The cleanliness of the milking system and the dairy is a critical determinant of milk quality. The New Zealand Food Safety Authority has strict guidelines about cleaning of the plant which relate to maintaining milk quality standards.

Cleaning must be done properly. Bacteria can build up in the plant and contaminate milk. They affect milk quality by breaking down the components in milk. This reduces the shelf life of milk and milk products, and produces off-flavours in cheeses and milk powders. Machine cleaning maintains milk quality by aiming to remove ALL of the milk residues from the plant and destroying any resident bacteria. Milk is a difficult material to clean from surfaces because it has many different components, each requiring different temperatures and chemical environments to aid removal.

Cleaning is not a job where shortcuts can be taken, however having good equipment and systems in place will ensure that it doesn’t take a long time. The consistent use of a cleaning routine that is tailored to the milking plant and other available resources (volume and quality of water) will reduce the need to manually scrub or BOMB clean the plant.

**Benefits**

**Maintain milk quality**

- Put in place a process which ensures cleaning is done properly, so that all residues are removed and bacteria are destroyed.

**Ensure safety issues are considered**
The plant cleaning process

Bacteria can enter the plant from cows (teat skin and infected udders) and the environment (drawn into the cluster). The milking environment is ideal for bacterial growth. Effective machine cleaning will control the presence of bacteria in the plant.

The quality of the water used is very important in achieving a successful clean. There are four key elements to the cleaning routine:

- **Thermal energy** which comes from hot water.
- **Time** taken for effective cleaning. This is often dependent on the type of cleaning system.
- **Kinetic energy** from water turbulence. Dictated by water volume and flow rate (hence the use of a flushing pulsator to improve the cleaning of milk lines and receivers).
- **Chemical energy** from acid (pH 2.5-3.0) and alkali (pH 11.5-12.5) detergents.

![Figure 1. The essential elements of an effective cleaning routine.](image)

**Suggested improvements**

**Actions to take**

**Thermal**

Water which is too cool leads to re-depositing of the milk residues removed, and water which is too hot denatures protein, breaks down detergents and damages seals and rubberware.

- Aim for a temperature of 80-85°C as water exits the hot water storage cylinder.
- Hot water washes should be dumped when wash water temperature falls to below 55°C.

**Time**

- Hot water must contact the surface for a minimum of 4 minutes; this should be extended to 7 minutes by re-circulating during an alkali wash. Pre-heating the plant will help achieve at least 5 minutes of contact time at the recommended temperature.
- For the milking plant 10 litres of hot water per cluster is recommended to achieve sufficient contact time.
- For the bulk milk tank, hot water should be a minimum of 2% of the bulk milk capacity or 120 litres for 5,700 litre tanks or smaller.

**Kinetic energy**

- Air injectors and a reservoir of water at the end of the milk line can create a slug formation for cleaning the top of the milk line.
- Small flushing pulsators used to induce turbulence are largely ineffective and regular brushing or use of a large flushing pulsator/air injector may be required.
- Milk lines generally require turbulence created via an effective flushing pulsator to fill the line and clean the milk line or some alternate effective cleaning system.
Chemical energy

- Acid detergents remove mineral deposits. They can be used in hot or cold water but are more effective in hot water. Acid sanitisers commonly incorporate chemicals which also kill bacteria. These sanitisers are intended to stay in the plant after washing to provide extended protection. Acid sanitisers should always be added to the final wash.
- Alkaline detergents remove fat and protein. If left in the plant, they can cause damage to rubberware so they must be followed with an acid wash to neutralise the alkali and leave the plant sanitised. The alkaline detergent is almost always chlorinated, or chlorine added.

Plant and bulk milk tank cleaning routines

As a minimum the following steps need to be carried out:

- Cold water rinse after every milking.
- An alkali wash at least twice weekly.
- An acid wash after every milking.
- An acid rinse after every alkali wash.

An example of an ideal cleaning sequence which includes the minimum requirements is as follows:

Cold Water Rinse

The post milking rinse needs to be completed immediately after milking or milk collection. It rinses most of the residual milk from the milking system and bulk milk tank.

Hot Water Alkaline / Acid Wash

The milking system should be hot washed as least once a day and twice a day during high risk periods (e.g. when grading, calving). The bulk milk tank should be hot washed after every collection. The purpose of the hot detergent wash is to remove any adhered non-rinsing milk residue. This process should alternate between acid and alkaline in some systematic way to ensure all residues are removed on a routine basis.

Alkaline Detergent Wash

A hot water alkaline wash should be carried out at least twice weekly on the milking system and bulk milk tank. The wash water should be recycled for 5-7 minutes once water discharging the plant/tank is hot.

Cold Water Acid Wash

The cold water acid wash is normally carried out at night and hot alkaline washes done after the morning milking.

Acid Sanitiser Detergent Wash

This should always be the final wash through the milking system and bulk milk tank. Acid sanitiser washes can be used hot or cold.
**Typical plant wash programme**

C = Cold wash, H= Hot wash

**Morning wash**

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NB. The alkaline wash should be recycled for 5-7 minutes (if wash water falls to 55°C it should be immediately dumped).

**Typical bulk milk tank wash programme**

C = Cold wash, H= Hot wash

**Following milk collection**

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NB. The alkaline wash should be recycled for 5-7 minutes (if wash water falls to 55°C it should be immediately dumped). When milk is collected every second day alkaline wash every second pickup.

**Documenting cleaning procedures**

All farm dairies require a written cleaning procedure that is laminated and displayed prominently in the farm dairy. Even if you are the only person working on the farm, there may be a time when someone needs to unexpectedly cover for you.

The procedures must be written clearly so that someone who has never worked in your dairy before can accurately follow the procedure.
Figure 2. A documented bulk milk tank wash procedure on a dairy wall.

Safety when using chemicals

Suggested improvements

Actions to take

- Scourer gloves are great for cleaning cluster exteriors.
- Keep a thermometer in the dairy for checking water temperatures. Glass and mercury thermometers are not allowed for measuring temperatures in the dairy (NZFSA, 2007).

Handling chemicals

- Designated (and marked) chemical measuring jugs save time and chemical.
- Always read labels before using unfamiliar products.
- Never mix acid and alkaline detergents together.
- Always add chemical to water, not the other way round.
- Never mix chlorinated products with acid. This can produce a poisonous gas.
- Never mix chlorinated products with oil or store them close together - there may be a flammable reaction.
- Never store chemicals in unmarked containers.
- Never store non-dairy chemicals such as herbicides and pesticides with dairy chemicals.
- Never use a food contact hose for filling non-dairy chemical containers.
Protective clothing
Always wear protective clothing when using chemicals including:

- safety goggles,
- apron or other waterproof clothing,
- waterproof gloves,
- gumboots.

Further reading
- Refer to New Zealand Food Safety Authority standards “NZCP1: Code of Practice for the Design and Operation of Farm Dairies” for water requirements in the dairy.

Action points

- Display washing instructions on the wall.
- Effective milking machine cleaning routines require the use of concentrated chemicals and/or large volumes of hot water. Take care! Health and Safety issues arise from this practice. Training and emergency response procedures should be developed for each work site.
- Regular inspections of the milking machine are necessary to ensure it is being cleaned properly. A checklist is a good way to identify the different parts of the plant that need to be checked on a regular basis. Once the visual inspections have been completed, the checklist can be dated and signed off. This significantly reduces the risk of something being missed and causing a grade.