – there are no hoses to drag around and they can reduce yard cleaning time to a minimum. Hydrant systems may be the best option if yard slopes make flood washing ineffective.

- Hydrant systems can output up to 2000 litres of water a minute.
- Most yards require no more than 3 hydrants. Small yards may be able to get away with only 1.
- Several fixed risers with hydrants are attached and mounted along the yard – generally attached to a 100 mm supply line.
- The top may be fitted with a swivel. When turned on, the operator only needs to direct the nozzle (see Figure 6.5).
- Hydrant systems have significant OH&S benefits – no long hose to drag around and the high-volume swivel hose is easy to direct.

Properly installed and designed hydrant systems make a good choice for upgrading yard cleaning, particularly if existing yard slopes may make a flood wash system ineffective.

Figure 6.5: Hydrants with an industrial swivel are safer to use.
Source: National Milk Harvesting Centre.

Avoid inhaling droplets if using recycled water – there is a real risk of contracting Legionnaires Disease.

Automated yard cleaning systems

Automated systems reduce the requirement for labour input, but some tasks may still need to be completed to ensure a high-quality clean. Options include:

- Backing gate cleaning systems.
- Flood wash systems.

Backing gate cleaning

Cleaning times can be reduced using scrapers and water jets mounted on backing gates.

Options include:

- Four or 5 nozzles mounted with a drag chain between each water outlet – as the gate moves, the chain breaks up manure pads and the water flushes the manure away.
- A system with a number of small high-pressure jets behind a scraper-like barrier. This washes the yards as the backing gate moves – suitable for rectangular and circular yards. It still may to necessary to scrape or hose a narrow wedge of the yard, but this should take less than a minute.

Automated backing gate systems need a 'dead-man' switch.

Figure 6.6: This system uses sections of chain and a number of water outlets on the backing gate.

Flood wash cleaning

Flood wash systems work best in single slope yards with no cross flow. If the yards are appropriate, a well-designed system can mean opening a gate valve or pushing a button and walking away. In practice, however, the potential saving in time can be lost if some form of manual cleaning is required before or after the flood wash waters are released.

There are a number of different ways to flood wash holding yards:

- elevated tanks – tanks in yard or on the roof; and
- sub-surface risers.

In suitable yards, flood wash systems are the ultimate in high-volume, low-pressure cleaning systems. A stored volume of water is released from the top of the yard and sweeps the yard clean in one hit.

- To shift the manure, a 50 mm high wave of water moving at 1 m per second needs to wash over the yard – these figures are minimum figures.
- A flood washing system usually takes between 15 seconds and 1 minute to clean a yard.
- Between 5000 to 25,000 litres are commonly used per milking. Water from the plate cooler can be diverted into the flood wash water reservoir tank.
- A minimum of 1000 litres per metre width of yard is recommended – for example, if the yard is 8 m wide, a minimum of 8000 litres will be required per cleaning.
- Two single 250 mm outlets or several 150 mm outlets may be needed to produce the correct wave effect.
- The facilities receiving the waste water must be designed to handle a large slug of water in a short space of time.

- Slopes that are too steep (greater than 4% or 1 in 25) or too shallow (less than 2% or 1 in 50) impact on cleaning performance – appropriate slope design is critical for flood wash systems.
- Keeping the yard wet during milking helps a flood washing system.
- Cleaning can be difficult if the main manure build up is near the sump area. A build up near the sump can restrict the flow of wash water and effluent from the rest of the yard.

The reality for many existing flood wash systems is that time is required to break up pads before the 'flood' is released. Improved yard design, in terms of slope and surface texture, as well as water delivery to the yard, should reduce the need to spend time preparing for flood washing.

Chapter 4 – Dairy entry.

Flood wash controls should be sited to give a clear view of the wash area and be well clear of the water gush.

Large tank in yard

This flood wash option uses a tank that is filled between milkings. Pre-wetting the yard improves the effectiveness.

- Locate a gravity storage tank beside the yard or place a tank on either side of the yard to ensure adequate flow (see Figure 6.7).
- The advantage of a large tank with an outlet in the middle of the yard is that water can be distributed evenly across the yard – this is especially useful for wide yards.
- The efficiency of these systems is improved by increasing the height of the tank and the delivery of water through a large diameter outlet onto the yard surface.

Figure 6.7: Flood wash option – large water tank in yard.

Source: National Milk Harvesting Centre.

Pipe and riser flood wash

This flood wash system delivers water via pipe laid under the concrete yard about a 1 m down the slope from the top of the yard.

- Riser pipes are placed at regular intervals to bring water from the main supply pipe up onto the yard (see Figure 6.8).
- Risers are usually placed where the greatest amount of waste is expected to accumulate – in the entry and exit lanes of the yards.

Figure 6.8: Flood wash system with sub surface riser.

Source: National Milk Harvesting Centre.

Where possible, people entry points should be away from the path of the flood wash water.

200-litre flood wash drums

Drums used in this system will automatically fill and tip as long as the water supply continues to run.

- A pivot system is used to tip the drums over – they over-balance when full. Once empty, they return to an upright position.
- The unpredictable nature of this system could represent an OH&S issue and should be considered carefully before adoption.

Elevated water structures pose a hazard if poorly maintained.

Rounding up ...

Efficient machine cleaning requires the correct balance of temperature, chemicals, mechanical energy and time.

The less time cows are kept on the yard, the less manure there should be to deal with.

Volume beats pressure when washing down yards.

CowTime Cost Cutters

Many of the suggestions covered in this chapter can be implemented easily and for little cost. The following list contains quick and cheap changes to improve milking machine and yard cleaning.

Suggestions for machine cleaning:

- Check that your machine cleaning routine is appropriate.
- Hot water plumbing into the pit helps if using a bucket system.
- Scourer gloves are great for cleaning cluster exteriors.
- Designated (and marked) chemical measuring jugs save time and chemical.
- An auto shut-off, float valve in the wash water drum saves waiting for it to fill.
- If upgrading, rapid-dump hot water systems fill the wash drum fast.

Suggestions for yard cleaning:

- A stone trap at the laneway-yard junction helps stop stones getting onto the concrete surface.
- Reducing the time the cows are in the yard reduces clean-up times.
- Keep yards and dairy walls wet during milking with sprinklers or dribble pipes.
- Break up cow pats with a chain attached to the backing gate.
- Keep drains clean to save unblocking pipes.
- Increase the number of take-offs and shorten hoses to reduce hosing time.
- Reduce hose wear and tear by protecting them from concrete corners.
- Reduce snags on the yard surface to stop hoses being caught.
- Check out automation options, such as mounting a system on the backing gate.

Further information...

Cleaning and sanitizing milking equipment (AS 1536 – 2000) Standards Australia, 2000.

Managing dairy-shed wastes. Volume 1. Lee-Ann Monks and Roger Wrigley (editors) Glen Iris (Vic), Dairy Research and Development Corporation, 1993.

Managing dairy-shed wastes. Volume 2. Roger Wrigley (editor) Glen Iris (Vic), Dairy Research and Development Corporation, 1994.

Managing dairy effluent – website. Go to the Target 10 website: http://www.target10.com.au then to the Online Consultant, then to Managing Dairy Effluent.