Bulletin No. SCB1000.8

Water by

Pureflow©

FILTRATION DIV.

Cleaner Than Nature Made

Maywood Mutual Water Company No. 1
Maywood, CA
1,000 GPM Iron and
Manganese Removal System

Sundance Water Treatment Plant
Buckeye, Arizona
5,000 GPM Arsenic, Iron and
Manganese Removal System

City of Paramount, CA
3,000 GPM Arsenic, Iron and
Manganese Removal System

City of Fredericton
New Brunswick, Canada
4,755 GPM Iron and Manganese
Removal System

Town of Tropic, Utah
200 GPM Arsenic, Iron, Manganese,
Antimony, Radium 226 and 228
Removal System

Pureflow©

FILTRATION DIV.

A TRADITION OF RELIABILITY

Pureflow Filtration Div. specializes in the removal of heavy metals, and metalloids, from drinking water supplies, industrial water sources and process streams. The Pureflow Filtration Div. of California Environmental Controls, Inc. was founded in 1973 when we designed and sold our first iron and manganese removal pressure filtration system to the City of Fillmore, CA. Since then Pureflow has sold pressure, and gravity, water filtration processes for the removal of arsenic, iron, manganese, cadmium, zinc, radium, uranium, antimony and fluoride to municipalities, private water companies and industrial clients in the United States, Canada and Mexico. Typical filter flow rates vary from 20 gpm (1.26 L / S) to 9,000 gpm (568 L / S).

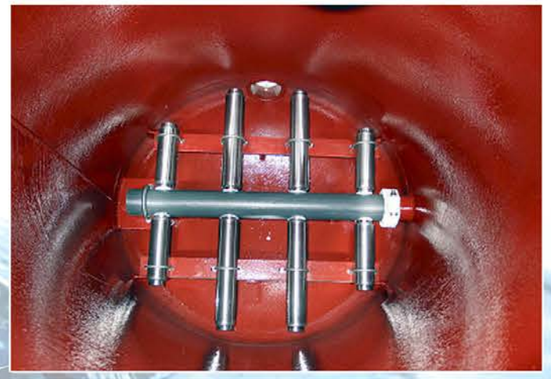
We recognize that there is not one media that is ideal for all metal removal applications. In a given situation, a certain media and / or process may adequately remove metal contaminants. In another situation, the same media / process may fail to remove the same metal contaminants. Understanding the application of filter media, and pretreatment processes, is key to designing and manufacturing water treatment systems that successfully, and continuously, remove metal contaminants. We continue to search for, and pilot test, filter media to meet various water treatment parameters and offer a variety of permanent and disposable media options.

THE TRADITION CONTINUES

Pureflow Filtration Div. continues to work closely with municipal and consulting engineers to conduct job site pilot filter studies, design, specify and manufacture water treatment processes that meet and exceed World Health Organization (WHO), United States Environmental Protection Agency (USEPA), National Sanitation Foundation (NSF) 60 / 61, and State Department of Health Standards (SDHS). We will also form joint venture associations with engineering contractors and consulting engineers to provide a qualified team approach to Design / Build water treatment plant facilities.

Arsenic Removal

As



Stainless steel underdrain assembly with wedge-wire wrapped laterals in a vertical filter vessel.

The PUREFLOW SYSTEM FOR ARSENIC FILTRATION is an improved design for the water treatment industry. A highly adsorptive, NSF approved, media and chemical pretreatment system combine to provide a simple, safe, compact filtration system requiring minimal attendance by maintenance personnel.

The removal of arsenic occurs by its adsorption onto an iron precipitate that is formed in the Pureflow pretreatment process. The Pureflow multi-media filter includes a highly adsorptive active media that adsorbs the iron and arsenic (as well as other heavy metals such as cadmium, zinc, etc.) in, essentially, oxidized forms. The filter media is cleaned by backwashing the filter with processed water. The backwash to filtration ratio is less than 5%.

Well water containing arsenic is chemically treated with an oxidant (such as chlorine) at the first static mixer. If dissolved iron (in sufficient concentration) is not present in the raw water, ferric salt is also fed ahead of the second static mixer. The iron is oxidized to a processable form and a free chlorine residual is provided to the water distribution system.

The filter media does not contain greensand or activated alumina, and, therefore, does not require costly regenerating chemicals such as potassium permanganate or acid / caustic solutions. Backwash water is usually discharged to the sewer system. An optional backwash water reclaim system is available to reclaim approximately 99% of the backwash water.

The chemical pretreatment is manually set and automatically operated. The filter effluent is continuously monitored with a chlorine residual analyzer to permit the positive, simple, and automatic adjustment of the chemical feed pump.

A field pilot testing program is available to insure the proper design and operation of every system. The cost of this program is deductible from the purchase price.

- Permanent and disposable media systems
- ASME code pressure vessels up to 250 psi
- Oxidation pretreatment equipment
- Multi-media filter load (NSF 61 Approved)
- Filter face piping
- Electrically operated butterfly valves
- Filter flow control valves
- Backwash flow control valves
- Automatic control panel (PLC Based)
- Stainless steel wedge-wire wrapped laterals
- NSF approved interior coatings (holiday tested)
- Process analyzer
- Manways, plus hatchway when required
- Up to 4" valved drain on each filter
- Air relief valves
- Start-up instruction
- Design - Build Systems

Iron Removal

Fe

The PUREFLOW SYSTEM FOR IRON AND MANGANESE REMOVAL is an improved design for the water treatment industry. A highly adsorptive, NSF approved, media and chemical pretreatment system combine to provide a simple compact filtration system requiring only weekly attendance by maintenance personnel.

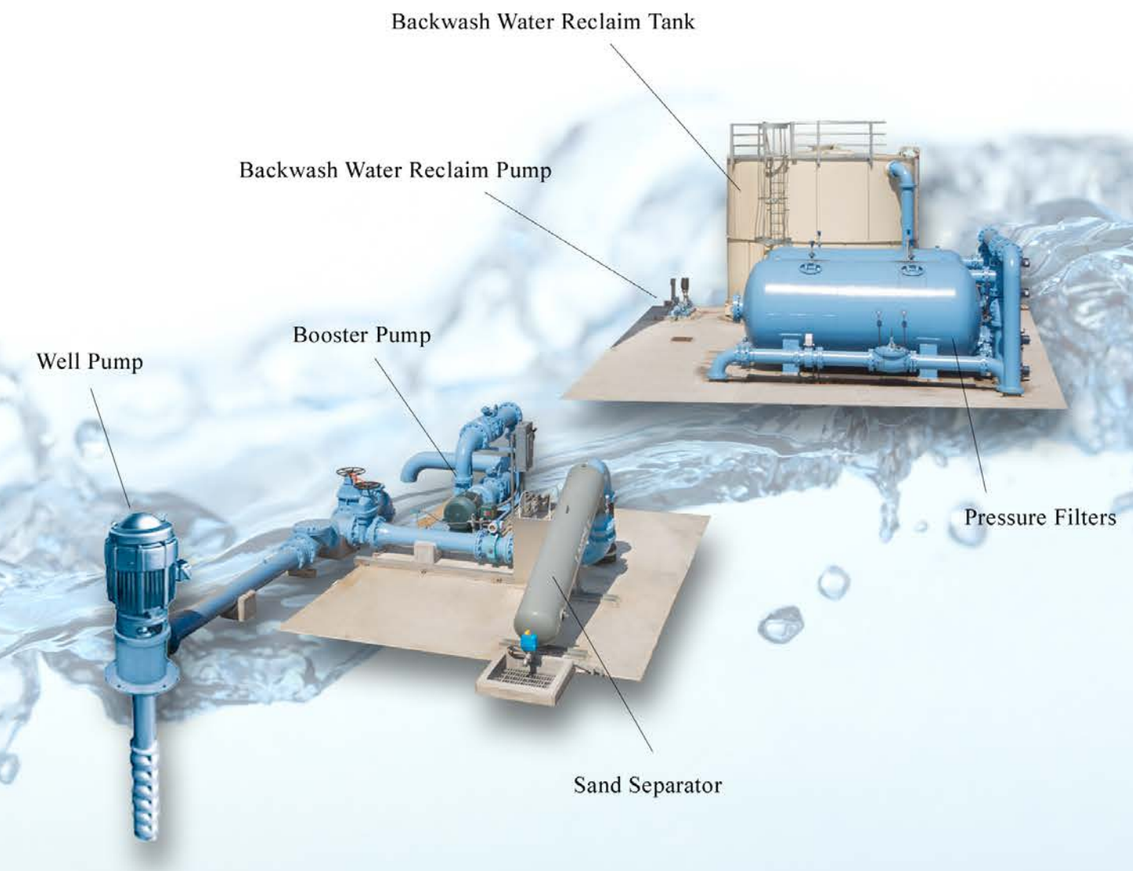
Well waters containing iron and / or manganese, along with other dissolved contaminants, such as hydrogen sulfide, organic carbon, arsenic, etc., are treated with chlorine prior to filtration. This step oxidizes these contaminants to a processable form and provides a free chlorine residual to the water distribution system.

The filtration step collects the iron and manganese on NSF approved adsorptive media in hydroxide form. The filter media is cleaned by reversing the flow using processed water. The typical backwash to filtration ratio is less than 2%. The backwash water can be drained to a sanitary sewer; or an optional reclaim system can be supplied, allowing approximately 99.9% recovery / recycle.

The chemical pretreatment is manually set and automatically operated. Stand-by equipment provides continuous uninterrupted treatment. The filter effluent is continuously monitored with a chlorine residual analyzer to ensure complete oxidation of contaminants and disinfection of the treated water.

Automatic filter operation is provided by a system control panel which includes a programmable logic controller with an operator interface. The control panel operates the well pump, system valves, filter cycles, and the chemical pre-treatment system.

Pilot testing of each well water is recommended to determine oxidation demand, filtration process design (chemical dosage rate, vessel sizing, etc.) and operational costs. Pureflow will provide pilot testing equipment and field personnel.



City of Yuma, Arizona
6,000 GPM Iron and Manganese Removal System
AWPCA 2005 Water Project Of The Year

Mn

Manganese Removal

- Permanent media
- No regeneration required
- ASME code pressure vessels up to 250 psi
- Chemical pretreatment equipment
- Multi-media filter load (NSF 61 Approved)
- Filter face piping
- Electrically operated butterfly valves
- Filter flow control valves
- Backwash flow control valves
- Filter and backwash flow meters
- Automatic control panel (PLC Based)
- Stainless steel wedge-wire wrapped laterals
- NSF approved interior coatings (holiday tested)
- Process analyzer and recorder
- Manways, plus hatchway, when required
- Up to 4" valved drain on each filter
- Air relief valves
- Custom written O & M Manuals
- Design - Build Systems

Fluoride Removal

F^-

Fusion Bonded Lining

The PUREFLOW FLUORIDE REMOVAL PROCESS includes a unique, highly porous activated alumina media that is physically and chemically stable. It has large surface areas and a high porosity that makes it an excellent adsorbent. The media is chemically inert to all but the most corrosive gases and liquids, and resists abrasion and disintegration.

Well water containing fluoride is chemically pretreated to adjust the pH. At the optimum fluoride removal pH, some organic molecules and some trace heavy metals, including arsenic, are adsorbed on the media.

Automatic pH control insures optimum chemical pretreatment. Fluoride ions are attracted and held to the vast surface areas throughout the pores of the activated alumina, and fluoride removal is achieved.

When the activated alumina bed has removed the maximum amount of fluoride, it requires regeneration to remove the fluoride from the media. The bed is backwashed to remove suspended solids. Next the bed is treated with caustic solution to dissolve fluoride from the media. The bed is then flushed with raw water to remove excess caustic solution and neutralize the bed.

- ASME code pressure vessels up to 250 psi
- Chemical pretreatment equipment
- Process analyzers, recorder
- Filter face piping
- Electrically operated butterfly valves
- Filter flow control valves
- Backwash flow control valves
- Filter and backwash flow meters
- Automatic control panel (PLC Based)
- NSF approved interior coating
- Regeneration chemical treatment equipment
- Manways, plus hatchway when required
- Up to 4" valved drain on each filter
- Air relief valves
- Start-up instruction
- Design - Build Systems

Radium Removal

Ra

316L Stainless Steel Wedge -Wire Wrapped Underdrain Assembly

PUREFLOW SYSTEMS FOR RADIUM AND URANIUM REMOVAL combines pretreatment chemical feed and NSF approved filter media with an automated process to provide an operator friendly filtration system requiring minimal attendance by maintenance personnel. Both disposable resin and coagulation / filtration media processes are available.

The removal of radium and uranium from potable water supplies can be achieved by coagulation / filtration processes as follows: radium is removed by sorption onto preformed hydrous manganese oxides (HMOs) and the removal of the HMO / radium by adsorption onto a filter media. Uranium is removed by sorption onto a ferric hydroxide floc, and by its adsorption onto a filter media. The Pureflow multi-media filter includes a highly active catalytic adsorptive media that adsorbs heavy metals, including iron, manganese, cadmium, zinc, etc., in essentially hydroxide forms. The filter media is cleaned by backwashing the filter with processed water. The backwash to filtration ratio is less than 2%.

Well water containing radium / uranium is chemically treated first with chlorine to oxidize any iron in the raw water. Ferric salt (if required) is then fed to remove the uranium by sorption onto the ferric hydroxide floc; an HMO is then fed to remove the radium by sorption onto the hydrous manganese oxide floc. Excess chlorine is fed to provide a free chlorine residual to the treated water distribution system.

Disposable resin media systems are provided when raw water quality allows sufficient media bed volumes to justify media replacement costs.

- ASME code pressure vessels up to 250 psi
- Chemical pretreatment equipment
- Multi-media filter load (NSF 61 Approved)
- Filter face piping
- Electrically operated butterfly valves
- Flow control valves
- Backwash flow control valves
- Filter and backwash flow meters
- Permanent and disposable media
- Stainless steel wedge-wire wrapped laterals
- Automatic control panel (PLC Based)
- NSF approved interior coating
- Chemical feed equipment
- Air relief valves
- O & M Manuals
- Skid mounted systems

Uranium Removal

U

Mobile Pilot Filter Laboratory

Process functions include automated backwashing and chemical pretreatment controls. The four (4) pilot filters can be loaded with identical media, with different pretreatment schemes, or each can be loaded with different media with different pretreatment schemes. Installed on-line instrumentation includes pH, O.R.P., turbidity and chlorine analyzers. Four (4) chemical storage tanks are installed (for oxidant, acid, caustic or coagulant feed) with multiple chemical metering pumps, each followed by an in-line static mixer to provide the required pretreatment. Centrifugal pumps and water tanks for backwash storage, and backwash water reclaim, are also included. Pureflow will also provide single or multi-parameter field and laboratory Colorimeter and / or Spectrophometers as required.

PILOT FILTER TESTING is required to verify the treatability of raw water, to predict the performance of a full scale water treatment plant, and to optimize its efficiency. Raw water quality can vary significantly, and since such variability will affect contaminant removal efficiency, field pilot testing of the proposed removal process is strongly recommended. Comprehensive raw water quality analyses should be performed, and the data evaluated, prior to pilot testing, to determine all of the constituents that may affect the specific treatment process(es). Refer to Pureflow General Mineral Analysis bulletins for additional information.

The Pureflow Filtration Division Mobile Pilot Filter Laboratory contains four (4), six (6) inch I.D. by six (6) feet high pilot filter columns. Each column has five (5) electrically actuated control valves, and a P.L.C. - based control panel that allows the filters to be operated 24 hrs. / day.

- Air conditioned trailer (20' x 8' x 8')
- Fully automated PLC based control panel
- Four (4) six inch (6") I.D. filter columns
- Electrically actuated valves
- Four (4) chemical feed systems
- Backwash water storage tank
- Backwash water reclaim storage tank
- Ample counter space for performing tests
- Ozone treatment pilot studies
- Flow control valves for each filter column
- Flow meters for each filter column
- On-line water quality monitors include: pH, turbidity, ORP, and chlorine
- Laboratory analytical instruments
- Can be operated 24 hours / day fully automated
- Simultaneous testing of up to four (4) media including common or various pretreatment chemicals.
- In-line static mixers

Quality .... the Art of Pilot Testing

Filter Remediation

Pureflow Filtration Division offers remediation services for existing arsenic, iron, and manganese removal, pressure and gravity, filtration systems. Our field personnel are qualified to inspect / troubleshoot on-line filter systems, perform field pilot filter studies to optimize filter efficiency, and offer recommendations for improvement of filter operation. After review of raw and filtered water quality data, and consultation with our engineering staff, we will offer a proposal to remediate and recommission the filter system. Operator training will be included when required.

Filter remediation can be as simple as adding media (e.g., sand, garnet, anthracite, catalytic adsorptive proprietary media, manganese dioxide, etc.) or, can include supervising the unloading of the existing media, inspecting the filter internals, including upper and lower manifold / lateral assemblies, and the interior coating of the vessel(s). Defective PVC underdrains can be replaced with similar laterals, or with sturdier, 316L stainless steel wedge-wire wrapped laterals.

Additional remediation can include replacement of existing control panel, butterfly valves / actuators, pretreatment chemical feed pumps and water quality monitors. A pilot filter study may also provide data to improve the treatment process, select the media for metals removal, and indicate the feasibility of adding a backwash water reclaim system that can recover up to 99.9% of the existing backwash water that is currently disposed to a sewer or pond.

TYPICAL REMEDIATION SERVICES AND PRODUCTS

- Qualified field personnel
- Inspection of filter internals / media
- Replacement of PVC filter underdrains with 316L stainless steel wedge-wire wrapped laterals
- Media replacement including: support media, garnet, catalytic adsorptive (proprietary) media, manganese dioxide, etc.
- Control panel replacement
- Butterfly valve / actuator replacement
- Chemical feed pumps
- Field pilot filter testing
- Optional backwash water reclaim system (storage tank, valves, controls)
- Optional backwash water solids fluidization and transfer system

Disposable Media Processes

TITANIUM OXIDE BASED DISPOSABLE MEDIA PROCESSES

Pureflow has selected a disposable titanium oxide (TiO2) based adsorbent media as an option to coagulation filtration, for the removal of arsenic, and to remove antimony and selenium. The free following granular media is a patented technology that meets National Sanitation Foundation (NSF) 61 standards. The kinetic advantages of our disposable media allows for flexible system design, faster flow rates and smaller footprint, without limitation to flow or pre-treatment.

Higher Capacity Allows Smaller Systems

Many factors affect a media's capacity in operation, including the pH of feed water, amount and ionic form of arsenic present, as well as interfering ions. Our disposable media has been shown to be one of the highest capacity media available for a wide variety of water conditions. It is effective in removing both As3 and As5 under all typical pH conditions. The media's higher capacity for arsenic is independent of sulfate, phosphate and vanadium concentrations, and is the most resistant to the presence of silica. Because our media has higher capacity than most other commercially available media, it can be effectively used in existing system designs.

Contaminant Removal:

- Arsenic (As)
- Antimony (Sb)
- Selenium (Se)
- Consult factory for other applications

Consistent Performance

Adsorption medias typically have higher capacity at lower pH. Treatment system operators can adjust the pH in the feed stream to obtain higher operating capacity. Loss of pH control has been shown to result in elevated levels of arsenic from many media. Pureflow's media has stable performance and provides consistent removal of arsenic, even with fluctuating pH conditions. This is important when using pH adjustment chemicals, but is also beneficial when using a feed source that has natural, seasonal fluctuations in pH.

Easy Disposal

Pureflow's disposable media is designed with high absorbent capacity so regeneration is not required. This eliminates the need to worry about disposal of contaminant-laden waste regenerate streams. Our media offers an affordable, easy-to-operate approach, especially for small or mid-sized systems. Its strong affinity for arsenic also allows the media to maintain a strong hold on the removed arsenic, allowing for easier and safer disposal. Spent media from arsenic loading tests have been shown to pass the Toxicity Characteristic Leaching Protocol (TCLP) as well as the California Waste Extraction Test (CWET), indicating that it meets the typical United States criteria for disposal in a landfill as non-hazardous waste.

Town of Alta, Utah
200 GPM Antimony Removal System

Standard Equipment Features Include the Following:

- NSF 60 / 61 approved media
- ASME Code Vessels
- NSF Approved interior coatings
- Filter face piping
- Optional manual or automatic control panel
- Flow control valves
- Stainless steel wedge-wire wrapped laterals
- Air relief valves
- O & M manuals

Residual Solids Fluidization and Transfer System

Iron and manganese filter systems generate residual solids that are collected in backwash water holding tanks or backwash water reclaim tanks. The holding tanks are used to store one or more backwash volumes and slowly feed the water, and residual solids, into a local sewage lift station at a controlled rate to prevent the flow from exceeding the wet well storage capacity and pumping rate. If a local sewer connection is not available the solids can be thickened and hauled to a disposal site via tank truck.

The backwash water reclaim tank allows the iron and manganese residual solids to settle and the resulting clarified water (supernatant) to be reclaimed. A Pureflow Filtration floating decanter assembly is connected to an external backwash water reclaim pump to remove the supernatant water from the tank. The decanter floats on the surface of the water and after a predetermined amount of time has passed, and adequate settling of the residual solids is achieved, the Filter Control Panel (F.C.P.) and Operator Interface Terminal (O.I.T.) activates the backwash water reclaim pump. The clarified backwash water is then drawn down to a fixed distance above the top of the settled residual solids and is pumped back to the raw water inlet of the filter system at a flow rate equal to 10% of the filter process flow. The reclaim process is activated while the filter is treating the raw well water. The floating decanter assembly and reclaim pump will remove the supernatant without disturbing the layer of accumulated residual solids below.

The oxidized iron / manganese residual solids that settle at the bottom of backwash water holding and reclaim tanks will require removal on a periodic basis. When a backwash water reclaim tank (and reclaim system) is installed it is important to prevent the settled residual solids from building up to a level that would cause the residual solids to mix with the supernatant.

If this occurs the reclaimed water will contain a high concentration of iron / manganese which will result in over loading the filter media. This condition will eventually cause iron / manganese to pass through the filter media, into the filter effluent, and exceed the MCL of these contaminants. Settled iron and manganese residual solids can be removed from backwash water holding and reclaim tanks by manual or automatic methods.

MANUAL RESIDUAL SOLIDS REMOVAL

If the iron / manganese residual solids that settle on the bottom of backwash water holding or reclaim tanks are not removed on a regular schedule they will eventually age and form a thick mound that will not completely fluidize when the tank is drained. This solidified mound will continue to grow and will require removal. The manual removal of the solidified residual solids is time consuming, labor intensive, expensive and usually requires a two (2) man team to enter the confined space of the backwash water holding or reclaim tank. The operators either use a vacuum pump and suction hose to remove the residual solids from the tank or (if the mound has solidified) tools and a high pressure hose, using potable water to "blast" the solids so they become fluidized. The fluidized solids can then be pumped or drained from the tank for disposal to a sanitary sewer. If a sanitary sewer is not available, or the local sewer authority will not accept the residual solids, a tank truck may be used to haul the liquefied solids to a disposal site. Another option is to transfer the residual solids to a sludge thickening tank and then to a filter press to dewater the solids. The resulting non-hazardous cake is then hauled to an off-site land fill for disposal.

AUTOMATIC RESIDUAL SOLIDS REMOVAL

Iron and manganese residual solids can be automatically removed from backwash water holding and reclaim tanks that contain multiple backwash volumes. The concentration of iron / manganese in the raw well water is calculated using the flow rate and the average daily pumping hours of the well(s) to determine the total amount of dry solids that will be collected per day. When a predetermined amount of residual solids are collected in the tank (based on the number of backwash cycles that have been collected), and a supernatant reclaim cycle has been completed, the concentrated residual solids will be fluidized and transferred via a centrifugal pump that is connected to a piping system located inside the reclaim tank. If conditions at the filter site will not allow the disposal of residual solids, thickened residual solids can be pumped to a filter press. The liquid is pumped back to the reclaim tank and the solids are hauled from the site. This will result in a zero liquid discharge system.

Backwash water reclaim pump

Sludge fluidization / Transfer pump

Ion Exchange Resin

Main Yard Nitrate Removal Facility
EPCOR San Tan District

ION EXCHANGE RESIN

Ion exchange resins are tough, durable plastic beads that remain stable when exposed to strong acids, bases and solvents. Ion exchange resins provide selective removal of trace contaminants by matching the contaminant with a resin for a lock-and-key fit. Ion exchange resins include specialized chemistries developed for selective removal of nitrate / nitrite, perchlorate, chromium, sulfate and many other trace contaminants.

Ion exchange processes often concentrate the contaminant so effectively that the loaded resin represents the smallest possible volume of waste. In some applications, the resins can be regenerated and used repeatedly for years. As an alternative, off-site disposal services can be used so that the contaminant is completely removed. In either case, ion exchange resins enable effective and efficient removal of contaminants, as well as safer disposal options.

FOR THE REMOVAL OF:

- Nitrate
- Perchlorate
- PFAS / PFOS
- Chromium
- Radium
- Uranium
- Sulfate
- Arsenic
- Selenium
- Consult factory for other applications

Biological Filtration

BIOLOGICAL FILTRATION

Biological treatment of potable water, defined by the use of specialized bacteria to remove contaminants, has emerged as an increasingly popular alternative to the traditional use of chemicals in a oxidation / coagulation process. The biological process is an attractive solution when the levels of raw water contaminants are abnormally elevated. Given this scenario, backwash intervals can be greatly reduced when compared to the backwash intervals of traditional coagulation filtration in the same application.

PureflowBio uses Pureflow Filtration's state-of-the-art hardware including our 316L stainless steel wedge-wire wrapped underdrain laterals, electrically actuated control valves, fusion bonded epoxy lined piping, operator friendly PLC automated controls, remote monitoring and other Pureflow Filtration proven features.

FOR THE REMOVAL OF:

- Nitrate
- Iron
- Manganese
- Consult factory for other applications

Pureflow®

FILTRATION DIV.

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