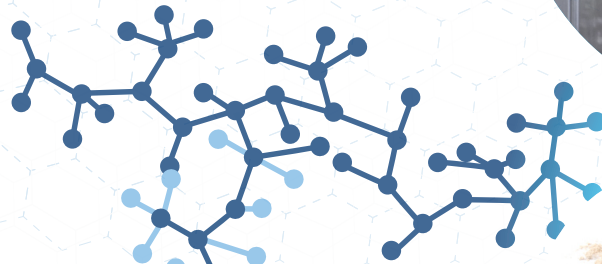
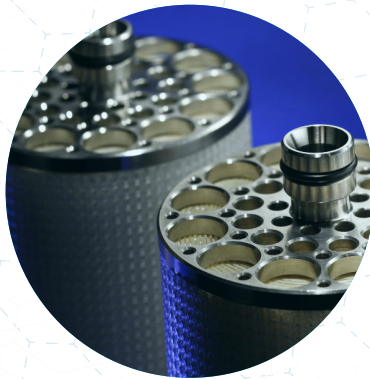




## *Company Overview and Introduction to Dairy*



## About Our Company

Nanostone Water is a membrane solutions company with a broad and unique portfolio of ceramic and polymeric membranes serving industrial process fluid and water treatment applications. Headquartered in Eden Prairie, Minnesota, the company has ceramic manufacturing operations in Halberstadt, Germany and manufactures polymeric membrane products at its Oceanside and Carlsbad, California facilities.

The Nanostone Water team is comprised of industry experts with deep domain expertise resulting from multiple decades of experience solving the world's most challenging separations problems.

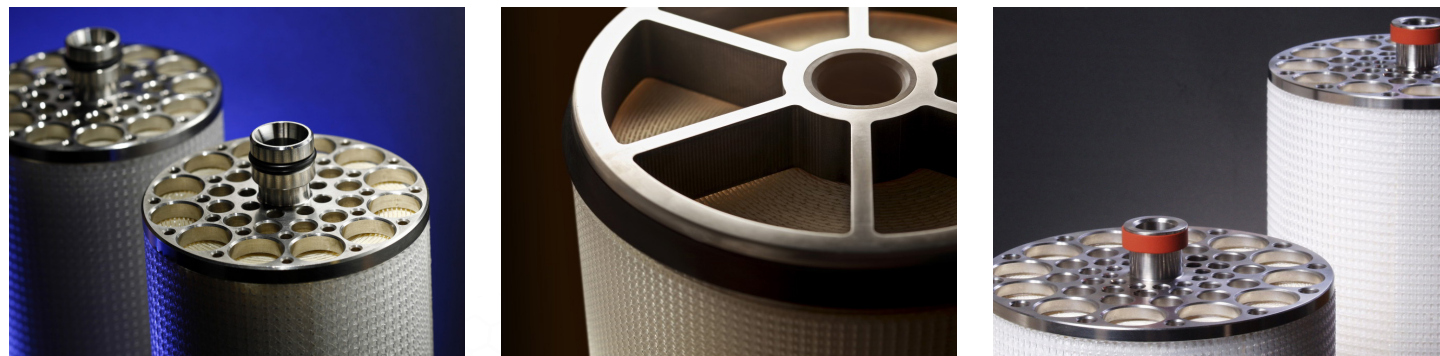
Simply stated, our mission is to combine the power of a new generation of ceramic membranes with a robust portfolio of high performance polymeric membrane products to deliver the highest level of cost effectiveness and separations efficiency to our industrial process fluid and water treatment customers.

Nanostone Water has proven products that have been operating across the Dairy industry for over 20 years.

Our team of applications engineers and industry experts understands the unique challenges of the dairy industry and can help you select the right membrane to keep your dairy operation running smoothly and efficiently.

Nanostone Water's unique product portfolio includes Microfiltration (MF), Ultrafiltration (UF), Nanofiltration (NF), and Reverse Osmosis (RO) membranes for a broad range of Dairy applications.

**All of Nanostone Water's sanitary elements conform to 3A Sanitary Standards, FDA (CFR Title 21), and EU Commission Directive 2002/72/EC.**



## Products

APPLICATION	MEMBRANE TYPE	MEMBRANE MATERIAL	MWCO (Dalton) PORE SIZE (µm)
<b>MF</b> MICROFILTRATION			
Cheese Brine Treatment	PV500	PVDF	0.16 µm
	PV650	PVDF	0.29 µm
Whey Defatting	PV500	PVDF	0.16 µm
	PV550	PVDF	0.24 µm
Casein Enrichment	PV650	PVDF	0.31 µm
	PV500	PVDF	0.16 µm
Removal of Bacteria and Spores	PV550	PVDF	0.24 µm
	PV500	PVDF	0.16 µm
Other	PV700	PVDF	0.5 µm
<b>UF</b> ULTRAFILTRATION			
Milk and Whey Protein Concentration/Isolation	PES3	PES	4,000 Da
	PES5 <sup>1</sup>	PES	5,000 Da
	PES10	PES	10,000 Da
Milk & Whey Concentration	PES10HR <sup>2</sup>	PES	10,000 Da
	PES10HpHT <sup>3</sup>	PES	10,000 Da
Protein Fractionation	PV400R	PVDF	250,000 Da
<b>NF</b> NANOFILTRATION			
Lactose Concentration/De-ashing	NF3A	Polyamide	200 Da
	NF4	Polyamide	200 Da
	NF8	Polyamide	200-300 Da
Fractionation of Low MWCO Components	NF6	Polyamide	500-600 Da
<b>RO</b> REVERSE OSMOSIS			
Milk/Whey/Permeate Concentration	RO3	Polyamide	< 100 Da
Polishing	RO3	Polyamide	< 100 Da

<sup>1</sup> Used in last stages of whey systems

<sup>2</sup> High flux UF membrane with improved protein rejection

<sup>3</sup> High temperature, high pH tolerant membrane

## Application Descriptions

### MILK PROCESSING

Microfiltration, Ultrafiltration, Nanofiltration and Reverse Osmosis membranes are used to concentrate, standardize and/or remove certain components from whole and skim milk. UF concentrates can be used for cheese, yogurt and MPC production or in combination with microfiltration to produce MPis. RO is used to concentrate UF permeates for lactose recovery or polishing of NF permeate after lactose concentration and de-ashing or to reduce volume for transport or save energy in front of evaporation.

Nanostone's range of MF, UF, NF and RO products offers a solution for every application in milk processing.

### DEMINERALIZATION OF WHEY & LACTOSE STREAMS

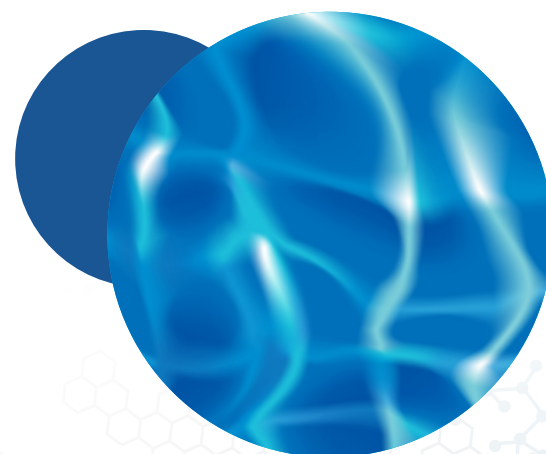
Adjusting the mineral content in whey and lactose is an important step in the production of whey protein and lactose products. Nanostone's range of NF membranes offer the perfect solution for your process needs.

### WHEY PROTEIN CONCENTRATION & ISOLATION(WPC/WPI)

The nutritional and technological value of whey proteins has only been recognized within last several years and has changed whey into a high value raw material, while it had previously only been considered a waste product of the cheese production process. Whey Protein Concentrates and Isolates are widely used as value adding components in many food and beverage products, especially in infant food and animal feed. Nanostone's range of MF, UF, NF and RO membranes help to concentrate, isolate and fractionate whey proteins from milk or cheese whey to the targeted composition.

### PERMEATE POLISHING - WATER RECYCLING

Water consumption and wastewater discharge are challenging issues at dairy plants. Nanostone's RO products help tackle the challenge. Designed for the highest ion and COD rejection, our RO membranes assure discharge limits or enable wastewater reuse within the plant.



### PROTEIN STANDARDIZATION

Milk is a natural product and will show seasonal and/or regional variations. Adopting casein and whey protein content and composition to the specific product requirements is an important technological tool for product improvement and cost optimization. This can go as far as fractionating single protein components. The standardizing casein and/or whey protein content of cheese milk is only one already well-established example. The cheese making process becomes more stable and predictable as a result of protein standardization. It also enables using the valuable surplus proteins for other products thus improving plant economics. Nanostone's variety of UF and MF will allow you to find the ideal membrane combination for your process.

### FAT REMOVAL FROM WHEY

Remaining milk fat reduces the value of whey protein products and makes processing more difficult. Our microfiltration membranes economically reduce the fat content of whey streams.

### CHEESE BRINE CLARIFICATION

NaCl brine is used for cheese salting. The brine accumulates proteins, fat and microbiological load during its use and requires regular replacement. The disposal and replacement is expensive and is becoming more and more challenging from an environmental perspective. Nanostone Microfiltration membranes, typically applied in a kidney process, will remove the brine contaminants and stabilize and increase lifetime of the brine bath. This will make your cheese process more stable and productive.

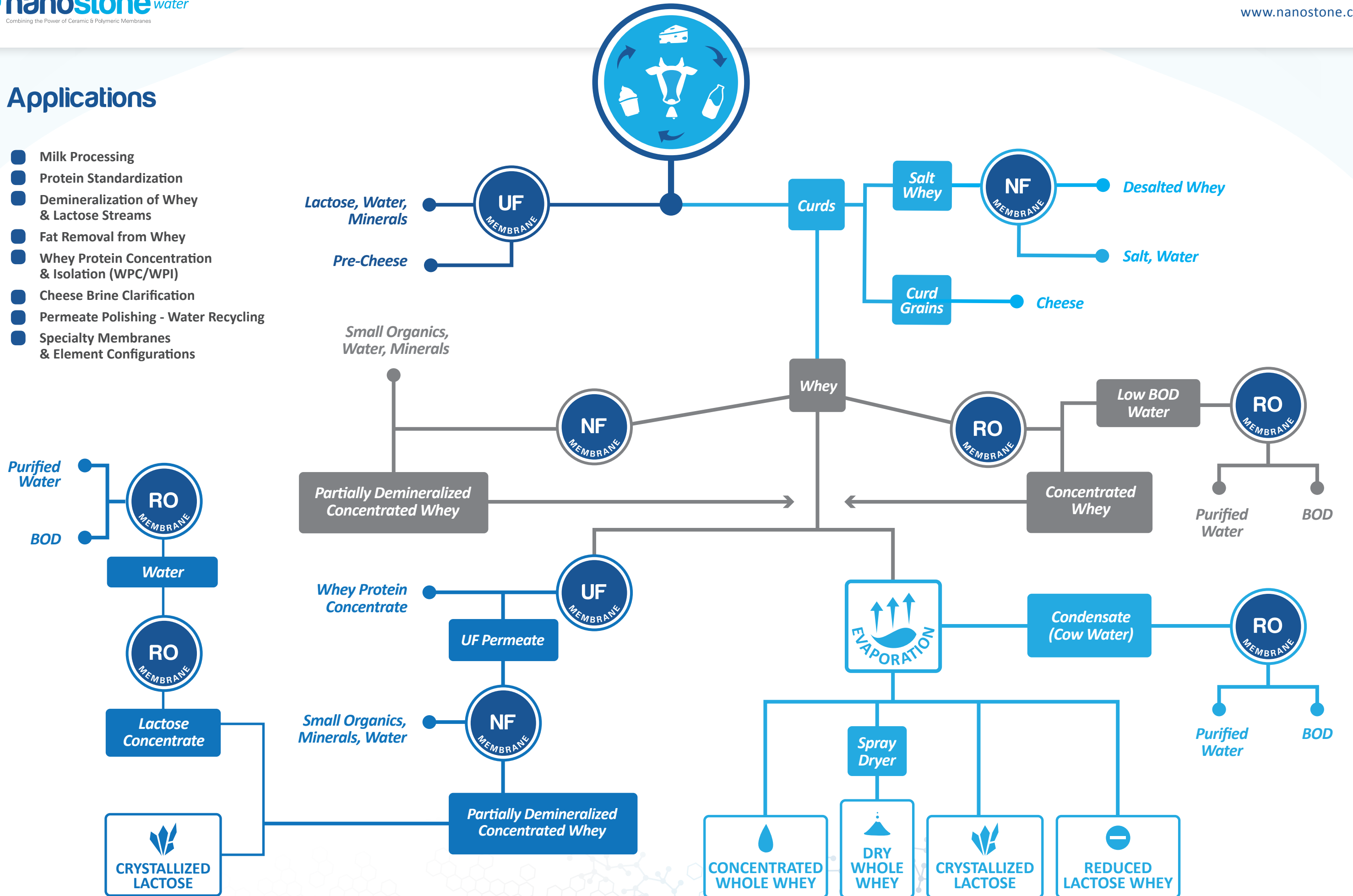
### SPECIALTY MEMBRANES & ELEMENT CONFIGURATIONS

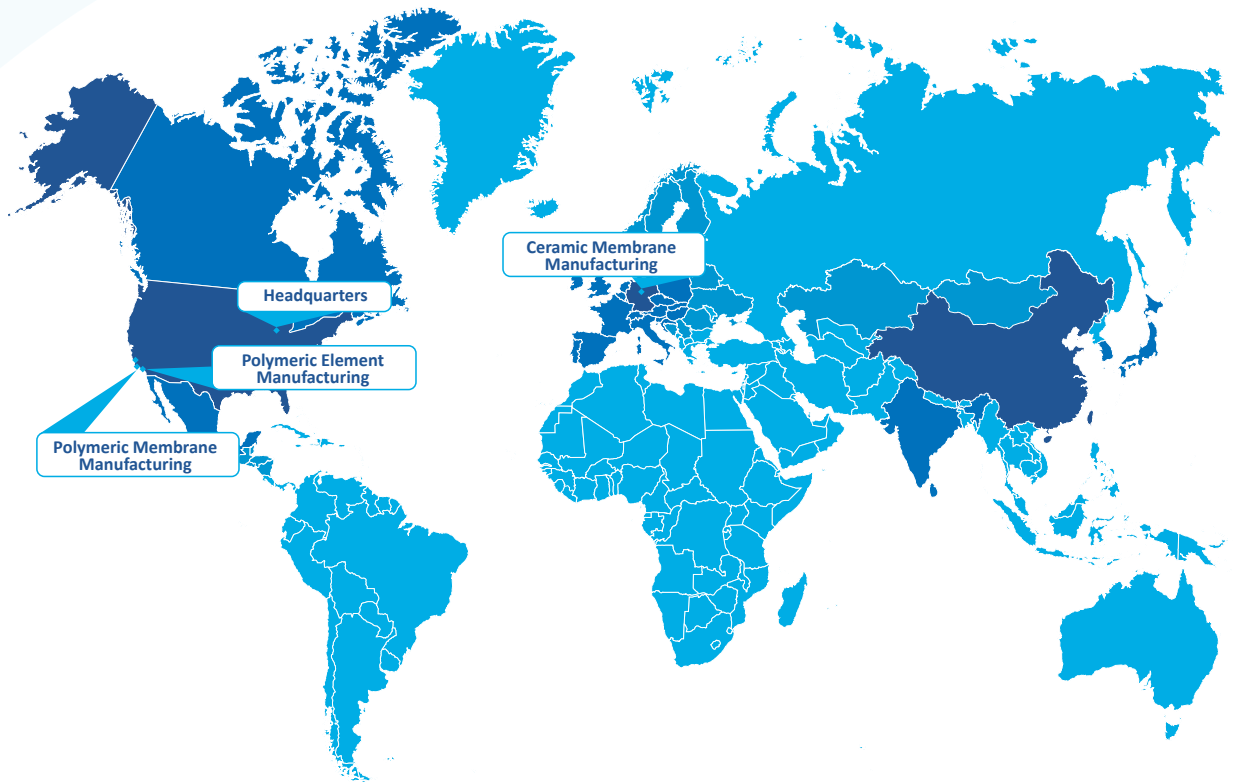
Nanostone Water offers high temperature and high pH membrane products for special cleaning requirements and applications. In addition, we have specialty element configurations with feed spacer thicknesses of up to 120 mil for high solids applications. We accommodate and manufacture non-standard sized dairy elements to fit a broad range of housings and plants.



## Applications

- Milk Processing
- Protein Standardization
- Demineralization of Whey & Lactose Streams
- Fat Removal from Whey
- Whey Protein Concentration & Isolation (WPC/WPI)
- Cheese Brine Clarification
- Permeate Polishing - Water Recycling
- Specialty Membranes & Element Configurations





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