CASE STUDY: CLEANING STUDY ASSISTS AUSTRALIAN CONSOLIDATED MILK RECLAIM THEIR WATER PLANT CAPACITY

IMPACT SUMMARY:

Membrane Works and Australian Consolidated Milk (ACM) worked together to solve membrane fouling issues that led to:

- Increasing water production from 700 m^3/d to 950 m^3/d
- 10 trucks of water avoided per week

SITUATION:

Australian Consolidated Milk (ACM) is a milk and dairy producer located in northern Victoria. They produce milk and cheese products for use across Australia and for export.

Water for the factory is sourced from a raw water channel that is also used by the local community. The water is purified using an ultra-filtration membrane plant to remove micro-organisms and suspended solids, before passing through a granulated activated carbon (GAC) bed to remove colour and flavour, and then sterilised using chlorine dioxide.

The water treatment plant was required to produce 1,000 m^3 of water per day but but due to premature fouling was struggling to product 650 - 750 m^3, despite excess designed capacity and having recently replaced the membranes.

As a result, ACM were trucking in 200 m^3 per week of water and an expansion of the dairy plant was increasing the pressure to improve water supply.

The water availability was a constraint on production flexibility and certain operations could only be run when water was available. As a dairy, you never want to run the plant around utility constraints!

FOULING INVESTIGATION

Our first step was to conduct an autopsy of the membranes. Upon opening the membranes, we noted a heavy fouling around the top and bottom of the module, but limited fouling in the high flow areas. This showed that the Chemically Enhanced Backwash (CEB) and flushing cycles were not completely cleaning the membranes. The fouling was a mix of organic bacterial slime (EPS), alumino-silicate clays and precipitated iron.

A cleaning study showed that hypochlorite and EDTA were both effective at removing the deposit at 40C.

Analysis of the influent water showed that aluminium and iron may have been precipitating on the membranes during high pH cleaning cycles.

We also inspected the membranes that had been replaced two years prior, they were found to be fouled with large amounts of iron. A cleaning study showed this could be removed with reducive cleaners such as sodium metabisulphite and sodium hydrosulphite.

Benchmark of the sites cleaning and operational procedures identified a number of potential improvements.

WORKING TOGETHER TO SOLVE THE PROBLEM:

They key to improving operations was the partnership between ACM and Membrane Works. From the start we shared operational observations and the preliminary results from the autopsy. ACM then worked dilligently in improving every aspect of their operation. This showed the benefits of a close partnership in solving operational problems.

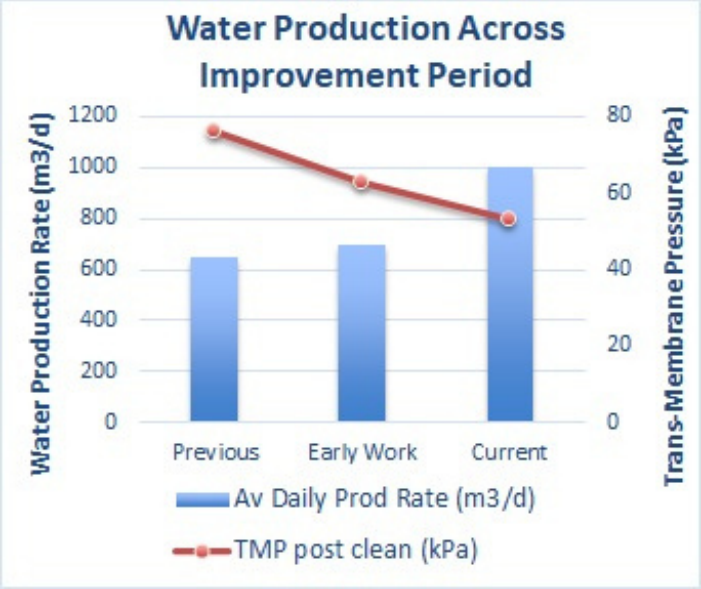
We were blindfolded throwing darts at the dart board and hoping, but the darts were landing all over the place.

Membrane Works helped identify the root cause that meant we could take action earlier to help recover the plant.

JOHN IOANNOU - ACM
PROJECT ENGINEER

Heavy silt, iron and biological fouling.

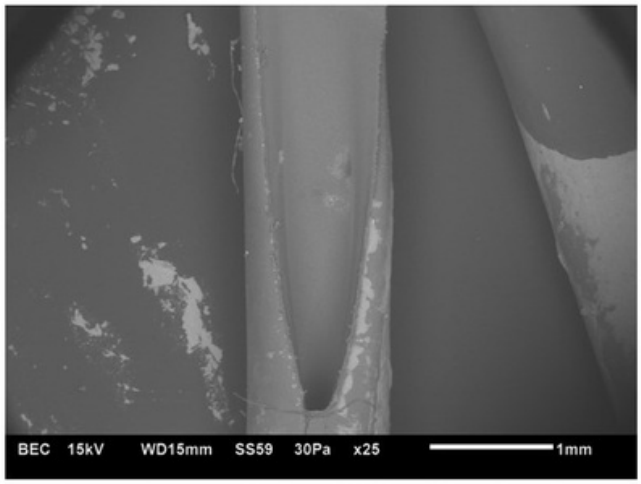
Clean areas in CEB cleaned zones



Initially, ACM implemented a range of cleaning improvements, including the use of hot Clean In Place (CIP) procedures to remove organic deposits and sodium metabisulphite to remove accumulated iron fouling. They also increased the flush volumes, to ensure that any loosened deposits are completely removed from the membrane before they are put back into operation.

The site is now installing a coagulant dosing system to better remove aluminium and iron before they reach the membrane system.

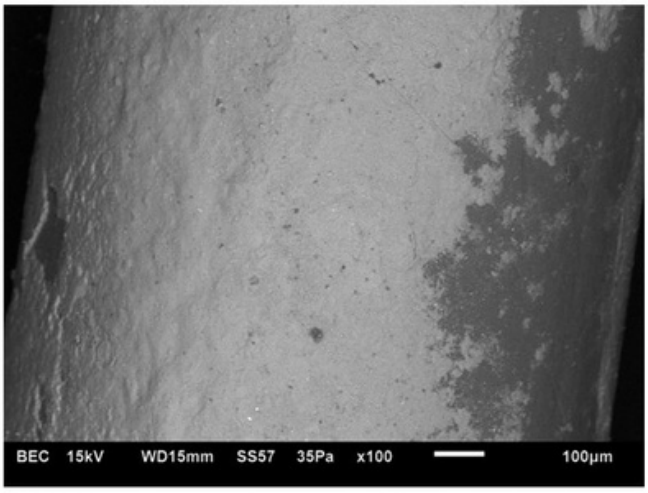
Through their work ACM were able to provide a more robust cleaning methodology to recover the membrane performance, and most importantly maintain the gains.



Electron microscope image of hollow fibre showing clear interior

IMPACT:

Through persistence and a systematic approach to improving their operation, ACM have increased their operational cycle times from 30 minutes to 45 minutes. However, the most important improvement is in water production. The improvements have taken the plant from 650 m^3/day up to their target of 950 m^3/day and eliminated the need to have water delivered by truck.



Electron microscope image of hollow fibre showing clay coating the exterior of the membrane fibre

The frustration that was felt at having a 1MLD plant that was quickly losing its capacity has been relieved and the site operations team are now able to focus on achieving the 1 MLD plant capacity.

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