



## MBR plant subject to tidal ingress of seawater improves performance using PermaCare® MPE50™

Using PermaCare MPE50 helped the plant to operate twice as long, extend the intervals between cleanings, and substantially reduce the foam.

In this study, PermaCare MPE50 provided the following results:

- Allowed the plant to operate for up to twice as long before significant decline in permeability was observed.
- Extended the intervals between cleanings by about 20-100%. This extended cleaning interval, which minimizes the plant downtime and thus helps maintain the plant throughput, is very important, especially during tourist season.
- Substantially reduced foam, decreasing the need for labor and potable water for spraying.

From other trials, PermaCare MPE50 treatment has shown a number of other benefits that may translate to improvement in plant operation or cost savings to customers. These include:

- Improved membrane performance at low temperature
- Improved biological stability against bulking/upset
- Operation at higher MLSS (less sludge production)
- Reduction of scouring air (because of reduced membrane area for the same flow) and thus lower membrane operating costs

—Reduced plant maintenance (lower cleaning frequency)

- Improved permeate quality: reduction in TOC, COD, TSS, color and turbidity and increased removal of pathogens, including viruses and phages
- Foam reduction and prevention
- Reduction of polymer consumption in sludge dewatering
- Smoother plant start-up

### Problem

A membrane bioreactor (MBR) plant from a coastal town in England treating municipal wastewater, was having operational problems due to tidal ingress of seawater from old sewer connections. Repairs or replacement of the sewage system would require significant costs and a long lead-time. To improve plant performance while the problem was addressed, the membrane equipment supplier contacted Nalco to explore alternative solutions to these challenges:

- Because of leakage into the sewerage system during high tides, substantial quantities of seawater were entering the plant, at times exceeding 50% of the plant flow. This dramatic change in salinity and the rapid change in salt levels lead to an unhealthy poor quality biomass and very poor filterability sludge.



The high salinity feed upset the MBR sludge condition, causing excessive production of biopolymers and a consequential increase in membrane fouling. In addition, each time the saline levels rose significantly there was an associated substantial increase in foam levels.

- The resulting membrane fouling required increased trans-membrane pressures to achieve the flows the plant needed. This increase in operating head resulted in lower plant throughput during these high salinity periods and an increased risk of inadvertent storm discharge. To maximize plant performance plant operators would have to clean membranes more frequently and had to arrange sprays to suppress foam, and manually clean-up foam spillages.

The plant flow and the plant parameters were as shown in Figure 1

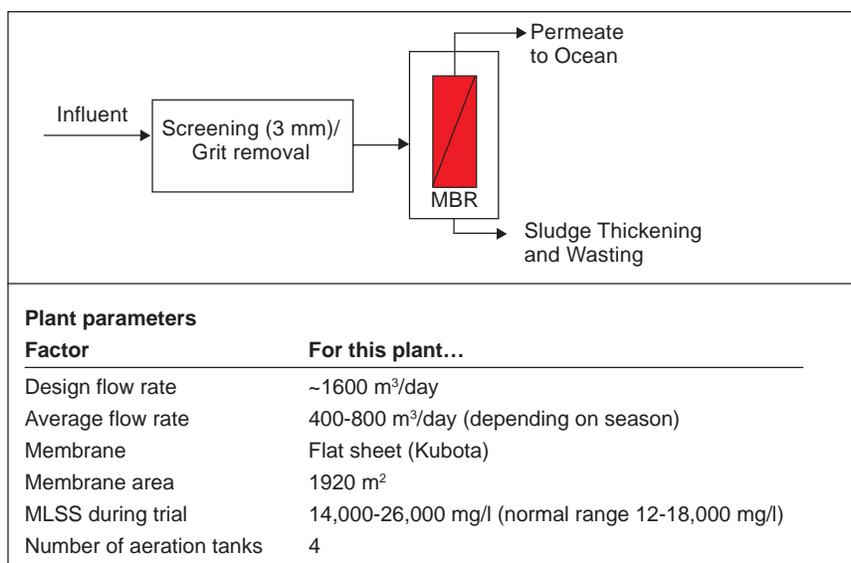


Figure 1 – Plant flow diagram

Table 1 – PermaCare MPE50 reduces permeability decline rate and extends the cleaning interval.

Tank #	Days Required for 50% Reduction in Permeability		Cleaning Interval (Days)	
	With MPE50	Without MPE50	With MPE50	Without MPE50
1	90	42	120	90
2	120	22	72	30
3	80	30	98	42
4	67	55	113	92

## Solution

Nalco’s proprietary Membrane Performance Enhancer (MPE) products help to condition the MBR mixed liquor to reduce fouling and consequently increase the sustainable membrane flux.

Biopolymers, suspended solids and colloidal materials are generally regarded as primary foulants in MBRs. MPE interacts with these foulants to help bind them more strongly into the sludge floc and effectively keep them away from the membrane surface. Additionally, MPE increases the particle size and thus helps increase the porosity of the foulant cake layer on the membrane surface to allow water to permeate easily.

## Approach

PermaCare MPE50 typically requires an initial application followed by supplemental product feeds. The evaluation process for this plant was approached as follows:

1. Based on the jar test results, the initial dosage of PermaCare MPE50 required at this plant was determined to be in the range of 400-700 ppm.

Initially, 400 ppm PermaCare MPE50 was added to the mixed liquor, after the membranes were cleaned.

2. 21 days after the initial PermaCare MPE50 addition, more MPE50 was added to make the total concentration 700 ppm. This was done to offset the charge neutralizing effects of intruded salt on PermaCare MPE50. The high level (400-700 ppm) of MPE50 was maintained for a further ten days (a total of 31 days).
3. We stopped the PermaCare MPE50 feeding and allowed it to gradually purge through sludge wasting, in order to study the effects of residual MPE50 on long-term performance of membranes.

We measured efficacy of PermaCare MPE50 on fouling minimization by monitoring the membrane permeability before and during MPE50 presence in the mixed liquor, and after MPE50 feeding was stopped. We expected fouling minimization by PermaCare MPE50 to result in slower decline in membrane permeability, even during high tide periods.

## Results

Table 1 compares the number of days before reaching a 50% reduction in the initial permeability, and compares the cleaning interval for all four tanks, with and without PermaCare MPE50.

The data clearly shows that after treatment with PermaCare MPE50, the plant was able to operate for much longer periods before a significant reduction in permeability was observed. Also, the cleaning interval was extended by 20-100% in the presence of MPE50.

Figure 2 shows a representative time-permeability profile for Tank # 4.

It is apparent from Figure 3 that the permeability decline slowed down when MPE50 was present in the mixed liquor, compared to the last period when MPE50 was almost purged out from the tanks.

Figure 3 shows that MPE50 treatment also resulted in a substantial reduction in the amount of foam at this plant. The management of foam had required labor and use of potable water after the increase in sewage salinity caused by seawater intrusion.

## Conclusions

PermaCare MPE50 treatment at this plant resulted in:

- Slower decline in membrane permeability
- Increased interval of membrane cleaning, and
- Substantial reduction in foam production during high salinity periods

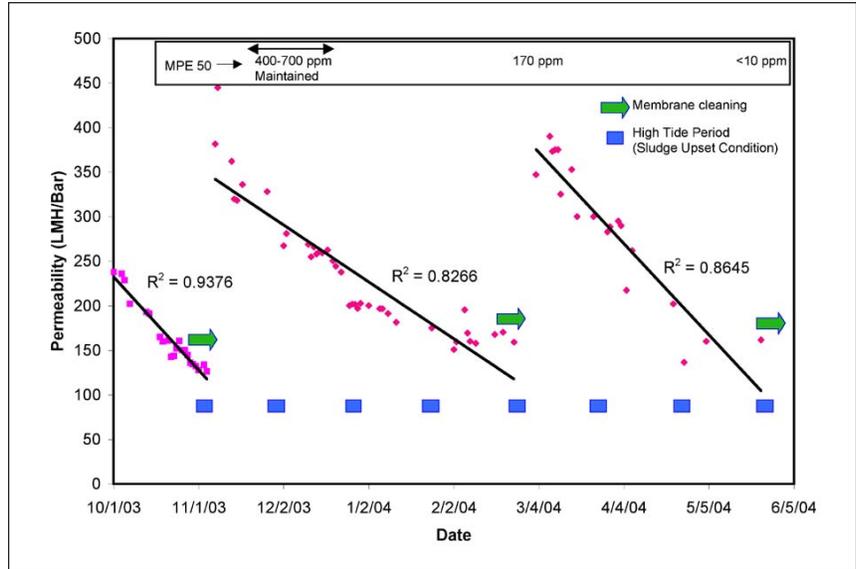


Figure 2 – Membrane Permeability in Tank #4 with PermaCare MPE50™



Figure 3 – Comparison of the foam levels before and after MPE50 addition (no tidal ingress at the time of the photographs).

“Foam level during and after high tide periods was dramatically reduced in the presence of PermaCare MPE50 treatment compared to all previous tides since the plant commissioning.”  
– plant operator

**PermaCare®**

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