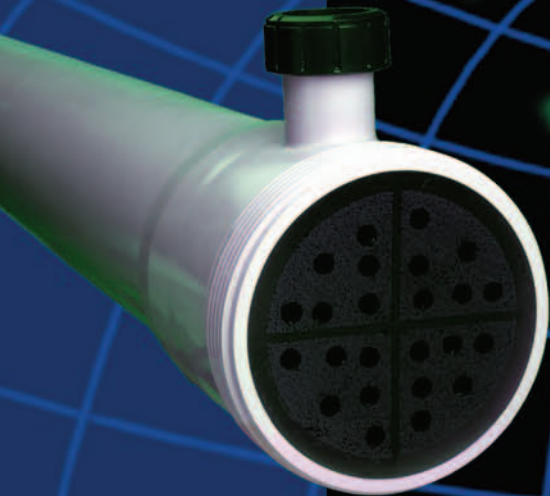
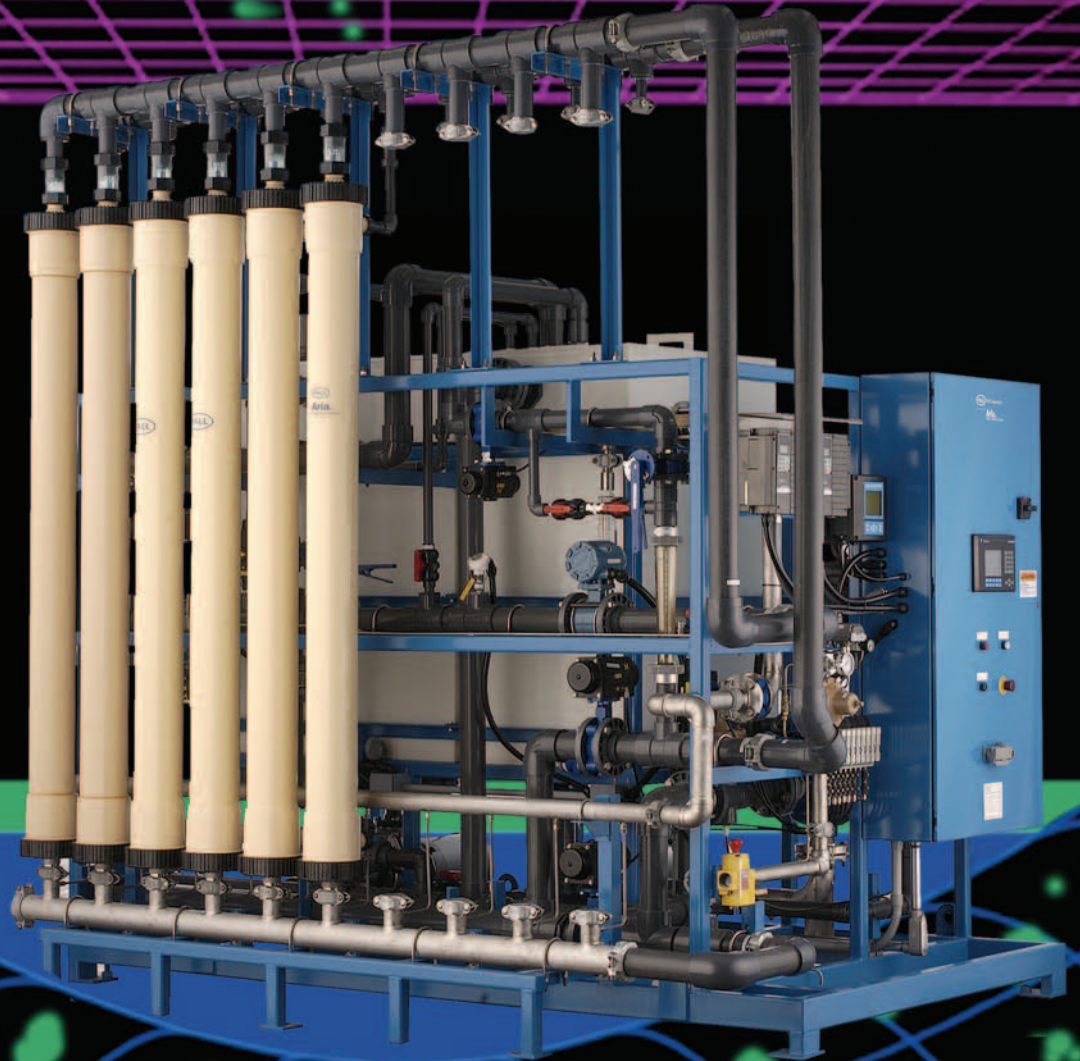




Pall Corporation

Pall Aria™  
AP-Series  
Packaged  
Water  
Treatment  
Systems



*Filtration. Separation. Solution.™*

# Pall Aria™ AP-Series Packaged Water Treatment Systems

## Installations

Point Hope, AK

Wainwright, AK

Nuiqsut, AK

Point Lay, AK

Atkasuk, AK

Anchorage, AK

Kaktuvik, AK

Kernville, CA

Burbank, CA

## Membrane Filtration for Safe Drinking Water

Pall Aria™ water treatment systems are specifically designed to produce drinking water that meets today's stringent standards. The systems use uniquely designed filtration modules in a hollow fiber configuration to remove the following contaminants from surface and ground water sources.

- Suspended Solids/Turbidity
- Viruses
- Bacteria
- Cysts and Oocysts
- Iron and Manganese
- Arsenic
- Organics

The Microza<sup>1</sup> hollow fiber membranes are highly permeable resulting in high water production rates. Each hollow fiber module provides high active surface area of up to 538 ft<sup>2</sup>. Pall's dedication to a simplified process and control design has produced a family of systems that are characterized by:

- Tough, long-service hollow fiber membranes
- Operator friendly controls
- Simple surface water treatment without coagulation
- Unique air scrub and flush operation
- High efficiency, low waste
- Excellent compatibility with chlorine and common treatment chemicals
- Minimal cost of operation
- Easy installation using modular skids
- Compact system footprint
- Full system NSF 61 listing
- ISO 9001 certified manufacturing
- ETV certified for surface water treatment rule

Site testing confirmed Pall Aria Systems meet or exceed EPA standards for safe drinking water. The system is also the first to receive 'full system' certification in accordance with ANSI/NSF 61 Specifications.

<sup>1</sup> Microza is a registered trademark of Asahi Kasei Corp., Ltd. Pall Aria is a trademark of Pall Corporation.







Membrane filtration is a pressure driven process that uses a semi-permeable (porous) membrane to separate particulate matter from soluble components in the carrier fluid, such as water. In Pall Aria systems, microfiltration or ultrafiltration membranes act much like a very fine sieve to retain particulate matter, while water and its soluble components pass through the membrane as filtrate, or filtered water. The retained solids are concentrated in a waste stream that is discharged from the membrane system. The pore size of the membrane and the integrity of the sealing mechanism controls the fraction of the particulate matter that is removed. Microza membranes, with their fine pore size and absolute seal, remove virtually all of the fine matter, such as silica, bacteria, and parasite cysts.

# Pall Aria Systems - Overview

## Installations

Forestville, CA

Avon, CO

Pinellas Park, FL

Hobart, NY

Youngs River, OR

Beverly Beach Park, OR

Bullards Beach, OR

Astoria, OR

Hite Marina, UT



## Transforming Water from Any Source to Match Your Requirements

Pall Aria water treatment systems are used to filter ground and surface waters for drinking water supply and industrial uses, and secondary wastewater effluent for reuse.

### Ground Water

- Lowers turbidity and removes microbial pathogens from ground water under the influence of surface water.
- Removes iron and manganese with oxidation.
- Removes arsenic with coagulation.

### Surface Water

- Lowers turbidity and removes microbial pathogens from raw water drawn from rivers, streams, lakes, and reservoirs.
- Removes organics with coagulation to improve disinfection by-products rule compliance, taste and odor.

### Secondary Wastewater Effluent

- Removes suspended solids and reduces SDI prior to RO treatment for reuse.
- Removes bacteria and other pathogens, and suspended solids to produce water suitable for landscape irrigation and similar reuse applications.

## Pall Membrane Microbial and Particulate Removal

Contaminants	Typical Removal <sup>2</sup>	
	Microfiltration (MF)	Ultrafiltration (UF)
Giardia	>6 (log)	>6 (log)
Cryptosporidium	>6 (log)	>6 (log)
MS2 Coliphage or Bacteriophage	0.5 – 2.5 log <sup>3</sup>	4.5 – 6 log <sup>3</sup>
Turbidity	<0.1 ntu	<0.1 ntu

<sup>2</sup> Based on third party testing.

<sup>3</sup> Virus removal varies depending on coagulation process upstream of system.

## Application Guidance

Design Parameter	Ground Water (GW)		Surface Water		Secondary Wastewater
	Under the Influence of Surface Water	High Iron & Manganese	Low TOC or Turbidity	High TOC or Turbidity	
Contaminants	Turbidity & Microbial Pathogens	Iron & Manganese	Turbidity & Microbial Pathogens	Turbidity & Microbial Pathogens	Suspended Solids & Pathogens
Pretreatment	None	Oxidation & Precipitation	Strainer	Strainer, Oxidation, or Coagulation	Disinfection & Strainer
Filtered Water Quality	Turbidity <0.05 ntu No Detectable Giardia & Crypto	Turbidity < 0.05 ntu Iron & Manganese < 0.05 mg/L	Turbidity <0.05 ntu No Detectable Giardia & Crypto	Turbidity <0.05 ntu up to 60% TOC Removal	SDI ≤3 Turbidity <0.05 ntu

# Pall Aria Systems - Specifications

## Packaged for Fast, Easy Installation

Pall Aria water treatment systems are highly flexible, production scale, membrane filtration packages, designed to filter a wide range of feed streams. Standard systems are available in the following skid-mounted configurations.

## Standard System Specifications

Model Number	Maximum Number of Modules	Filtered Water Capacity (gpm [m <sup>3</sup> /hr])	Dimensions (L x W x H : ft [m])	
			Shipped <sup>4</sup>	Installed
AP-1	2	3-25 [0.7-5.7]	6.1 x 2.8 x 6.5 [1.9 x 0.9 x 2.0]	6 x 2.8 x 9.8 <sup>7</sup>
AP-2	8	10-50 [2.3-11.4]	8.1 x 2.8 x 6.5 [2.5 x 0.9 x 2.0]	8 x 4.1 x 9.9 <sup>7</sup>
AP-3	10	25-200 [5.7-45.4]	8.2 x 5.7 x 7.5 [2.5 x 1.7 x 2.3]	9.5 x 6.9 x 10.3 <sup>7</sup>
AP-3x	20	25-200 [5.7-45.4]	8.2 x 5.7 x 7.5 [2.5 x 1.7 x 2.3] <sup>5,6</sup>	8.8 x 18.6 x 10.8 <sup>5</sup>
AP-4	36	50-350 [11.4-79.5]	10 x 6.8 x 7.7 [3 x 2.1 x 2.3] <sup>5,6</sup>	10.8 x 20.8 x 10.8 <sup>5</sup>
AP-6	60	200-700 [45.4-159]	10 x 6 x 6.8 [3 x 1.8 x 2.1] <sup>5,6,8</sup>	19.1 x 17 x 10.8 <sup>5,8</sup>

<sup>4</sup> Crating add 0.5 ft. [0.15m] to each dimension.

<sup>5</sup> Module rack is off the skid.

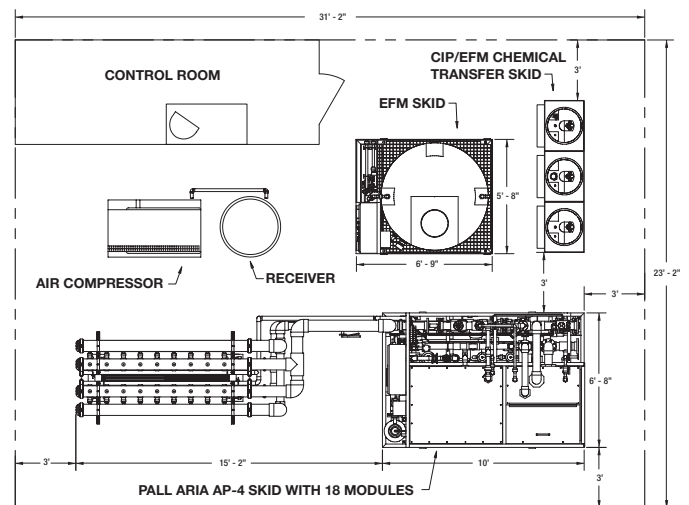
<sup>6</sup> Module rack shipped as crated parts kit.

<sup>7</sup> Control skid w/attached module rack.

<sup>8</sup> Two freestanding tanks 5'6" wide x 7'6" high, shipped separately for each skid.

## Optional and Auxiliary Equipment

- Modem for Remote Access
- Auto Dialer for Alarms
- PC for Operator Interface Terminal and Data Acquisition
- Feed or Filtrate Turbidimeters
- Oxidant Dosing Systems
- Air Compressor Systems
- EFM Systems to Reduce System Costs
- Disinfectant Dosing Systems
- Coagulant and CIP Chemical Storage/Dosing Systems
- Filtrate Particle Counter



Typical treatment plant layout for 500,000 gallons per day.

Auxiliary equipment to improve treatment capabilities is available on separate skids, which are equipped with distributed controls that can be integrated into a master control system to provide optimal, automatic integrated system operation.



## Installations

Basalt, UT

Lake Powell UT

Stoney Creek, VA

Ashford, WA

Meeteetse, WY

Point of Rocks, WY

Manati, Puerto Rico

Burleigh Falls, Canada

Bruce Mines, Canada

Panel Ray, Mexico

## Standard Components

A standard Pall Aria AP Package consists of 1 to 60 membrane modules, one feed/CIP tank and pump, one reverse filtration tank and pump, manual and automatic valves, flow meter, pressure and temperature sensors, PLC control, control panel, and a painted carbon steel frame. Other items can be added on request. Separate auxiliary skids are available for compressed air and chemical feed/pre-oxidation.

- Painted Carbon Steel Frame
- 316 SST Pumps W/TEFC Motors and VFDs
- PVC and Stainless Steel Piping
- Butterfly Valves (Manual and Air Operated)
- PE Tanks with Level Control
- PLC Controls and Software
- Instrumentation (Digital and 4-20 ma Analog Signal)
- NEMA-4 Electrical Enclosures

### Operating Conditions

- Maximum Inlet Pressure: 44 psi (3 bar)
- Maximum Operating Temperature: 104°F (40°C)
- Minimum Operating Temperature: 33°F (1°C)

### Utility Requirements

Electrical Connection:

AP 1:	1 ph	230v	50 A
AP 2:	1 ph	230v	30 A or
	3 ph	230v	25 A or
	3 ph	460v	15 A
AP 3/3x:	3 ph	230v	40 A or
	3 ph	460v	25 A
AP 4:	3 ph	460v	40 A
AP 6:	3 ph	460v	70 A

Other voltage can be accommodated, if required. Water Supply for CIP: 75-95°F (25-35°C)



Module cutaway showing hollow fibers.



#### Microza Hollow Fiber Microfiltration Module<sup>9</sup>

- Membrane Material: PVDF
- Pore Rating: 0.1 micron ( $\mu\text{m}$ )
- Fiber OD / ID: 1.3 mm/0.7 mm
- Active Filter Area: 538 ft<sup>2</sup>
- Module Size: 6" diameter x 79" long
- Housing: PVC or ABS
- Gasket: EPDM
- Potting Material: Silicone Epoxy or Urethane

<sup>9</sup> Ultrafilters also available

#### NSF System Listing

Pall's family of hollow fiber membrane systems were the first "full systems" to be listed in accordance with ANSI/NSF 61 specifications. The Pall Aria system is manufactured from NSF approved materials and meets all requirements for potable water service.

#### ISO 9000 Certification

Pall's North American manufacturing, engineering, sales and marketing operations have received ISO 9001 registration from Lloyd's Register of Quality Assurance Limited. ISO 9001, which also covers design and development functions, represents the highest, most comprehensive level of ISO 9000 Certification. The quality system and procedures are regularly audited to assure compliance and proper record keeping before the certification is renewed.



Pall R&D Team Members

# Pall Aria Systems - Operations

## Clean Water, Clean System

### Filtration (Normal Production)

Feed water enters the bottom of the module and is distributed uniformly to the outside of the fibers. Since it is under pressure, the water passes through the hollow fiber membranes and filtered water exits from the top of the module. Under normal conditions, all of the feed water flows through the membranes and exits as filtered water. Depending on feed quality, a small amount of the feed water may be circulated past the outside of the hollow fibers. This flow prevents the accumulation of foulants and debris on the surface of the membrane and helps evenly distribute flow through the membrane fibers.

### Air Scrub

As water is filtered, rejected particulate accumulates in the module or on the membrane fiber's surface. The effect is a flow restriction in the module, resulting in an increase in trans-membrane pressure (TMP). Air Scrubbing (AS) is a mechanical process to remove the debris from the module and decrease the rate of overall increase in trans-membrane pressure.

AS is usually initiated at a preset interval of water throughput. As a secondary trigger, AS is initiated if the rate of TMP increase exceeds a specified maximum. The air injection valve opens and air is injected at low pressure into the feed side of the module. At the same time, filtrate that has been collected in the Reverse Filtration (RF) tank is pumped in the reverse direction through the module and out through the main system drain. Air and RF flow are then stopped. At this point, most if not all of the accumulated debris in the module have been swept to drain.

To complete the cycle, a forward flush (FL) is implemented, circulating feed water from the feed tank on the outside (feed side) of the membrane fibers at high velocity. This fast flow of liquid is directed through the excess recirculation port of the module to drain. This further dislodges and removes from the module debris that was captured by the membrane fibers.

This fully automated cycle is included in every Pall Aria System and occurs every 20-120 minutes, and stops forward filtrate flow for about 1.5-2 minutes.





### Enhanced Flux Maintenance (EFM)

To assure maximum efficiency and lowest total cost of ownership, Pall has developed techniques to keep the membranes free of fouling materials. EFM is a patent pending, fully automated process that uses warm water with mild chemical solutions tailored to specific foulants that may be present in the application on a daily basis. EFM is used to reduce the times when a partially fouled membrane results in a system operating at less than peak efficiency.

The benefits to using EFM are a smaller system footprint, which reduces floor space and facility heating and cooling costs, and a lower average trans-membrane pressure, which reduces pumping energy.

The durable, strong and chemical resistant hollow fiber which is incorporated into every Pall Aria System makes this possible. Best of all, it can be subjected to thousands of EFM cycles with no reduction in service life.

In addition, the flexible, control system on-board the Pall Aria System allows EFM to be enabled only when warranted by feedwater conditions.

EFM capability is included on the Pall Aria AP-1 System and can be included via an auxiliary skid mounted EFM system on the larger Pall Aria AP-Series systems.



### Chemical Clean In Place (CIP)

Backwash and EFM are designed to remove particulate matter and foulants. In most applications, it will occasionally be necessary to perform a complete CIP process. The CIP process is a 2-step protocol using an acidic solution and a caustic solution with chlorine. This process will return the modules to "nearly new" condition and can be performed hundreds of times over the life of the modules.



Due to the low frequency of CIP operation, the process is designed as a semi-automated process. The rinse cycles are programmed for manual initiation. This process requires minimal operator intervention to "setup" the system for CIP and can be achieved by turning 5 manual valves.

Pictured on the left is a Pall Aria System installed at Stoney Creek, VA.



### **Pretreatment Requirements**

Pall Aria water treatment systems provide reliable, low maintenance performance. A 400- $\mu\text{m}$  strainer is included on the feed water line to prevent debris from clogging small passages in the system.

### **Enclosures**

A heated structure is required where freezing temperatures are expected. A roof may be required in other areas to prevent damage from sunlight and high temperatures.

A pre-engineered metal, concrete, or wood frame building is acceptable and can be designed to meet many aesthetic concerns.

### **Seismic Design**

The skid can be modified for use in Seismic Zone 4 areas (highest hazard). An anchoring plan will be furnished upon request.

### **CIP Conditions**

Pall recommends that all chemicals for treatment and CIP be purchased in solution form. Water for CIP should be heated to 90-100°F (31-38°C).

Contact Pall to obtain the recommended CIP procedures and specifications for chemicals.

### **Wastewater Disposal**

The RF and AS wastewater and CIP wastes can be discharged to a sanitary sewer if available. In areas without sanitary sewers, the RF and AS wastewater can be discharged to a settling pond to remove suspended solids. The clarified supernatant may be discharged to a local receiving stream or recycled to the plant feed water. Pilot testing may be required before recycling the supernatant. If sanitary sewers are unavailable, CIP wastes should be combined and neutralized prior to collection and disposal by a waste hauler. These wastes, can be disposed of like septic system sludge. The customer is responsible for contacting the local regulatory agencies and obtaining the appropriate permits and approvals before initiating any discharge of process wastewater.

### **Contact Us for Support or Information**

Remote online monitoring of system performance by Pall water specialists and membrane maintenance contracts are available from Pall. Contact your local Pall representative or Pall Corporation to obtain more information.







Pall Corporation

2200 Northern Boulevard  
East Hills, New York 11548-1289


1.888.428.5597 toll free (only in US)  
516.801.9906 phone  
516.484.3216 fax  
[www.pall.com/water](http://www.pall.com/water)

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	<p>201 Lincoln Boulevard Middlesex, NJ 08846</p> <p><b>(732) 469-4540</b></p> <hr/> <p><a href="http://www.psiprocess.com">www.psiprocess.com</a> <i>Employee Owned</i></p>
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8/06 3M BRD