PFOS/PFOA/PFAS Filtration

ZeoMaxx PFAS Filtration Systems

ZaoMaxx is a family of filter systems designed for a variety of contaminants and flow rates. The filters can be provided as a single, double, triple or more filter vessel system for sequential or parallel orientation and multi-staged contaminant reduction processes.

PFAS is a class of fluoronated chemicals. There are about 4700 chemicals in this class. About 600 are common. They are all man-made and contain linked chains of carbon and fluorine. These chemicals don't degrade easily in the environment as the atomic bond is the strongest in nature and are stable in water but are also fully soluble. Typical chemicals are perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS).

PFOS FILTER SYSTEMS.PDF

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Filtration Method

The filtration process used to remove PFOS/PFOA contaminants would start with the ZeoMaxx ZPF media filters(s) followed by the ZAC media filter(s) plumbed in series. To assure thorough PFAS removal two ZPF filters followed by two or more ZAC filters. The PFAS reduction after the ZPF filters can be up to 91% and after the ZAC reduction of up to 98%. This simple, step-by-step treatment train will also remove TAH, BTEX, VOCs, metals and a wide variety of other products and organics. The ZeoMaxx systems can be sized for any flow rate.

PFAS (as PFOS & PFOA or others) are found in:

- Airport deicing, firefighting ponds and collection systems.
- Ship firefighting foam water.
- Food packaging with PFAS-containing materials, processed with equipment that uses PFAS, or grown in PFAS-contaminated soil or water.
- Commercial household products, including stain and water-repellent fabrics, nonstick products (e.g., Teflon), polishes, waxes, paints, cleaning products, and AFFF fire fighting foams (a source of groundwater contamination at airports and military bases where firefighting training occurs).
- Workplace, including production facilities or industries (e.g., chrome plating, electronics manufacturing or oil recovery) that use PFAS.
- Drinking water, typically localized and associated with a specific facility (e.g., manufacturer, landfill, wastewater treatment plant, firefighter training facility).
- Living organisms, including fish, animals and humans, where PFAS have the ability to build up and persist over time.

PFAS are also found in a wide range of consumer products that people use daily such as cookware, pizza boxes and stain repellants. According to EPA and other public sources most people have been exposed to PFAS due to the ubiquitous nature of the products and their wide use. Certain PFAS can accumulate and stay in the human body for long periods of time. Per EPA there is evidence that exposure to PFAS can lead to adverse health outcomes in humans. The most-studied PFAS chemicals are PFOA and PFOS. Studies indicate that PFOA and PFOS can cause reproductive and developmental, liver and kidney, and immunological effects in laboratory animals. Both chemicals have caused tumors in animals according to EPA references.

What is the difference between PFOA, PFOS and GenX and other replacement PFAS?

Per and polyfluoroalkyl substances (PFAS) are a group of man-made chemicals that have been in use since the 1940s, and are (or have been) found in many consumer products like cookware, food packaging, and stain repellants. PFAS manufacturing and processing facilities, airports, and military installations that use firefighting foams are some of the main sources of PFAS. PFAS may be released into the air, soil, and water, including sources of drinking water. PFOA and PFOS are the most studied PFAS chemicals and have been voluntarily phased out by industry, though they are still persistent in the environment. There are many other PFAS, including GenX chemicals and PFBS in use throughout the US and world economies.

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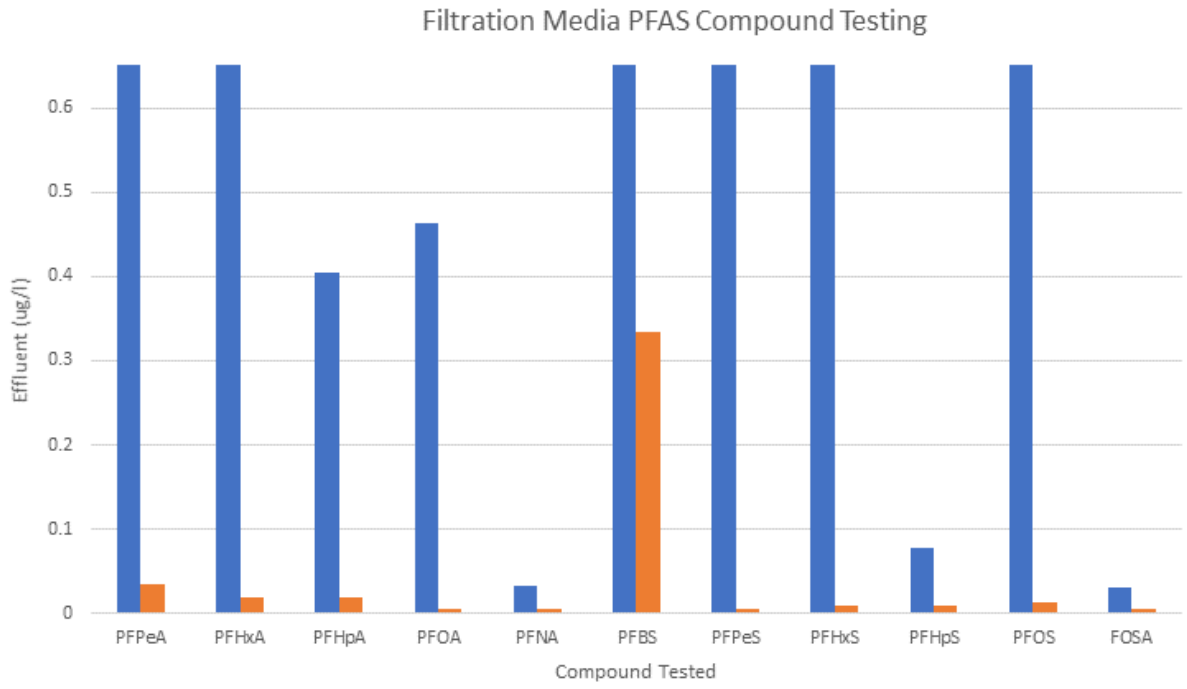
PFAS/PFOS/PFOA Treatment Solutions
Technologies:
– Solids prefiltration prior to ZeoMaxx filters
– ZeoMaxx ZPF filter followed by the ZAC filter

PFAS Process Testing Results with ZPF & ZAC filters: Blue = Influent (ug/L) Orange = after ZPF filter (ug/L)



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	Influent (ug/L)	Z-PF (ug/L)	
PFPeA	1.19	0.0352	
PFHxA	2.43	0.02	ND
PFHpA	0.405	0.02	ND
PFOA	0.463	0.005	ND
PFNA	0.0337	0.005	ND
PFBS	2.94	0.334	
PFPeS	0.984	0.005	ND
PFHxS	2.36	0.0093	ND
PFHpS	0.0777	0.0093	ND
PFOS	2.02	0.014	ND
FOSA	0.03	0.005	ND

ND: Non-detectable

ZeoMaxx Separation Medias

ZeoMaxx is a family of mineral and organoclay medias offering the removal of a wide variety of water born contaminants.

ZeoMaxx media have high cation exchange capacities. Ammonia (NH4), heavy metals (Pb, Cu, Cd, Zn, Co, Cr, Mn and Fe; Pb, Cu as high as 97 %), toxins, low level radioactive elements (Cs, Co, Sr, Ag), flouride, petrochemicals, non-polar oils, fuels, hydraulic fluids, transmission fluid, petroleum distillates and many others are adsorbed by ZeoMaxx.

Due to its high cation exchange capacity, large surface area, highly porous crystal structure, eco-friendly composition it has a wide range of applications for water treatment. ZeoMaxx's ion exchange efficiency is not affected by temperature or pH changes.

The Key to successful water treatment and filtration is selecting the right combination of media and hardware. For treatment of hydrocarbons, heavy metals, and other organic contaminants, the optimal solution is efficient oil and water separation followed by ZeoMaxx or no oil water separation if oil concentration is low. Because ZeoMaxx can adsorb up to 70% of its weight in hydrocarbons, its life expectancy inside a filter vessel is much longer than that of other process media

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such as granular activated carbon (GAC) as GAC is not designed for high fuels/oils concentrations and is best suited to low concentration products where blinding is a lesser effect.

Comparisons between ZeoMaxx and organo-clays (OCs)

- ZeoMaxx has cation exchange capacity OCs do not
- Active media by volume: ZeoMaxx provides 100%, OCs provide 30% (OCs are mixed 30/70 with anthracite)
- Bulk density: ZeoMaxx is 58 lbs/ft3, OCs are 53 lbs or less.
- Lbs of active media/ft3, ZeoMaxx is 58 lbs, OCs are 21.5 Lbs.
- OCs swell on oils absorption requiring an anthracite mix to provide expansion space

Superior Liquid Filtration

- No swelling upon water exposure
- More active ingredients per cubic foot than organoclay media
- Prolongs life of activated carbon and resins thereby reducing costs and increases efficiency
- Cost effective and environmentally sound technology

ZeoMaxx is Versatile

Free Standing Mode:
Used alone ZeoMaxx can be loaded in filter vessels for use as an efficient filtration medium. Other applications include tank cleaning, oil spill mitigation, groundwater remediation, car / all vehicle wash water treatment, bilge treatment.

Pre-Treatment Mode
ZeoMaxx can be used upstream to enhance the performance and extend the useful life of other filtration processes and media such as reverse osmosis, activated carbon and exchange resins.

Post-Treatment Mode:
ZeoMaxx utilized downstream of an oil-water separator or coalescing filter, has the ability to act as an effective cleaning and polishing agent.

ZeoMaxx Models and Uses

- **Z100 & Z100C** Zeolite media for ammonium removal (and others) and particle filtration.
- **Z200** Our most versatile media with more active media per Ft3 than organoclays, removes ammonia, oils/fuels, sheens, heavy metals and similar organics from water. Because Z200 series can absorb up to 70% of its weight in hydrocarbons, it is often used prior to granular activated carbon to extend the GAC media life and increase system performance.

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- **Z250AC** A 50/50 mix of the Z200 & ZAC which takes advantage of the characteristics of these two media for high surface area of carbon, high capacity capture of the Z200 for a variety of inorganic and organic contaminants.
- **Z275** Modified organoclay, specially to remove lower molecular weight petroleum. The liquid phase filtration media is a 4 x 10 mesh ZeoMaxx impregnated with dimethyldioctadecylammonium chloride per kilogram of ZeoMaxx. Product density: 53-56 pounds per Ft3.
- **Z300** Modified organoclay media to remove anionic compounds including phosphates and nitrates. The liquid phase filtration media ZM300 to be 8 x 14 mesh ZeoMaxx impregnated with Naphthalkonium chloride. Product density: 57-59 pounds per Ft3.
- **ZAS** Activated alumina media paired with iron oxide for arsenic, fluoride removal (and others).
- **ZPF** For removal of multiple PFAS/PFOA/PFOS compounds when used in combination with ZAC or other medias best removal rates can be achieved. Performance can be the 49 - 99% range depending on the compound.
- **ZMT** Media blend of Z200 and modified earth for removing dissolved metals, common metals such as cadmum, chromium, nickel, thallium and zinc.
- **ZF** An activated alumina media for fluoride and metals removal. NSF/ANSI 61 certified for drinking water use.
- **ZAC** Activated carbon medium are used to remove BTEX, VOCs, Napthalene, phenol, MEK, PCBs, TCE, THMs, fertilizers, pesticides, taste, odor, many other organic contaminants, MBAS, and chlorine as well as use in drinking water applications. Too many contaminants to list here, contact us to review your application.
- **ZDF 55** Designed specifically for removing or reducing chlorine and water-soluble heavy metals. It controls scale, bacteria and algae, even in hot water. The process medium received NSF International Certification and is certified by NSF to NSF/ANSI Standard 42 – Drinking Water Treatment Units – Aesthetic Effects. This medium is also in compliance with California's Health and Safety Code Section 166875 (or commonly know as AB1953) and Vermont Act 193.
- **ZDF 85** Removes or reduces iron and hydrogen sulfide from municipal or other water supplies. Also controls scale, bacteria and algae.
- **ZDF-F** Designed to remove chlorine and control bacteria when incorporated into carbon blocks as well as into other matrix-type filters.
- **ZDF-C** Granules are used for removal or reduction of soluble heavy metals and chlorine. For use when less pressure drop is required.

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ZeoMaxx Removes (partial list)

Oils, Grease, Fuels, Petroleum, Refined & Unrefined
Free and dispersed oils can be removed 95% +

Heavy Metals

Aluminum	Lead	Zinc
Cadmium	Mercury	
Chromium	Nickel	
Copper	Selenate	

Hydrocarbons and other contaminants

Acenaphthene	Flourine	Flouranthene
Ammonia	Gas Range Hydrocarbons	
Anthracene	2-Methylnaphthalene	
Benzo (a) Anthracene	Motor Oil	
Benzo (b) Flouranthene	Naphthalene	
Benzo (a) Pyrene	PCP (pentachlorophenol)	
Benzo (g,h,i) Perylene	Phenanthrene	
BOD's	Phenolics (recoverable)	
BTEX	Pyrene	
4-chloro-3-Methylphenol	TCE	
Chromate	TOC	
Chrysene	Total Phosphorus	
COD's	TPH (Total-Petroleum Hydrocarbons)	
1,1 Dichloroethane	TSS's	
1,2 Dichloroethane	Vinyl Chloride	

Operating Conditions

Temperature range:	33-170° F
pH Range:	4-10
Density:	30-58#/ft3
Porosity:	0.332 cm3/g average
Particle structure:	Crystalline pore
ZeoMaxx material:	Modified zeolite, organoclay, carbons
Mesh:	8 X 14
Activator:	125 milimoles of cetyl trimethyl ammonium chloride per kilogram of zeolite
Ionic charge:	Negative, non-selective
Crush strength:	1600 psi
Dusting:	Dusting amount similar to GAC
Backwashable:	Yes and can extend bed life if solids are an issue

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Retention Timing (Approximate, column & analytical testing recommended to verify)

Oils:	5-7 minutes
Metals:	10-15 minutes

Applications

Treatment

- Direct filtration of wastestream, vehicle washwater, industrial wastewater, groundwater and more
- Use our BF filter system prior to ZeoMaxx filter to remove suspended solids

Post Treatment:

- Following Oil Water Separators
- Following DAFs
- Following Slant Plate Clarifiers

Pretreatment:

- Prior to membrane filters
- Prior to GAC filters
- Prior to resin filters

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