

WHITEPAPER



FLOORING CONSIDERATIONS FOR THE DAIRY INDUSTRY



An overview of the factors to consider when specifying a resin flooring system within a dairy processing environment.



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Flooring Considerations for the Dairy Industry



In 2015–16, dairy companies across New Zealand processed a total of 21 billion litres of milk — which represents a staggering 3% of all the milk produced in the world!

Successfully processing this much milk on an annual basis, from 5 million cows across the country, requires a commitment to high standards throughout the dairy industry.

This intense workload and the excessive volumes involved means that the sector's infrastructure, procedures and guidelines have all got to be carefully analysed to guarantee that they are up to the task at hand. Ensuring high quality produce across the nation is vital in order to safeguard the reputation and marketability of New Zealand's milk, which in 2015-16 made \$NZ 12.2 billion in export revenue (which amounts to 33% of the nation's total primary industry export value).

New Zealand's dairy industry has been very successful in recent years in its efforts to minimise the risk of contaminants spoiling the produce. Despite the vast amount of milk produced every year, its inherent vulnerability to spoilage and the fact that dairy is one of the nation's main dietary sources, foodborne illness from dairy products in New Zealand is very rare.

However it is important to keep a close eye on the quality of the milk. This was exemplified in 2015, when the Ministry for Primary Industries, in its report Foodborne Disease in New Zealand 2015, identified that dairy products were the leading factor for VTEC/STEC infections.

To ensure that food-borne illness risks are reduced as much as possible, it is vital to ensure that impeccable hygiene standards are adhered to at all points of the dairy production process. To be both hygienic and productive means carefully considering each element of a dairy facility's design prior to operation, and the choice of flooring used throughout the complex is a crucial aspect to meeting both of these key criteria.

Challenges Facing Dairy Floors

Milking facilities have to be efficient, reliable and hygienic environments that can cope with the challenges of an arduous workload and an inadequate floor can create a multitude of problems.

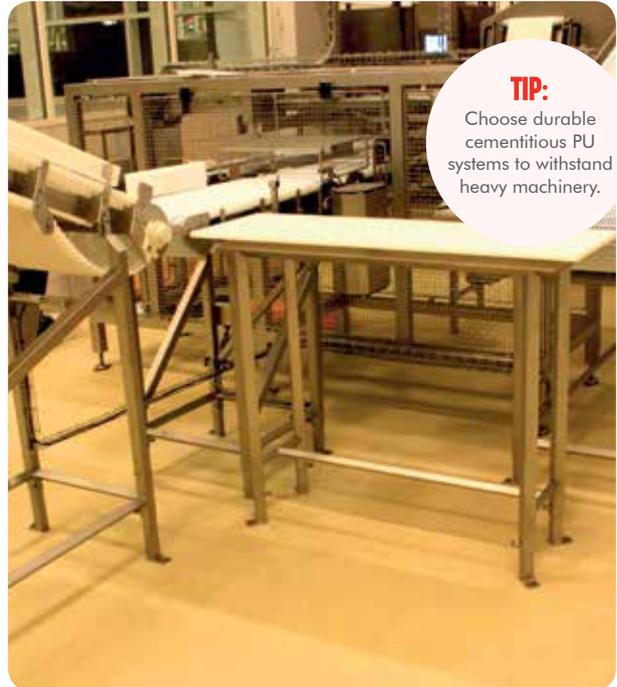
Every day the dairy environment will be subject to traffic from rubber boots, cattle and forklift trucks as well as having to manage heavy machinery, lactic acid spillages and intense cleaning routines. While all this is occurring, the level of cleanliness, animal welfare and employee safety have to be simultaneously accounted for.

All of these routine factors can potentially cause irreparable damage to the floor and a failing floor will not only affect the movement of people, vehicles and animals across the facility but also cause a dangerous hygiene risk. Contaminants can quickly accumulate within hard to clean cracks or gaps and this drastically increases the possibility of spoiled products, sick cattle, damaged reputations and a failure to meet the expectations of regulatory bodies.

Regulations that dairies have to comply with include the Food Standards Australia New Zealand Food Standards Code (FSC) Standard 4.2.4. This is the primary standard in which dairy farms must adhere and states that all dairy farms are legally required to develop and implement a documented Food Safety Program (FSP).

A HACCP based Quality Assurance Program to ensure:

- they gain a licence to operate from their State Dairy Food Safety Authority (SDFA), and
- their milk is accepted by their manufacturer.



TIP:

Choose durable cementitious PU systems to withstand heavy machinery.

Once delivered to the manufacturer, milk is processed and prepared for transport. Dairy manufacturers must also have an approved FSP before they can be issued a licence by their SDFA. A HACCP based food safety plan and quality assurance program ensures that consumer needs and specifications, including food safety, are constantly being met.

Making sure the floor is up to the task it faces is a key part of achieving this status. Food Standards Australia New Zealand, Standard 3.2.2 – Food Safety Practices and General Requirements specifically states: “Floors must be designed and constructed in a way that is appropriate for the activities conducted on the food premises.”

In addition, floors must facilitate effective cleaning, be unable to absorb grease, food particles or water, be laid so that there is no ponding of water and to the extent that is practicable, be unable to provide harbourage for pests.

The Properties of Resin Floors

There are many types of hard flooring systems available to the dairy industry to help maximise the potential of their buildings. The advice from the Guidelines for Food Safety: Dairy Food Manufacturers is that floors are made from “impervious, non-toxic materials”.

Floors should be “soundly built of durable materials and be easy to clean and where appropriate, easily disinfected.”

The robust finish of a resin floor creates a shield against damaging corrosives that is far more durable than the recommended concrete. A resin floor will also provide a smooth, easy to clean surface that will work effectively with the cleaning regime to remove germ from the area.

The hard wearing nature of a resin floor also means that dairy farmers can subject it to heavy trauma from cattle, staff, machinery and vehicles without concern for its integrity. The sturdy and level surface is even ideal for coping with the internal transport from forklift trucks that will be frequently braking and turning on the floor. Should even further resilience be required, aggregates such as quartz sand, aluminium oxide and bauxite can be added to the resin layer to improve its strength and anti-slip properties.

Resin floors have varying chemical and bacterial resistance profiles, depending on the specific make up of the system. This affects the floor’s ability to protect from corrosive chemicals that would otherwise lead to the floor failing from erosion, softening, embrittlement, blistering or delamination. Of the different types of resin flooring systems, one of the most popular is cementitious urethane. This material combines cement and water-based technologies to produce a mortar that is trowel applied onsite to create a very strong and seamless finish. Cementitious urethane has a high cross-linked density, which makes it a good choice for areas that undergo abusive chemical attack.

The impervious nature of cementitious urethane helps to avoid bacterial contamination as pathogens cannot seep into the floor and are much easier to remove during cleaning. This solution is better than epoxy alternatives at resisting bacterial excretion on the floor, which is especially beneficial in areas of the dairy that are prone to contact with excessive amounts of dung.

Importantly, cementitious urethane is much better at resisting thermal shock than other types of resin flooring, so it won’t fail when subjected to extreme temperature changes such as from steam cleaning, ovens or hot

**TIP:**

Lay flooring to falls with integrated drainage to avoid water pooling.

liquids. It also has a thermal coefficient of expansion similar to concrete, which means that when it is applied over concrete it is able to expand and contract with the substrate during gradual temperature fluctuations. Floor coatings that do not react in line with the substrate are likely to crack along the surface.

Cementitious urethane has good resistance to corrosives, including organic acids, which is highly beneficial in a dairy environment where lactic acid is present in large quantities and where it will often spill onto the floor.

In the milking areas, an epoxy floor would not be as effective as cementitious urethane due to the high level of organic chemical attacks and thermal shock, which is likely to make an epoxy floor crack or de-bond.

Importance of Hygiene

Maintaining a high standard of hygiene within food production areas requires an effective cleaning routine. If not acted upon, contaminant build up could lead to corrosion of the floor and also affect the health of the animals, spoil the milk and ruin the dairy's reputation.

To maintain a hygienic milking area, many dairies undergo cleaning sessions of between 30 to 60 minutes after the milking. If there are two or three milking sessions per day then just the cleaning can take up a significant amount of time and energy.

According to CSIRO, "the floor should be an impervious surface and maintained in good repair. It should be kept clean both during and at completion of milking". If it is not strong enough, then the frequent washes will erode the surface layer and make a previously impervious floor porous and ineffective. This means that the floor needs to not only be



smooth and level to allow for effective cleaning but also highly durable to withstand the intensive maintenance.

Unprotected concrete floors are especially at risk of deteriorating when faced with hot water cleaning that could potentially eat into the surface layer. The harsh cleaning chemicals required to eliminate dangerous and resilient microorganisms will also damage concrete over time, making it harder to clean.

If a floor coating is not able to cope with the strains of the environment then it will start to crack. Substances can penetrate cracks in a floor, which could result in microbial growth and the spread of bacteria from pathogens that are able to thrive in broken flooring. This means that the facility could face an increased contamination risk that the cleaning regime will find difficult to cope with and which could adversely affect the sanitation of the dairy, with the possibility of contaminants entering into the extraction and storage processes.

Joints Between the Floor and Wall

A key area of the floor to consider when designing or renovating a dairy is the joint between the floor and the wall, as this creates a difficult to clean gap where bacteria can accumulate. All rooms involved with the production, handling, processing, packaging or storage of milk should therefore have coved or sealed joints to help prevent bacteria build up.

Coving creates a seamless transition between the floor and wall surfaces, covering up the gap with an easy to clean layer. The coving must be made of a material that can withstand the same abuses as the floor, as it will encounter the same corrosives, heat and use.

Draining in a Dairy

Liquid from dung, cleaning fluids, lactic acid spillages and many other sources can create substantial excess water. Water ponding can be a serious hygiene concern as it is a prime site for bacterial growth. A non-porous, well-drained floor will make sure that water does not stagnate and lead to unhygienic conditions.

A resin floor is impervious to water and facilitates draining, avoiding pools of standing water and allowing for more effective removal of unwanted matter or liquid. This is especially important when coping with the large amounts of faecal matter that build up during milking, as blocked dung channels or long standing effluence pose exceptionally dangerous hazards.

The potential danger from unmoved animal waste is evident in the fact that disease causing pathogens such as Salmonella, E. coli and faecal coliform can be 10 to 100 times more concentrated than in human waste. It was manure from dairy cows that was thought to have contributed to the disastrous Cryptosporidium contamination of Milwaukee's drinking water in 1993, which killed more than 100 people, made 400,000 sick and resulted in USD 37 million in lost wages and productivity.

Effective drainage is vital to making sure that the unwanted effluence quickly flows away. Properly sloped floors will aid this process and help to avoid undesirable, unhygienic and unsafe conditions. Installing a floor that effectively drains is another way to ensuring the dairy meets the FSANZ regulations.

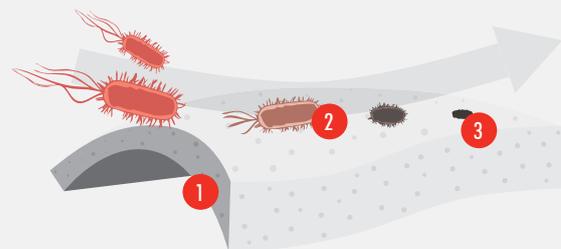
Antimicrobial Floor Solutions

Resin flooring systems are highly adaptable and additives can be included to cater for specific challenges. To enhance hygiene levels even further, antimicrobial agents that actively inhibit the growth of bacteria can be included into the finish.

Combining these additives into the resin matrix of a robust cementitious urethane system means that harmful microorganisms in contact with the floor are destroyed.

When looking into the best antimicrobial floor solution it is important to keep in mind that some will have the additive spread throughout the resin while others will only have it on the surface. The practical difference is that as the surface becomes worn then if the additive is present throughout the coating it will still be able to deal with microbes.

How the Polygiene® Antimicrobial Additive Works



- 1 The silver ions are homogenously distributed throughout the floor.
- 2 The silver ions migrate to the surface of the floor.
- 3 The silver ions kill the surface bacteria by penetrating the cell.

**TIP:**

Including a textured, anti-slip profile will help to reduce slips and trips.

Workers' Health and Safety

Contamination isn't the only danger that can stem from excessive water, as slippery conditions are a danger to the health and safety of workers and visitors.

In any facility with areas prone to wet conditions, the site's management needs to minimise the risk of slippery surfaces, especially in a workplace as potentially dangerous as a dairy, which the Journal of Agromedicine identified as "among the most hazardous occupations".

When assessing the onsite conditions it is not just the main milking zone that needs to be considered, but also the storage rooms, staff areas, corridors and walkways.

Drains are important in tackling slip hazards, but to further decrease the chance of falling, special anti-slip aggregates can be added into the mixture of a resin floor to actively enhance grip underfoot.

Again, hygiene requirements need to be brought into the decision-making process, as the ease of cleaning needs to be balanced against the level of grip required because coarsely textured surfaces are harder to clean than smooth surfaces.

Away from the Milking Area

While the main focus of attention will be on the milking area, a dairy operator shouldn't overlook all the other buildings that make up the facility — as the condition of these areas can have a significant impact on a dairy's productive capacity. A recent study by the University of Guelph highlighted this fact as it showed that the frequent cleaning of barn alley floors has a significant correlation to the cow's health.

The FSANZ states: "floors must be designed and constructed in a way that is appropriate for the activities conducted on the food premises". Some areas within a dairy processing facility will require additional properties including resilience to low temperatures in cool rooms or different slip-resistance grades for different areas within the facility.

Epoxy resin surfaces are ideal for non-processing zones such as offices, entrances, staff rooms, corridors, warehousing and most areas exposed to less rigorous service conditions. Like the other systems, they can have anti-slip profiles, limiting the risk of falls across the dairy complex.

A resin floor is useful in storage rooms in particular, as they especially need to be kept clean at all times. Ideally placed away from all the obvious sources of contamination, this room's design should mimic the main milking area with impervious floors that are free draining to a suitable trapped drain and walls that are smooth and easy to clean.

Considerations Prior to Installation

Before you decide to have a resin floor installed, it is important to weigh up a dairy's specific requirements. Contacting the local dairy inspector and inviting them to take a look at your facility, construction and equipment is a great way to understand what changes need to be carried out to comply with regulations. By talking to a resin flooring specialist about the individual demands of a facility you will get a good understanding of what solutions will work best for you. For example do you need a very high-level of anti-slip flooring? Will the floor be exposed to thermal shock? Where is hygiene the biggest priority? What type of chemicals will the floor be exposed to?

Once you have come to an informed conclusion, make sure the specialist resin floor is installed by a qualified applicator to ensure that the coating adheres properly to the substrate with a seamless finish that provides a strong and impervious surface.

After installation, the finish needs to be properly cleaned and maintained. If you are introducing a new cleaning product, conduct a small spot test on an inconspicuous area as a precaution. Most special purpose cleaning materials won't damage a resin floor but to get the most out of a new surface and to maintain any properties that may have been added, treat the floor in accordance with the manufacturer's instructions.

This guide has been produced to give an overview of the choices available and factors to consider when specifying resin flooring within a dairy processing environment.

Detailed recommendations and advice are available from our network of regional technical and sales representatives.

For more information on Flowcrete's specialist flooring solutions, get in touch with the team today...



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