



Water Technologies & Solutions

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Subject: Pre-treatment Guidelines and Assessment

Hello Michael,

SUEZ has been made aware of the continuing challenges with maintaining membrane performance at the Lewes, DE MBR facility. It is our hope that this letter will clarify our guidelines and best practices around successfully preventing entry of excessive trash and debris into a SUEZ MBR system. It is important to recognize that systems designed with appropriate measures as laid out below rarely if ever require remedial action such as you are having to take.

Commissioned in 2007, this facility operated with a high degree of stability and reliability until the end of 2019. Over the first 10 years there had been an ongoing campaign to keep accumulating solids within the membrane fiber bundles at a level that did not impact system performance. Based on invoices I observed, it appears that the effort involved for that period was approximately 60 hours of labour per membrane cassette per year (of 12 total cassettes in the facility) and was quite successful in maintaining system performance and reliability. Unfortunately, that campaign effectively ended in 2017 when the current operating company was not selected for the new operations contract in 2017. The new operations company, despite repeated communication with SUEZ, did not appear to have elected to continue that effort in any meaningful way with the unfortunate consequences at the end of 2019. Aside from the direct impact to system performance, this gap in managing the accumulated solids also means that we have no quantifiable information on any changes to the efficacy of the existing headworks over that period. It is possible that there has been a deterioration in the effectiveness of the pre-treatment system, but that is beyond our scope of supply and expertise.

To assist you in your efforts to quantify where the pretreatment system operation is now, I will review some of the parameters and best practices we use for our MBR systems in the larger size range of your facility:

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- For systems with a relatively small quantity of membrane (smaller than 100,000 GPD capacity), screening may be substituted with a combination of a trash trap tank (that will intercept any large sinkable or floatable objects) followed by an equalization tank with grinder pumps for transfer into the process. This is done in a balancing of higher cost pre treatment infrastructure vs lower cost membrane replacement in systems of this size.

For any larger systems, the following items are often considered but are not mandatory:

- Primary clarification
- Grit removal
- Our standard design requires a fine screen with the following characteristics:
 - 2mm maximum opening size in the largest direction (generally punched hole, not mesh and not wedgewire). This is in place at Lewes.
 - No mechanism for screen bypass (either by design or bypass due to poor installation)
- Other guidelines or preferences around screening:
 - A screen with minimal joints, seals, or moving parts is preferred as these are often points of bypass or failure. Typical styles of screen that are 'good' are rotating drum, rotating brush, or screw style screens. Travelling band screens (in place at Lewes), with several hinged filter elements and long perimeter seals are subject to mechanical wear and have proven to be prone to bypass. The potential issues with this style of screen was only coming to light when the facility was commissioned. There have been facilities that have had reasonably good performance with this style of screen. Our own layman inspection of the screen at Lewes did not show any large issues with bypass but given the nature of this screen they require regular inspection of the gap seals and hinges.
 - **We do not recommend any mastication, maceration, grinding, or chopping of any debris prior to the screening step**, as this reduces the average size of inert solid material and will increase the amount of said material that will pass through even a 2mm screen. Based on our observations of the material in the membrane bundles and the material pushing through the screen elements at Lewes, there appears to be a substantial amount of material that has been ground fine enough to get through the existing headworks and into the process where it can "re-rope" in the membrane cassettes making removal and management more difficult.



- We have seen very effective solids removal with screen designs that operate with a generated 'mat'. Where solids are allowed to accumulate on the screen to create a secondary tighter filtration layer. Although this is not our area of expertise, we are aware that some clients have been able to operate their headworks to add this functionality with great benefit when dealing with higher levels of material that can be pushed through a 2mm punched hole such as lint.

Finally, to ascertain the efficacy of an existing systems pre-treatment, I have also included a procedure for testing the amount of material in the mixed liquor. If you suspect the headworks is allowing too much material into the process, this procedure can help quantify the nature and amount of material in the system and if monitored over time it will allow you to identify screen breaches, should they occur, minimizing the affect on the membranes.

I hope this summary has been helpful, and we look forward to assisting you and the BPW's effort to restore the stability and reliability that this system enjoyed for a decade.

Best Regards,

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