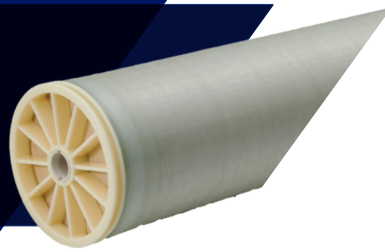


CASE STUDY

NF | UF | MBR | CHEMICALS

Drinking Water

Yucaipa Valley Water District USA



TORAY

Long-Term Performance of NF Membranes at Yucaipa Valley Water District



Figure 1: Yucaipa Valley Water District, California

BACKGROUND

The Yucaipa Valley Water District (YVWD) is committed to providing reliable water and wastewater services in an efficient and cost-effective manner. To enhance water treatment capabilities, the District installed Toray nanofiltration (NF) membranes in 2015 to ensure high-quality water supply while meeting regulatory standards. After nine years of consistent performance, a new set of NF membranes was installed in 2024 to maintain peak efficiency and long-term sustainability.

YVWD operates an extensive water system, which includes:

- 243 miles of drinking water pipelines
- 27 reservoirs with a combined storage capacity of 38 million gallons
- 18 pressure zones
- 10.360 acre-feet annual water demand (3.376 billion gallons)
- Two water filtration facilities:
 - 1 MGD Oak Glen Surface Water Filtration Facility
 - 12 MGD Yucaipa Valley Regional Water Filtration Facility

CHALLENGES AND MEMBRANE SELECTION

The decision to install NF membranes was driven by the need to enhance water quality, improve operational efficiency, and comply with stringent water regulations. Toray's NF membranes were chosen due to their superior performance, cost-effectiveness, and reliability in treating the District's diverse water sources, which include groundwater wells and surface water from Birch Creek, Oak Glen Creek, Adams Tunnel, and Clark Tunnel.

LONG-TERM PERFORMANCE OF NF MEMBRANES

Since their initial installation, the NF membranes have maintained operational stability, meeting water quality standards and demonstrating:

Table 1 – Quick Facts

Plant location	Yucaipa, California	
Feed source	Surface Water	
Treatment	Microfiltration, Nanofiltration	
Membrane model	NE8040-40	
Membrane type	High productivity NF element with low monovalent ion rejection	
Active area	400 ft ² (37.2 m ²)	
System capacity	3-6 MGD	
Elements/train	420 elements per train - Two Trains	
End use	High quality water meeting regulatory standards	
Commissioned	2015	Replaced 2024

- Consistent rejection of contaminants such as TDS, organics, and turbidity.
- Minimal clean-in-place (CIP) cycles, reducing maintenance costs.
- Stable feed pressure over nine years.
- High recovery rates, optimizing water usage efficiency.
- Long term membrane integrity with high chlorine tolerance. To effectively control biogrowth, a chlorine residual of 2 mg/L as free chlorine is applied to the NF feed once per week until 0.5 ppm of free chlorine is detected in the concentrate. Additionally, the

membranes can tolerate intermittent exposure to free chlorine levels of up to 2.5 mg/L, ensuring robust biofouling prevention while maintaining long-term membrane integrity.

MEMBRANE REPLACEMENT AND SYSTEM UPGRADE

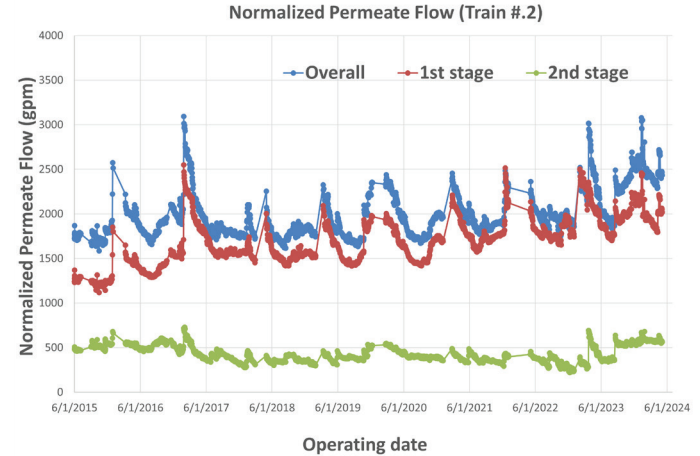
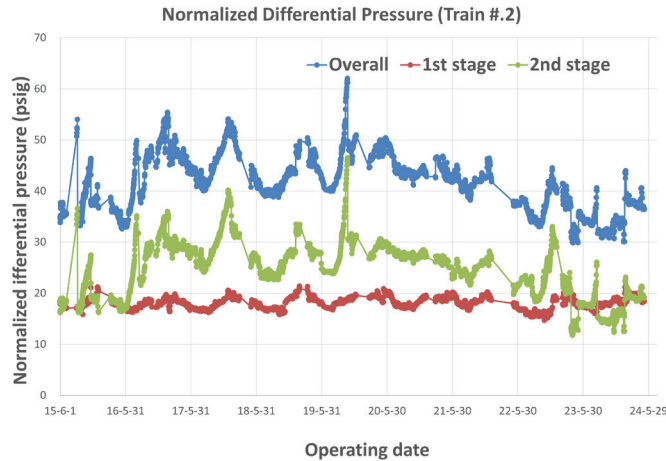
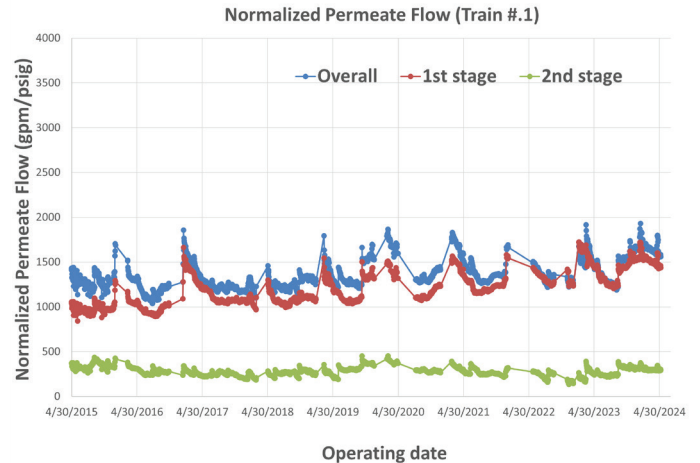
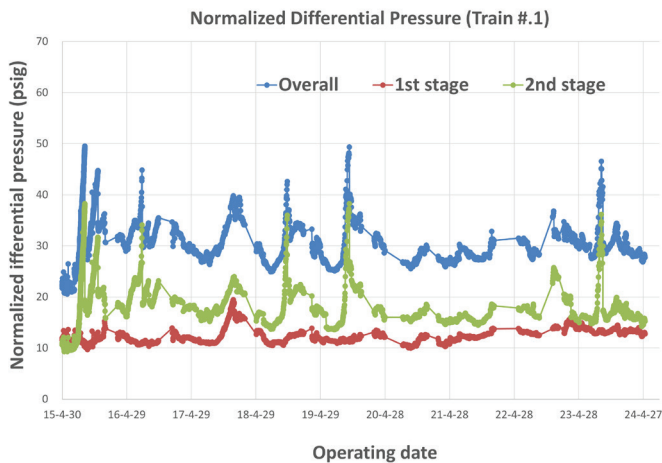
Following years of reliable operation, the district replaced the NF membranes in 2024 to maintain system performance and ensure future reliability.

YVWD's investment in this upgrade underscores its commitment to long-term water sustainability and operational excellence. The successful performance of the NF membrane highlights the importance of proactive maintenance and strategic upgrades in

ensuring uninterrupted, high-quality water treatment.

INTO THE FUTURE

YVWD is adding two more primary trains with Toray NF membranes in a strategic move by YVWD to enhance water treatment capabilities, increase capacity, and maintain long-term system sustainability. With the success of the initial membrane installation and the proven performance of Toray NF membranes, the District is poised to continue delivering high-quality, reliable water to its customers for years to come. This expansion ensures that YVWD remains at the forefront of modern water treatment technology, meeting the challenges of growing demand and stringent regulatory requirements.



Graphical performance data indicates that the membranes sustained high flux rates with minimal degradation, proving their durability over nearly a decade of service.

TORAY INDUSTRIES, INC.

Head Office: Nihonbashi Mitsui Tower 24th Floor, 1-1, Nihonbashi-Muromachi 2 chome, Chuo-ku, Tokyo, 103-8666, JAPAN

www.water.toray [+81 3 3245-4540](tel:+81332454540) [LinkedIn](#) [YouTube](#)

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CASE STUDY

RO/NF | UF | MBR | CHEMICALS

Wastewater Treatment
Gujarat, India



TORAY

Toray NF-RO Integrated Membrane System (IMS) provides sustainable solution that meets stringent wastewater treatment regulations for dye production

CLIENT OVERVIEW

JAY CHEMICAL is a dye manufacturer based in India, handling highly colored wastewater with an extremely high COD concentration. Due to the stringent local discharge regulations, failure to comply could result in a forced shutdown of operations. Therefore, it was imperative to promptly evaluate an effective wastewater treatment process. At the same time, from a "Water Positive" perspective, the client was also aiming to minimize wastewater volume through reuse and recycling.

OUR PROPOSAL AND TRIAL IMPLEMENTATION

In 2010, we proposed an Integrated Membrane System (IMS), two-stage nanofiltration (NF) membrane process for COD removal (NE8040-70 and NE8040-90) followed by a one-stage reverse osmosis (RO) membrane process (TM720-D400) to further treat the NF permeate for potential reuse. A pilot test was subsequently conducted.

CHALLENGES

The client's wastewater had an exceptionally high COD concentration of 4,800 mg/L, which was primarily composed of refractory substances. This rendered conventional biological and chemical treatment methods ineffective, necessitating the development of a new and advanced treatment approach. It was also necessary to consider a total process that utilized the client's existing wastewater treatment facilities.



Figure 1: Water quality comparison
(Wastewater on the left and RO effluent on the right)

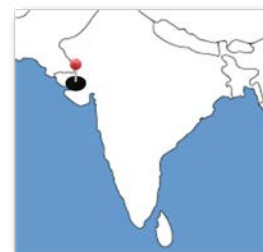


Figure 2: Gujarat, India

Table 1 — Quick Facts

Client	Jay Chemical
Location	Gujarat, India
Operation start	2010
Production capacity (Permeate)	1,680 m ³ /d
Toray Product model	NE8040-70 (NF 1st Pass), NE8040-90 (NF 2nd Pass), TM720D-400 (RO)
Recovery rate	80% (NF 1st Pass), 85% (NF 2in second Pass), 90% (RO)
Operating temperature	28 - 39 °C
pH	7 - 8

CASE STUDY

RO/NF | UF | MBR | CHEMICALS

Toray NF-RO Integrated Membrane System (IMS) provides sustainable solution that meets stringent wastewater treatment regulations for dye production

Table 2 — Target Characteristics

	Feed Water	NF 1st Pass Permeate	NF 2nd Pass Permeate	RO Permeate
TDS (mg/L)	20,000	13,000	4,000	200
COD (mg/L)	4,800	1,800	600	250
System Recovery (%)	-	80	85	90
CIP Frequency	-	Daily	Once in a week	Once in 2 - 3 months
Membrane Life	-	1 Year	2 - 3 Years	3 Years +

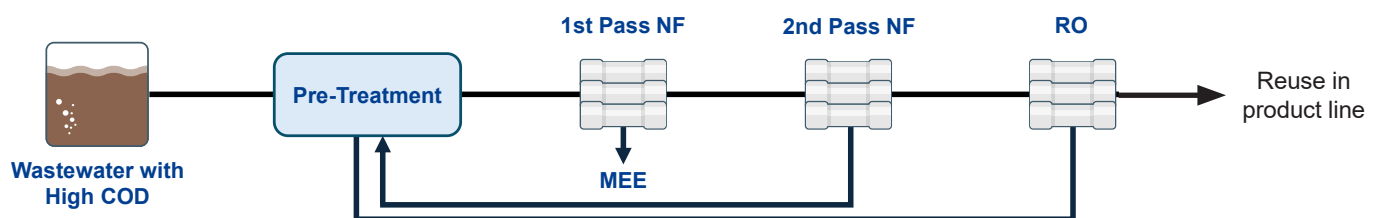


Figure 3: Process Flow

RESULTS

NF 1st Pass was able to remove 37% of the refractory COD and NF 2nd Pass 87% of the refractory COD, giving a total COD removal rate of 95% including the RO process. Membrane life was sufficient, and chemical cleaning was less frequent, reducing capital and operating costs.

The integration of NF and RO membranes for COD reduction and wastewater reuse is an important innovation in industrial water treatment. This case study highlights the transformative potential of this technology, which is particularly important for industries with high COD, BOD, TDS and TSS in their wastewater. These membranes provide answers to the challenges of modern industry by addressing operational costs, environmental compliance and water management issues.

CUSTOMER VOICE

The customer was so happy after using these membranes that he offered us the performance certificate of Toray NF membranes. Toray has been supplying the NF and RO membranes for 12 years, and the customer has remained loyal to us.



Figure 4: NF and RO membranes

TORAY ASIA PTE. LTD. (TAS)

111 Somerset Road, #14-22-#14-27, Singapore 238164
Republic of Singapore

www.water.toray

+65-6226-0525

[LinkedIn](#)

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