

Industrial Wastewater

Multi-tech solutions for treating challenging water sources



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DuPont Water Solutions Portfolio

The broadest in the industry



Expertise Beyond the Product



Design Software

- The industry's first fully integrated modeling software program to integrate our leading technologies – UF, RO, CCRO, IX



Online Normalization Tool

- FT-Norm PRO – makes the normalization process simple to accomplish but robust enough to allow for effective monitoring of UF and RO systems



Webinars

- Water Education Resource
- Provides insight on Application, Technology and Design Best Practices
- 30+ Webinars Available Online



Value Calculators

- Cost Savings Calculator
- Resin Replacement Calculator
- Sustainability Navigator



R&D Capabilities

- 4 world-class R&D centers
- Real world testing conditions
- Industrial scale assets
- Best-in-class analytical lab
- Cooperation with key institutions
- Product and application experts
- Customer collaboration projects



System Optimization Services

- Testing, evaluation, and troubleshooting of IX, RO, NF and UF systems, water analysis
- Suggest corrective actions to enhance system performance
- DuPont™ FilmTec™ Fortilife™ DIRECTOR™, the biofilm quantification method

Introduction

There is growing necessity for sustainable industrial wastewater treatment solutions. Currently, eighty percent of global wastewater, including industrial wastewater, is released to the environment without adequate treatment, according to UN World Water Development Report. There is considerable societal and environmental pressure on industrial water users to reduce the volume of wastewater they generate and ensure proper treatment of wastewater before discharge by adopting solutions that allow for the reuse of wastewater and recovery of valuable resources.

DuPont Water Solutions has a longstanding record of developing best-in-class industrial wastewater treatment technologies, offering customers an advanced portfolio of solutions, to tackle complex wastewater challenges and realize a circular water economy by:

- **Reducing effluent discharge:** DuPont multi-tech solutions help reduce the level of pollutants and overall volume of discharge, which can help to easily surpass the minimum standards of environmental regulations and can help organizations achieve their sustainability goals.
- **Reusing wastewater:** DuPont multi-tech solutions can support the reuse of wastewater, helping to reduce the cost of sourcing water and wastewater surcharges, while improving water availability in regions facing water scarcity.
- **Recycling by-products:** DuPont multi-tech solutions can help recover salts and other valuable materials from wastewater streams to compensate for wastewater treatment operational costs by offering additional revenue streams.

DuPont Water Solutions is working to create a water optimized world, helping organizations to demonstrate corporate social responsibility through responsible wastewater stewardship with energy efficient and circular economy approaches.

Ultrafiltration (UF): Removal of Suspended Solids & Colloids in Wastewater

Ultrafiltration (UF) is a high-performance membrane technology that provides consistent water quality across diverse industrial applications. Using size-exclusion filtration, UF removes suspended solids, colloids, bacteria, viruses, and other large molecules, while allowing water and dissolved salts to pass.

Widely used as a pretreatment for Reverse Osmosis (RO), UF protects membranes from fouling, can reduce cleaning frequency, and extends system life. Beyond RO support, UF is increasingly applied as a standalone solution for wastewater treatment, providing water reuse and reducing discharge costs. It also plays a critical role in specialized industrial processes, where precise separation and clarification are essential for product quality and operational performance.



Key Products

Type	Product Name	Surface Area (m ²)	Best Used For
Rack Solutions	IntegraTec™ XP 51 IP IG	51	• Containerized or small size plant
	IntegraTec™ XP 77 IP IG	77	• Medium to large size plant
	IntegraTec™ XTP 100 IP IG	100	• Medium to large size plant requiring lower footprint and CAPEX
Open Platform Modules	IntegraTec™ XP 51 IG	51	• Containerized or small size plant
	IntegraTec™ XP 55 UXA	55	• Replacement for other competitive PVDF modules
	IntegraTec™ XP 77 IG	77	• Medium to large size plant
	IntegraTec™ XTP 100 IG	100	• Medium to large size plant requiring lower footprint and CAPEX



For more information about our full ultrafiltration portfolio, please check out the DuPont™ Ultrafiltration Capabilities brochure:



Wastewater Reuse



Treating Challenging Waters with FilmTec™ Fortilife™ CR-series

Clean less, recover more, and waste less

Industrial water use is under increasing scrutiny due to its impact on local water resources and infrastructure. Regulatory pressure and internal sustainability targets are driving the need to reduce freshwater withdrawal and improve overall water efficiency. In many cases, freshwater reduction alone is insufficient, positioning wastewater reuse as a necessary and immediately accessible alternative.

Industrial wastewater, while available, is inherently complex. High and variable levels of COD, TOC, TSS, and TDS introduce challenges for process stability, fouling control, and downstream performance. Achieving reliable reuse therefore depends on technologies that can sustain consistent operation under these conditions while balancing recovery, operability, and total cost.

DuPont Water Solutions provides an integrated portfolio designed to address these constraints at the system level – supporting a practical approach to “clean less, recover more,

and waste less.” At the core of this approach, FilmTec™ Fortilife™ CR-series reverse osmosis (RO) elements are engineered for high-fouling environments, maintaining permeate quality while reducing cleaning frequency in streams dominated by biological and organic loading. This provides more stable operation, improved uptime predictability, and reduced chemical and maintenance demand without compromising recovery.

By sustaining performance at higher recovery levels under challenging feed conditions, Fortilife™ elements also allow operators to extend the role of membrane separation within the overall treatment scheme. This increases the fraction of water recovered upstream and can reduce the hydraulic and contaminant load on downstream processes – including, where applicable, minimizing or partially displacing energy-intensive thermal treatment steps.

FilmTec™ Element	% Salt Rejection		Flow GPD (m³/day)	Benefit
	Stabilized	Minimum		
FilmTec™ Fortilife™ CR200	99.7%	99.4%	12,500 (47.3)	Expertly designed membrane and ultra-low pressure drop module design to reduce energy consumption while providing superior biological and organic fouling resistance.
FilmTec™ Fortilife™ CR100(i)	99.8%	99.6%	11,500 (43.5)	Advanced membrane and ultra-low pressure drop module design providing superior biological fouling resistance.
FilmTec™ Fortilife™ CR50(i)	99.6%	99.4%	11,500 (41.6)	Robust membrane and low pressure drop module design providing biological fouling resistance.

Sustainable solutions for industrial wastewater treatment.



Minimum Liquid Discharge

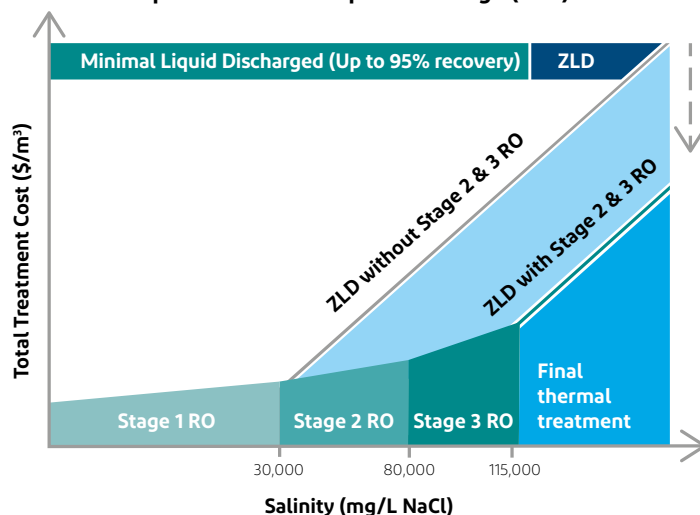
A water management approach aimed to increase water recovery and reduce costs

Reduced access to freshwater and increasingly stringent discharge regulations are driving demand for more efficient and sustainable wastewater management. As a result, wastewater is no longer viewed simply as waste, but as a recoverable resource with both environmental and economic value.

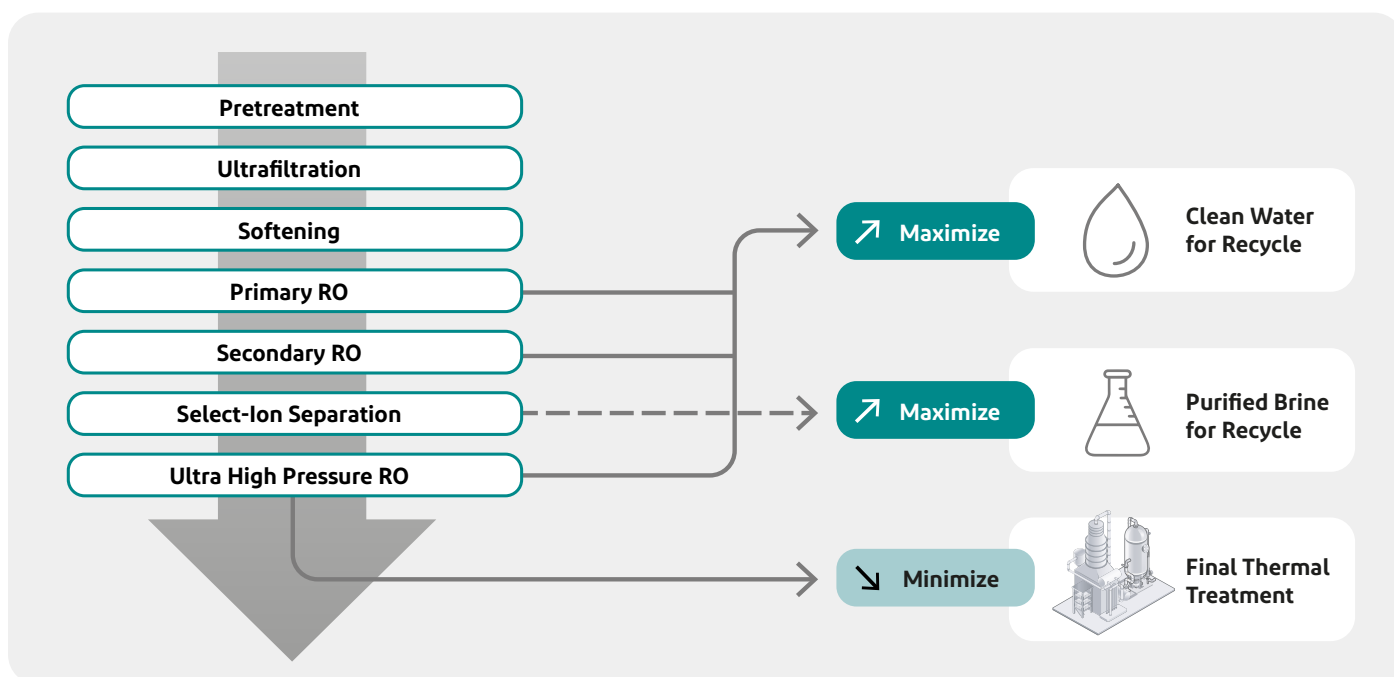
Conventional zero liquid discharge (ZLD) systems, which rely heavily on thermal processes, are effective but come with significant trade-offs. They are energy-intensive and generate solid waste streams (salts) requiring landfill disposal, creating both cost and long-term sustainability challenges. Minimum liquid discharge (MLD) offers a more balanced approach by maximizing water recovery while reducing reliance on thermal treatment. DuPont's MLD solution integrates established technologies – including FilmTec™ Fortilife™ reverse osmosis (RO) and nanofiltration (NF), IntegraTec™ ultrafiltration (UF), and DuPont™ AmberLite™ ion exchange systems – to achieve high recovery levels (typically up to ~95%) at substantially lower energy and operating cost than full ZLD.

By extending the recovery limits of membrane-based separation in high-fouling and high-salinity streams, FilmTec™ Fortilife™ elements can provide greater upstream water recovery, minimizing or partially displacing the load on downstream thermal systems. This can reduce overall energy consumption and supports more flexible system design, where thermal treatment is right-sized rather than fully relied upon.

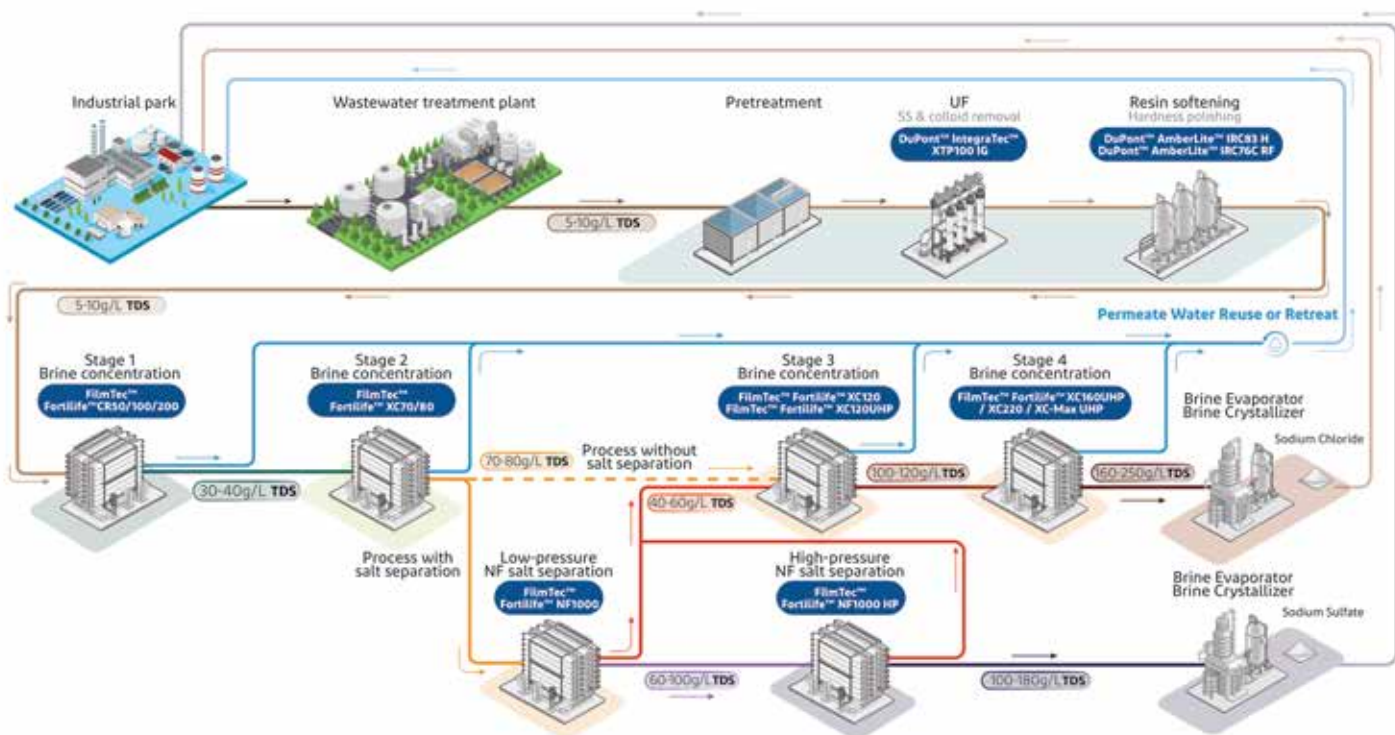
**Cost Benefit of Minimal Liquid Discharged (MLD)
Coupled with Zero-Liquid Discharge (ZLD)**



When combined with selective thermal processes, MLD can further optimize performance – reducing energy demand while improving management of residual streams, including opportunities for salt recovery and reuse instead of disposal. This integrated approach helps operators meet regulatory requirements while maintaining control over operating costs, system stability, and recovery performance. DuPont Water Solutions supports a practical pathway toward higher recovery, lower energy intensity, and more predictable long-term operation.



Minimum Liquid Discharge (MLD) Total Solution



The FilmTec™ Fortilife™ Elements for MLD

The FilmTec™ Fortilife™ portfolio is comprised of nine products, each offering unique features and benefits, enabling a tailored solution to meet your MLD goals.

FilmTec™ Fortilife™ Element Approximate TDS Treatment Range (g/L)	Benefits
FilmTec™ Fortilife™ XC70 Element 15 – 70 g/L NaCl	- Improved productivity and stability for higher recovery operation - Fouling resistant membrane and module design for increased up-time and less frequent chemical cleanings
FilmTec™ Fortilife™ XC80 Element 15 – 80 g/L NaCl	- Reduced footprint with 440 ft² active area element - Module design suitable for high-scaling feed waters
FilmTec™ Fortilife™ XC120 Element 60 – 120 g/L NaCl	Specially designed RO element to achieve higher concentrate TDS with high pressure operating condition up to 83bar
FilmTec™ Fortilife™ XC120UHP Element 60 – 120 g/L NaCl	- High quality permeate water suitable for reuse - Efficient system design with ultra-high-pressure operation up to 120 bar
FilmTec™ Fortilife™ XC160UHP Element 100 – 160 g/L NaCl	Ultra-high-pressure RO element to achieve brine concentration up to 160 g/L NaCl and minimize liquid waste volume for thermal process
FilmTec™ Fortilife™ XC220 Element 120 – 220 g/L NaCl	- Significantly reducing water volume for final thermal treatment step, potentially bypassing evaporation process. - With efficient system design with other high-pressure FilmTec™ Fortilife™ XC series elements enabling simpler operation experience and equipment accessibility
FilmTec™ Fortilife™ XC-Max UHP Element 150 – 250 g/L NaCl	- Significantly reducing water volume for final thermal treatment step, potentially bypassing evaporation process. - With efficient system design with other ultra-high-pressure FilmTec™ Fortilife™ XC series elements, helps minimize permeate recycling and physical footprint of the system
FilmTec™ Fortilife™ NF1000 Element FilmTec™ Fortilife™ NF1000HP Element 0 – 210 g/L Na ₂ SO ₄	- Selective membrane with high monovalent ion passage - High permeability for low energy operation - Suitable for brine reuse or recycling applications - HP element designed for operation > 400 psi (28 bar)

Resource Recovery

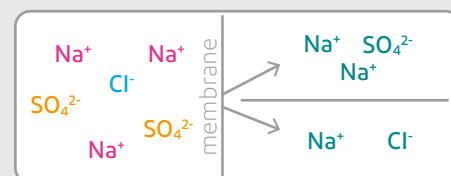
Industrial wastewater has incredible potential as a source of valuable resources. By recovering salts and other chemical compounds, resource recovery can help enable a circular economy while increasing the sustainability and affordability of water recycle systems.

DuPont's resource recovery approach uses FilmTec™ Fortilife™ NF1000 and NF1000 HP nanofiltration (NF) elements to help reduce the volume of costly waste disposal by converting a large proportion of the RO concentrate into purer, easier to crystallize salt solutions. Facilitated by DuPont technologies, China's Coal to Chemical industry recovers high quality sodium chloride and sodium sulfate from its wastewater MLD process, allowing for the reuse of those salts within other industries, including chlor-alkali, soda, dying, leather processing, and construction. Salt recovery has helped these facilities reduce operational costs, shrink their carbon footprint, and open additional revenue streams through carbon credits and carbon trading programs.



Recycled Salt options

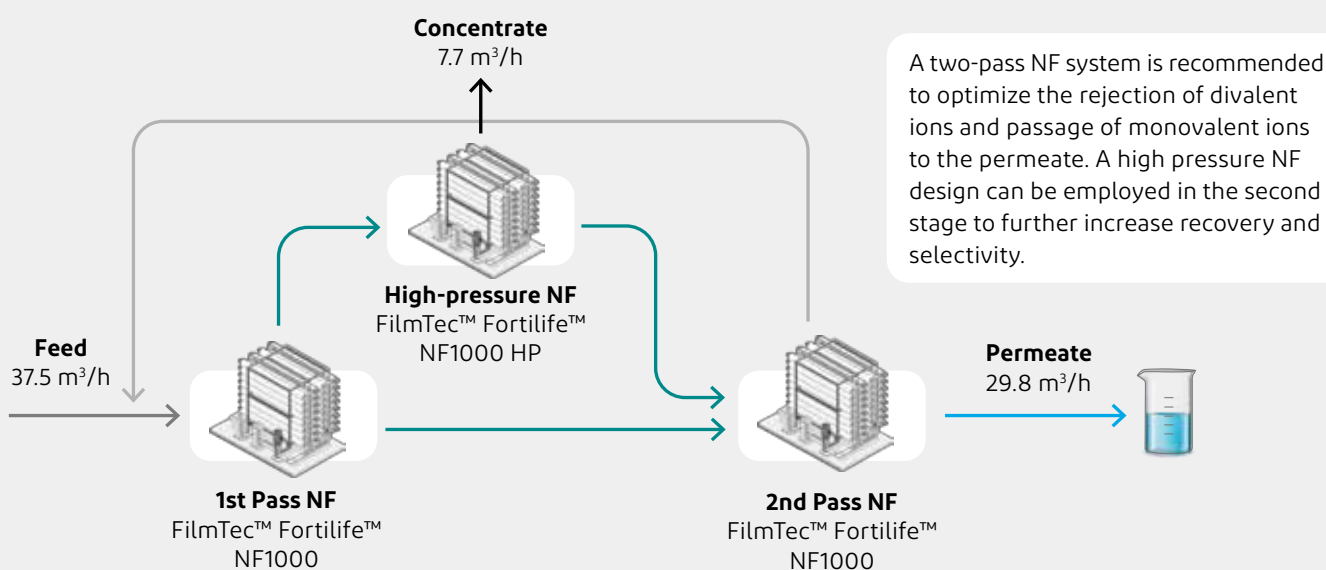
Use NF membrane process to separate NaCl and Na₂SO₄



FilmTec™ Element	Approximate TDS Treatment Range (ppm)*	Benefits
FilmTec™ Fortilife™ NF1000/NF1000 HP	0 – 160,000+	• Selective membrane with high monovalent ion passage • High permeability enabling low energy operation • Less dissolved solid waste

* Values are representative of a feedwater containing sodium chloride

Recommended salt separation system design with FilmTec™ Fortilife™ NF1000 HP



Ferric Phosphate (FePO₄) Wastewater Treatment

As part of the evolving new energy landscape, there is increasing demand for Lithium Ferric Phosphate (LFP) batteries. As the important precursor of LFP cathode material, the production of ferric phosphate (FePO₄) is also booming. However, treating the manufacturing wastewater can be extremely costly and cumbersome, and can hinder efforts to expand the capacity of FePO₄ plants. The traditional wastewater treatment process requires a vast amount of chemicals and generates solid waste almost equal to the weight of the FePO₄ product – creating a significant barrier to the growth of the industry.

DuPont's resource recovery approach provides a total solution combining proven membrane technologies to allow for the high recovery of water and valuable resources from FePO₄ wastewater. By using a combination of state of the art membrane products such as FilmTec™ Fortilife™ XC120HR, FilmTec™ Fortilife™ XC70, FilmTec™ Fortilife™ XC120, FilmTec™ Fortilife™ CR200, FilmTec™ Fortilife™ CR100 as well as FilmTec™ BW30XHR PRO and FilmTec™ ECO PRO-440, high quality RO permeate water can be reused in the manufacturing process and valuable salt by-products, such as ammonia sulfate or sodium sulfate, can be re-purposed as chemical fertilizer.

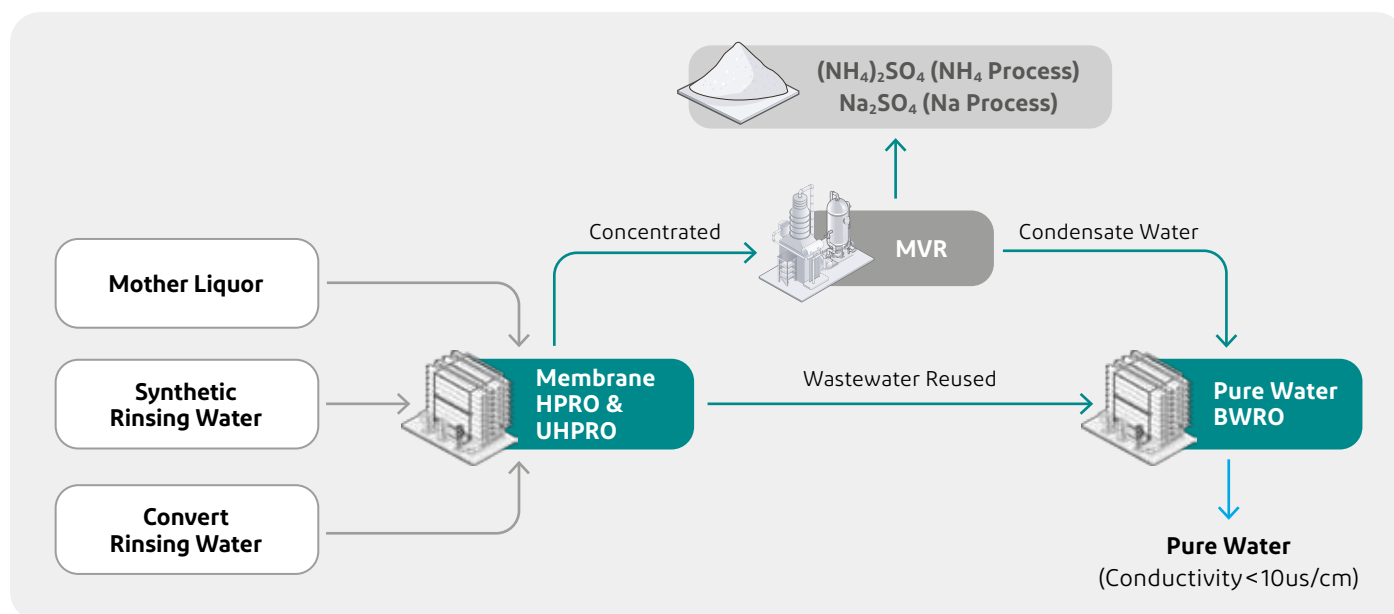
Ultimately, DuPont's FePO₄ wastewater treatment solution can significantly reduce the discharge of wastewater and production of solid waste by maximizing the recovery of water and valuable solid resources. This approach is helping FePO₄ plants to significantly reduce their operational costs while demonstrating a sustainable method of LFP material manufacturing.



Product Recommendation

FilmTec™ Element	Process step	Benefits
FilmTec™ Fortilife™ XC70	High pressure (<83bar)	- Concentrate TDS to reach > 140,000 ppm* while operating ≤ 83 bar - High productivity and high quality permeate water for reuse - Fouling resistant membrane and module design - Less frequent cleaning, allowing for greater up-time and extended element life
FilmTec™ Fortilife™ XC120	High pressure (<83bar)	- Concentrate TDS to reach > 160,000 ppm* while operating ≤ 83 bar - Robust membrane designed for an extended element life - Durable and capable of withstanding cleaning over a broad pH range (1-13) for effective membrane/system maintenance
FilmTec™ Fortilife™ XC120UHP	Ultra-high pressure (<120bar)	- Concentrate TDS to reach > 200,000 ppm* while operating ≤ 120 bar - Produces high quality permeate ready for reuse - Robust membrane designed for an extended element life - Durable and capable of withstanding cleaning over a broad pH range (1-13) for effective system maintenance
FilmTec™ ECO-PRO 440	2nd-pass BWRO	- Low energy BWRO membrane element - High TDS rejection
FilmTec™ BW30XHR PRO-440	2nd-pass BWRO	- Extra high rejection BWRO membrane element - Exceptional permeate quality including excellent silica, boron, nitrate, TOC and ammonium rejection

* Values are representative of a feedwater containing ammonium sulfate



Treatment of Landfill Leachate

Globally, leachate from landfill or municipal solid waste incineration power plants contain high concentrations of COD, BOD, dissolved salts, ammonia, nitrogen, and heavy metals, making it one of the most challenging wastewater sources to treat.

A RO/NF membrane is a barrier to soluble salts, inorganic molecules, and organic molecules, making it highly effective at removing contaminants in the leachate treatment process. However, leachate is prone to causing fouling of membranes, requiring frequent CIP, shortening the lifespan of membranes and leading to instability in the quality of permeate water. DuPont™ FilmTec™ NF products benefit from robust, expertly designed and optimized membrane chemistry to help enable

reliable performance over an extended element lifetime. They can help overcome challenges in the leachate treatment process, achieving consistent permeate water quality through excellent COD and color removal, in addition to partially removing hardness.

DuPont™ FilmTec™ Fortilife™ RO products feature robust, fouling-resistant membranes to help achieve reliable long-term performance.

They are capable of withstanding cleanings over a broad pH range (pH 1–13) allowing for effective cleaning in cases of severe fouling without impacting on membrane integrity or lifespan.

Objective 1

High recovery for reuse



Challenge 1

high recovery expectation with increasingly challenging feed water

- Membrane fouling
- Membrane scaling

Objective 2

Qualified permeate water quality for reuse/discharge



Challenge 2

more stringent discharge & reuse requirements

- Color issue
- Specific ions requirements (like TN, Cl- or TDS)

Objective 3

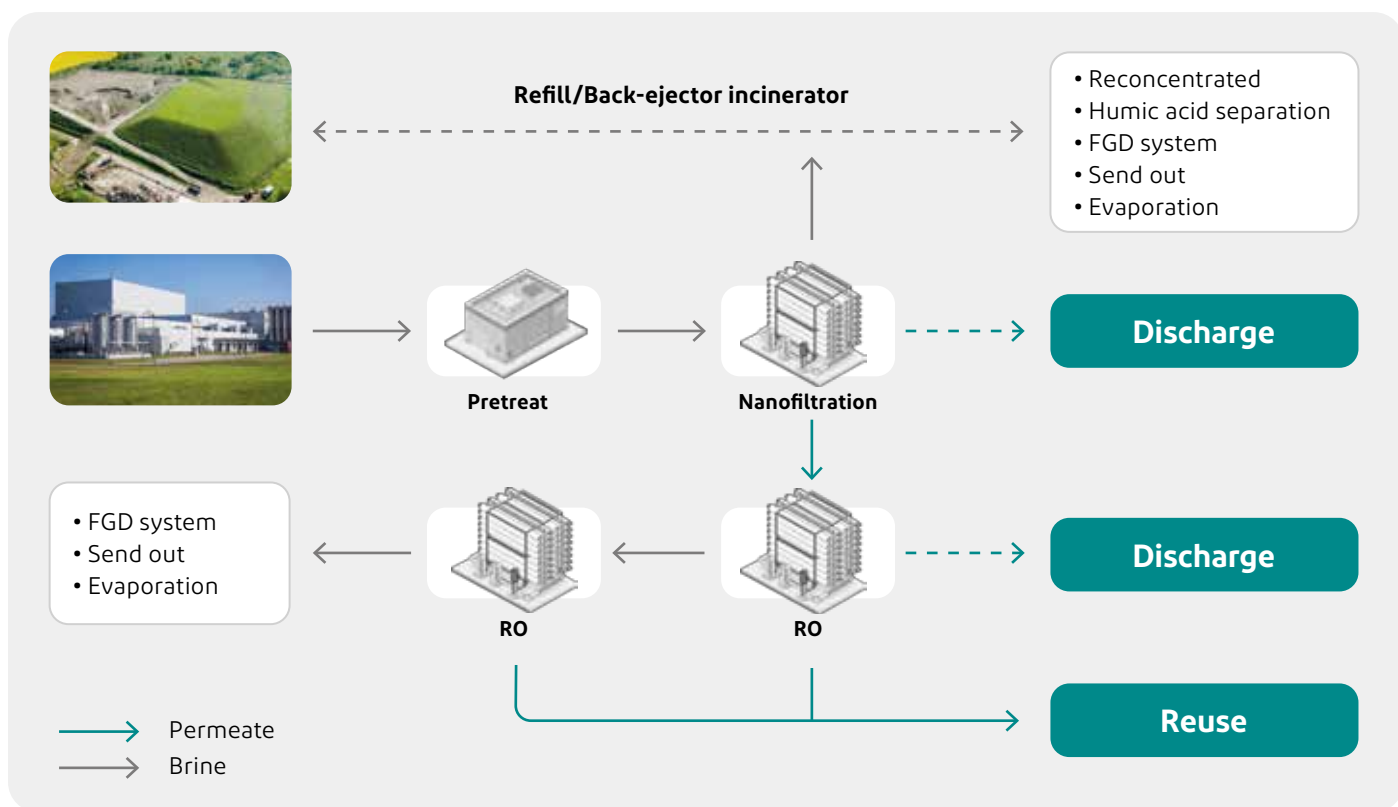
MLD/ZLD



Challenge 3

excessive amount of brine water leads to MLD process

- Lower the cost of ZLD
- Provide alternatives to ZLD



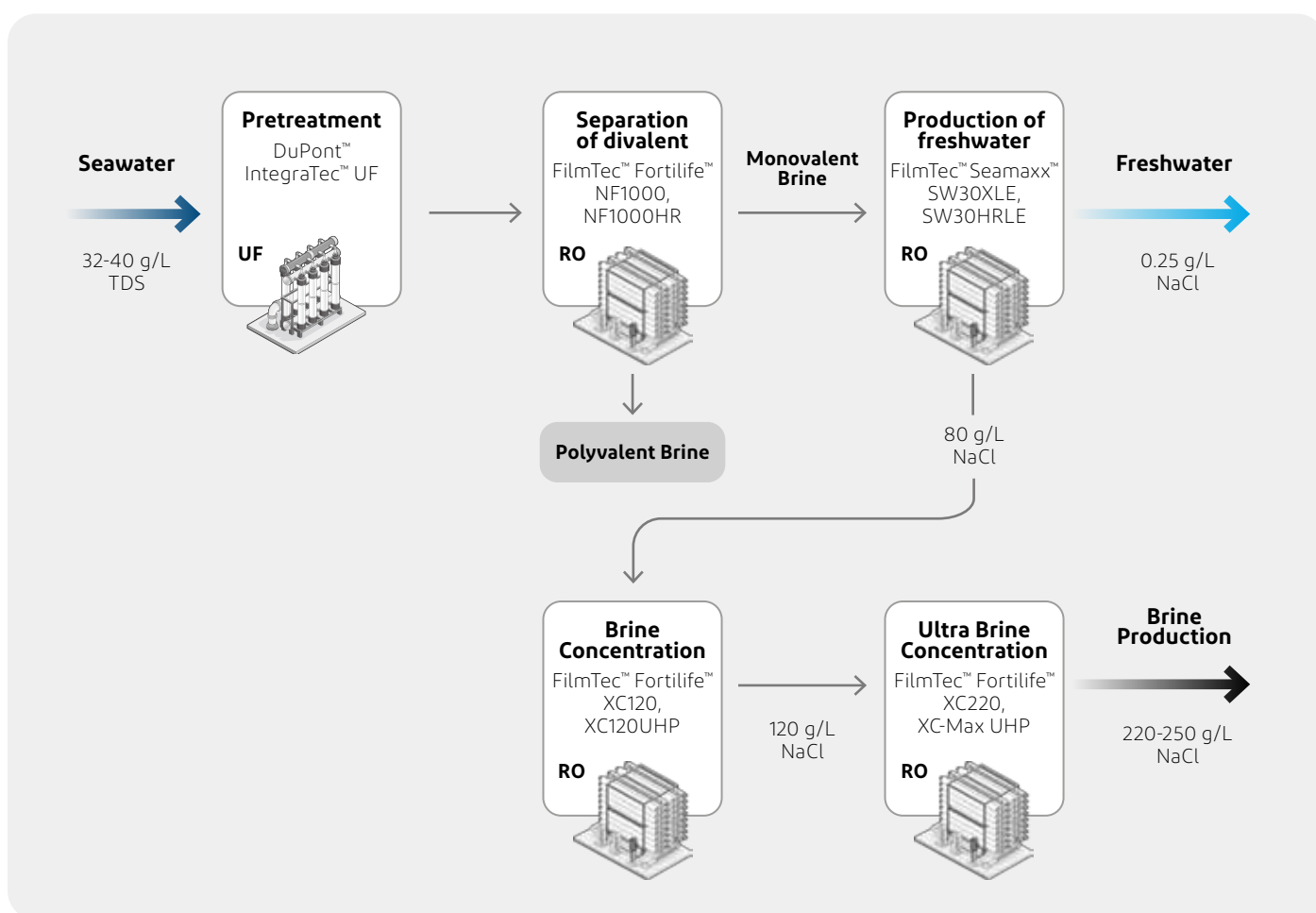
FilmTec™ Element	Benefits
FilmTec™ Fortilife™ NF1000	• High monovalent-divalent ion selectivity allows for the production of high purity salt solutions while reducing the volume of liquid directed to downstream thermal treatment • Expertly designed and optimized membrane chemistry to enable robust and reliable performance throughout element lifetime • High productivity membrane allows for increased water and resource recovery and/or reduced energy consumption
FilmTec™ Fortilife™ XC70	• Allows system reject total dissolved solids (TDS) levels > 70,000 mg/L and reduced concentrate stream volume within standard RO system operation. • Robust, fouling-resistant membrane for reliable long-term performance. • Durable and capable of withstanding cleaning over a broad pH range (pH 1-13) allowing for effective cleaning in cases of severe fouling.

Seawater Brine Recovery

Seawater desalination produces a high-salinity brine stream that is typically discharged, despite containing recoverable water and valuable salts. Increasing regulatory pressure and disposal costs are driving interest in brine recovery as a standalone optimization step within desalination and resource recovery schemes.

Membrane-based brine concentration provides a practical pathway to increase overall recovery while reducing downstream treatment burden. Using FilmTec™ Fortilife™ elements, seawater brine can be progressively concentrated from conventional levels (~60–80 g/L TDS) to ultra-high salinity ranges of 220–250 g/L. This extends the effective operating window of membrane systems under high osmotic pressure and fouling conditions.

By achieving higher concentration upstream, membrane systems can significantly reduce the volume sent to thermal evaporation – or in some cases enable direct crystallization – thereby lowering energy consumption, simplifying system design, and improving overall process economics.



Powering Performance Worldwide

Location	Industry	Process	Application	Feed capacity m³/h
Australia	Municipal	sUF - RO	WWR	540
Brazil	Food & Beverage	RO	WTP	450
Brazil	Chemical & Petrochemical	RO	WTP	300
Brazil	Food & Beverage	UF + RO	WWR	134
China	Textile	UF+RO+WAC+UF+NF1+RO2+UF+RO3+RO4+MVR	MLD	6,600
China	Municipal	UF+RO	IWT	3,300
China	Coal Chemicals	UF+BWRO+IER+UF+NF+BWRO+SWRO+UHPRO	MLD	3,000
China	Coal Chemicals	UF+SAC+WAC+BWRO+SWRO	MLD	2,800
China	P&P	UF+RO	WWR	2,500
China	Coal chemicals	UF+RO	WWR	2,500
China	Metal	UF+RO	WWR	2,500
China	Coal Chemicals	UF+WAC+BWRO+SWRO(HERO)	MLD	2,300
China	Steel	UF+RO	WWR	2,000
China	Coal Chemicals	UF+IER+ROSWRO	MLD	2,000
China	Chemicals	UF+RO	WWR	2,000
China	Coal chemicals	UF+RO	WWR	2,000
China	Chemicals	UF+RO	WWR	1,600
China	Coal Chemicals	UF+RO	MLD	1,500
China	Steel	UF+ 2 pass RO+NF+SWRO	MLD	1,300
China	Coal Chemicals	UF+IER+RO+NF+SWRO	MLD	1,300
China	P&P	UF+SWRO+UHPRO	MLD	1,250
China	P&P	UF+RO	WWR	1,200
China	P&P	UF+RO	WWR	1,200
China	Coal chemicals	UF+MLD	MLD	1,000
China	Coal chemicals	UF+MLD	MLD	1,000
India	Textile	PT+QF+WAC+RO+NF+RO+MEE+ATFD	ZLD	333
India	Textile	PT+QF+WAC+RO+MEE+ATFD	ZLD	250
India	Textile	PT+QF+WAC+RO+UF+NF+RO+MEE+ATFD	ZLD	230
India	Textile	PT+MGF+UF+RO+MEE+ATFD	ZLD	175
India	Textile	PT+UF+NF+RO+MEE+ATFD	ZLD	110
India	Textile	PT+MBR+RO+MEE+ATFD	ZLD	75
India	Textile	PT+MGF+RO+MEE+ATFD	ZLD	50
Indonesia	Palm Oil	UF RO	IWW	120
Indonesia	Nutrition - Sugar	RO	IWT	80
Malaysia	Power	MMF+2-pass RO	IUW	90
Mexico	Chemical & Petrochemical	UF + RO	WWR	910
Mexico	Metal & Mining	MBR + RO	WWR	55
Singapore	Microelectronics	h-DWS UF+RO	IWW	260
Thailand	Industrial	RO	IWW	225
Thailand	Starch	RO	IWW	100
Thailand	Latex	RO	IWW	100
Thailand	Starch	RO	IWW	100

You can learn more about our solutions here

Just scan QR-code



Applications for Industrial Wastewater



FilmTec™ Fortilife™ RO Portfolio



DuPont™ Ultrafiltration Capabilities



Water Academy



Industrial Wastewater Casestudies



Join our WeChat Community



Water Solutions

Have a question? Contact us at:
[dupont.com/water/contact-us](https://www.dupont.com/water/contact-us)

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