HYDROUS MANAGEMENT GROUP, LLC

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OBJECTIVE

Optimize the treatment of produced water by using innovative technology that guarantees high quality of treated water, reduced operating costs and minimization of waste.

INTRODUCTION

Since December 2022, an exploration and production (E&P) operator implemented a continuous produced water treatment operation using powder membrane technology. This technology was transferred from another site and sought to address 24/7 operating needs, as well as the treatment of water with variations in quality and flow.
Simultaneously, the performance of this technology was evaluated against a dissolved air flotation (DAF) system installed at a nearby location.

PROBLEM

The operator faced two main concerns:

- **Efficient removal of iron from produced water to meet treated water quality standards.**
- **Optimization of costs related to the management of sludge generated during treatment, one of the most expensive stages of the process.**

Additionally, direct competition from the DAF system presented an additional challenge to demonstrate the technical and economic superiority of powder membranes.

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FULL-TIME PRODUCED WATER OPERATIONS

SOUTH TEXAS

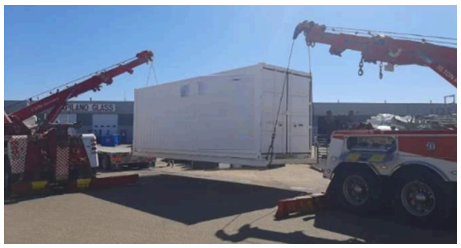
SOLUTION

A combined approach was implemented to address operator concerns:

- **Iron Oxidation: Hydrogen peroxide (H_2O_2) was dosed to the raw water to precipitate iron as a solid prior to treatment with powder membranes.**
- **Advanced Powder Membrane Treatment: This system enabled the removal of key contaminants such as residual oil and iron, producing a high-quality permeate.**
- **Sludge Generation Optimization: Powder membranes demonstrated a unique ability to reduce the volume of sludge generated by 90% compared to DAF technology.**

RESULTS

- **Treated water quality:** The final permeate significantly exceeded the standards achieved by DAF technology, especially in the removal of iron and residual oil.
- **Sludge reduction:** The powder membrane technology generated 90% less sludge volume, decreasing the costs associated with its transport and disposal.
- **Continuous and adaptable operation:** The system maintained its efficiency under varying flow and water quality conditions, ensuring reliable 24/7 operation.
- **Lower costs:** The lower sludge volume and higher system efficiency represented significant economic advantages for the operator.



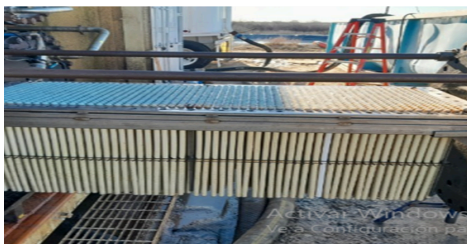


Figure 1 & 2. Easy mobility for the 100 m3/hour powder membrane treatment unit being moved from Barstow, Texas to an E&P operator site in South Texas

BENEFITS

- **Significant savings:** Reduction in operating costs due to less sludge generation and greater efficiency.
- **Return on investment:** The adaptability of the system ensured competitive performance compared to other technologies such as DAF, standing out as a cost-effective long-term solution.

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CONCLUSION

The use of powdered membranes for the treatment of produced water in South Texas proved to be a highly effective and cost-effective solution. By offering superior water quality, a dramatic reduction in sludge generation, and competitive operating costs, this technology surpassed the capabilities of the DAF system, establishing itself as the preferred choice for treatment applications in exploration and production. This case highlights the potential of powdered membranes to optimize industrial processes and reduce operating costs.

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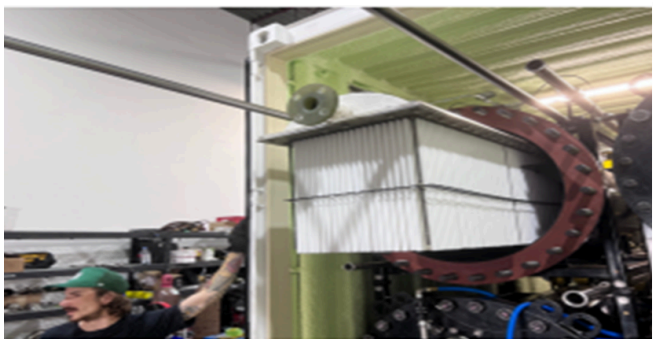
Figure 3. The following table provides a more detailed analysis of the treatment capability of the powder membranes.

Date	February 13-23- average of two separate samples (Feb 11 and 12)				
Parameter	Raw Produced Water before Hydroxide addition	% Reduction based on treated water	Raw Produced Water after Hydroxide addition	% Reduction based on treated water	Permeate (treated) from powder membranes
Turbidity	135	98.52%	190-390	99.31%	<2
TSS (ppm)	94	94.68%	110-290	97.50%	<5
Oil (ppm)	56	95.54%	93	97-31%	<2.5
pH	6.9		7		6.78
ORP	-95		180-30		200-375
H2S					
CO2					
Al (ppm)	<5	0.00%	<5	0.00%	<5
Arsenic (ppm)	<1	0.00%	<1	0.00%	<1
Barium (ppm)	13.7	1.46%	14	6.25%	13.5
Boron (ppm)	113	1.77%	116	4.31%	111
Calcium (ppm)	6570	10.35%	6500	9.38%	5890
Chloride (ppm)					
Cobalt (ppm)	<1	0.00%	<1	0.00%	<1
Chromium (ppm)	<1	0.00%	<1	0.00%	<1
Copper (ppm)	<1	0.00%	<1	0.00%	<
Iron (ppm)	7	71.43%	10.5	80.95%	<2
Lead (ppm)	<1	0.00%	<1	0.00%	<1
Lithium (ppm)	94.4	10.70%	92.3	8.67%	84.3
Magnesium (ppm)	565	2.65%	606	9.24%	550
Manganese (ppm)	4.09	19.32%	3.75	12.00	3.3
Nickel	<1	0.00%	<1	0.00%	<1
Phosphorus	4.28	69.63%	3	54.70%	1.3
Potassium (ppm)	1160	12.07%	1160	12.07%	1020
Sodium (ppm)	26400	5.68%	27400	9.12%	24900
Strontium (ppm)	622	6.27%	617	5.51%	583
Sulfate (ppm)					
Zinc (ppm)	12.4	89.11%	11	87.73%	1.35



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