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PFAS FILTRATION MARKET

GLOBAL FORECAST TO 2029

BY TECHNOLOGY (WATER TREATMENT SYSTEMS, WATER TREATMENT CHEMICALS), PLACE OF TREATMENT (IN-SITU, EX-SITU), REMEDIATION TECHNOLOGY, ENVIRONMENTAL MEDIUM, CONTAMINANT TYPE, AND REGION

Report Code: CH 9022

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LIST OF ABBREVIATIONS

ABBREVIATION	FULL FORM
ATSDR	Agency for Toxic Substances and Disease Registry
CAGR	Compound Annual Growth Rate
CERCLA	Environmental Response, Compensation & Liability Act
DoD	Department of Defense
EPA	Environmental Protection Agency
ELGs	Effluent Limitations Guidelines
EPL	Environment Protection Law
FDA	Food and Drug Administration
GSPI	Green Science Policy Institute
ITRC	Interstate Technology and Regulatory Council
MCLs	Maximum Contaminant Levels
NHI	National Institutes of Health
NPDES	National Pollutant Discharge Elimination System
NSF	National Science Foundation
OSHA	Occupational Safety and Health Administration
PFAS	Per- And Polyfluoroalkyl Substances
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctanesulfonic Acid
PFNA	Perfluorononanoic Acid
PPT	Parts Per Trillion
US	United States
USD	United States Dollar
TRI	Toxics Release Inventory

1 INTRODUCTION

1.1 STUDY OBJECTIVES

- To define, describe, and forecast the per- and polyfluoroalkyl substances (PFAS) filtration market in terms of value and volume
- To provide detailed information regarding the significant drivers, opportunities, restraints, and challenges influencing market growth
- To estimate and forecast the market size based on remediation technology, place of treatment, environmental medium, technology, contaminant type, service type, end-use industry, and region
- To forecast the size of the market with respect to major regions: Europe, North America, Asia Pacific, Rest of World, along with their key countries
- To strategically analyze micro markets[1] with respect to individual growth trends, prospects, and their contribution to the overall market
- To analyze opportunities in the market for stakeholders and provide a competitive landscape for market leaders
- To track and analyze recent developments, such as investments & expansions, product launches, partnerships & agreements, and mergers & acquisitions, in the market
- To strategically profile key market players and comprehensively analyze their core competencies[2]

1.2 MARKET DEFINITION

PFAS filtration refers to the processes and methods employed to remove or neutralize per- and polyfluoroalkyl substances (PFAS) from contaminated environments, such as soil, water, and air. Due to the chemical stability and persistence of PFAS, conventional treatment methods are often ineffective. Therefore, remediation strategies typically involve advanced technologies designed to break down or extract these compounds.

Common filtration techniques include activated carbon adsorption, ion exchange, and advanced oxidation processes. Activated carbon adsorption captures PFAS molecules, while ion exchange replaces PFAS ions with less harmful ions in water. Advanced oxidation processes use reactive species to degrade PFAS into less toxic components. Emerging methods like electrochemical oxidation and bioremediation are also being explored for their potential effectiveness.

1. Micromarkets are defined as the sub-segments of the PFAS filtration market included in the report.
2. Core competencies of the companies are covered in terms of their key developments and strategies adopted to sustain their position in the market.

1.3 INCLUSIONS & EXCLUSIONS

TABLE 1 PFAS FILTRATION MARKET: INCLUSIONS & EXCLUSIONS

SEGMENT	INCLUSION	EXCLUSION
Place of Treatment	In-situ & Ex-situ	Nil
Technology	Water Treatment Systems Water Treatment Chemicals	New & niche systems & chemicals are excluded
Remediation Technology	RO Membranes, Chemicals (Activated Carbon Adsorption, Ion Exchange Resin, Bioremediation, Chemical Oxidation)	PFAS destroying technologies are excluded
Environmental Medium	Soil, Ground Water, Surface Water & Sediment	Nil
Contaminant Type	PFOA & PFOS, Multiple-PFAS contaminant	New & niche contaminant types are excluded
End-use Industry	Municipal, Industrial & Commercial	New & niche end-use industries are excluded
Service Type	On-site & Off-site	Nil

1.4 STUDY SCOPE

1.4.1 MARKETS COVERED

1.4.2 REGIONS COVERED

NORTH AMERICA

- US
- Canada
- Mexico

EUROPE

- Germany
- UK
- France
- Rest of Europe

ASIA PACIFIC

- China
- Japan
- Australia
- Rest of Asia Pacific

MIDDLE EAST & AFRICA

- GCC Countries
  - Saudi Arabia
  - UAE
  - Rest of GCC
- South Africa
- Rest of Middle East & Africa

SOUTH AMERICA

- Brazil
- Argentina
- Rest of South America

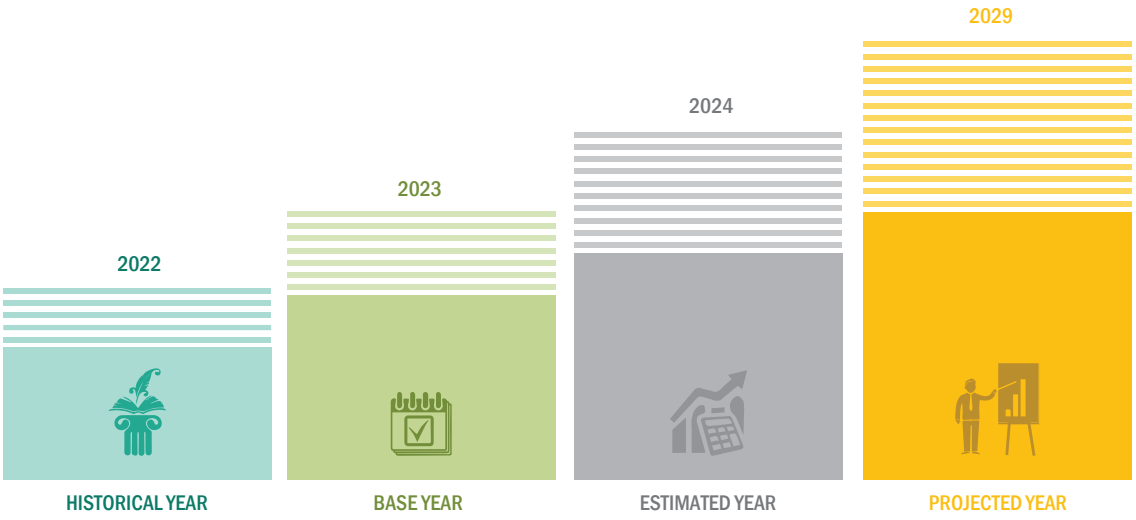
Notes: Rest of Europe includes Italy, Spain Russia, the Netherlands, Poland, Ukraine, and Romania.

Rest of Asia Pacific includes India, South Korea, Indonesia, Thailand, and the Philippines.

Rest of the Middle East & Africa includes Nigeria, Algeria, and Morocco.

Rest of South America includes Chile, Venezuela, Colombia, and Ecuador.

1.4.3 YEARS CONSIDERED



Note: The base year used for company profiles is 2023. In cases where information is not available for the base year, the previous year is considered.

1.5 CURRENCY CONSIDERED

- The currency used in the report is the United States Dollar (USD), with the market size indicated only in USD million.
- Revenues of all companies have been taken from their annual reports.
- For companies reporting their revenues in other currencies in their annual reports, the average annual currency conversion rate has been used to convert the value to USD.

1.6 UNIT CONSIDERED

- The unit used for market size in terms of volume is kilotons, where 1 kiloton = 1,000 tons

1.7 STAKEHOLDERS

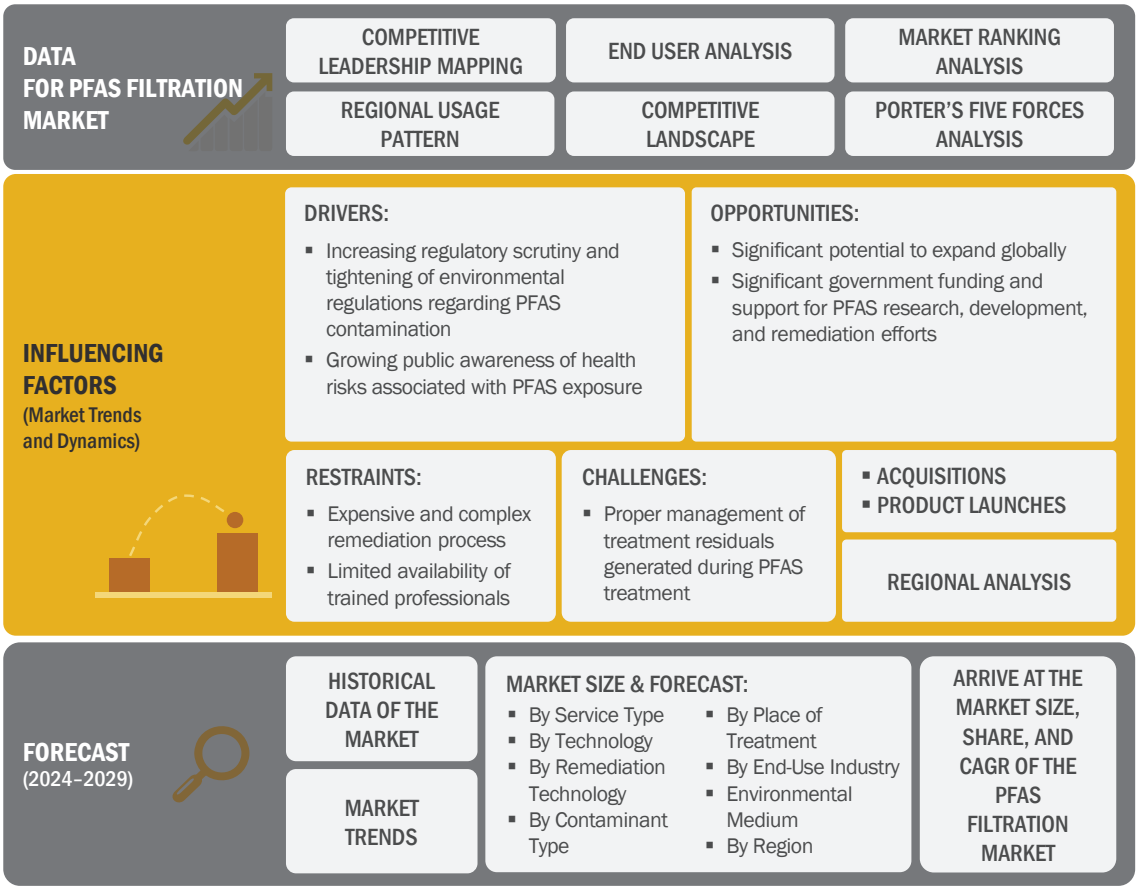
- PFAS filtration product providers
- PFAS filtration product distributors and suppliers
- Government and private research organizations
- Associations and industrial bodies
- R&D institutions

2 RESEARCH METHODOLOGY

2.1 RESEARCH DATA

This technical, market-oriented, and commercial study of the PFAS filtration market involved the use of extensive secondary sources, directories, and databases such as Hoovers, Bloomberg L.P., Factiva, ICIS, and OneSource. Primary sources are mainly industry experts from core and related industries, preferred suppliers, manufacturers, distributors, service providers, and organizations related to all segments of the value chain of this industry. In-depth interviews have been conducted with various primary respondents, including key industry participants, subject matter experts, C-level executives of key market players, and industry consultants, among other experts, to obtain and verify critical qualitative and quantitative information as well as to assess growth prospects of the market.

FIGURE 1 PFAS FILTRATION MARKET: RESEARCH DESIGN



Source: Related Industry Publications, Journals, Associations, Interviews with Experts, and MarketsandMarkets Analysis

2.1.1 SECONDARY DATA

The market size of companies globally offering PFAS filtration products has been determined based on secondary data available through paid and unpaid sources. It has also been arrived at by analyzing the product portfolios of the major companies and rating companies based on their performance and quality.

In the secondary research process, various sources have been referred to for identifying and collecting information for this study. The secondary sources include annual reports, press releases, and investor presentations of companies; white papers, journals, and certified publications; and articles from recognized authors, directories, and databases.

Secondary research has been mainly used to obtain key information about the industry's value chain and supply chain, to identify the key players by various products, market classifications, and segmentation according to offerings of the major players and industry trends related to service type, technology, remediation technology, place of treatment, contaminant type, end-use industry, and region, and key developments from both, market and technology-oriented perspectives.

2.1.1.1 Key data from secondary sources

PARAMETER	SOURCE
INDUSTRY REVENUE	▪ Company Financials ▪ Magazines ▪ Journals ▪ Press Releases ▪ Paid Databases ▪ MarketsandMarkets Data Repository
MARKET REVENUE OF COMPANIES	▪ Annual Reports ▪ Company Websites ▪ Public Databases ▪ MarketsandMarkets Data Repository
QUALITATIVE INFORMATION (Market Dynamics &Trends)	▪ Company Websites ▪ Annual Reports ▪ Press Releases ▪ MarketsandMarkets Data Repository

2.1.2 PRIMARY DATA

In the primary research process, various sources from both the supply and demand sides have been interviewed to obtain qualitative and quantitative information on the market. Primary sources from the supply side include various industry experts such as Chief X Officers (CXOs), Vice Presidents (VPs), Directors, from business development, marketing, product development/innovation teams, and related key executives from PFAS filtration product providers such as Kimberly-Clark Corporation, Domtar, and International Paper; small and medium-sized enterprises; industry associations (ICFPA, AF&PA, CEPI and IMF); importers; distributors; and key opinion leaders.

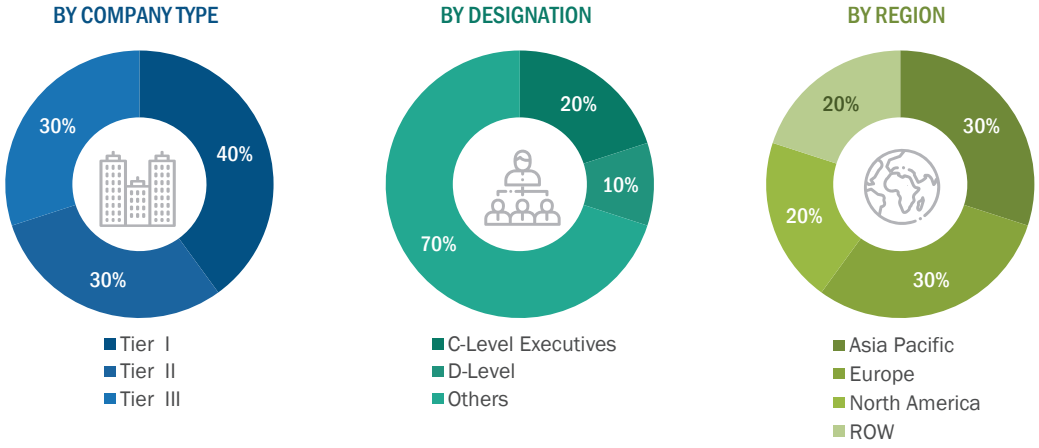
Interviews with experts have been conducted to gather insights such as market statistics, data on revenue collected from the products and services, market breakdowns, market size estimations, market forecasting, and data triangulation. Primary research also helped understand the various trends related to product type, application, end user, and region. Stakeholders from the demand side, such as CIOs, CTOs, and CSOs, and marketing teams of the customers/end users, who utilize PFAS filtration products, have

been interviewed to understand buyers' perspectives on suppliers, products, and their current usage of PFAS filtration products and future outlooks of their businesses, which are expected to affect the overall PFAS filtration market.

2.1.2.1 Key data from primary sources

TYPE	PARAMETER	KEY DATA
REGIONAL SPLIT	▪ Regional Segmentation of PFAS Filtration Market ▪ CAGR of PFAS Filtration Market in Each Region During the Forecast Period (2024–2029)	▪ PFAS Filtration Market, by Region – Asia Pacific, North America, Europe, South America, Middle East & Africa
GLOBAL MARKET SIZE	▪ PFAS Filtration Market Size in 2023 ▪ CAGR of PFAS Filtration Market During the Forecast Period (2024–2029)	▪ PFAS Filtration Market, by Value (USD Million), Volume (Kiloton)
MARKET SPLIT	PFAS Filtration Market ▪ By Service Type ▪ By Technology ▪ By Remediation Technology ▪ By Contaminant Type ▪ By Place of Treatment ▪ By Environmental Medium ▪ By End-Use Industry	▪ Service Type: On-site & Off-site ▪ Technology: Water Treatment Systems, Water Treatment Chemicals ▪ Remediation Technology: RO Membranes, Chemicals (Activated Carbon Adsorption, Ion Exchange Resin, Bioremediation, Chemical Oxidation) ▪ Contaminant Type: PFOA & PFOS, Multiple-PFAS contaminant ▪ Place of Treatment: In-situ & Ex-situ ▪ Environmental Medium: Soil, Groundwater, Surface water & Sediment ▪ End-use Industry: Municipal, Industrial & Commercial

2.1.2.2 Breakdown of interviews with experts



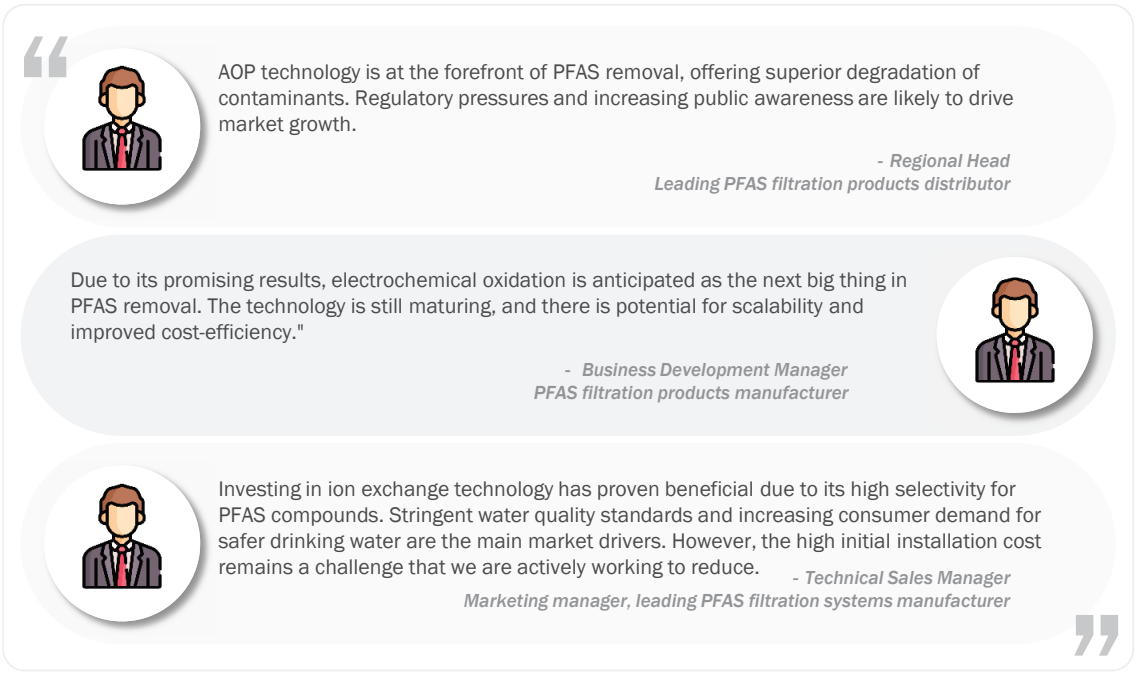
Note: Companies are classified based on their annual revenues in 2023 as Tier 1 = > USD 1 billion, Tier 2 = USD 500 million–USD 1 billion, and Tier 3 = < USD 500 million.

Other designations include sales representatives, production heads, and technicians.

After the complete market engineering process (which includes calculations for market statistics, market breakdown, market size estimations & projections, and data triangulation), extensive primary research has been conducted to gather information and to verify and validate the critical numbers arrived at. Primary research has also been conducted to identify segmentation, industry trends, Porter's Five Forces analysis, key players, competitive landscape of market players, and market dynamics such as drivers, restraints, opportunities, challenges, industry trends, and strategies adopted by leading players.

In the market engineering process, both the top-down and bottom-up approaches have been used along with several data triangulation methods to carry out estimations and projections for the overall market and its subsegments listed in this report. Extensive qualitative and quantitative analyses have been carried out to list key information/insights throughout the report.

2.1.2.3 Key industry insights



Source: Interviews with Experts

In the market engineering process, both the top–down and bottom–up approaches have been used along with several data triangulation methods to carry out estimations and projections for the overall market and its sub–segments listed in this report. Extensive qualitative and quantitative analyses have been carried out to list key information/insights throughout the report.

2.2 MARKET SIZE ESTIMATION

In the market engineering process (which includes calculations for market statistics, market breakdown, market size estimations, market forecast, and data triangulation), both the top-down and bottom-up approaches have been extensively used, along with several data triangulation methods to gather, verify, and validate the market figures arrived at. Extensive qualitative and quantitative analyses have been performed after the complete market engineering process to provide key information/insights throughout the report. The research methodology used to estimate the market size includes the following steps:

- The key players in the market have been identified through secondary research.
- All percentage shares, splits, and breakdowns have been determined by using secondary sources.
- All possible parameters that affect the markets covered in this research study have been accounted for, viewed in extensive detail, verified through primary research, and analyzed to get the final quantitative and qualitative data. This data has been consolidated and added with detailed input and analysis and presented in this report.

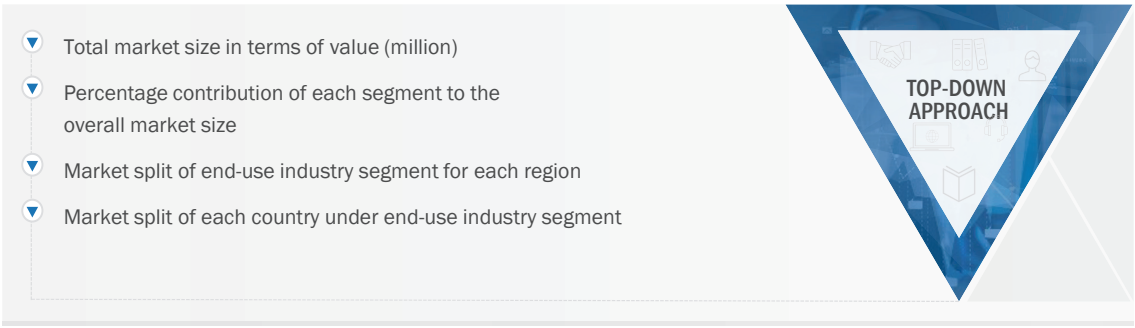
2.2.1 TOP-DOWN APPROACH

In the top-down approach, the PFAS filtration market size has been used to estimate the size of country-level data for types through percentage splits from secondary and primary research.

This overall market size has been used in the top-down approach to estimate the size of other individual markets (mentioned in the market segmentation based on service type, technology, remediation technology, place of treatment, contaminant type, end-use industry, and region) through percentage splits obtained from secondary and primary research.

For calculating a specific market segment, the most appropriate, immediate parent market size has been used to implement the top-down approach.

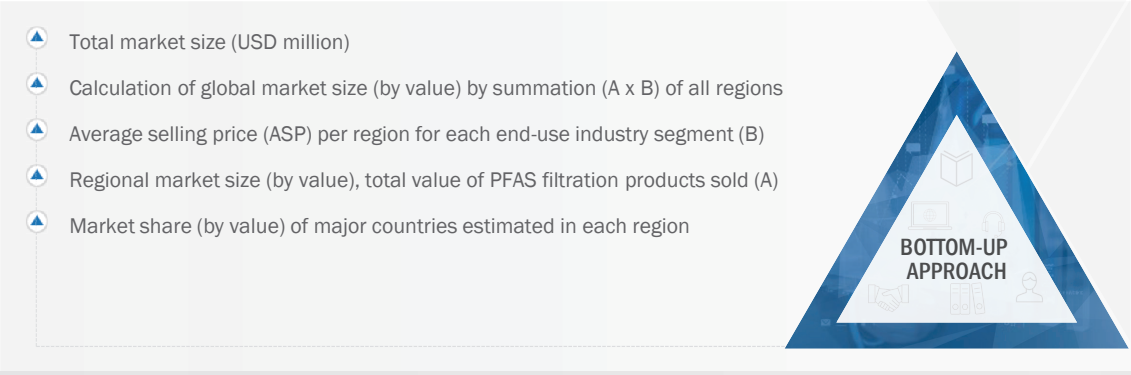
FIGURE 2 TOP-DOWN APPROACH



2.2.2 BOTTOM-UP APPROACH

The bottom-up approach has been used for estimating the PFAS filtration market for each country. The market has been segmented based on end-use industries such as industrial (oil & gas, pharmaceuticals, chemical manufacturing, mineral processing), municipal, and commercial. The country-level data for each segment has then been summed up to estimate the total size of the PFAS filtration market.

FIGURE 3 BOTTOM-UP APPROACH



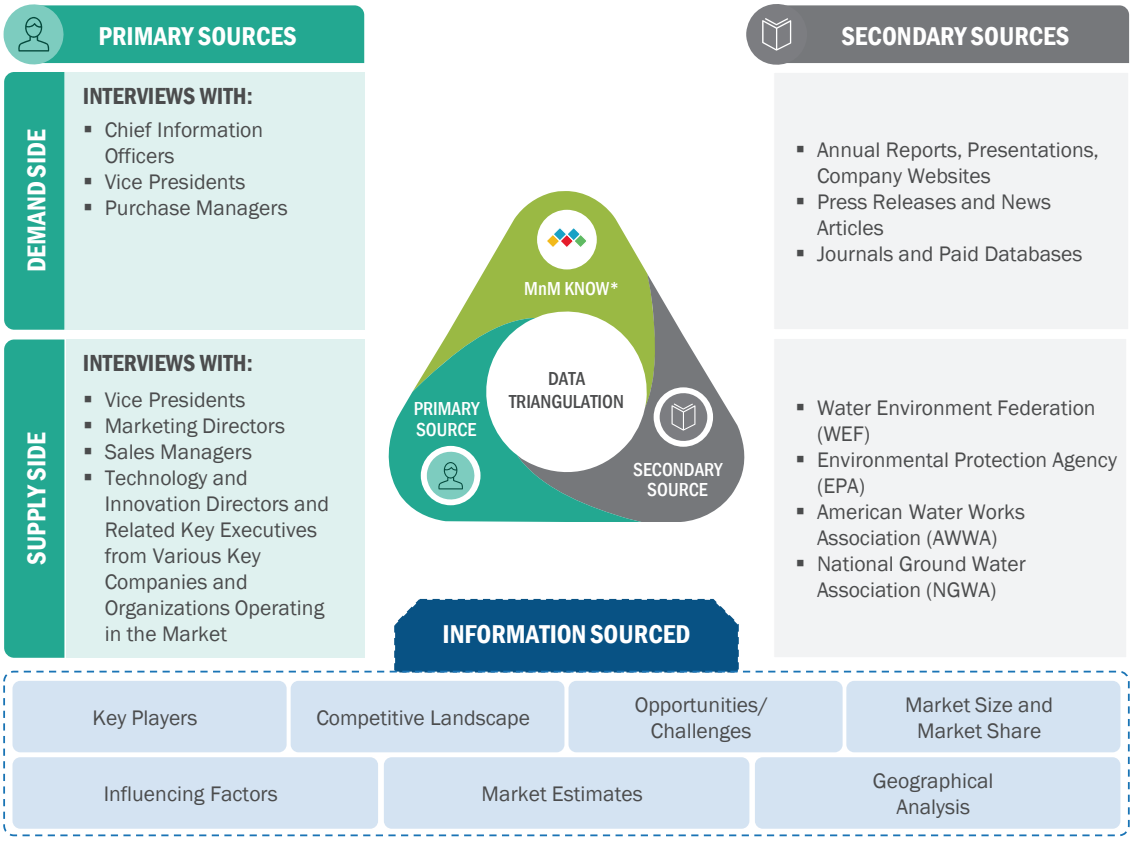
The bottom-up approach has been used to arrive at the overall size of the PFAS filtration market by estimating the revenue of key players and their shares in the market. Calculations based on the revenue of key players identified in the market led to determining the overall market size.

The bottom-up approach has also been implemented for the data extracted from secondary research to validate the market segment revenues obtained. Market share has been estimated for each company to verify the revenue share used earlier in the bottom-up procedure. With the data triangulation procedure and data validation through primaries, the exact values of the overall parent market size and each market size have been determined and confirmed in this study.

2.3 DATA TRIANGULATION

After arriving at the total MARKET, the overall market was split into several segments. The data triangulation procedure was employed, wherever applicable, to complete the overall market engineering process and arrive at the exact statistics for all the segments. The data was triangulated by studying various factors and trends from the demand and supply sides. It was then verified through interviews with experts. Hence, for every data, there were three sources: primary source, secondary source, and MNM KNOW. The data was assumed to be correct when the values arrived at from the three points matched.

FIGURE 4 PFAS FILTRATION MARKET: DATA TRIANGULATION



*MnM KNOW stands for MarketsandMarkets' 'Knowledge Asset Management' framework. In this context, it stands for existing market research knowledge repository of over 5,000 granular markets, our flagship competitive intelligence and market research platform "Knowledge Store", subject matter experts, and independent consultants. MnM KNOW acts as an independent source that helps us validate information gathered through primary and secondary sources .

2.4 RESEARCH ASSUMPTIONS

PARAMETER	ASSUMPTION
RECESSION IMPACT PERIOD	According to primary respondents, the impact of the recession is assumed to prevail in this industry, as a result of which, there was a decline in the key applications and the overall market in 2023.
CLASSIFICATION OF SEGMENTS	All market segments and sub-segments listed in this report through various forms of classifications have been considered mutually exclusive of each other.
GLOBAL ECONOMIC LANDSCAPE	The global economy has a direct impact on any market. Downturns and economic collapses, apart from recession, have not been considered while estimating the market size in this research study.
SEGMENT SPLITS AND PROJECTIONS	Wherever the exact segment market splits were not available, historical trends and inputs from primary respondents have been considered, and accordingly, the splits and projection rates have been assumed.
MARKET SIZE ESTIMATION	Production is equivalent to the demand.

2.5 RESEARCH LIMITATIONS

PARAMETER	LIMITATION
PRIMARIES, BY KEY PLAYERS	▪ The quantitative information for some of the market segments is kept confidential by industry players. ▪ Hence, qualitative insights gathered during the course of the study have been used to arrive at the market size for the sub-segments.
PRIMARIES, BY COUNTRY	▪ There are a limited number of industry experts in some regions. ▪ In such cases, the market is derived on the basis of weight assigned to these markets based on the qualitative insights from global industry experts.

2.6 FORECAST ESTIMATION

The growth forecast model was defined based on assessing qualitative and quantitative factors affecting market growth. These include:

- Historical revenue growth trends of leading market players
- Demand-side factor assessment, including the development of PFAS filtration products
- Impact assessment of historical trends, such as product launches, strategic growth initiatives, innovation trends, and R&D initiatives, driving market growth
- Impact assessment of regulatory guidelines/mandates on market growth over the forecast period

2.6.1 SUPPLY-SIDE APPROACH

The growth rate on the supply side was calculated by accessing secondary sources such as industry articles, company websites, and annual reports. The study provided relative growth rates at country and regional levels by analyzing PFAS filtration product sales for specific types and applications in different countries.

2.6.2 DEMAND-SIDE APPROACH

On the demand side, operational data for PFAS filtration products was identified. Macroeconomic indicators such as the production value of PFAS filtration products and market revenue were identified and analyzed through the EPA, Statista, industry association websites, and World Water magazine websites.

2.7 RECESSION IMPACT

The impact of a recession on the PFAS filtration market can be multifaceted, influencing both demand and supply dynamics. During economic downturns, industries and municipalities often face budget constraints, leading to reduced investments in infrastructure and environmental projects. This financial tightening can slow the adoption and expansion of PFAS filtration systems, as both public and private sector entities may delay or downscale their water treatment initiatives.

On the demand side, a recession can lead to decreased industrial activity, which might temporarily reduce the generation of PFAS-contaminated wastewater. However, this does not diminish the existing contamination in water sources, maintaining a steady, if not urgent, need for effective remediation. In some cases, heightened public health concerns during a recession might even drive regulatory agencies to impose stricter water quality standards, indirectly sustaining demand for PFAS filtration technologies.

Supply chain disruptions are another significant impact of a recession. The PFAS filtration market, like many others, relies on a global supply chain for components and raw materials. Economic downturns can lead to supply chain bottlenecks, increased costs, and delays in manufacturing and delivery of filtration systems.

Additionally, investment in research & development (R&D) can suffer during a recession. Companies might scale back on R&D spending to conserve cash, potentially slowing technological advancements in PFAS filtration methods. This can impact long-term market growth and innovation.

3 EXECUTIVE SUMMARY

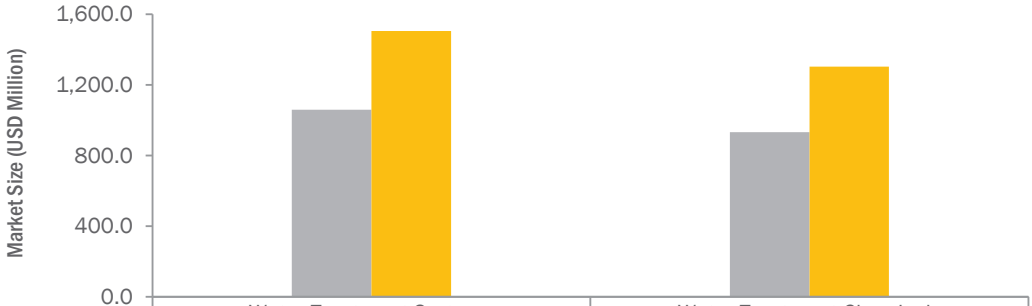
The market for PFAS (per- and polyfluoroalkyl substances) filtration has been rapidly expanding due to increasing awareness of the environmental and health risks posed by these persistent chemicals. PFAS are found in various industrial applications, including non-stick cookware, water-repellent clothing, firefighting foams, and food packaging. Their resistance to degradation and widespread use have led to significant environmental contamination, prompting a demand for effective removal technologies across multiple sectors. Several advanced technologies are employed in the PFAS filtration market such as activated carbon adsorption, RO membrane, ion exchange resin, bioremediation, and others. Out of these, Granular Activated Carbon (GAC) is one of the most used technologies for PFAS removal. It works by adsorbing PFAS molecules onto the surface of activated carbon particles. This method is effective for removing long-chain PFAS but can be less efficient for short-chain variants.

Moreover, municipalities are increasingly implementing PFAS removal technologies to ensure safe drinking water supplies. Regulatory pressures and public health concerns are major drivers in this sector Furthermore, industries such as manufacturing, aerospace, and electronics often deal with PFAS contamination due to their use in various processes. These industries are investing in treatment solutions to comply with environmental regulations and avoid liability.

The PFAS filtration market size is estimated to be USD 1,990 million in 2024 and is projected to reach USD 2,806 million by 2029, at a CAGR of 7.1% between 2024 and 2029. One of the key drivers is increasing awareness and concern about PFAS contamination in water sources worldwide. Moreover, governments and environmental agencies are implementing stricter regulations regarding PFAS contamination levels in water sources. This necessitates the adoption of effective filtration technologies to comply with regulatory standards.

The key global players in the PFAS filtration market include Veolia (France), AECOM (US), WSP (Canada), Clean Earth (US), Wood (UK), Xylem (US), Jacobs (US), TRC Companies, Inc. (US), Battelle Memorial Institute (US), and Cyclopure, Inc. (US).

FIGURE 5 WATER TREATMENT SYSTEMS TO BE LARGER TECHNOLOGY TYPE BETWEEN 2024 AND 2029

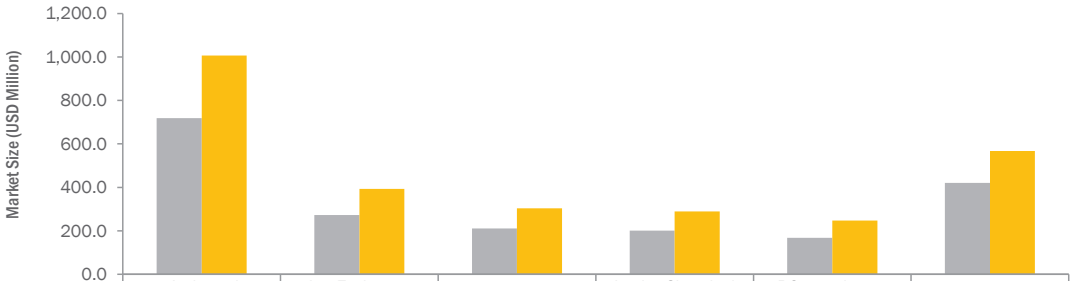


	Water Treatment Systems	Water Treatment Chemicals
2024	1,058.7	931.9
2029	1,504.3	1,302.2
CAGR (2024–2029)	7.3%	6.9%

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

The growth of water treatment systems in PFAS filtration has surged due to escalating concerns about the widespread contamination of water sources by these persistent chemicals. Recent developments in this field have focused on enhancing filtration efficacy, scalability, and sustainability. Additionally, there is a growing emphasis on the development of decentralized and modular treatment solutions to cater to diverse applications and settings, including industrial facilities, municipal water treatment plants, and residential areas affected by PFAS contamination. These modular systems offer flexibility, scalability, and cost-effectiveness, enabling tailored solutions for specific contamination scenarios.

FIGURE 6 ACTIVATED CARBON TO LEAD PFAS FILTRATION MARKET BETWEEN 2024 AND 2029

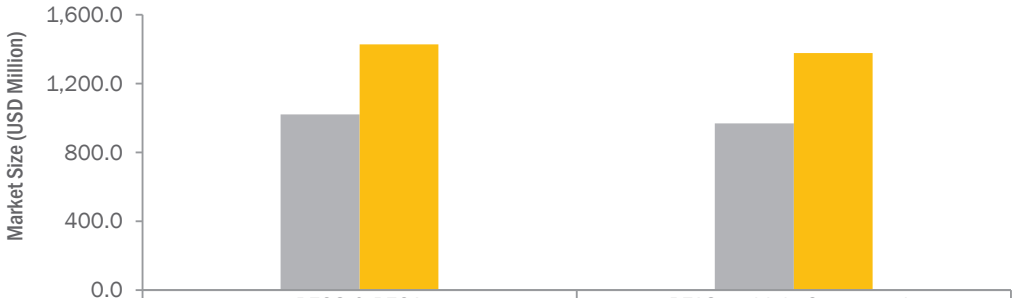


	Activated Carbon	Ion Exchange Resin	Bioremediation	In-situ Chemical Oxidation	RO membrane & Nanofiltration	Others
2024	718.6	272.7	211.0	201.1	167.2	420.0
2029	1,007.5	392.9	303.1	289.1	247.0	566.9
CAGR (2024–2029)	7.0%	7.6%	7.5%	7.5%	8.1%	6.2%

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

Chemical remediation technology includes activated carbon adsorption, chemical oxidation, ion exchange, bioremediation, and others. The common benefits of these PFAS filtration methods include high efficiency in reducing PFAS concentrations, versatility in treating various types of contaminated media, and the ability to target a broad spectrum of PFAS compounds. These methods often produce minimal secondary waste, making them environmentally friendly.

FIGURE 7 PFOA & PFOS CONTAMINANT TYPE TO LEAD PFAS FILTRATION MARKET BETWEEN 2024 AND 2029

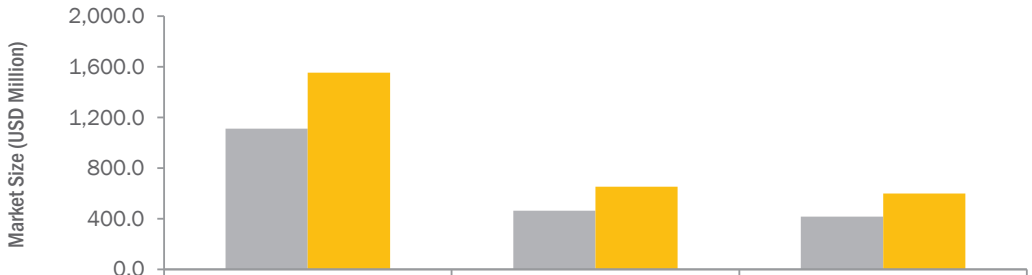


	PFOS & PFOA	PFAS multiple Compounds
2024	1,021.5	969.1
2029	1,428.5	1,378.0
CAGR (2024–2029)	6.9%	7.3%

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

Perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) are two of the most well-known members of the per- and polyfluoroalkyl substances (PFAS) family. These synthetic chemicals have been widely used in various industrial and consumer products due to their unique properties, such as resistance to water, oil, and heat. The primary sectors utilizing PFOA and PFOS have historically been the manufacturing and chemical industries, particularly those producing non-stick cookware, waterproof fabrics, and fire-retardant materials. Firefighting foams containing PFOS and PFOA have been extensively used at military bases, airports, and industrial sites, leading to significant environmental contamination.

FIGURE 8 GROUNDWATER ENVIRONMENTAL MEDIUM TYPE TO LEAD PFAS FILTRATION MARKET BETWEEN 2024 AND 2029

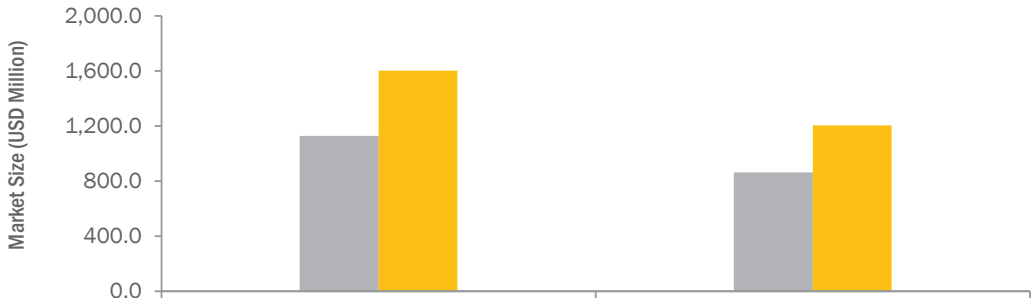


	Groundwater	Surfacewater & sediment remediation	Soil
2024	1,111.1	463.8	415.7
2029	1,554.8	653.9	597.8
CAGR (2024–2029)	7.0%	7.1%	7.5%

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

The presence of PFAS in groundwater results from various pollution sources such as industrial discharges, firefighting foam runoff, and landfill leachate. Industrial sites using PFAS in manufacturing processes or firefighting training areas contribute to groundwater pollution when these substances leach into the soil and eventually percolate down into aquifers. Similarly, landfills accepting PFAS-containing waste can generate leachate that carries these compounds into groundwater supplies.

FIGURE 9 EX-SITU TO LEAD PFAS FILTRATION MARKET BETWEEN 2024 AND 2029



	Ex-situ	In-situ
2024	1,128.3	862.3
2029	1,602.5	1,204.0
CAGR (2024–2029)	7.3%	6.9%

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

Ex-situ processes for the treatment of per- and poly-fluoroalkyl substances (PFAS) involve the removal of contaminated soil or groundwater from the site and treat it outside the contaminated area. Ex-situ PFAS treatment provides effective solutions for managing contamination in various environments, ensuring that extracted materials are treated to meet regulatory standards before being returned to the environment or disposed of safely.

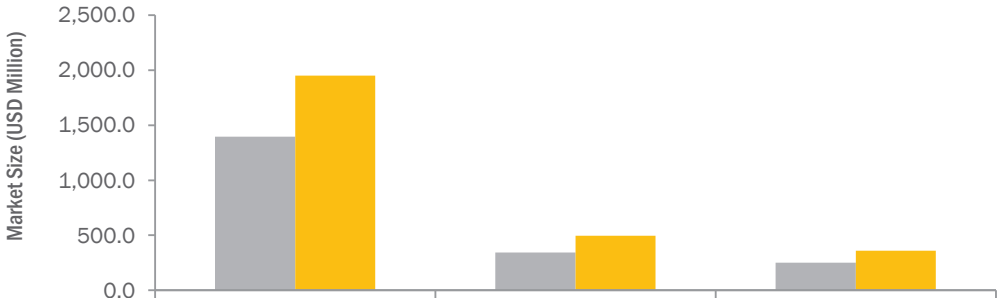
FIGURE 10 OFF-SITE TO LEAD PFAS FILTRATION MARKET BETWEEN 2024 AND 2029

	Off-site	On-site
2024	1,262.0	728.6
2029	1,765.3	1,041.2
CAGR (2024–2029)	6.9%	7.4%

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

Off-site PFAS removal involves transporting contaminated water to a central treatment facility where advanced purification technologies are employed. Common technologies used in off-site treatment include large-scale activated carbon adsorption, advanced oxidation processes (AOPs), and sophisticated membrane filtration systems. These facilities are often equipped with more comprehensive and high-capacity treatment technologies than those feasible for on-site use.

FIGURE 11 MUNICIPAL TO LEAD PFAS FILTRATION MARKET BETWEEN 2024 AND 2029



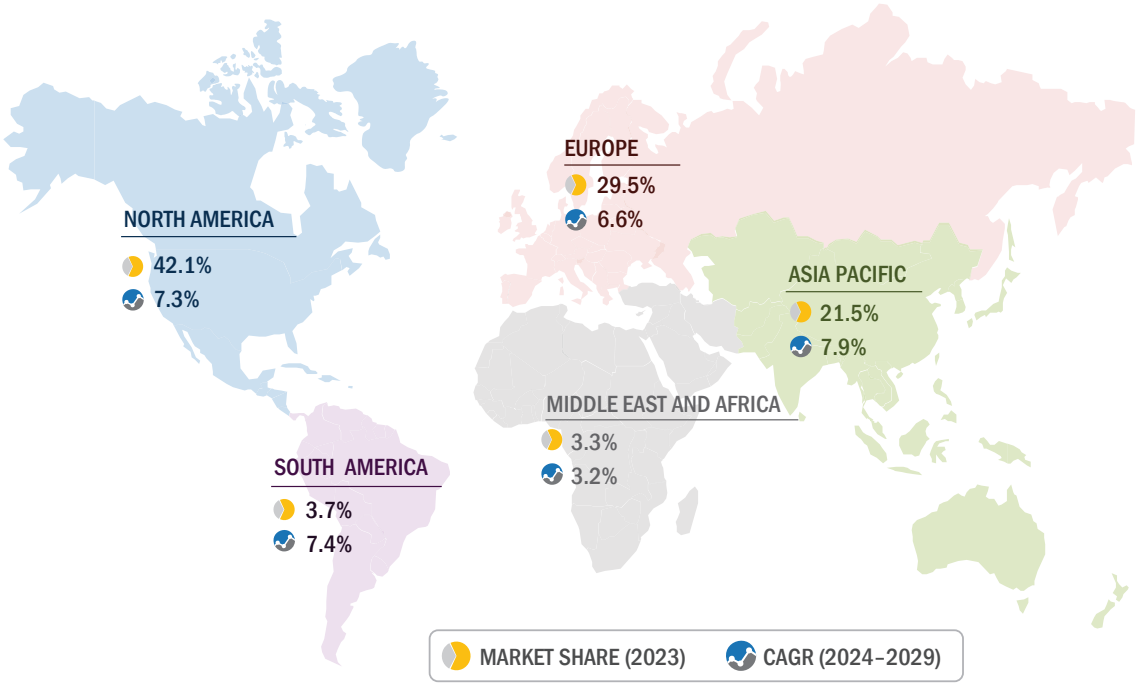
	Municipal	Industrial	Commercial
2024	1,396.2	343.8	250.7
2029	1,950.9	496.3	359.3
CAGR (2024–2029)	6.9%	7.6%	7.5%

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

Municipalities are a key end-use industry for PFAS filtration due to their critical role in providing safe drinking water to communities. The persistent nature of PFAS compounds and their associated health risks necessitate effective filtration technologies in municipal water treatment facilities. These facilities are increasingly adopting advanced filtration methods such as granular activated carbon (GAC), ion exchange resins, and reverse osmosis to remove PFAS from water supplies. Regulatory pressures and growing public

awareness of PFAS contamination drive municipalities to invest in and upgrade their filtration systems, ensuring compliance with safety standards and protecting public health.

FIGURE 12 NORTH AMERICA TO LEAD PFAS FILTRATION MARKET, 2024–2029



Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

The PFAS filtration market in North America, particularly in the US, is experiencing significant growth driven by heightened awareness of the environmental and health impacts of PFAS contamination. PFAS, or per- and polyfluoroalkyl substances, have been widely used in industrial applications and consumer products for decades. Their persistence in the environment and potential adverse health effects have led to increased regulatory scrutiny and public concern. The U.S. Environmental Protection Agency (EPA) has been actively working on setting stricter standards for PFAS levels in drinking water. States like Michigan, New Jersey, and New York have already implemented stringent PFAS regulations, driving the need for advanced filtration systems to ensure compliance.

4 PREMIUM INSIGHTS

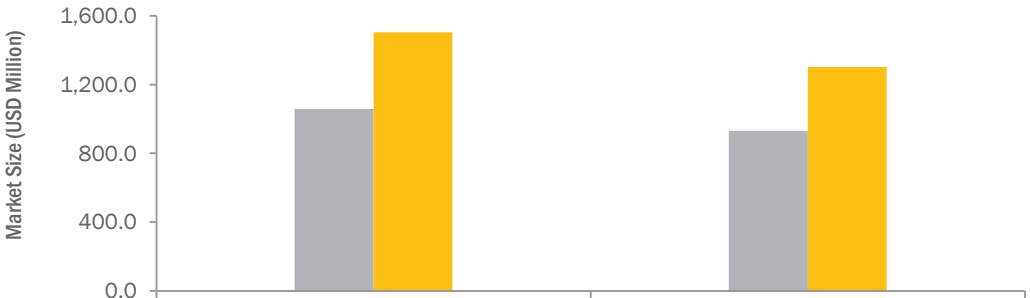
4.1 ATTRACTIVE OPPORTUNITIES FOR PLAYERS IN PFAS FILTRATION MARKET

FIGURE 13 EMERGING ECONOMIES TO WITNESS HIGHER DEMAND FOR PFAS FILTRATION PRODUCTS DURING FORECAST PERIOD

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

4.2 PFAS FILTRATION MARKET, BY TECHNOLOGY TYPE

FIGURE 14 WATER TREATMENT SYSTEMS TO BE FASTER-GROWING MARKET DURING FORECAST PERIOD

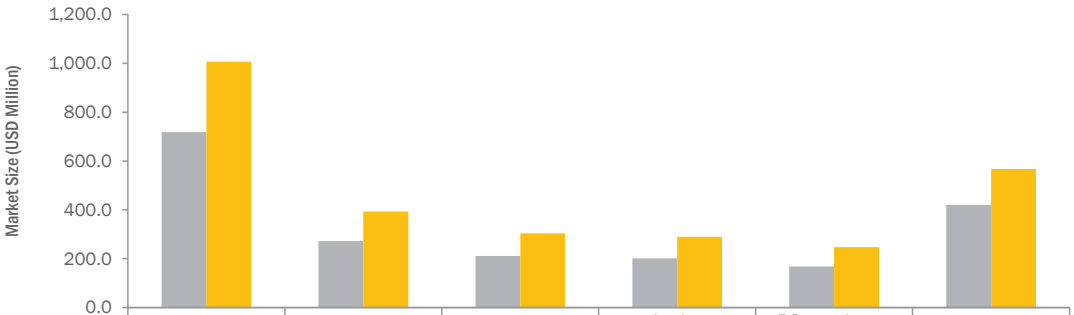


	Water Treatment Systems	Water Treatment Chemicals
2024	1,058.7	931.9
2029	1,504.3	1,302.2
CAGR (2024–2029)	7.3%	6.9%

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

4.3 PFAS FILTRATION MARKET, BY REMEDIATION TECHNOLOGY

FIGURE 15 RO MEMBRANE & NANOFILTRATION TO GROW AT HIGHEST CAGR DURING FORECAST PERIOD

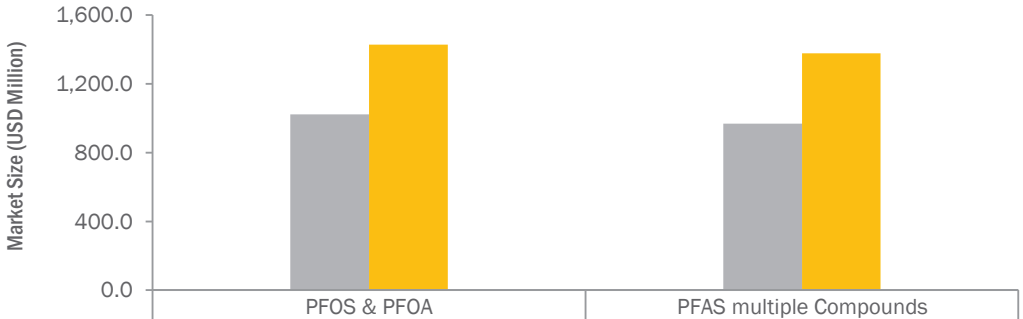


	Activated Carbon	Ion Exchange Resin	Bioremediation	In-situ Chemical Oxidation	RO membrane & Nanofiltration	Others
2024	718.6	272.7	211.0	201.1	167.2	420.0
2029	1,007.5	392.9	303.1	289.1	247.0	566.9
CAGR (2024–2029)	7.0%	7.6%	7.5%	7.5%	8.1%	6.2%

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

4.4 PFAS FILTRATION MARKET, BY PLACE OF TREATMENT

FIGURE 16 PFAS MULTIPLE COMPOUNDS TO GROW AT HIGHER CAGR DURING FORECAST PERIOD

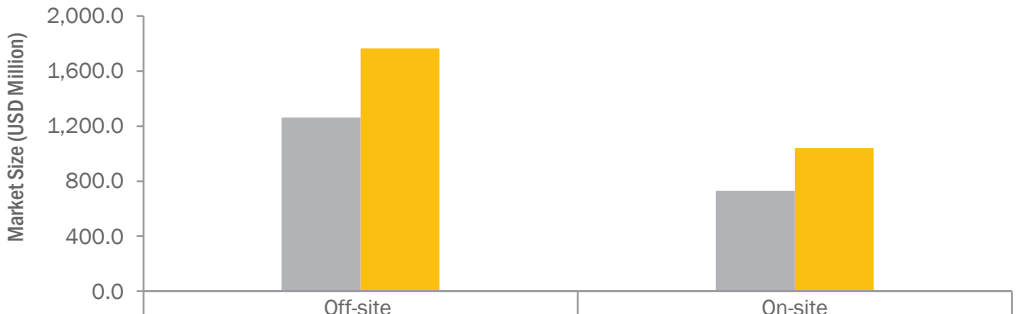


	PFOS & PFOA	PFAS multiple Compounds
2024	1,021.5	969.1
2029	1,428.5	1,378.0
CAGR (2024–2029)	6.9%	7.3%

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

4.5 PFAS FILTRATION MARKET, BY SERVICE TYPE

FIGURE 17 ON-SITE SERVICE TYPE TO GROW AT HIGHER CAGR DURING FORECAST PERIOD

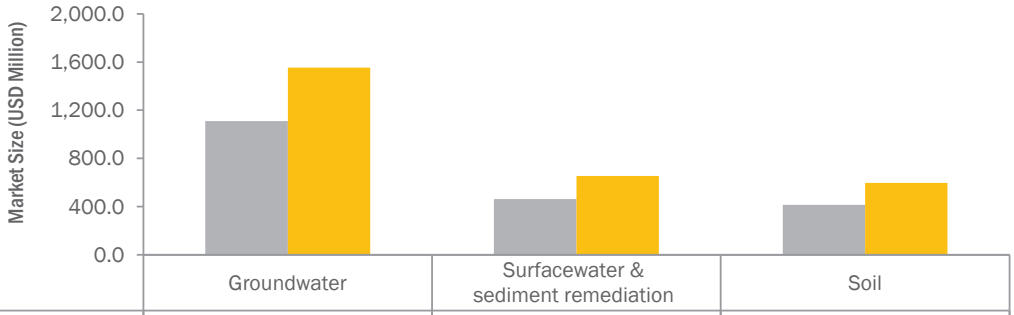


	Off-site	On-site
2024	1,262.0	728.6
2029	1,765.3	1,041.2
CAGR (2024–2029)	6.9%	7.4%

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

4.6 PFAS FILTRATION MARKET, BY ENVIRONMENTAL MEDIUM

FIGURE 18 SOIL REMEDIATION TO GROW AT HIGHEST CAGR DURING FORECAST PERIOD

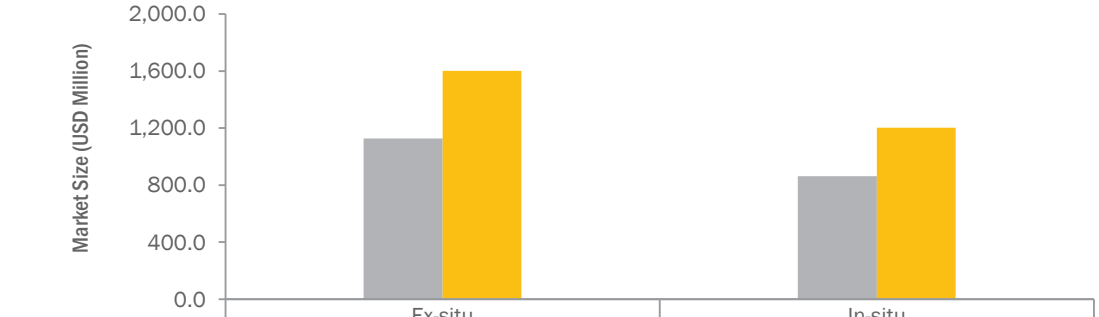


	Groundwater	Surfacewater & sediment remediation	Soil
2024	1,111.1	463.8	415.7
2029	1,554.8	653.9	597.8
CAGR (2024–2029)	7.0%	7.1%	7.5%

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

4.7 PFAS FILTRATION MARKET, BY CONTAMINANT TYPE

FIGURE 19 EX-SITU TREATMENT TO GROW AT HIGHER CAGR DURING FORECAST PERIOD

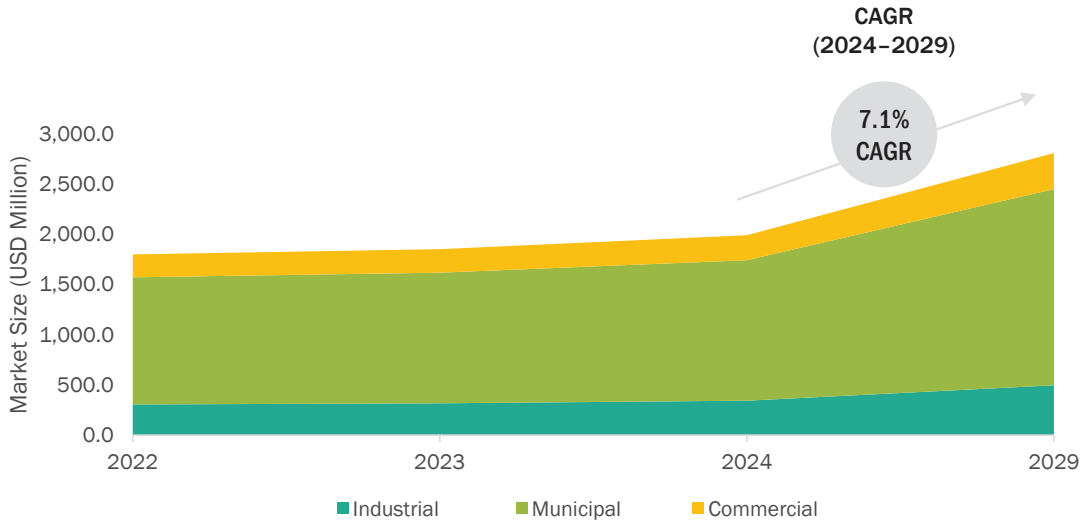


	Ex-situ	In-situ
2024	1,128.3	862.3
2029	1,602.5	1,204.0
CAGR (2024–2029)	7.3%	6.9%

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

4.8 PFAS FILTRATION MARKET, BY END-USE INDUSTRY

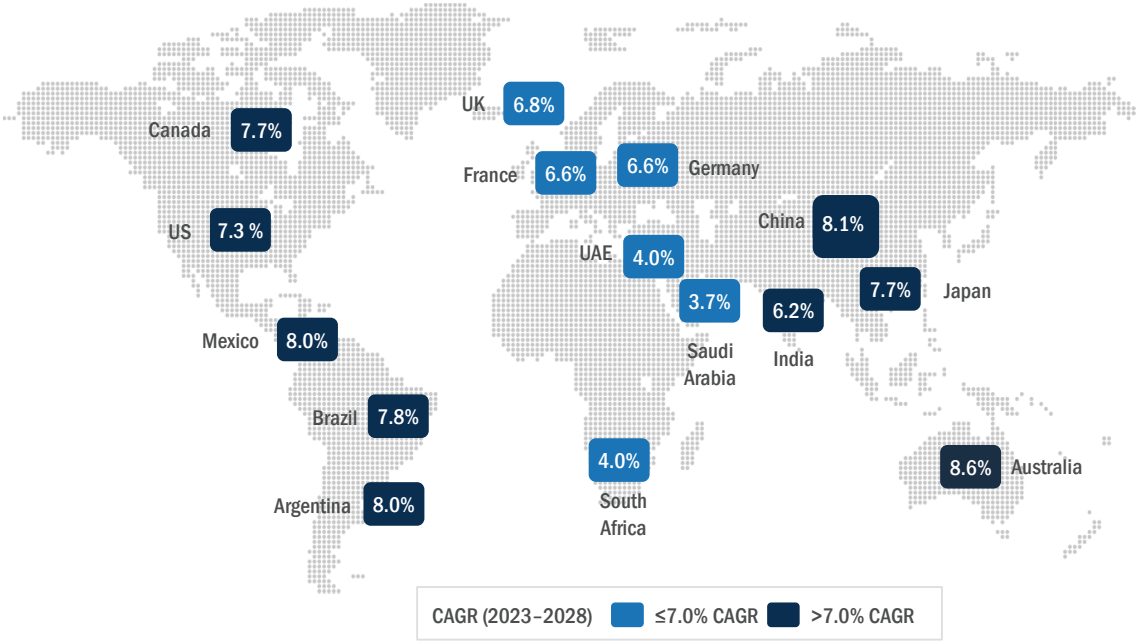
FIGURE 20 INDUSTRIAL SEGMENT TO GROW AT HIGHEST CAGR DURING FORECAST PERIOD



Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

4.9 PFAS FILTRATION MARKET, BY COUNTRY

FIGURE 21 MARKET IN AUSTRALIA TO REGISTER HIGHEST CAGR FROM 2024 TO 2029



Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

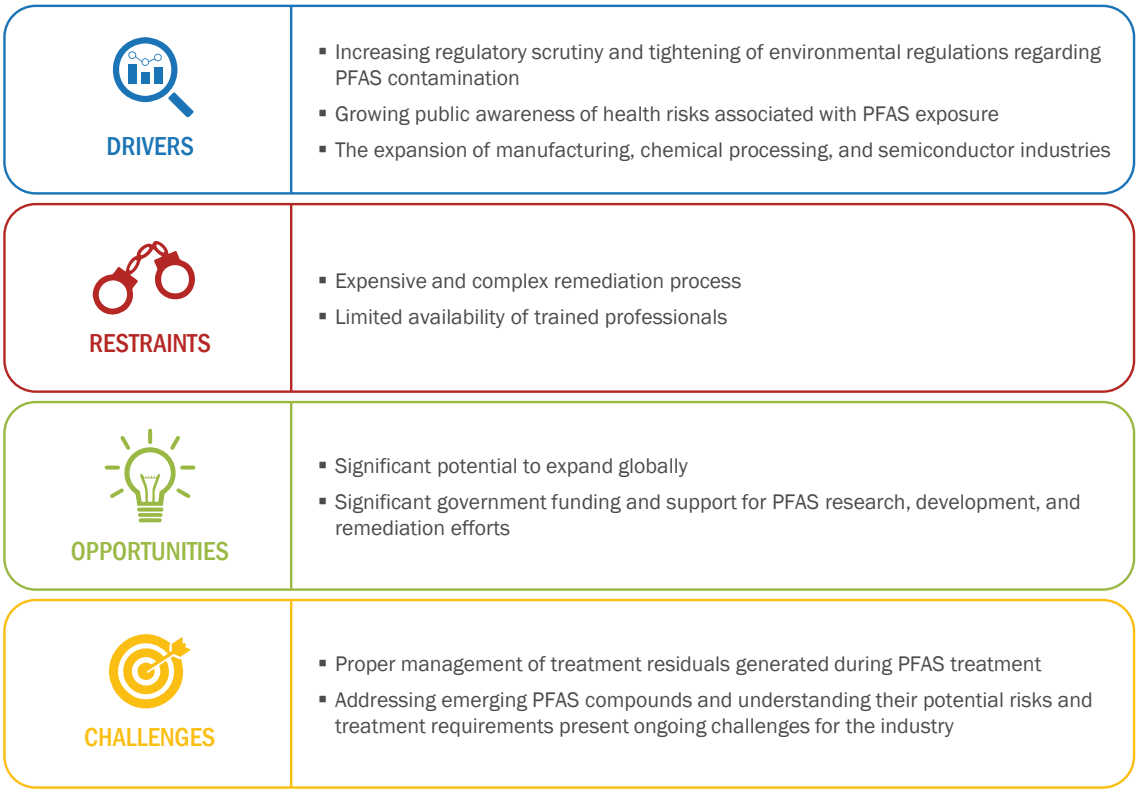
5 MARKET OVERVIEW

5.1 INTRODUCTION

The PFAS filtration market is centered on technologies and systems designed to remove or reduce PFAS contamination from water and other mediums. This market is driven by several key factors, including increasing regulatory pressure, heightened health concerns, and technological advancements. Governments worldwide are instituting stringent regulations and guidelines to limit PFAS levels in drinking water and the environment, spurred by growing awareness of the health risks these chemicals pose, such as cancer and hormonal disruptions.

5.2 MARKET DYNAMICS

FIGURE 22 DRIVERS, RESTRAINTS, OPPORTUNITIES, AND CHALLENGES IN PFAS FILTRATION MARKET



Source: Secondary Literature, Interviews with Experts, and MarketsandMarkets Analysis

5.2.1 DRIVERS

5.2.1.1 Increasing regulatory scrutiny and tightening of environmental regulations regarding PFAS contamination

Increasing regulatory scrutiny and the tightening of environmental regulations regarding PFAS are shaping the demand for filtration solutions. The recognition of PFAS as persistent, bioaccumulative, and potentially harmful contaminants has prompted regulatory bodies at both the central and state levels to enact stringent measures to address PFAS contamination and mitigate associated risks.

The Environmental Protection Agency (EPA) has taken steps to address PFAS contamination through various initiatives and regulatory actions. In 2019, the EPA issued a PFAS Action Plan outlining strategies to address PFAS contamination, including monitoring, research, and regulatory actions. Additionally, the EPA has developed health advisories and established lifetime health advisory levels for PFAS compounds in drinking water, providing guidance for regulatory compliance and filtration efforts. Furthermore, the EPA has initiated regulatory proceedings to designate PFAS chemicals as hazardous substances under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), which would trigger comprehensive cleanup requirements for PFAS-contaminated sites nationwide. In 2021, Canada published various regulations, which prohibit the producers, use, sale, and import of PFOA and its salts, as well as certain other related compounds, except under specific circumstances. Also, Canada, has designated PFOS, PFOA, and their salts as toxic substances under the Canadian Environmental Protection Act (CEPA), 1999, which enables the government to take action to manage and reduce their risks to human health and the environment.

In Asia Pacific, China, Japan, and South Korera have established certain guidelines and regulations. For instance, in 2021, China added PFAS-containing firefighting foam to its hazardous waste list, which made it necessary to handle and dispose of it in accordance with hazardous waste regulations. In Japan, PFOS and PFOA are designated as “Specified Chemical Substances” under the Chemical Substance Control Law. The regulations require companies to notify on the production, import, and use of these substances above a certain threshold. In 2020, under the act of Registration and Evaluation of Chemicals, South Korea designated PFOS and PFOA as "harmful substances."

Furthermore, individual states have implemented their own regulations and guidelines to address PFAS contamination based on local conditions and concerns. States such as Michigan, New Jersey, and California have been at the forefront of PFAS regulation, enacting laws and regulations to establish maximum contaminant levels (MCLs) for PFAS compounds in drinking water and surface water. For example, Michigan has established MCLs for several PFAS compounds, including perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS), in drinking water, triggering extensive monitoring and filtration efforts statewide.

In addition to regulatory actions specific to drinking water, states have also implemented regulations addressing PFAS contamination in other environmental media, such as soil and groundwater. These regulations often include requirements for site investigation, filtration, and reporting of PFAS contamination, driving demand for filtration solutions and services. These regulatory actions drive demand for filtration solutions by establishing clear requirements and standards for addressing PFAS contamination and ensuring regulatory compliance at contaminated sites nationwide.

5.2.1.2 Growing public awareness of health risks associated with PFAS exposure

PFAS are a group of synthetic chemicals known for their persistent nature and widespread presence in the environment. These chemicals have been linked to numerous adverse health effects, making them a significant concern for public health.

Research has shown that exposure to PFAS compounds can lead to various health problems, including reproductive and developmental issues, immune system disorders, liver damage, and certain types of cancer. PFAS have been associated with adverse pregnancy outcomes, such as low birth weight and preterm birth, as well as impaired fetal growth and development. Additionally, PFAS exposure has been linked to thyroid disorders, hormonal imbalances, and disruptions in cholesterol levels.

One of the most concerning aspects of PFAS exposure is their bioaccumulative nature, meaning they build up in the body over time and can persist for years. This prolonged exposure to PFAS compounds increases the risk of adverse health effects, particularly in vulnerable populations such as pregnant women, infants, and children. Moreover, PFAS contamination in drinking water sources poses a significant risk to public health, as it can lead to widespread exposure through consumption and everyday activities such as bathing and cooking. Even low levels of PFAS exposure have been associated with health risks, prompting growing concerns among communities and individuals about the safety of their drinking water.

The burgeoning awareness among the public regarding the perilous health risks associated with PFAS exposure has ignited a groundswell of advocacy and activism aimed at addressing this pressing issue. Across North America and globally, communities and individuals have mobilized to raise awareness about PFAS contamination and advocate for meaningful action to protect public health and the environment. Public campaigns and movements have played a pivotal role in amplifying the voices of affected communities and driving public discourse on PFAS contamination. Grassroots organizations, such as the "Fight Forever Chemicals" movement and "Clean Water Advocates," have emerged as powerful advocates for PFAS awareness and accountability. Moreover, high-profile documentaries and media coverage, such as "The Devil We Know" and investigative reports by major news outlets, have helped to shed light on the far-reaching implications of PFAS contamination. These media exposés have sparked public outrage and catalyzed calls for stronger regulatory action to address PFAS pollution and hold responsible parties accountable.

As public awareness of the health risks associated with PFAS exposure continues to grow, there is increasing pressure on regulatory agencies, policymakers, and industries to take action to address PFAS contamination and protect public health. This heightened awareness drives the demand for PFAS treatment technologies that can effectively remove these harmful contaminants from water sources and mitigate the risks of exposure.

5.2.1.3 Expansion of manufacturing, chemical processing, and semiconductor industries

Industrial expansion across various sectors in the world, including manufacturing, semiconductor, and chemical processing, has led to an increased utilization of PFAS-containing substances. PFAS can be extensively used in this industry due to exceptional water and grease resistance, thermal stability, and chemical inertness. In the manufacturing sector, PFAS are crucial in automotive applications for lubricants and fuel-resistant coatings, in textiles for water and stain repellency, and in electronics for insulation and semiconductor components. In the chemical processing industry, PFAS serve as surfactants in fluoropolymer dispersions, stabilizers in various chemical reactions, and key components in firefighting foams. However, these uses result in PFAS being released into the environment through production processes, product use, and improper disposal, leading to contamination of wastewater, soil, and air.

According to the U.S. Environmental Protection Agency (EPA), the manufacturing industry is one of the primary sources of PFAS contamination, contributing to water pollution through wastewater discharge. Recent data from the EPA indicates that more than 57,000 facilities across the US are known or suspected of using PFAS in their operations, and 5,021 locations in the US are confirmed to be contaminated with PFAS. A Large Newsroom Investigation revealed that Europe has over 17,000 PFAS-contaminated sites, resulting in significant environmental impact. As these industries expand, there is a growing need to address the environmental impact of PFAS contamination. Regulatory standards set by agencies such as the EPA, EU, and state-level environmental authorities necessitate stringent measures to mitigate PFAS pollution. Consequently, there is an increasing demand for PFAS filtration systems within these industries to comply with regulatory requirements and ensure environmental sustainability. PFAS treatment becomes imperative to prevent the release of these persistent and harmful contaminants into the environment, safeguarding water resources and public health.

5.2.2 RESTRAINTS

5.2.2.1 Expensive and complex filtration process

The PFAS filtration process is very complex and expensive. The complexity arises from several interrelated factors, including the persistent and widespread nature of PFAS contamination, the diverse range of affected environmental media, and the limited efficacy of conventional treatment methods. Addressing PFAS contamination often requires a multifaceted approach involving various treatment technologies and filtration techniques tailored to specific site conditions and contaminant characteristics. Moreover, the intricate chemistry of PFAS compounds, characterized by their stability and resistance to degradation, further complicates the filtration process. Furthermore, the costliness of PFAS filtration is driven by several factors, including the need for specialized treatment equipment, consumables, and skilled personnel. PFAS filtration technologies often require sophisticated infrastructure and high-performance filtration systems capable of effectively capturing and removing PFAS compounds from contaminated water sources. Additionally, the scale and scope of filtration efforts, particularly at large-scale contaminated sites or municipal water treatment facilities, can significantly escalate costs. Moreover, ongoing monitoring and regulatory compliance requirements impose additional financial burdens on filtration projects, further exacerbating the costliness of PFAS filtration.

Maintenance of PFAS filtration systems also presents a considerable ongoing expense. Regular maintenance and monitoring are essential to ensure the continued effectiveness and efficiency of filtration systems in removing PFAS contaminants from water sources. This includes routine inspections, filter replacements, and calibration of equipment to maintain optimal performance. Moreover, the need for proper disposal of spent filter media and treatment residuals adds to the overall maintenance costs. Additionally, as treatment technologies evolve and regulatory requirements change, periodic upgrades and modifications may be necessary to ensure compliance and effectiveness, further contributing to the maintenance expenses associated with PFAS filtration systems. So, the expensive and complex nature of PFAS filtration, coupled with the ongoing maintenance costs, poses significant restraints for the PFAS filtration market.

5.2.2.2 Limited availability of trained professionals

The treatment and filtration of PFAS (per- and polyfluoroalkyl substances) contamination presents significant technical and operational challenges. One of the major obstacles in effectively addressing PFAS issues is the limited availability of trained professionals in this specialized field. Professionals need expertise in a range of filtration technologies, including in-situ chemical oxidation, adsorption methods, and novel approaches like electrochemical and enzymatic degradation. This level of specialization often requires advanced degrees and targeted professional development.

Moreover, the growing regulatory focus on PFAS contamination and the increasing number of contaminated sites have created a high demand for qualified professionals. However, the supply of trained experts has not kept pace. This gap hinders the timely and effective implementation of filtration projects, as firms struggle to find and retain personnel with the necessary expertise.

5.2.3 OPPORTUNITIES

5.2.3.1 Significant potential to expand globally

Countries across the globe are grappling with the pervasive presence of PFAS compounds in their water supplies, soil, and air, necessitating urgent filtration efforts to mitigate the associated health and environmental risks. Countries such as Australia, Canada, European nations, and parts of Asia, including China and India, have witnessed a surge in PFAS contamination incidents, prompting heightened regulatory scrutiny and public outcry.

In response to the escalating PFAS crisis, many countries have enacted stringent regulations and guidelines to address PFAS contamination and protect public health. For instance, the European Union has proposed regulations to restrict the use of PFAS chemicals in various consumer products and establish strict limits on PFAS levels in drinking water and food. Similarly, Australia has implemented comprehensive PFAS management frameworks, including guidelines for soil and water contamination and health-based guidance values for PFAS compounds in drinking water. In Canada, the federal government has established interim guidelines for PFAS in drinking water, and several provinces have developed their own regulations to address PFAS contamination.

Moreover, government support and funding initiatives further bolster the opportunities for PFAS treatment companies to expand internationally. Many countries have allocated substantial resources to support PFAS filtration efforts, including funding for research and development of innovative treatment technologies and financial assistance for contaminated site cleanup projects. For example, the Australian government has established dedicated funding programs, such as the National PFAS Contamination Response Plan, to address PFAS contamination and support affected communities. Similarly, Canada has allocated funds for PFAS research and filtration projects through initiatives like the Federal Contaminated Sites Action Plan. Furthermore, international collaborations and partnerships present avenues for PFAS treatment companies to leverage their expertise and technology to address PFAS contamination on a global scale. By forging alliances with local stakeholders, government agencies, and international organizations, companies can navigate regulatory complexities, access new markets, and demonstrate the efficacy of their PFAS treatment solutions. In conclusion, the growing global concern over PFAS contamination represents a strategic opportunity for PFAS treatment companies to expand their footprint and make a meaningful impact on a global scale.

5.2.3.2 Significant government funding and support for PFAS research, development, and filtration efforts

The government's support for research & development (R&D) in PFAS filtration technologies is pivotal for fostering innovation. Government funding for PFAS research and development in the US and other countries has been significant in recent years. For instance, the EPA's PFAS Research Program has invested over USD 50 million in projects related to PFAS since 2019. Recently, US Rep. Mark Pocan announced federal funding of USD 963,000 for a new Center of Excellence in PFAS Environmental Science at the University of Wisconsin-Madison. EU also funds the various projects related to PFAS. Currently, the EU is funding the ZeroF project, which is being co-funded by the EU's Horizon Europe investment package for research projects and the Swiss State Secretariat for Education, Research and Innovation. This project involves 12 research and industry partners from nine countries to create a safe and sustainable alternative to PFAS. Additionally, agencies like the Environmental Protection Agency (EPA), the National Institutes of Health (NIH), and the National Science Foundation (NSF) allocate substantial funding to bolster research

initiatives aimed at addressing PFAS contamination and propelling the development of advanced filtration technologies.

These investments in R&D drive the development of cutting-edge PFAS filtration technologies, focusing on enhancing performance, affordability, and environmental sustainability. Collaborative efforts between researchers and industry partners explore novel materials, advanced filtration methods, and innovative treatment processes to tackle the challenges posed by PFAS contamination effectively. Government-funded research initiatives prioritize interdisciplinary approaches, bringing together experts from diverse fields such as chemistry, materials science, engineering, and environmental science. This collaboration enhances the understanding of PFAS behavior and facilitates the development of tailored filtration strategies to remove PFAS contaminants effectively from water sources. Therefore, the government's support for R&D in PFAS filtration technologies creates significant opportunities for market players to gain a competitive edge. By leveraging government-funded research and translating scientific advancements into practical filtration solutions, companies can position themselves at the forefront of the PFAS filtration market.

5.2.4 CHALLENGES

5.2.4.1 Proper management of treatment residuals generated during PFAS treatment

Proper management of treatment residuals generated during PFAS treatment presents multifaceted challenges stemming from both the nature of the contaminants and the treatment processes employed. Residuals are typically generated as byproducts of PFAS treatment methods such as adsorption, filtration, or chemical oxidation. These residuals often consist of concentrated PFAS compounds adsorbed onto treatment media, spent filter cartridges, or sludge from precipitation or coagulation processes.

The challenges associated with managing these residuals are manifold. Disposal of PFAS-laden residuals requires careful consideration due to the persistent and bioaccumulative nature of PFAS compounds, which pose long-term environmental risks if not handled properly. Conventional disposal methods such as landfilling may inadvertently contribute to the spread of PFAS contamination, as leaching from landfills can result in groundwater or surface water contamination. Incineration, another common disposal method, can release PFAS compounds into the atmosphere unless stringent emission controls are in place.

Moreover, the volume and composition of PFAS treatment residuals can vary widely depending on factors such as the type of treatment technology used, the concentration of PFAS contaminants in the source water, and the duration of treatment. Managing these diverse residuals requires tailored approaches and specialized expertise to ensure effective containment and minimize recontamination risks. Additionally, regulatory requirements governing the handling, transport, and disposal of PFAS residuals add complexity to the management process, requiring compliance with stringent standards to protect public health and the environment.

The improper management of PFAS treatment residuals can have far-reaching consequences, including the potential for recontamination of water sources, soil, or air, and the perpetuation of PFAS pollution. Inadequate disposal practices may also result in legal liabilities and reputational damage for companies involved in PFAS filtration activities. As such, the proper management of treatment residuals is essential to ensure the efficacy of PFAS treatment efforts and prevent unintended environmental harm.

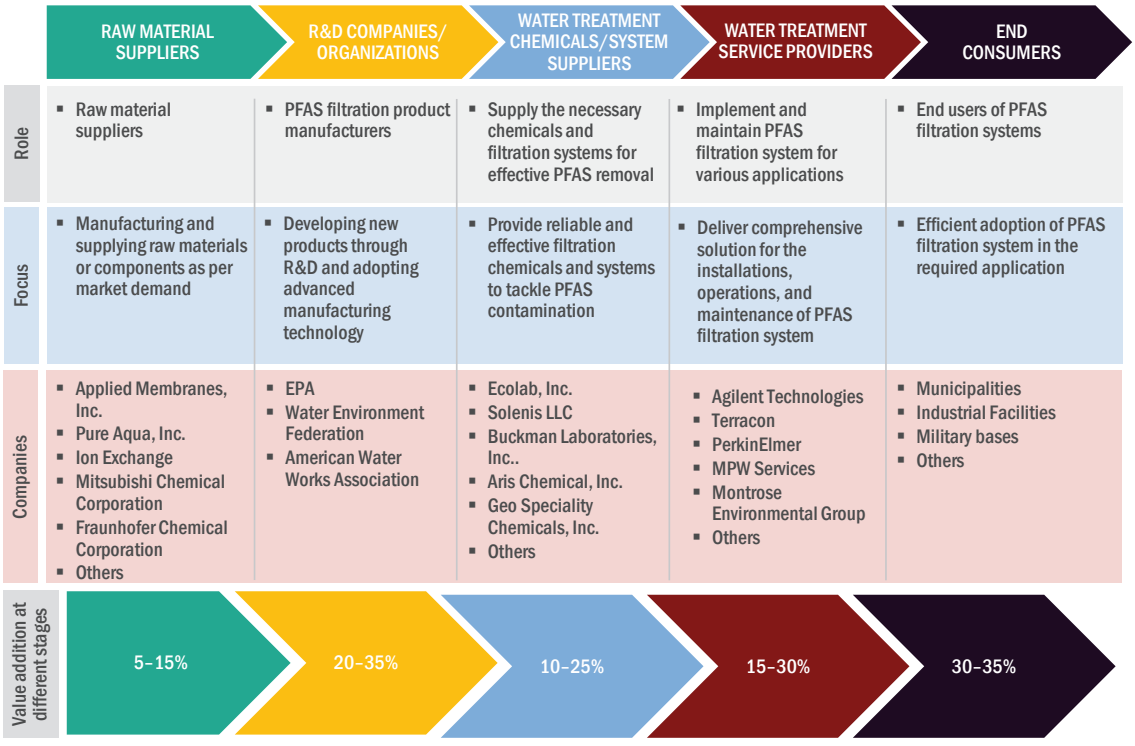
5.2.4.2 Addressing emerging PFAS compounds and understanding their potential risks and treatment requirements

Emerging PFAS compounds, such as GenX, PFBS, PFHxS, and PFHxA, are synthetic chemicals used in various industrial processes and consumer products as alternatives to legacy PFAS compounds like PFOA and PFOS. For instance, GenX is commonly used in the production of non-stick coatings, stain-resistant textiles, and firefighting foams. However, limited information is available regarding the toxicity, persistence, and environmental fate of these emerging compounds, making it challenging to assess their potential risks accurately. Studies suggest that emerging PFAS compounds may exhibit similar adverse health effects as legacy PFAS compounds, including reproductive and developmental issues, immune system disorders, and potential carcinogenicity. Exposure to GenX, for example, has been linked to adverse health effects such as liver and kidney damage, as well as developmental and reproductive toxicity in animal studies. Similarly, PFBS exposure has been associated with adverse effects on thyroid function and hormone disruption in laboratory animals. Therefore, understanding the treatment requirements for emerging PFAS compounds is crucial to developing effective filtration strategies. Treatment technologies such as advanced oxidation processes, ion exchange, and membrane filtration have shown promise in removing emerging PFAS compounds from contaminated water sources. However, ongoing research and monitoring efforts are needed to evaluate the efficacy of these treatment methods and ensure comprehensive protection of public health and the environment from the risks associated with emerging PFAS compounds.

5.3 VALUE CHAIN ANALYSIS

The value chain for PFAS filtration describes the entities involved in various manufacturing stages until water treatment service providers to end consumers. The value chain shows the value added to the product at each stage of production before the end-use industries finally utilize it. It also summarizes these entities' deliverables and explains their relationship with the preceding and succeeding manufacturers across the entire value chain. The value chain for PFAS filtration begins with raw material suppliers and ends with end users.

FIGURE 23 VALUE CHAIN ANALYSIS



Source: Secondary Research

5.3.1 RAW MATERIAL SUPPLIERS

Raw material suppliers are essential in the PFAS filtration value chain as they provide critical components like activated carbon, specialized polymers, and RO membranes required for manufacturing filtration systems. These suppliers ensure the availability of high-quality materials that meet stringent performance and regulatory standards, enabling downstream manufacturers to produce effective PFAS filtration products. Their role includes sourcing, quality assurance, and logistical support to maintain a reliable supply chain for the filtration industry's raw material needs. Some of the raw material suppliers in this market are Applied Membranes, Inc., Pure Aqua, Inc., Ion Exchange, Mitsubishi Chemical Corporation, and Fraunhofer USA CMW.

5.3.2 R&D COMPANIES AND ORGANIZATIONS

Research & development (R&D) companies play a critical role in the PFAS treatment market by driving innovation and advancing new technologies to address the complex challenges posed by these persistent chemicals. These companies focus on developing cutting-edge solutions, such as advanced filtration materials, electrochemical degradation techniques, and biofiltration strategies. By conducting rigorous scientific research and pilot testing, R&D firms help validate the effectiveness and safety of emerging PFAS filtration methods. Some of the R&D companies for PFAS filtration market are EPA, Water Environment Federation, and AWWA.

5.3.3 WATER TREATMENT CHEMICALS/SYSTEM SUPPLIERS

Suppliers of water treatment chemicals and systems specialize in manufacturing and distributing tailored solutions designed specifically for PFAS removal in water treatment applications. They offer a range of filtration systems, adsorbents like activated carbon and ion exchange resins, as well as specialized coagulants and flocculants. These suppliers ensure that water treatment facilities have access to reliable, efficient, and compliant technologies that meet regulatory standards for PFAS concentrations in treated water. Some of the water treatment chemicals/system suppliers in this market are Ecolab, Inc., Veolia, Calgon Carbon Corporation, Xylem, and Geo Specialty Chemicals, Inc.

5.3.4 WATER TREATMENT SERVICE PROVIDERS

Water treatment service providers play a critical role in the testing, implementation, operation, and maintenance of PFAS filtration systems. They specialize in installing and managing filtration technologies across water treatment plants, industrial facilities, and municipal networks, ensuring seamless system integration. Through regular maintenance schedules and comprehensive operational assessments, these providers monitor filtration system performance, identify issues promptly, and provide technical support to optimize filtration efficiency and reliability. Their expertise ensures that PFAS filtration systems operate effectively, delivering consistent water quality outcomes that meet regulatory requirements and customer expectations. Some of the water treatment service providers in this market are Agilent Technologies, Terracon, PerkinElmer, and MPW Service.

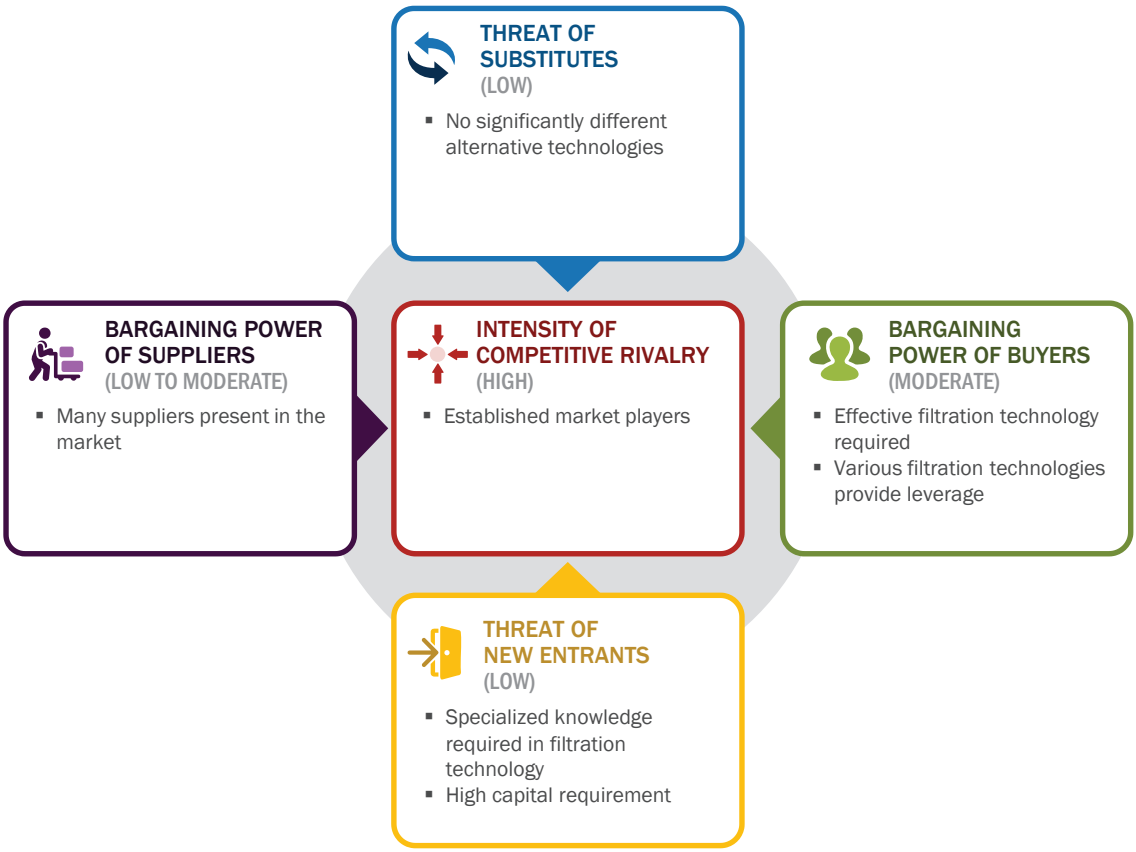
5.3.5 END USERS

End users are the ultimate consumers or businesses that utilize PFAS filtration-based products or systems in their operations. They rely on water treatment to remove harmful PFAS contaminants, ensuring compliance with health and environmental regulations. End consumers drive demand for effective filtration solutions by prioritizing water quality and sustainability in their operations and daily activities. End consumers of this market are municipalities, military, chemical, oil & gas, and pharmaceutical industries.

5.4 PORTER'S FIVE FORCES ANALYSIS

Porter's Five Forces analysis determines the competitive intensity and attractiveness of the PFAS filtration market. It helps in making decisions on entering and exiting a market. This section analyzes the market from five different perspectives: intensity of competitive rivalry, threat of new entrants, bargaining power of suppliers, bargaining power of buyers, and threat of substitutes.

FIGURE 24 PFAS FILTRATION MARKET: PORTER'S FIVE FORCES ANALYSIS



Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

5.4.1 THREAT OF NEW ENTRANTS

The threat of new entrants refers to the threat that the new players can pose to the current players in the PFAS filtration market. Establishing a business in the PFAS filtration market requires significant financial resources to invest in advanced technology, production facilities, and research and development. This high capital requirement is a substantial barrier to new entrants. Additionally, companies must navigate complex and stringent environmental regulations to ensure their filtration systems meet safety and efficacy standards. Obtaining the necessary certifications and approvals is both costly and time-consuming, further deterring new entrants. Furthermore, developing effective PFAS filtration solutions necessitates specialized knowledge in chemical engineering and environmental science. Acquiring this expertise is challenging and limits the entry of new competitors.

Considering all the factors, the threat of new entrants in the PFAS filtration market is low.

5.4.2 THREAT OF SUBSTITUTES

The threat of substitutes refers to any technology, product, or innovation that can entirely replace the use of current technology. Activated carbon, reverse osmosis, oxidation, and ion exchange are recognized as effective technologies for PFAS removal, and they are included as part of the current solutions in the PFAS filtration market. Since these are the primary methods of PFAS filtration, there are no significantly different alternative technologies threatening to replace them.

Therefore, the threat of substitutes in the PFAS filtration market is low.

5.4.3 BARGAINING POWER OF SUPPLIERS

The bargaining power of suppliers refers to the pressure that suppliers of raw materials can exert on the market players. While there is some concentration in the market for specific high-quality components like membranes and resins, there is a substantial number of suppliers providing the essential materials needed for PFAS filtration systems. This includes a wide array of suppliers offering activated carbon, various types of resins, and other necessary filtration materials. The presence of multiple suppliers for these key inputs reduces the bargaining power of any single supplier because manufacturers have the flexibility to switch between suppliers to secure the best deals.

Therefore, the bargaining power of suppliers in the PFAS filtration market is low to moderate.

5.4.4 BARGAINING POWER OF BUYERS

The bargaining power of buyers refers to the pressure that buyers can exert on the PFAS filtration manufacturers. As public awareness of PFAS contamination and its health risks grows, demand for effective filtration solutions increases. This increased awareness empowers buyers to demand higher quality and effectiveness from suppliers. Additionally, buyers can choose from various filtration technologies, such as activated carbon filters, ion exchange resins, and reverse osmosis systems. The availability of these alternatives gives buyers leverage to negotiate better prices and terms.

Therefore, the bargaining power of buyers in the PFAS filtration market is moderate.

5.4.5 INTENSITY OF COMPETITIVE RIVALRY

The intensity of competitive rivalry in the PFAS filtration market is notably high due to the presence of numerous global players competing fiercely for market share. The industry is populated with numerous established players, increasing the intensity of competition. High exit barriers due to significant investments in specialized equipment and long-term contracts further contribute to the intensity of competition as companies strive to remain viable.

Hence, the intensity of competitive rivalry in the PFAS filtration market is high.

TABLE 2 PFAS FILTRATION MARKET: PORTER'S FIVE FORCES ANALYSIS

PORTER'S FIVE FORCES	IMPACT
Intensity of Competitive Rivalry	High
Bargaining Power of Suppliers	Low to Moderate
Bargaining Power of Buyers	Moderate
Threat of Substitutes	Low
Threat of New Entrants	Low

5.5 PATENT ANALYSIS

Patent analysis in the PFAS filtration market involves a systematic evaluation of patents related to PFAS filtration technology. This analysis provides insights into innovations, manufacturing processes, and their diverse applications. Studying patents can reveal emerging technologies, trends, and competitors in the PFAS filtration market. This valuable information includes strategic decisions for businesses, researchers, and stakeholders seeking to understand the technological landscape and potential growth opportunities.

5.5.1 METHODOLOGY

This patent analysis offers crucial insights into patent filing, business interests, and patenting activities year-wise and country-wise. The developing trends of products or technologies can be identified by analyzing patent information. Patent analysis is a technique and tool to research the knowledge contained in patents. This study defines patents claiming inventions linked to "PFAS Filtration." A well-planned strategy was devised in this study. The patents were categorized and analyzed using the keyword "PFAS Filtration" which is contained in the Patent "Title OR Abstract OR Claim." Since this chapter aims to provide an overview of patenting activity in the title, abstract, or claim area, the source used for this analysis is *The Lens - Patent and Scholarly Search.*

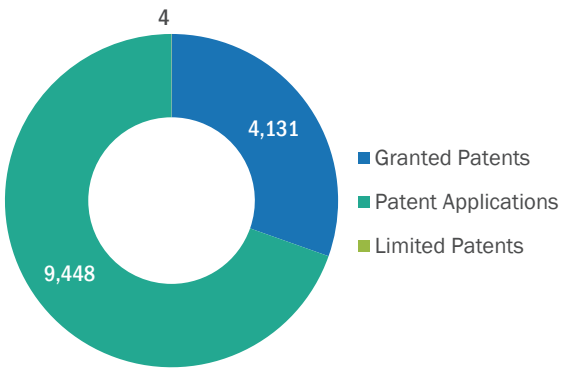
5.5.2 DOCUMENT TYPES

This section presents an analysis of "PFAS Filtration" patents registered from 2014 to 2023. During this period, approximately 13,583 patent counts were registered. Limited patents and patent protection are granted for a limited period, generally 20 years from the filing date of the application.

Granted patents are important for individual inventors, the business community, and the economy at large. These patents encourage development and new ideas. They make new inventions available to the public.

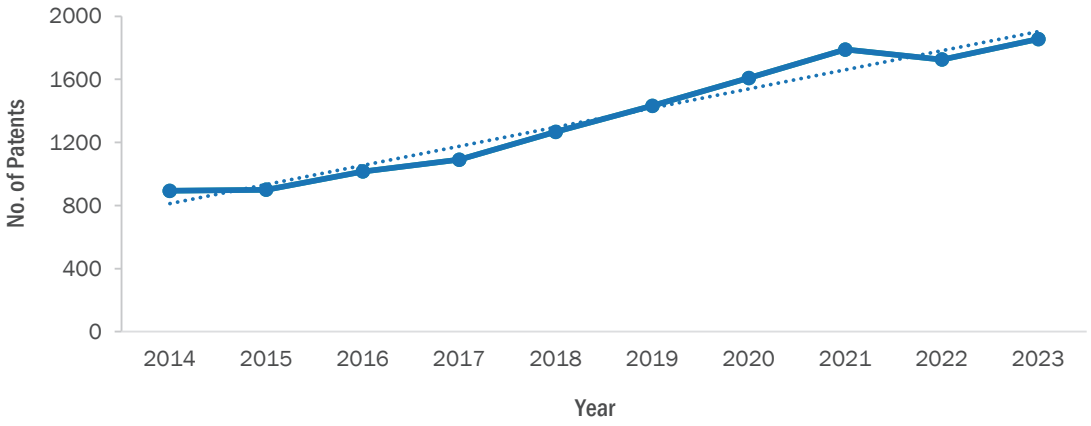
The granted patents accounted for 30% of the total patent count in the last 10 years.

FIGURE 25 GRANTED PATENTS



Source: The Lens - Patent and Scholarly Search

5.5.3 PUBLICATION TRENDS IN LAST 10 YEARS

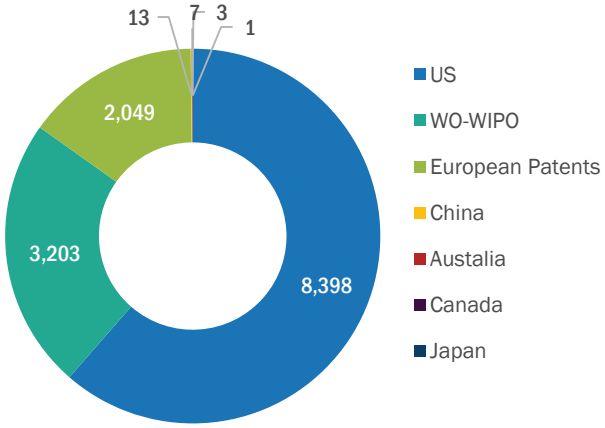


Source: The Lens - Patent and Scholarly Search

5.5.4 INSIGHTS

The study was conducted to monitor the trend of patenting activity of PFAS filtration from 2014 to 2023 worldwide based on 13,583 patents. Global patenting trend analysis demonstrates an overall uptrend. A decline in patent activity was observed during 2021–2022, but a continuous upgrade occurred during 2015–2021.

5.5.5 JURISDICTION ANALYSIS



Source: The Lens - Patent and Scholarly Search

Patents are valid only in the jurisdiction that grants them. This, in turn, implies that regardless of the strength of statutory patent protection, the same invention may be patent protected in one jurisdiction but not in another.

Jurisdiction analysis is performed to have a better understanding of the PFAS filtration interests of different jurisdictions between 2014 and 2023. The data of the last 10 years clearly indicates major patenting activity for the jurisdictions of the US and Wo-Wipo European Patents.

5.5.6 TOP 10 PATENT OWNERS IN LAST 10 YEARS

SR. NO.	TOP 10 PATENT OWNERS	NO. OF PATENTS
1	Novozymes A/S	247
2	Fujifilm Corporation	205
3	Iovance Biotherapeutics Inc.	141
4	Biogen Inc.	117
5	The Regents of the University of California	115
6	AGC Inc.	109
7	Massachusetts Institute of Technology	96
8	Canon Kabushiki Kaisha	95
9	Daikin Industries Ltd.	77
10	Entegris Inc.	75

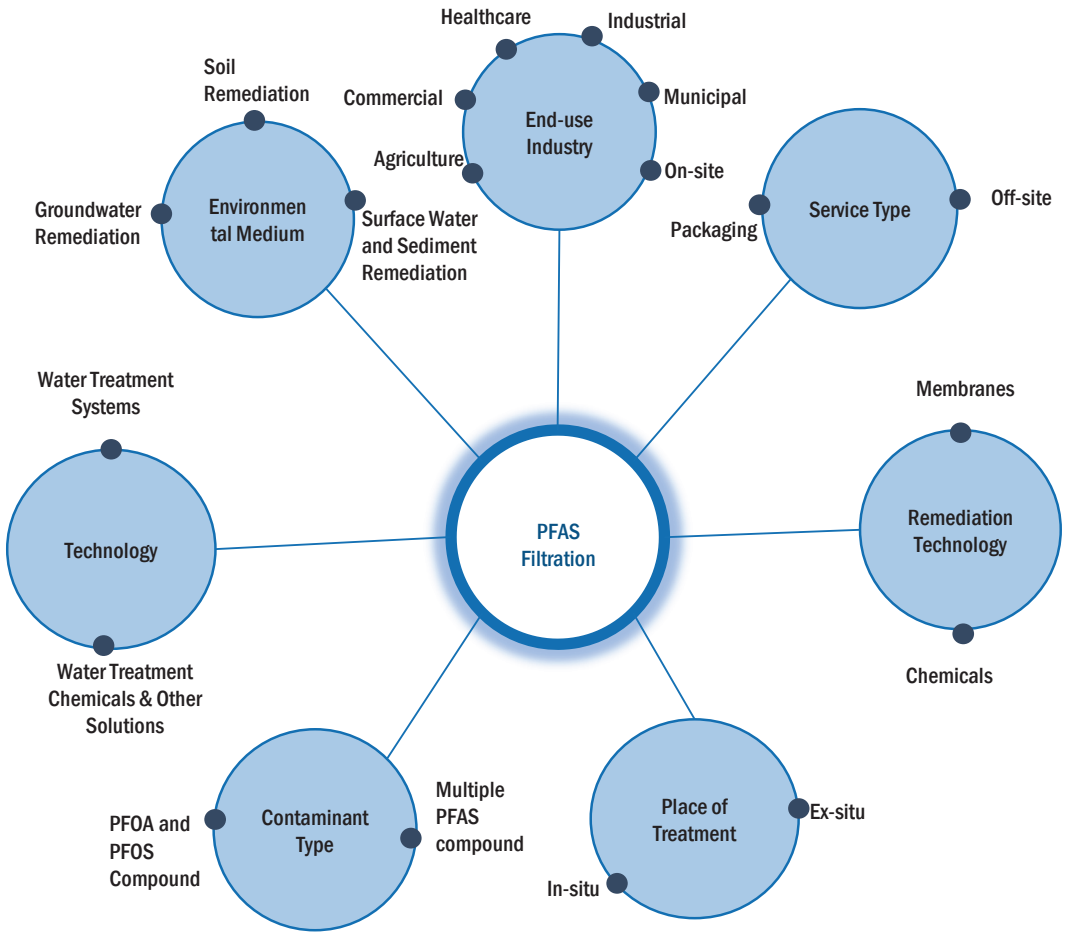
Source: The Lens - Patent and Scholarly Search

Disclaimer: The main purpose of this chapter is to provide basic information on the patent activity. The criteria supported by different search services may vary. Accordingly, individual results also may vary.

5.6 ECOSYSTEM/MARKET MAP

The ecosystem generally includes all the related technology, filtration technology, place of treatment, environmental medium, contaminant type, service type, end-use industry, and other related markets that influence the PFAS filtration market.

FIGURE 26 PFAS FILTRATION MARKET ECOSYSTEM



Source: Primary Research and MarketsandMarkets Analysis

The PFAS filtration ecosystem comprises raw material suppliers, who supply various raw materials to the manufacturers; manufacturers, who research & develop the final products for use in various industries; and intermediaries & distributors, who provide a link between the manufacturers and end users by supplying the final products. They work together to supply the final products to the end users in different industries. It involves a series of processes, beginning with raw material procurement from suppliers to manufacture the end products and distribute them to end users for further use in various applications.

TABLE 3 PFAS FILTRATION: ECOSYSTEM

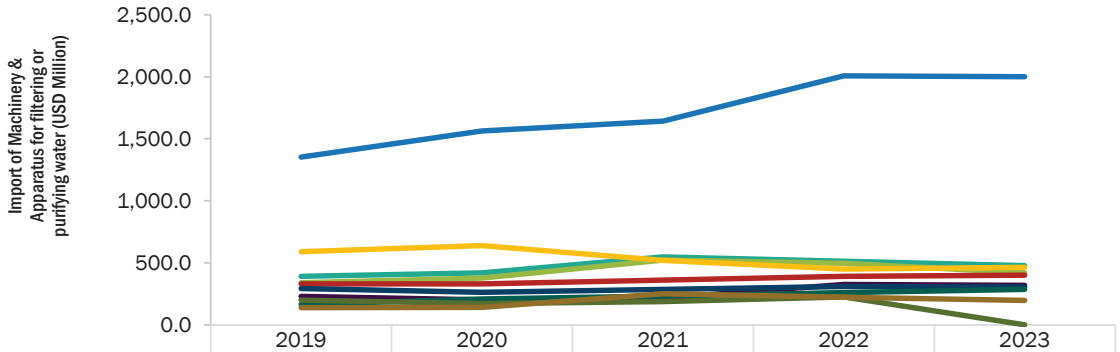
COMPANY	ROLE IN ECOSYSTEM
Veolia	Product Manufacturing
AECOM	Product Manufacturing
WSP	Product Manufacturing
Applied Membrane, Inc.	Raw Material
Ion Exchange	Raw Material
Ecolab	Water Treatment Chemical/System Suppliers
Solenis, LLC	Water Treatment Chemical/System Suppliers

5.7 TRADE ANALYSIS

5.7.1 IMPORT SCENARIO OF MACHINERY AND APPARATUS FOR FILTERING OR PURIFYING WATER

The worldwide import of machinery and apparatus for filtering or purifying water was valued at ~USD 10,989.17 million in 2022. Among the available data for the countries given below, the US led the imports in 2022, which were valued at ~USD 2,007.1 million, followed by Germany, with imports valued at ~USD 512,9 million. The table below provides the import data for HS code 842121 in various key countries from 2019 to 2023. Trade data is restricted to machinery and apparatus for filtering or purifying water.

FIGURE 27 IMPORT OF MACHINERY AND APPARATUS FOR FILTERING OR PURIFYING WATER, BY KEY COUNTRY, 2019–2023



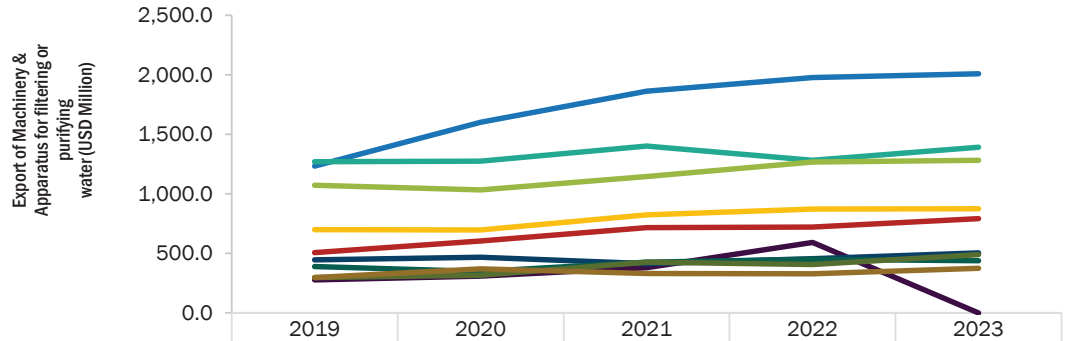
	2019	2020	2021	2022	2023
US	1,352.1	1,563.9	1,642.2	2,007.1	1,999.7
Germany	390.9	418.9	548.4	512.9	477.4
France	338.9	377.8	521.1	495.7	419.6
China	590.3	638.8	519.0	449.7	464.0
Canada	329.0	330.2	360.6	391.3	400.1
UK	229.5	202.3	215.4	325.5	318.3
Malaysia	293.5	262.1	284.5	309.5	304.5
Italy	164.5	208.1	232.7	260.8	285.1
Mexico	199.3	170.7	186.8	224.3	-
Belgium	137.7	139.4	249.7	222.1	197.7

Source: ITC Trade Data

5.7.2 EXPORT SCENARIO OF MACHINERY AND APPARATUS FOR FILTERING OR PURIFYING WATER

The worldwide export of machinery and apparatus for filtering or purifying water was valued at ~USD 11,887.6 million in 2022. Among the available data for the countries given below, China led the exports in 2022, which were valued at ~USD 1,977.2 million, followed by Germany, with exports valued at ~USD 1,281.8 million. The table below provides the export data for HS code 842121 in various key countries from 2019 to 2023. Trade data is restricted to machinery and apparatus for filtering or purifying water.

FIGURE 28 EXPORT OF MACHINERY AND APPARATUS FOR FILTERING OR PURIFYING WATER, BY KEY COUNTRY, 2019–2023



	2019	2020	2021	2022	2023
China	1,232.7	1,600.2	1,861.9	1,977.2	2,007.2
Germany	1,269.9	1,274.8	1,400.7	1,281.8	1,390.4
US	1,071.1	1,034.2	1,144.5	1,267.7	1,281.6
Korea, Republic of	700.0	696.2	823.2	871.6	873.7
Italy	507.0	605.1	716.9	720.6	791.6
Israel	277.8	308.8	379.1	592.9	-
Canada	446.3	467.6	414.6	456.2	504.7
France	390.9	348.3	426.0	450.7	437.8
Netherlands	298.3	317.8	427.0	406.5	490.9
Spain	296.8	371.4	331.6	328.1	374.7

Source: ITC Trade Data

5.8 MACROECONOMIC OVERVIEW AND KEY TRENDS

This section analyzes the key economic factors that affect the PFAS filtration market. It covers gross domestic product (GDP) trends and forecasts in North America, Europe, Asia Pacific, South America, and the Middle East & Africa, and their impact on the PFAS filtration market.

5.8.1 GDP TRENDS AND FORECASTS

GDP represents the monetary value of all goods and services produced in a country over a period. It is mainly used to determine the economic performance of a region or a country. The following table shows the growth of GDP at the current prices of various countries between 2023 and 2029.

TABLE 4 PROJECTED REAL GDP GROWTH (ANNUAL PERCENTAGE CHANGE) OF KEY COUNTRIES, 2023–2029

Country	2023	2024	2025	2026	2027	2028	2029
Australia	2.1	1.5	2	2.1	2.2	2.2	2.3
Brazil	2.9	2.2	2.1	2.1	2	2	2
Canada	1.1	1.2	2.3	1.9	1.7	1.7	1.7
Chile	0.2	2	2.5	2.4	2.3	2.3	2.3
China	5.2	4.6	4.1	3.8	3.6	3.4	3.3
Egypt	3.8	3	4.4	4.7	5.1	5.5	5.6
France	0.9	0.7	1.4	1.6	1.5	1.4	1.3
Germany	-0.3	0.2	1.3	1.5	1.1	0.8	0.7
India	7.8	6.8	6.5	6.5	6.5	6.5	6.5
Indonesia	5	5	5.1	5.1	5.1	5.1	5.1
Italy	0.9	0.7	0.7	0.2	0.3	0.8	0.8
Japan	1.9	0.9	1	0.8	0.6	0.6	0.4
Malaysia	3.7	4.4	4.4	4.4	4	4	4
Mexico	3.2	2.4	1.4	1.9	2.1	2.1	2.1
Netherlands	0.1	0.6	1.3	1.9	1.9	1.8	1.6
Norway	0.5	1.5	1.9	1.7	1.6	1.4	1.4
Peru	-0.6	2.5	2.7	2.3	2.3	2.3	2.3
Russia	3.6	3.2	1.8	1.2	1.3	1.2	1.3
Saudi Arabia	-0.8	2.6	6	4	3.5	3	3.5
South Africa	0.6	0.9	1.2	1.4	1.4	1.4	1.4
Spain	2.5	1.9	2.1	1.8	1.6	1.6	1.6
UAE	3.4	3.5	4.2	4.3	4.4	4.5	4.5
UK	0.1	0.5	1.5	1.7	1.7	1.6	1.4
US	2.5	2.7	1.9	2	2.1	2.1	2.1

Source: International Monetary Fund (IMF)

5.9 TECHNOLOGY ANALYSIS

The technology landscape surrounding PFAS filtration is diverse and continually evolving, marked by various innovations aimed at advancing sustainable materials. Key technologies contributing to the development and adoption of PFAS filtration include coated sand, foam fractionation, modified clay technology, zeolite, and clay minerals.

5.9.1 COATED SAND

Coated sand technology is an emerging and promising method for PFAS (per- and polyfluoroalkyl substances) filtration. This innovative approach involves using sand particles coated with specialized materials that have a high affinity for PFAS compounds. These coated sands can effectively capture and immobilize PFAS from contaminated water sources, offering a cost-effective and scalable solution for addressing this pervasive environmental issue. Coated sand technology is being tested in pilot projects across the US. For example, municipal water treatment plants in areas with significant PFAS contamination are exploring this technology as a part of their treatment train to ensure safe drinking water. Additionally, industrial sites and military bases with known PFAS issues are considering coated sand as a viable filtration option.

5.9.2 FOAM FRACTIONATION

Foam fractionation, also known as froth flotation, is a process used to separate hydrophobic particles from hydrophilic ones by using a rising column of bubbles. This technique has gained traction in the field of environmental filtration, particularly for the removal of PFAS. In foam fractionation, air is introduced into a column containing the contaminated water. The PFAS, which have hydrophobic properties, adhere to the air bubbles, and are carried to the surface, forming a foam. This foam, enriched with PFAS, is then removed, resulting in cleaner water. The process is advantageous due to its simplicity, low energy requirement, and effectiveness in concentrating PFAS from large volumes of water.

Several companies have adopted foam fractionation for PFAS filtration. One of the prominent companies is Evoqua Water Technologies. Evoqua offers foam fractionation systems designed to treat water contaminated with PFAS, utilizing its expertise in water treatment and purification technologies. Another key player is Clean TeQ Water, which provides a foam fractionation solution called CIF (Continuous Ionic Filtration) specifically designed to remove PFAS from water sources. Additionally, Battelle, a major research and development organization, has been involved in advancing foam fractionation technologies for PFAS removal. They have conducted extensive research and pilot projects to optimize the process for different water matrices and PFAS concentrations.

5.9.3 MODIFIED CLAY TECHNOLOGY

Modified clay technology involves the use of naturally occurring or engineered clays that have been treated to enhance their ability to adsorb contaminants like PFAS. In North America, several companies are at the forefront of developing and implementing modified clay technologies for PFAS filtration. CETCO, a division of Minerals Technologies Inc., offers a range of products based on their proprietary modified clay technology, including FLUORO-SORB, which is specifically designed to capture and remove PFAS from water. FLUORO-SORB is used in various applications, from large-scale groundwater treatment systems to point-of-use filters.

5.9.4 ZEOLITE & CLAY MINERALS

Zeolites and clay minerals are increasingly recognized for their potential in PFAS (per- and polyfluoroalkyl substances) filtration due to their unique structural properties and high adsorption capacities. These naturally occurring materials can be engineered or modified to enhance their affinity for PFAS compounds, providing an effective and sustainable solution for mitigating contamination in water sources. Both zeolites and modified clays exhibit a high capacity for adsorbing PFAS, even at low concentrations, making them highly effective in reducing contamination levels.

5.10 TARIFF & REGULATORY LANDSCAPE

5.10.1 REGULATIONS

5.10.1.1 North America

- In April 2024, the EPA finalized National Primary Drinking Water Regulation for PFAS. The regulatory body sets enforceable Maximum Contaminant Levels (MCLs) for six PFAS chemicals in drinking water, impacting millions of Americans.
- In April 2024, the U.S. Environmental Protection Agency (EPA) proposes to designate seven PFAS and their related salts as hazardous substances under the Environmental Response, Compensation & Liability Act (CERCLA), also known as the Superfund law. This classification would mandate reporting and cleanup responsibilities for responsible parties in case of a release.
- In January 2023, the EPA released revised Effluent Limitation Guidelines (ELGs) to control PFAS discharges from industries, including landfills and textile manufacturing. These guidelines are part of the EPA's ongoing efforts to reduce the environmental impact of PFAS and protect water quality.
- Additionally, the EPA has proposed a law to require the reporting of PFAS in products at any concentration, rather than at levels greater than 1% or 10,000 mg/kg.
- In October 2021, the Biden-Harris Administration's PFAS Strategic Roadmap is a comprehensive federal strategy aimed at addressing per- and polyfluoroalkyl substances (PFAS) contamination through various agencies like the Department of Defense (DoD), Department of Health (DoH), and others.
- The EPA is initiating regulation of discharge permits for PFAS into surface water through the National Pollutant Discharge Elimination System (NPDES) and Toxics Release Inventory (TRI) Programs. Furthermore, the EPA plans to establish maximum contaminant levels for drinking water for six PFAS compounds, with proposed levels for PFOA and PFOS as low as 4 nanograms per liter.
- States such as California in 2020 passed a law (SB-1044) that requires manufacturers of cookware, bakeware, and other products to disclose whether they contain PFAS chemicals.
- California's Proposition 65 law requires warning labels on consumer products containing certain chemicals, including PFAS, known to cause cancer, birth defects, or reproductive harm. PFAS such as Perfluorooctanoic acid (PFOA), Perfluorooctanesulfonic acid (PFOS), and Perfluorononanoic acid (PFNA) are included on the Proposition 65 warning list.
- Additionally, California prohibits the sale or distribution of food packaging and children's products with intentionally added PFAS.
- Colorado prohibits the sale or distribution of products with intentionally added PFAS, spanning carpets, rugs, food packaging, oil & gas products, and children’s items.

- It also implements specific restrictions on PFAS in cookware and adopts a phased approach to PFAS regulations, gradually extending to additional products like cosmetics, indoor, and outdoor textile furnishings.
- Connecticut prohibits the intentional addition of PFAS to food packaging and imposes restrictions on its use in Class-B firefighting foam.
- Hawaii forbids the manufacturing, sale, distribution, and usage of wraps, liners, plates, food boats, and pizza boxes with intentionally added PFAS. Additionally, under specific circumstances, the state imposes limitations on the utilization of firefighting foams containing PFAS.
- Maine bans the sale of carpets, rugs, and fabric treatments with intentionally added PFAS. Moreover, the state has amended its existing PFAS reporting law, incorporating significant changes, and extending the reporting deadline to January 1, 2025.
- Maryland prohibits the intentional addition of PFAS in the manufacturing, distribution, or sale of carpets, rugs, food packaging, and Class-B firefighting foams.
- Minnesota prohibits the intentional manufacture, sale, or distribution of food packaging containing PFAS additives.
- In 2020, New York passed the "Child Safe Products Act," which mandates producers of children's products to disclose whether their products contain PFAS chemicals. The state also banned the use of PFAS in firefighting foam and is considering additional regulations related to PFAS in drinking water.
- In 2020, Michigan passed a law in which public water systems in the state are now required to test for PFAS and report the results to the state.
- Washington has implemented regulations banning various types of food packaging with intentionally added PFAS, encompassing packaging wraps, liners, plates, food boats, pizza boxes, and similar items. Additionally, the state has imposed restrictions on the utilization of PFAS in firefighting foam.
- In 2021, Canada published various regulations that prohibit the producers, use, sale, and import of PFOA and its salts, as well as certain other related compounds, except under specific circumstances. These regulations also require reporting of certain information by producers and importers of these substances.
- The country has designated PFOS, PFOA, and their salts as toxic substances under the Canadian Environmental Protection Act (CEPA), 1999, which enables the government to take action to manage and reduce their risks to human health and the environment.
- Provinces and territories such as Ontario, Quebec, and British Columbia sets maximum acceptable concentrations for PFOS and PFOA in drinking water.

5.10.1.2 Europe

- In 2020, the European UNION (EU) introduced the restriction on the production, use, and placing on the market of certain PFAS under REACH regulations (the Regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals).
- The EU also proposed an extensive change to the REACH Annex XVII, which could lead to a ban of over 10,000 PFAS.

- The German Federal Environment Agency (UBA) has identified PFAS as one of the priority substances of concern and has set up a comprehensive regulatory framework to address their use and impact. It includes measures such as restricting the use of certain PFAS in consumer products, implementing stricter waste management requirements, and monitoring PFAS levels in the environment.
- France has implemented a national strategy to minimize exposure to PFAS, including certain measures such as phasing out the use of PFAS in some applications and increasing monitoring of PFAS levels in the environment.
- The Italian National Health Institute (ISS) established a threshold limit of 8 nanograms per milliliter (ng/mL) for PFOA in human blood.

5.10.1.3 Asia Pacific

- In 2021, China added PFAS-containing firefighting foam to its hazardous waste list, which made it necessary to handle and dispose of it in accordance with hazardous waste regulations.
- The RoHS directive in China prohibits the use of certain hazardous materials, including PTFE, in electrical and electronic products.
- The Cleaner Production Promotion Law in China encourages companies to adopt cleaner production methods, including reducing the use of hazardous substances like PFAS and PTFE.
- China revised its drinking water guidelines to include tighter restrictions on PFAS, including PFOA (perfluorooctanoic acid) and PFOS (perfluorooctane sulfonate).
- In 2019, under the Chemical Substance Control Law, the Japanese government designated PFOS and PFOA as "specified chemical substances." The regulations require companies to notify on the production, import, and use of these substances above a certain threshold.
- In 2020, under the Registration and Evaluation of Chemicals Act, South Korea designated PFOS and PFOA as "harmful substances."
- In 2020, the Thai government issued a notification designating perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) as hazardous substances under the Hazardous Substances Act. The notification prohibits the import, export, and production of PFOS and PFOA above a certain threshold without prior approval.
- In 2018, Australia's federal government published the PFAS National Environmental Management Plan (PFAS NEMP) to guide the management of PFAS contamination in Australia.

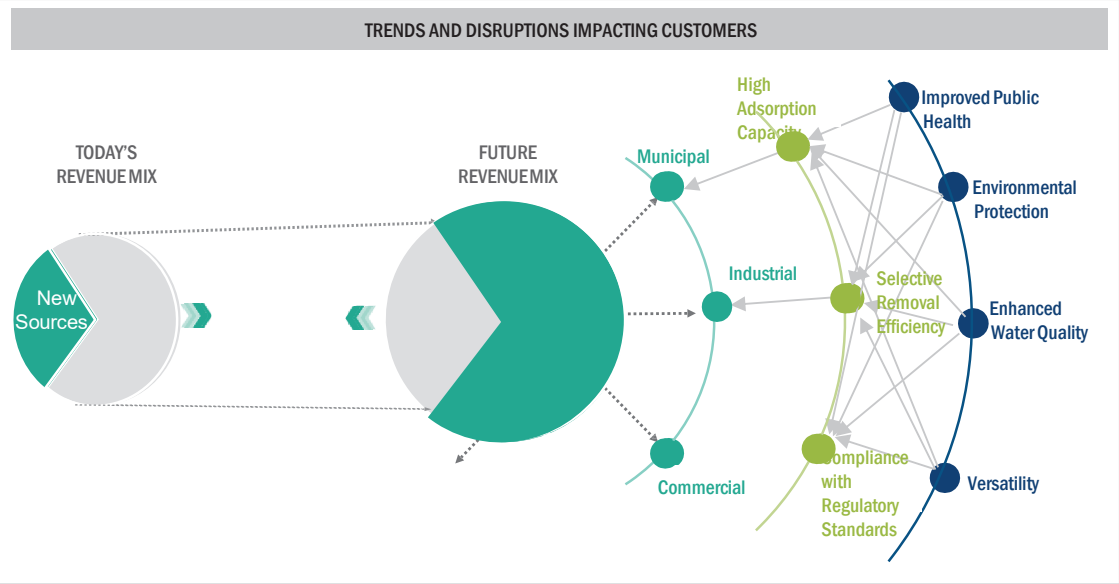
5.10.1.4 Middle East & Africa and South America

- The UAE has established regulations to control the use of PFAS and PTFE in products, including food packaging materials, and has set limits on their levels.
- Under the Stockholm Convention, South Africa needs to take measures to minimize and eliminate the production, use, and release of POPs, including PFOS and PFOA.
- In 2020, Brazil's government issued a resolution banning the use of PFAS in food packaging materials, including coatings, adhesives, and other substances.
- In 2018, the Argentinian government released "National Management Plan for Chemicals," which identifies PFAS and PFOA as priority substances for regulation and management. It also aims to develop a national inventory of PFAS and PFOA use in Argentina, and to establish control measures to prevent their release into the environment.

5.11 TRENDS/DISRUPTIONS IMPACTING CUSTOMER'S BUSINESS

The chemical industry is always changing and evolving. Every year, new trends emerge and are adopted within the industry, from technological advancements in the PFAS filtration industry to a stronger focus on sustainability. End users (such as municipal, industrial) look for cost-effective and sustainable solutions.

FIGURE 29 TRENDS/DISRUPTIONS IMPACTING CUSTOMER'S BUSINESS IN PFAS FILTRATION MARKET



Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

5.12 KEY CONFERENCES & EVENTS IN 2024–2025

This section includes key conferences and events related to the PFAS filtration market.

TABLE 5 PFAS FILTRATION MARKET: KEY CONFERENCES & EVENTS, 2024–2025

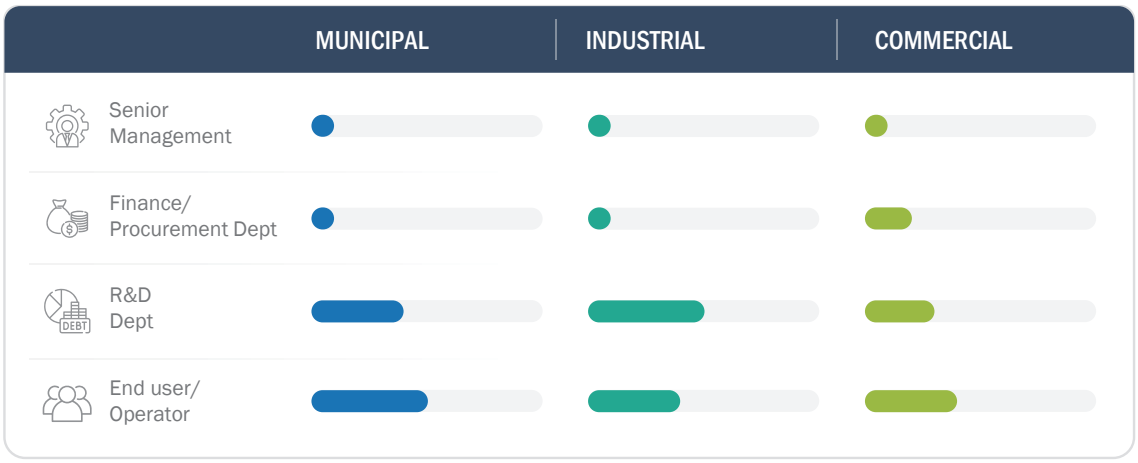
YEAR/ QUARTER	NORTH AMERICA	EUROPE	ASIA PACIFIC	REST OF THE WORLD
Q2' 24	(May) https://conferenceindex.org/event/international-conference-on-wastewater-icw-2024-may-new-york-us (June) https://conferenceindex.org/event/international-conference-on-wastewater-icw-2024-june-montreal-ca	(May) https://conferenceindex.org/event/international-conference-on-wastewater-icw-2024-may-barcelona-es (June) https://conferenceindex.org/event/international-conference-on-wastewater-icw-2024-june-barcelona-es	(June) https://conferenceindex.org/event/international-conference-on-wastewater-icw-2024-june-tokyo-jp https://conferenceindex.org/event/international-conference-on-wastewater-icw-2024-june-melbourne-au	
Q3' 24	(July) https://conferenceindex.org/event/international-conference-on-wastewater-icw-2024-july-new-york-us	(August) https://conferenceindex.org/event/international-conference-on-wastewater-icw-2024-august-edinburgh-gb	(July) https://conferenceindex.org/event/international-conference-on-wastewater-icw-2024-july-tokyo-jp	
Q4' 24	(October) https://conferenceindex.org/event/international-conference-on-wastewater-icw-2024-october-new-york-us	(October) https://conferenceindex.org/event/international-conference-on-wastewater-icw-2024-october-florence-it	(November) https://conferenceindex.org/event/international-conference-on-wastewater-icw-2024-november-melbourne-au	
Q1' 25	(January) https://conferenceindex.org/event/international-conference-on-wastewater-icw-2025-january-san-diego-us	(February) https://conferenceindex.org/event/international-conference-on-wastewater-icw-2025-february-barcelona-es	(January) https://conferenceindex.org/event/international-conference-on-water-purification-and-wastewater-technologies-icwpwt-2025-january-tokyo-jp	
Q2' 25	(April) https://conferenceindex.org/event/international-conference-on-wastewater-treatment-technologies-icwtt-2025-april-cancun-mx	(May) https://conferenceindex.org/event/international-conference-on-wastewater-icw-2025-may-paris-fr	(April) https://conferenceindex.org/event/international-conference-on-wastewater-icw-2025-april-toronto-au	

Source: Secondary Research

5.13 KEY STAKEHOLDERS & BUYING CRITERIA

The marketing mix has four components: product, pricing, promotion, and place of distribution. Each component has a direct or indirect impact on the buying decisions of consumers. Consumers mainly consider two things, the quality of the product and services, including the price, availability of the product at the required location, and transportation cost.

FIGURE 30 INFLUENCE OF STAKEHOLDERS ON BUYING PROCESS FOR TOP 3 END-USE INDUSTRIES



5.13.1 KEY STAKEHOLDERS IN BUYING PROCESS

TABLE 6 INFLUENCE OF INSTITUTIONAL BUYERS ON BUYING PROCESS FOR TOP 3 END-USE INDUSTRIES

Key Stakeholder	Municipal	Industrial	Commercial
Senior Management	10%	10%	10%
Finance/Procurement Department	10%	10%	20%
R&D Department	40%	50%	30%
End-user/Operators	50%	40%	40%
Total	**100%**	**100%**	**100%**

Note: This study section is based on insights obtained through primary interviews.

Source: Secondary Research, Interviews with Experts, MarketsandMarkets Analysis

5.13.2 BUYING CRITERIA

5.13.2.1 Quality

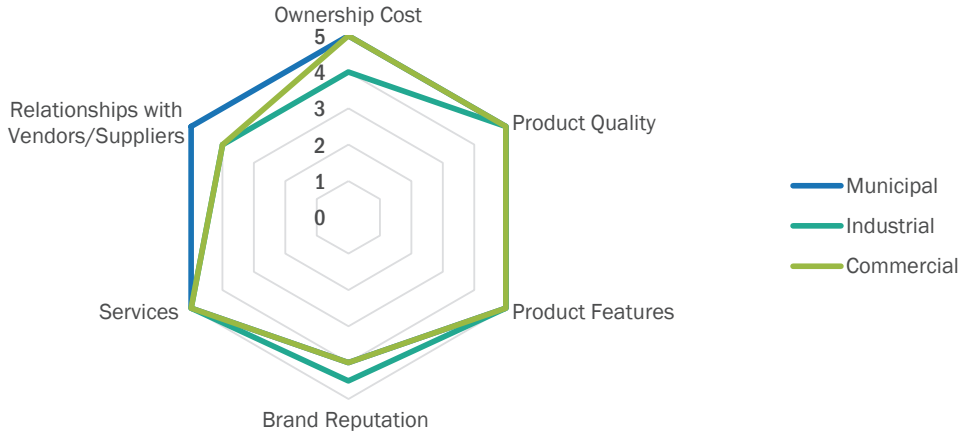
Quality is one of the primary parameters consumers consider before buying any raw material to produce finished goods. It is the product's performance characteristics according to the producer's commitment to the consumer. Products' unmet demand from various end-use industries will impact consumers' buying decisions in terms of quality. Hence, manufacturing companies are focused on delivering excellent quality and characteristics of the product through innovations and extensive R&D to sustain themselves in the competitive market.

5.13.2.2 Service

Service is another critical parameter that affects the buying decisions of consumers. It is the factor that is mainly taken into consideration to run the supply chain smoothly. This includes technological support, lead time, credit period, R&D support, domestic availability, geographic penetration, wider product portfolio, sustainability, adherence to government standards, and operational efficiency.

Consumers prefer companies offering products at a lower price with a diversified product portfolio. Manufacturers also consider the easy availability of raw materials along with complete technical and R&D support after purchases. The following figure depicts the ratings of the parameters based on primary and secondary inputs.

FIGURE 31 SUPPLIER SELECTION CRITERION



Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 7 KEY BUYING CRITERIA FOR TOP 3 END-USE INDUSTRIES

Buying Criteria	Municipal	Industrial	Commercial
Ownership Cost	5	4	4
Product Quality	5	5	5
Product Features	5	5	5
Brand Recognition/Reputation	4	4.5	4
Service	5	5	5
Relationship with Supplier/Vendor	5	4	4

Note: Respondents rated each criterion on a scale of 1–5, where 1 indicates Least Important, and 5 indicates Most Important or Critical.

- **Price:** Price plays a vital role in product demand. Increased prices typically result in lower demand, and demand increases generally lead to increased supply. Hence, the product's price is crucial in determining the service demand from the end-use industry.
- **Product Performance:** Product performance is another critical parameter impacting consumers' decisions. The higher the product performance, the greater the product demand and brand value in the market.
- **R&D Support:** Companies that offer R&D support help manufacturers stay competitive in the market by offering innovations in terms of technology and services.
- **Technical Support:** Maintenance and technical upgradation of the products are also important for supplier selection.
- **Brand:** Consumers prefer to buy the most well-known brand. Strong brand images improve perceptions of quality and benefits, reduce perceived risk, and soften the consumer tendency to evaluate only based on price. Consistent marketing and advertising help create emotional ties, thereby leading to the trust and loyalty of the consumer. These factors improve consumer purchase intentions.

5.14 CASE STUDY ANALYSIS

This section deals with practical application scenarios from various manufacturers and researchers.

5.14.1 VEOLIA

- **Background:** Veolia is a leader in environmental services. It provides a complete range of solutions for managing water, waste, and energy. The company offers PFAS filtration through its subsidiary, Veolia Water Technologies. The company has developed and introduced a range of treatment and PFAS filtration technologies to address contamination in each of the industrial, military, and municipal applications. The company has developed three technologies, namely, carbon adsorption, specialty anion ion exchange resin, and reverse osmosis or nanofiltration.
- **Challenge:** The company's customer had a challenging mix of PFAS materials in their process water. The customer needed to reduce PFAS levels quickly and efficiently to comply with regulatory standards.

- **Solution:** Veolia engineers inspected the whole process. After testing, Veolia identified PFOS, PFOA, PFNA, PFHpA, and PPFA together with other interfering components. Veolia engineers conducted extensive modeling of various treatment and concentration mechanisms to determine the optimal solution. The company suggested RO technology to meet customer challenges. RO is an effective treatment process. It would be able to treat the PFAS materials greater than 99.9%.

5.14.2 EVOQUA WATER TECHNOLOGIES

- **Background:** The Cape Fear Public Utility Authority (CFPUA) in Wilmington, North Carolina, faced a significant public health crisis when high levels of PFAS, particularly GenX, were detected in the Cape Fear River, the primary source of drinking water for over 200,000 residents. The contamination was traced back to industrial discharges from a nearby chemical manufacturing plant.
- **Challenge:** The primary challenge for CFPUA was to quickly reduce PFAS levels in drinking water to meet the strict safety standards imposed by regulatory authorities. Additionally, the utility needed to restore public confidence in the safety of its water supply while managing the financial and logistical constraints associated with upgrading its treatment infrastructure.
- **Solution:** CFPUA partnered with Evoqua Water Technologies, a leading provider of water and wastewater treatment solutions, to implement an advanced PFAS treatment system. Evoqua supplied a tailored solution utilizing granular activated carbon (GAC) technology. The GAC system was installed at the Sweeney Water Treatment Plant, effectively adsorbing and removing PFAS from the water. The project included the design, installation, and commissioning of the GAC system, which involved multiple large-scale carbon vessels capable of handling the high-water flow rates required by CFPUA. Evoqua's technology was chosen for its proven effectiveness in treating PFAS and its ability to be rapidly deployed. The system not only reduced PFAS levels to below detectable limits but also provided a scalable solution that could be expanded if needed.

5.14.3 CALGON CARBON CORPORATION

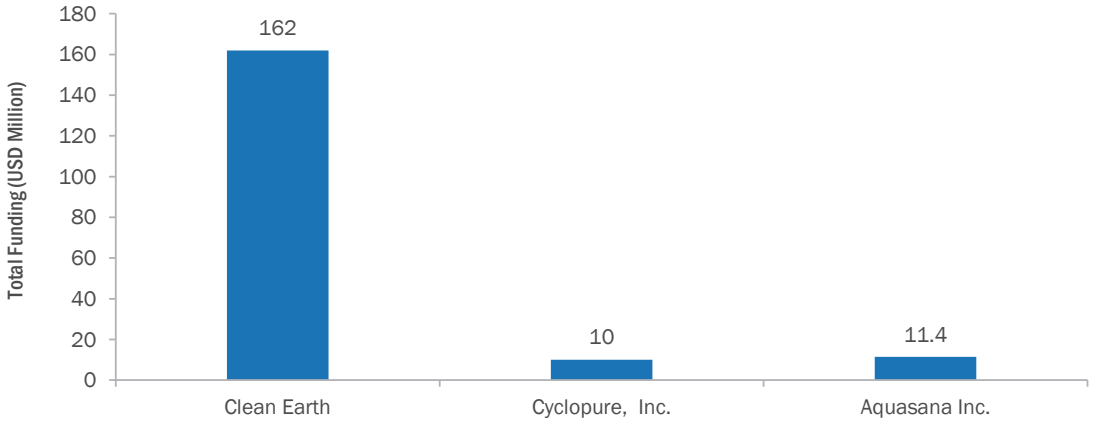
- **Background:** New Jersey American Water (NJAW), the largest water utility in the state, discovered PFAS contamination in several of their groundwater wells. These wells were crucial sources of drinking water for thousands of residents across multiple communities. The contamination levels exceeded the new stringent PFAS limits set by the New Jersey Department of Environmental Protection.
- **Challenge:** NJAW needed to reduce PFAS levels quickly and efficiently to comply with regulatory standards and ensure safe drinking water for its customers. This required finding a treatment solution that could be implemented without causing significant disruptions to the water supply and within the utility's budget constraints.

- **Solution:** NJAW partnered with Calgon Carbon Corporation, a leader in activated carbon technology, to design and install a treatment system specifically for PFAS removal. Calgon Carbon provided a custom engineered solution using their FILTRASORB granular activated carbon (GAC). This technology was selected for its high adsorption capacity for PFAS compounds and its proven track record in similar applications. The implementation process included the installation of large GAC vessels at the affected well sites, along with the necessary piping and control systems to integrate with NJAW's existing infrastructure. The system was designed to ensure minimal operational downtime and to meet the regulatory requirements for PFAS removal. Post-installation testing confirmed that the GAC system effectively reduced PFAS concentrations to below the detectable limits, ensuring compliance with state regulations and safeguarding public health.

5.15 INVESTMENT AND FUNDING SCENARIO

Investment and funding play crucial roles across markets, serving as essential resources for business growth and innovation. They encompass capital injections from various sources such as venture capital firms, angel investors, private equity, and public markets. These funds support activities ranging from research and development to scaling operations and market expansion. Access to adequate funding can significantly impact a company's ability to execute strategic initiatives, develop competitive advantages, and navigate market challenges effectively.

FIGURE 32 INVESTMENT AND FUNDING SCENARIO

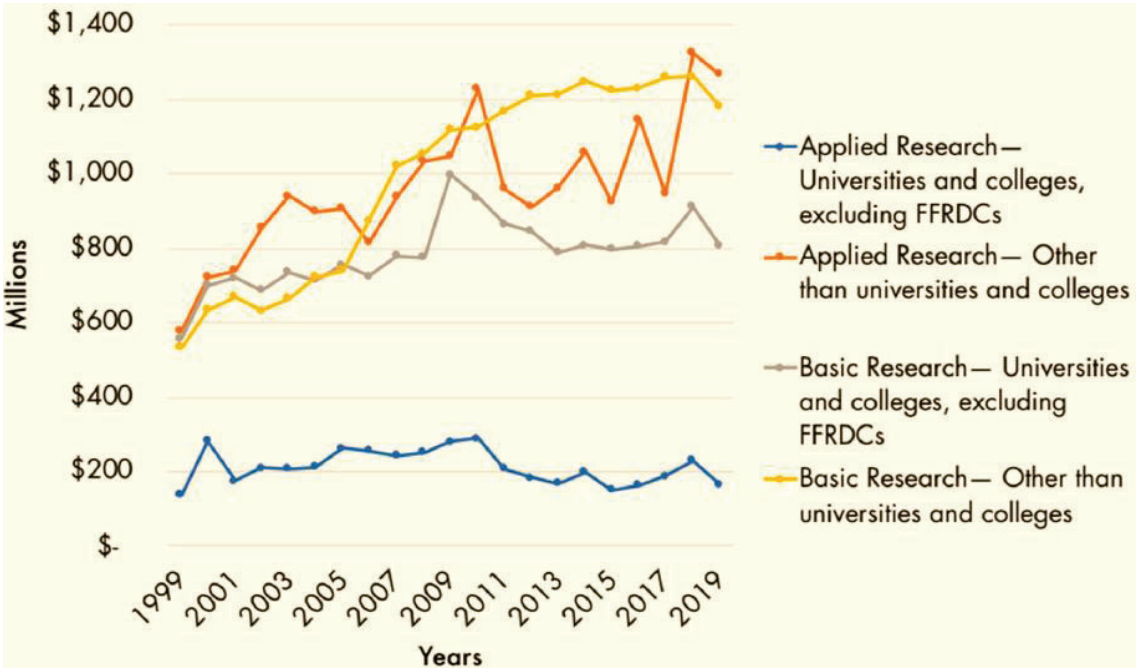


Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

5.16 FUNDING, BY USE-CASE/APPLICATION

In the realm of chemical research, funding plays a critical role in advancing scientific exploration and technological innovation. Research initiatives often secure funding from government grants, academic institutions, and private foundations dedicated to scientific advancement. The funding source supports crucial aspects of chemical research, including fundamental studies, applied research, development of novel materials, and solutions for environmental challenges, fostering breakthroughs that shape industries and benefit society at large.

FIGURE 33 FUNDING, BY USE-CASE APPLICATION



6 Funding Chemical Research | The Importance of Chemical Research to the U.S. Economy | The National Academies Press

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

6 PFAS FILTRATION MARKET, BY CONTAMINANT TYPE

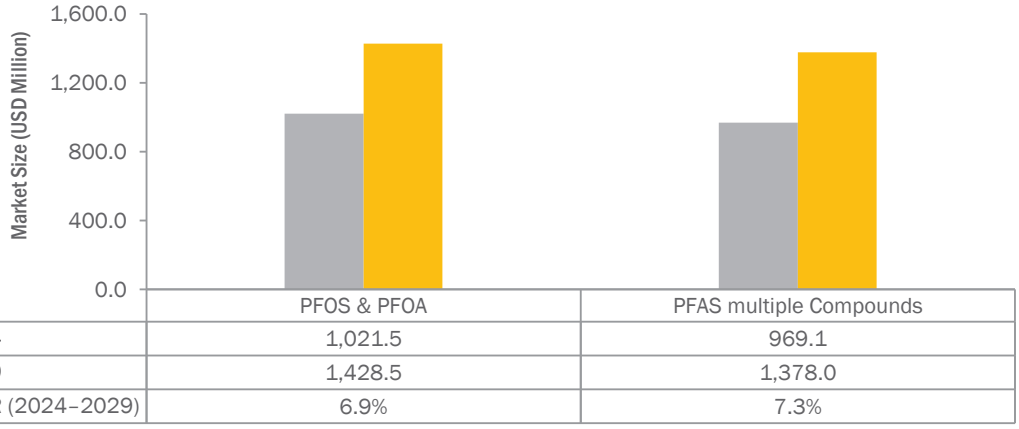
KEY FINDINGS

- The PFOS & PFOA segment accounted for the largest share of around 51.4% in terms of value, in 2023.
- The market size of the PFOA & PFOS segment was USD 950 million in 2023 and is projected to reach USD 1,428 million by 2029, registering a CAGR of 6.9% from 2024.
- The market for multiple PFAS compounds is projected to grow at the higher rate.
- The market size of the multiple PFAS compounds segment was USD 899 million in 2023 and is projected to reach USD 1,378 million by 2029, registering a CAGR of 7.3% from 2024.
- Firefighting foams containing PFOS and PFOA have been extensively used at military bases, airports, and industrial sites, leading to significant environmental contamination. PFOA and PFOS are highly persistent in the environment and bioaccumulate in living organisms, therefore it is necessary to remediate these chemicals.

6.1 INTRODUCTION

The PFAS filtration market is segmented based on contaminant type into PFOA & PFOS and multiple PFAS compounds. PFOA and PFOS are prominent PFAS compounds used extensively in non-stick cookware, waterproof fabrics, and firefighting foams. They are known for their environmental persistence and bioaccumulation, posing significant health risks such as liver damage, thyroid disease, and cancer. Other PFAS compounds, including PFBS, PFHxS, PFNA, PFDA, and GenX chemicals, share similar properties and applications, contributing to widespread contamination. These chemicals resist degradation, leading to their accumulation in water, soil, and living organisms, necessitating stringent regulations and advanced remediation technologies to mitigate their impact.

FIGURE 34 PFOA & PFOS SEGMENT TO DRIVE PFAS FILTRATION MARKET BETWEEN 2024 AND 2029



Source: Secondary Research, Primary Interviews, and MarketsandMarkets Analysis

TABLE 8 PFAS FILTRATION MARKET, BY CONTAMINANT TYPE, 2021–2023 (USD MILLION)

Contaminant Type	2021	2022	2023	CAGR (2021–2023)
PFOA & PFOS	866.0	927.9	950.9	4.8%
Multiple PFAS Compounds	807.9	871.5	899.1	5.5%
Total	**1,673.9**	**1,799.4**	**1,850.0**	**5.1%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 9 PFAS FILTRATION MARKET, BY CONTAMINANT TYPE, 2024–2029 (USD MILLION)

Contaminant Type	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
PFOA & PFOS	1,021.5	1,095.7	1,173.4	1,254.7	1,339.8	1,428.5	6.9%
Multiple PFAS Compounds	969.1	1,042.9	1,120.6	1,202.3	1,288.0	1,378.0	7.3%
Total	**1,990.6**	**2,138.5**	**2,294.0**	**2,457.0**	**2,627.8**	**2,806.5**	**7.1%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

6.2 PFOA & PFOS

6.2.1 SIGNIFICANT PUBLIC HEALTH RISKS ASSOCIATED WITH PRESENCE IN ENVIRONMENT TO DRIVE MARKET

Perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) are two of the most well-known members of the per- and polyfluoroalkyl substances (PFAS) family. These synthetic chemicals have been widely used in various industrial and consumer products due to their unique properties, such as resistance to water, oil, and heat. The primary sectors utilizing PFOA and PFOS have historically been the manufacturing and chemical industries, particularly those producing non-stick cookware, waterproof fabrics, and fire-retardant materials. Firefighting foams containing PFOS and PFOA have been extensively used at military bases, airports, and industrial sites, leading to significant environmental contamination. PFOA and PFOS are highly persistent in the environment and bioaccumulate in living organisms. This persistence is due to their strong carbon-fluorine bonds, which do not break down easily in the natural environment. Consequently, these chemicals can travel long distances, contaminate soil and water resources, and accumulate in the food chain. They are detected globally in water bodies, wildlife, and humans, raising serious concerns about their long-term environmental and health impacts. Exposure to PFOA and PFOS is associated with various adverse health effects, including liver damage, thyroid disease, decreased fertility, high cholesterol, and an increased risk of certain cancers. Their presence in the environment, particularly in drinking water, poses a significant public health risk.

In the US, numerous studies and surveys have highlighted the widespread contamination of water supplies with PFOA and PFOS. For instance, a 2020 report by the Environmental Working Group (EWG) found PFAS contamination in the drinking water of over 2,300 locations across 49 states. The highest levels were detected in states with extensive industrial activities, such as Michigan, New Jersey, and North Carolina. Specific sites, such as military bases and airports, have reported contamination levels significantly exceeding the health advisory levels set by the Environmental Protection Agency (EPA). In response to the growing concern over PFAS contamination, various US states and the federal government have implemented regulations to limit the presence of PFOA and PFOS in drinking water and the environment. For instance, in January 2023, the EPA released revised Effluent Limitations Guidelines (ELGs) to control PFAS discharges from industries, including landfills and textile manufacturing. These guidelines are part of the EPA's ongoing efforts to reduce the environmental impact of PFAS and protect water quality. Additionally, the EPA has proposed a law to require the reporting of PFAS in products at any concentration, rather than at levels greater than 1% or 10,000 mg/kg. Various states such as Hawaii, Maine, Maryland, and Minnesota prohibit the sale or distribution of products with intentionally added PFAS.

To address and remediate PFAS contamination, several technologies are being employed and developed. Granular activated carbon (GAC) filtration and ion exchange resins are widely used to remove PFAS from contaminated water sources. These technologies adsorb the PFAS molecules, effectively reducing their concentration in water. Advanced oxidation processes (AOP) and high-pressure membranes offer additional methods for treating PFAS-laden water.

6.3 MULTIPLE PFAS COMPOUNDS

6.3.1 STRINGENT REGULATORY RESPONSE TO DRIVE MARKET

In addition to PFOA and PFOS, the PFAS family includes a wide array of compounds such as perfluorobutane sulfonate (PFBS), perfluorohexane sulfonate (PFHxS), perfluorononanoic acid (PFNA), perfluorodecanoic acid (PFDA), and GenX chemicals. These compounds are characterized by their strong carbon-fluorine bonds, making them highly resistant to degradation and persistent in the environment. PFBS, often used as a replacement for PFOS, finds applications in stain-resistant fabrics, firefighting foams, and cleaning agents. Although its shorter carbon chain makes it less bioaccumulative than PFOS, it remains environmentally persistent. PFHxS, similar to PFOS, is used in firefighting foams and various industrial processes as a surfactant, known for its degradation resistance and bioaccumulation in wildlife and humans.

PFNA is utilized in the production of fluoropolymers, essential for manufacturing non-stick cookware, electrical insulation, and water-repellent fabrics. Its environmental stability and potential health risks are akin to those of PFOA. PFDA, used in similar sectors as PFNA, including fluoropolymer production and industrial processing aids, also has a long-chain structure contributing to its environmental persistence and bioaccumulation potential. GenX chemicals, such as hexafluoropropylene oxide dimer acid (HFPO-DA), were developed as replacements for PFOA in manufacturing fluoropolymers, used in non-stick coatings and waterproof fabrics. Despite being marketed as safer alternatives, GenX chemicals exhibit similar environmental persistence and potential health risks as their predecessors.

The environmental impact of these PFAS compounds is significant due to their resistance to degradation, leading to long-term persistence in soil, water, and living organisms. The bioaccumulation of PFAS compounds in wildlife can disrupt endocrine systems, reproductive functions, and growth. For humans, exposure to these chemicals is linked to adverse health outcomes, including developmental issues, immune system impairment, liver damage, and an increased risk of certain cancers.

Regulatory responses in the US and globally have become increasingly stringent. The US EPA is issuing a lifetime noncancer drinking water Health Advisory (HA) for PFBS of 2,000 nanograms per liter (ng/L) or 2,000 parts per trillion (ppt). The EPA also proposed using a hazard index for GenX, PFBS, PFHxS, and PFNA because it has determined that a combination of these PFAS compounds is more dangerous than the individual compounds.

Innovative remediation technologies, including advanced filtration systems, chemical oxidation, and novel bioremediation methods, are being developed to tackle PFAS contamination by Veolia, Clean Earth, Battelle, WSP, AECOM, Xylem, and others.

TABLE 10 US STATE GUIDELINE VALUES FOR PFBS

STATE	PFBS LEVEL ((PPT [NG/L])	STANDARD/GUIDANCE	TYPE OF MEDIUM
California	500	Notification level	Drinking water
Colorado	400,000	Translation level	Groundwater, Surface water
Hawai'i	600	Environmental action levels	Groundwater
Illinois	2,100	Health-based guidance level	Drinking Water, Groundwater
Maine	400,000	Remedial action guideline	Groundwater
Michigan	420	Maximum contaminant level	Drinking Water, Groundwater
Minnesota	100	Health-based value	Drinking Water, Groundwater
Nevada	667,000	Basic comparison level	Drinking Water
Ohio	2,100	Action level	Drinking Water

Source: Drinking Water Health Advisory

7 PFAS FILTRATION MARKET, BY END-USE INDUSTRY

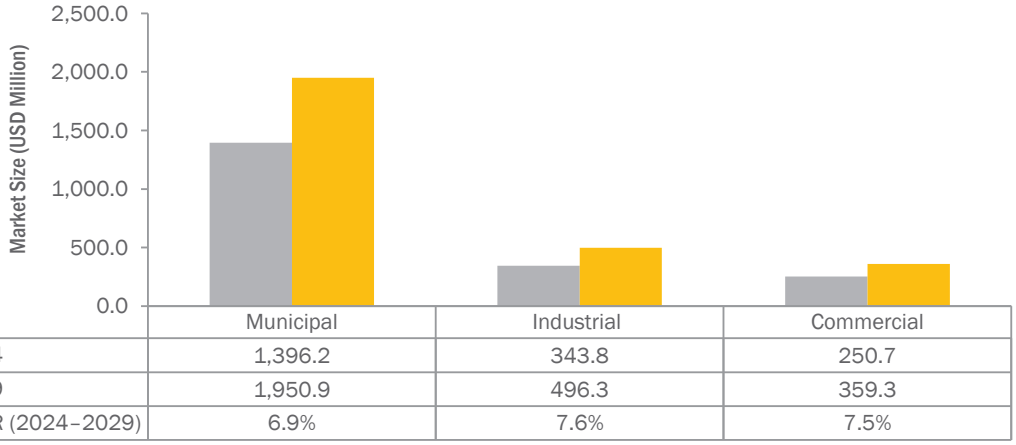
KEY FINDINGS

- The municipal segment accounted for the largest share of around 70.2% in terms of value, in 2023.
- The market size of the municipal segment was USD 1,298.5 million in 2023 and is projected to reach USD 1,950.9 million by 2029, registering a CAGR of 6.9% from 2024.
- The market for the industrial segment is projected to grow at the highest rate.
- The market size of the commercial segment was USD 233.9 million in 2023 and is projected to reach USD 359.3 million by 2029, registering a CAGR of 7.5% from 2024.
- The primary sources of PFAS contamination in the industrial area are the use of AFFFs during fire training exercises, emergency responses, and accidental releases, as well as leakage and disposal of PFAS-containing chemicals.

7.1 INTRODUCTION

The PFAS filtration market is segmented based on end-use industry into industrial, commercial, and municipal. Industrial sources, such as manufacturing facilities, contribute significantly to PFAS pollution through process discharges. Commercial entities, including airports and firefighting training sites, add to the contamination through the use of PFAS-containing firefighting foams. Municipal wastewater treatment plants must handle PFAS from various sources, including residential use of PFAS-containing products and landfill leachate. Advanced treatment methods like activated carbon filtration, ion exchange, and membrane technologies are employed to remove PFAS from wastewater, ensuring safe water quality and compliance with stringent regulatory standards.

FIGURE 35 MUNICIPAL SEGMENT TO DRIVE PFAS FILTRATION MARKET BETWEEN 2024 AND 2029



	Municipal	Industrial	Commercial
2024	1,396.2	343.8	250.7
2029	1,950.9	496.3	359.3
CAGR (2024–2029)	6.9%	7.6%	7.5%

Source: Secondary Research, Primary Interviews, and MarketsandMarkets Analysis

TABLE 11 PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2021–2023 (USD MILLION)

End-use Industry	2021	2022	2023	CAGR (2021–2023)
Industrial	284.1	307.2	317.6	5.7%
Municipal	1,176.5	1,263.9	1,298.5	5.1%
Commercial	213.3	228.4	233.9	4.7%
Total	**1,673.9**	**1,799.4**	**1,850.0**	**5.1%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 12 PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2024–2029 (USD MILLION)

End-use Industry	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Industrial	343.8	371.1	399.9	430.4	462.5	496.3	7.6%
Municipal	1,396.2	1,497.2	1,603.2	1,714.1	1,830.0	1,950.9	6.9%
Commercial	250.7	270.2	290.8	312.5	335.3	359.3	7.5%
Total	**1,990.6**	**2,138.5**	**2,294.0**	**2,457.0**	**2,627.8**	**2,806.5**	**7.1%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 13 PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2021–2023 (KILOTON)

End-use Industry	2021	2022	2023	CAGR (2021–2023)
Industrial	71.0	76.1	78.0	4.8%
Municipal	350.3	373.0	379.8	4.1%
Commercial	56.9	60.4	61.3	3.8%
Total	**478.3**	**509.5**	**519.2**	**4.2%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 14 PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2024–2029 (KILOTON)

End-use Industry	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Industrial	83.7	89.5	95.7	102.1	108.7	115.6	6.7%
Municipal	404.8	430.3	456.7	484.1	512.3	541.4	6.0%
Commercial	65.2	69.6	74.3	79.1	84.2	89.4	6.5%
Total	**553.7**	**589.5**	**626.7**	**665.3**	**705.2**	**746.4**	**6.2%**

7.2 INDUSTRIAL

7.2.1 OIL & GAS

7.2.1.1 Stringent environmental regulations to drive market

The oil & gas industry is a critical sector that significantly impacts the global economy. This industry encompasses the exploration, extraction, refining, transportation, and marketing of petroleum products. PFAS compounds are used extensively within the oil & gas industry due to their unique chemical properties, which include high thermal stability, chemical resistance, and surfactant qualities. These substances are commonly found in firefighting foams, specifically aqueous film-forming foams (AFFFs), which are employed extensively in fire suppression systems at refineries and storage facilities to control flammable liquid fires. In the exploration and production (E&P) phase of oil & gas operations, PFAS are utilized in several capacities. The primary use of PFAS in E&P is in hydraulic fracturing fluids, where they serve as surfactants to reduce surface tension and improve the efficiency of the fracturing process. PFAS are also used in drilling fluids to enhance lubrication, reduce friction, and prevent corrosion of drilling equipment. Moreover, PFAS-containing chemicals are applied as anti-foaming agents and in well stimulation treatments to enhance oil & gas recovery.

The primary sources of PFAS contamination in the oil & gas industry are the use of AFFFs during fire training exercises, emergency responses, and accidental releases, as well as leakage and disposal of PFAS-containing chemicals. These activities can lead to significant environmental contamination, affecting soil, groundwater, and surface water in and around oil & gas facilities. To address PFAS contamination, various filtration and treatment technologies are employed within the oil & gas sector. Granular activated carbon, ion exchange resin, and RO are among the most widely used methods for treating PFAS in contaminated water.

The exploration of oil and natural gas in the US is a complex enterprise that is subject to a wide range of regulations at multiple levels of government, including environmental regulations (Clean Air Act, Clean Water Act, National Environmental Policy Act (NEPA), and others. To comply with these regulations, companies are investing in water treatment infrastructure, which directly impacts PFAS filtration market.

7.2.2 PHARMACEUTICAL

7.2.2.1 Growing awareness of health and environmental impacts of PFAS contamination to drive demand

PFAS are utilized in the pharmaceutical industry due to their unique chemical properties, such as their ability to resist degradation and their role as effective surfactants. These compounds are employed in various stages of pharmaceutical manufacturing, including in the synthesis of certain active pharmaceutical ingredients (APIs), as processing aids, and in the formulation of drugs where they act as excipients to enhance the stability and bioavailability of medications. The use of PFAS in these capacities can lead to contamination of waste streams and water used in manufacturing, necessitating the need for effective PFAS filtration systems.

There are various factors driving the demand for PFAS filtration, including regulatory compliance, environmental concerns, health & safety, and market pressure. Various PFAS filtration technologies are utilized in the pharmaceutical industry to meet regulatory requirements and ensure the safety of products. Activated carbon filters are widely used due to their high surface area and ability to adsorb PFAS effectively. Ion exchange systems offer another solution, replacing PFAS ions in water with less harmful ions. Reverse osmosis (RO) is a highly effective membrane-based technology that can remove PFAS by filtering out particles and molecules down to very small sizes. Advanced oxidation processes (AOPs), which generate highly reactive radicals to degrade PFAS, are also employed to break down these persistent compounds into less harmful substances.

The market for PFAS filtration in the pharmaceutical industry presents several growth opportunities. Increasing regulatory pressure and the need for compliance are driving investments in advanced filtration technologies. Additionally, growing awareness of the health and environmental impacts of PFAS contamination is expected to drive the demand for cleaner production processes, further expanding the market for PFAS filtration solutions.

7.2.3 CHEMICAL MANUFACTURING

7.2.3.1 Expanding chemical manufacturing sector to drive market

In the chemical manufacturing sector, PFAS are extensively used due to their exceptional chemical properties, including high thermal stability, resistance to degradation, and surfactant qualities. These substances are found in various chemical segments, such as surfactants and emulsifiers in detergents, paints, coatings, and cleaning products; polymers and plastics, where they serve as processing aids and performance additives in non-stick cookware and weather-resistant materials; fluoropolymers, including Teflon, known for their non-reactive and heat-resistant properties; and textiles and leather, where they provide stain and water-resistant treatments. PFAS contamination of water and soil in the chemical manufacturing sector occurs through multiple pathways. Industrial discharges from manufacturing processes often contain PFAS, which can enter water bodies. Improper disposal of PFAS-containing waste, such as sludge from wastewater treatment plants, leads to soil contamination. Additionally, accidental spills and leaks during the handling and transport of PFAS-containing materials can result in localized contamination of soil and groundwater.

To address PFAS contamination, various remediation technologies are employed, such as GAC, RO, ion exchange, advanced oxidation processes, thermal desorption, and others. Several companies specialize in providing PFAS treatment technologies. Veolia offers comprehensive water treatment solutions, including GAC, ion exchange, and RO systems for PFAS removal. AECOM provides environmental consulting and engineering services with expertise in advanced PFAS remediation technologies. Clean Earth specializes in hazardous waste management and remediation, offering thermal desorption and other innovative PFAS treatment methods. WSP, a global engineering and consulting firm, offers integrated solutions for PFAS contamination, including site assessment and remediation. Various PFAS-related chemical manufacturers have implemented PFAS filtration systems. For instance, Chemours, known for producing PFAS-related

chemicals, utilizes RO and GAC at its facilities to remove PFAS from wastewater. The company also employs ion exchange to target a broader range of PFAS compounds, ensuring comprehensive treatment of their industrial effluents. Saint-Gobain, a producer of high-performance plastics, employs GAC and ion exchange technologies to address PFAS contamination in water near its manufacturing plant.

The expanding chemical manufacturing sector in the US presents significant growth opportunities for PFAS filtration technologies. As the demand for chemicals in various industries continues to rise, so does the potential for PFAS contamination. This expansion drives the need for effective PFAS treatment solutions to ensure environmental compliance and protect public health. Regulatory pressures from agencies such as the EPA, which set stringent limits on PFAS levels in industrial discharges, further amplify the demand for advanced filtration technologies.

7.2.4 MINING AND MINERAL PROCESSING

7.2.4.1 Growing mining industry, coupled with stringent regulations regarding discharge, to drive market

The mining and mineral processing industry plays a critical role in the global economy, extracting and processing raw materials essential for various sectors. PFAS are used in various mining applications due to their surfactant properties, which aid in the separation and extraction processes. For instance, they are utilized in flotation processes to separate minerals from ores and as dust suppressants. The widespread use of PFAS in these applications leads to potential contamination of water and soil.

PFAS contamination in mining and mineral processing occurs through several pathways. The primary source of contamination is the use of PFAS-containing chemicals in ore processing and dust suppression. When these chemicals are used, they can leach into the surrounding environment, contaminating soil and groundwater. Additionally, wastewater generated from mining operations, which often contain PFAS, can be discharged into local water bodies if not properly treated. Spills, leaks, and improper disposal of PFAS-containing materials further exacerbate the contamination problem, leading to long-term environmental and health impacts.

Regulatory frameworks play a crucial role in managing PFAS contamination in the mining sector. In January 2023, the U.S. Environmental Protection Agency (EPA) released revised effluent limitation guidelines (ELGs) aimed at controlling discharges from the mining industry. These guidelines set stringent limits on the levels of PFAS and other contaminants that can be discharged into water bodies, compelling mining companies to adopt advanced treatment technologies to comply with the regulations.

To address PFAS contamination in the mining and mineral processing industry, various treatment technologies are employed. Granular activated carbon (GAC) is one of the most widely used methods for PFAS removal, effectively absorbing these substances from water due to its high surface area. Ion exchange systems are another effective technology, replacing PFAS ions in water with less harmful ions. Reverse osmosis (RO) is a membrane filtration technology that separates PFAS from water at the molecular level, providing high efficiency in PFAS removal. Various other technologies, such as ball milling and thermal desorption, are also used for PFAS treatment. Overall, the expanding mining and mineral processing industry, combined with stringent environmental regulations, presents significant growth opportunities for PFAS filtration technologies.

7.2.5 OTHER INDUSTRIAL SEGMENTS

Others include electronics manufacturing, food processing, aerospace and defense, and textile and leather. In the electronics manufacturing sector, PFAS are used for their dielectric properties and stability, crucial in producing semiconductors and circuit boards. Contamination occurs from PFAS-laden wastewater, managed by technologies like granular activated carbon (GAC) and reverse osmosis (RO). In food processing, PFAS provides non-stick and grease-resistant qualities in cookware and packaging, with contamination managed using activated carbon filters and ion exchange systems. The aerospace and defense sectors utilize PFAS for fire resistance and durability in firefighting foams and coatings, with GAC and thermal desorption as key treatment methods. In textiles and leather, PFAS enhances water and stain resistance, with contamination treated using activated carbon and RO. These industries rely on advanced filtration technologies to meet regulatory standards and minimize environmental impact.

7.3 COMMERCIAL

7.3.1 ACTIVATED CARBON AND ION EXCHANGE ARE EFFECTIVE METHODS FOR PFAS FILTRATION IN COMMERCIAL SEGMENT

The commercial sector encompasses a wide range of activities and facilities outside of industrial and residential settings, including offices, retail spaces, hotels, airports, and restaurants. One of the primary sources of PFAS contamination is firefighting foams, specifically aqueous film-forming foams (AFFF). These foams are widely used for extinguishing flammable liquid fires, particularly in military bases and airports. When AFFF is deployed, PFAS can leach into the soil and groundwater, leading to widespread contamination. This contamination is especially problematic around airports and military installations, where large quantities of AFFF are used for training and emergency response. Airports are another significant source of PFAS pollution. Beyond the use of firefighting foams, PFAS can be found in de-icing agents and various maintenance activities. Runoff from these operations can carry PFAS into nearby water bodies and infiltrate groundwater, posing risks to local water supplies and ecosystems.

Moreover, PFAS contamination in commercial settings primarily arises from everyday products and materials that contain PFAS, such as carpets, furniture, food packaging, and firefighting foams. These substances can leach into the environment through product use, spills, improper disposal, and wastewater discharge, posing significant environmental and health risks. PFAS have been linked to adverse health effects, including developmental delays, reproductive issues, and increased cancer risks, prompting growing concern and regulatory scrutiny. Some states, such as Minnesota, Maryland, Maine, and Hawaii, have implemented regulations prohibiting the sale, distribution, and usage of PFAS-containing carpets, rugs, liners, plates, and food packaging with intentionally added PFAS. To mitigate these risks, various PFAS remediation methods are employed in the commercial sector. Activated carbon filtration is commonly used to remove PFAS from water sources, effectively capturing these compounds due to its porous structure. Ion exchange systems exchange PFAS ions with less harmful ions, providing another effective treatment method. Additionally, membrane filtration technologies like reverse osmosis (RO) are effective in separating PFAS from water at the molecular level.

7.4 MUNICIPAL

7.4.1 DRINKING WATER TREATMENT

7.4.1.1 Stringent environmental regulations related to drinking water to drive market

Drinking water contamination from PFAS occurs through various sources and pathways, posing significant challenges to public health and regulatory compliance. PFAS compounds enter drinking water supplies primarily from industrial discharges, firefighting foams, landfills, and wastewater treatment plant effluents. These substances are highly persistent and can travel long distances in groundwater, contaminating water sources even far from their original release points. In the drinking water treatment process, PFAS can resist traditional filtration methods due to their chemical structure, allowing them to persist through conventional treatment processes. Exposure to PFAS has been linked to adverse health effects in humans, including developmental delays, reproductive issues, liver damage, and increased cancer risks. These substances bioaccumulate in the body over time, leading to prolonged exposure and potential long-term health impacts. Furthermore, PFAS contamination can affect aquatic ecosystems and wildlife. Studies have shown that PFAS accumulation in plants and animals can disrupt biological functions, leading to reproductive abnormalities and decreased survival rates.

In response to these contamination concerns, the Environmental Protection Agency (EPA) and several states in the US have implemented stringent regulations to address PFAS in drinking water. In April 2024, the EPA finalized national primary drinking water regulations for PFAS, establishing enforceable Maximum Contaminant Levels (MCLs) for six specific PFAS chemicals. These regulations mandate that public water systems across the country monitor and maintain PFAS levels below these specified limits to ensure safe drinking water for consumers. Additionally, many states have enacted their own laws to address PFAS contamination. For example, Michigan passed legislation in 2020 requiring public water systems to test for PFAS and report results to the state, enhancing transparency and accountability in water quality management.

To remediate PFAS contamination in drinking water, several technologies have proven effective. Activated carbon filtration is widely used due to its ability to absorb PFAS compounds from water effectively. Ion exchange systems exchange PFAS ions for less harmful ions, providing another robust treatment method. Advanced oxidation processes (AOPs) employ chemical reactions to degrade PFAS molecules into non-toxic byproducts. Membrane filtration technologies such as reverse osmosis (RO) effectively remove PFAS at the molecular level. Several companies such as Aris Chemical, Geo Specialty Chemicals, Veolia, AECOM, Buckman Laboratories, Terracon, MPW services, and others are providing water treatment chemicals and their technologies for drinking water treatment. Various municipalities from different states have implemented various technologies for PFAS treatment. For instance, Ann Arbor, a municipality in Michigan state adopted GAC technology and Orange County water district from California adopted AOP, GAC, and ion exchange processes.

7.4.2 WASTEWATER TREATMENT

7.4.2.1 Growing public concern to drive market

Municipal wastewater treatment systems (WWTS) have become significant sources of PFAS contamination, as these chemicals are prevalent in domestic and industrial wastewater. During wastewater treatment, PFAS compounds enter WWTS through household waste, industrial effluents, and urban runoff. Conventional treatment processes, such as biological treatment and sedimentation, are largely ineffective in removing PFAS due to their chemical stability and resistance to degradation. Consequently, PFAS persist through the treatment process and are released into the environment via treated effluent and sludge.

Treated effluent discharged into surface waters can lead to contamination of aquatic ecosystems and downstream water supplies. Biosolids, the byproduct of sewage sludge treatment, are often applied as fertilizers on agricultural lands, leading to soil contamination and potential uptake by crops. This contamination pathway poses significant risks to human health and the environment due to the bioaccumulative and toxic nature of PFAS.

Advanced treatment technologies, such as activated carbon adsorption, ion exchange, and high-pressure membranes, have shown promise in removing PFAS from wastewater. However, these methods are often costly and not universally implemented. There is a pressing need for the development and deployment of more efficient and cost-effective PFAS removal technologies within municipal WWTS.

8 PFAS FILTRATION MARKET, BY ENVIRONMENTAL MEDIUM

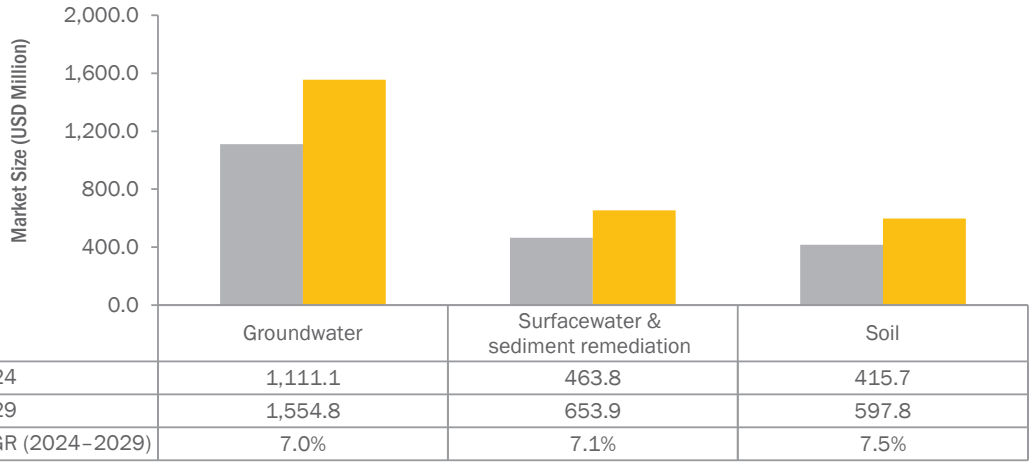
KEY FINDINGS

- The groundwater segment accounted for the largest share of 55.9% in terms of value, in 2023.
- The market size of the groundwater segment was USD 1.034.2 million in 2023 and is projected to reach USD 1,554.8 million by 2029, registering a CAGR of 7.0% from 2024.
- The market for soil remediation is projected to grow at the highest rate.
- The market size of surface water & sediment remediation segment was USD 431.1 million in 2023 and is projected to reach 653.9 USD million by 2029, registering a CAGR of 7.1% from 2024.
- Surface water and sediment remediation are essential for cleaning polluted rivers, lakes, and reservoirs, ensuring safe water quality and protecting aquatic ecosystems. There are various technologies that are used for remediation, such as activated carbon adsorption, ion exchange, advanced oxidation processes, ball milling, and others.

8.1 INTRODUCTION

The PFAS filtration market is segmented based on environmental medium into groundwater remediation, soil remediation, and surface water and sediment remediation. Groundwater remediation addresses the infiltration of PFAS from industrial discharges, firefighting foam, and landfill leachate into aquifers. Soil remediation tackles contamination from similar sources, focusing on restoring the soil's health and preventing further environmental damage. Surface water and sediment remediation are essential for cleaning polluted rivers, lakes, and reservoirs, ensuring safe water quality and protecting aquatic ecosystems. There are various technologies that are used for remediation, such as activated carbon adsorption, ion exchange, advanced oxidation processes, ball milling, and others.

FIGURE 36 GROUNDWATER SEGMENT TO LEAD PFAS FILTRATION MARKET BETWEEN 2024 AND 2029



Source: Secondary Research, Primary Interviews, and MarketsandMarkets Analysis

TABLE 15 PFAS FILTRATION MARKET, BY ENVIRONMENTAL MEDIUM, 2021–2023 (USD MILLION)

Environmental Medium	2021	2022	2023	CAGR (2021–2023)
Groundwater	941.3	1,008.9	1,034.2	4.8%
Soil	342.6	371.3	384.8	6.0%
Surface Water & Sediment Remediation	390.0	419.3	431.1	5.1%
Total	**1,673.9**	**1,799.4**	**1,850.0**	**5.1%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 16 PFAS FILTRATION MARKET, BY ENVIRONMENTAL MEDIUM, 2024–2029 (USD MILLION)

Environmental Medium	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Groundwater	1,111.1	1,191.9	1,276.6	1,365.3	1,458.0	1,554.8	7.0%
Soil	415.7	448.4	482.8	519.2	557.5	597.8	7.5%
Surface Water & Sediment Remediation	463.8	498.3	534.5	572.5	612.3	653.9	7.1%
Total	**1,990.6**	**2,138.5**	**2,294.0**	**2,457.0**	**2,627.8**	**2,806.5**	**7.1%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

8.2 GROUNDWATER REMEDIATION

8.2.1 STRINGENT FEDERAL AND STATE REGULATIONS TO DRIVE MARKET

The presence of PFAS in groundwater results from various pollution sources such as industrial discharges, firefighting foam runoff, and landfill leachate. These chemicals pose significant environmental and health concerns due to their persistence and potential bioaccumulative properties. Industrial sites using PFAS in manufacturing processes or firefighting training areas contribute to groundwater pollution when these substances leach into the soil and eventually percolate down into aquifers. Similarly, landfills accepting PFAS-containing waste can generate leachate that carries these compounds into groundwater supplies.

Effective methods for treating PFAS-contaminated groundwater include activated carbon adsorption, ion exchange, and advanced oxidation processes (AOPs). Activated carbon adsorption involves pumping contaminated groundwater through beds of activated carbon, where PFAS molecules adhere to the carbon's porous surface. This process effectively removes PFAS due to the carbon's high surface area and strong adsorptive properties. Ion exchange utilizes resin beads with specific functional groups that attract and bind PFAS ions in exchange for less harmful ions. As groundwater passes through these resin columns, PFAS ions are captured, allowing clean water to emerge. Advanced oxidation processes introduce strong oxidizing agents such as ozone or hydrogen peroxide into the groundwater. These agents generate hydroxyl radicals (OH) that react with PFAS molecules, breaking down their chemical bonds and transforming them into simpler, less harmful substances like carbon dioxide and water. Each remediation method is selected based on site-specific conditions, including PFAS concentrations, hydrogeological factors, and regulatory requirements.

In the US, groundwater remediation is guided by a combination of federal and state regulations. The Environmental Protection Agency (EPA) has established health advisory levels for PFAS in drinking water. Many states have enacted their own regulations that are often more stringent than federal guidelines. For example, Michigan has implemented some of the most comprehensive PFAS standards, including specific cleanup criteria for groundwater. New Jersey, New York, and California are also leading states with robust PFAS regulations, mandating rigorous testing and remediation efforts to ensure the protection of public health and the environment. Stringent environmental regulations coupled with growing public awareness are driving the market.

8.3 SOIL REMEDIATION

8.3.1 EFFECTIVE ELIMINATION OR NEUTRALIZATION OF PFAS CONTAMINATES TO DRIVE MARKET

Soil contamination through PFAS occurs through various pathways such as industrial spills, application of PFAS-containing firefighting foams, and leaching from landfills. These contaminants pose significant environmental and health risks. PFAS in soil can lead to groundwater contamination, uptake by plants, and exposure to wildlife and humans through various pathways. To address these issues, several soil remediation methods have been developed.

Ball milling is a mechanical process used to grind and mix contaminated soil with chemical additives, breaking down PFAS molecules through physical and chemical interactions. Modified clay technology involves treating clays to increase their adsorption capacity for PFAS, effectively capturing and immobilizing these contaminants. WSP is a prominent player in soil remediation, offering both ball milling and modified clay technologies to address PFAS contamination.

Stabilization involves mixing contaminated soil with binding agents that chemically stabilize PFAS, reducing their mobility and bioavailability. Thermal desorption involves heating the contaminated soil to high temperatures, in a controlled environment to volatilize and separate the PFAS compounds from the soil matrix. During thermal desorption, the heat causes the PFAS contaminants to vaporize, leaving behind

clean soil. Clean Earth provides both stabilization and thermal desorption services, effectively treating PFAS-contaminated soils. The demand for PFAS filtration technologies is driven by stringent regulatory standards imposed by governments worldwide, including the US, European Union, and others. Several states, such as Michigan, Alaska, and California, also issued an advisory on soil cleanup. All these factors contribute to the growth of the market.

8.4 SURFACE WATER AND SEDIMENT REMEDIATION

8.4.1 INCREASING AWARENESS OF PFAS CONTAMINATION TO BOOST MARKET

Surface water and sediment remediation involves the comprehensive effort to clean and restore contaminated water bodies and the sediment layers within them. Surface water, encompassing rivers, lakes, reservoirs, and sediment, refers to the accumulated particles of soil, sand, and organic matter at the bottom of water bodies. In these bodies, PFAS enter through pathways like industrial discharges, wastewater treatment plant effluents, and runoff from firefighting activities. Once in the water, PFAS can adsorb sediment particles, contributing to long-term contamination. These contaminants pose risks to aquatic ecosystems and human health through bioaccumulation in aquatic organisms and potential exposure through recreational activities or drinking water sources. Effective treatment methods for PFAS in surface water and sediment include activated carbon adsorption, where activated carbon is introduced into the water or sediment to adsorb PFAS molecules from the aquatic environment. Advanced Oxidation Processes (AOPs) are also used to degrade PFAS molecules into less harmful substances through chemical reactions that break down their carbon-fluorine bonds. In Situ Chemical Oxidation (ISCO) involves injecting oxidizing agents directly into contaminated sediments to treat PFAS in place, minimizing disturbance to the sediment layer. Physical methods such as dredging can remove contaminated sediment from water bodies, while capping involves placing a layer of clean material over contaminated sediment to isolate it from the water column and reduce exposure.

The US Federal government and states have imposed various stringent regulatory standards. In April 2024, EPA finalized the National Primary Drinking Water Regulation for PFAS. The regulatory body sets enforceable Maximum Contaminant Levels (MCLs) for six PFAS chemicals in drinking water, impacting millions of Americans. Also, the EPA is initiating regulation of discharge permits for PFAS into surface water through the National Pollutant Discharge Elimination System (NPDES) and Toxics Release Inventory (TRI) Programs. Furthermore, the EPA plans to establish maximum contaminant levels for drinking water for six PFAS compounds, with proposed levels for PFOA and PFOS as low as 4 nanograms per liter. These regulations mandate the cleanup of contaminated sites and the protection of water resources and public health. Moreover, increasing awareness of PFAS contamination risks among industries, communities, and regulatory bodies fuels the market growth.

9 PFAS FILTRATION MARKET, BY REMEDIATION TECHNOLOGY

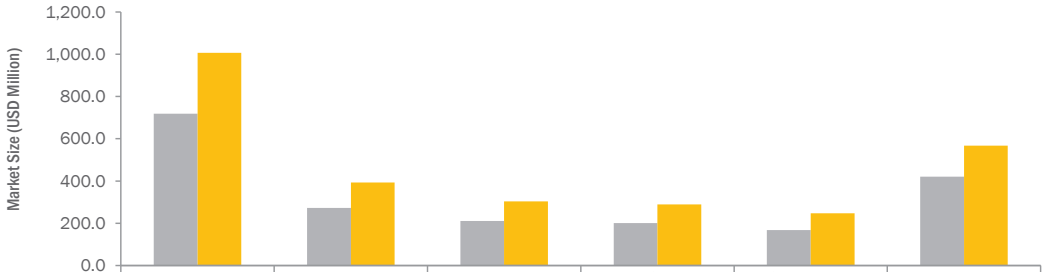
KEY FINDINGS

- The activated carbon segment accounted for a largest share of around 36.2% in 2023.
- The market size of the activated carbon segment was USD 669.7 million in 2023 and is projected to reach USD 1,007.5 million by 2029, registering a CAGR of 7.0% from 2024.
- The market for ion exchange is projected to grow at the second-highest rate.
- The market size of RO membrane segment was USD 153.5 million in 2023 and is projected to reach USD 247.0 million by 2029, registering a CAGR of 8.1% from 2024.
- Increasing awareness and regulatory pressure further propels the PFAS Filtration Market.

9.1 INTRODUCTION

The PFAS filtration market is segmented based on remediation technology into membranes and chemicals. Membrane technologies, particularly Reverse Osmosis (RO) membranes, are highly efficient, using semi-permeable barriers to separate PFAS from water due to their ability to reject small particles and dissolved ions. Chemical approaches include activated carbon adsorption, where activated carbon's porous structure traps PFAS molecules, and chemical oxidation, which uses strong oxidants to break down PFAS compounds into less harmful substances. Ion exchange employs resins to swap PFAS ions with less harmful ions in water. Additionally, bioremediation utilizes microorganisms to degrade PFAS, leveraging natural biological processes for detoxification. Together, these technologies offer a comprehensive approach to addressing PFAS contamination in various environmental settings.

FIGURE 37 ACTIVATED CARBON SEGMENT TO DRIVE PFAS FILTRATION MARKET BETWEEN 2024 AND 2029



	Activated Carbon	Ion Exchange Resin	Bioremediation	In-situ Chemical Oxidation	RO membrane & Nanofiltration	Others
2024	718.6	272.7	211.0	201.1	167.2	420.0
2029	1,007.5	392.9	303.1	289.1	247.0	566.9
CAGR (2024–2029)	7.0%	7.6%	7.5%	7.5%	8.1%	6.2%

Source: Secondary Research, Primary Interviews, and MarketsandMarkets Analysis

TABLE 17 PFAS FILTRATION MARKET, BY REMEDIATION TECHNOLOGY, 2021–2023 (USD MILLION)

REMEDIATION TECHNOLOGY	2021	2022	2023	CAGR (2021–2023)
Activated Carbon	609.3	653.2	669.7	4.8%
Ion Exchange Resin	226.8	244.7	252.5	5.5%
RO membrane & Nanofiltration	135.6	147.5	153.5	6.4%
In-situ Chemical Oxidation	167.8	180.8	186.4	5.4%
Bioremediation	176.2	189.8	195.6	5.4%
Others	358.3	383.3	392.3	4.6%
Total	**1,673.9**	**1,799.4**	**1,850.0**	**5.1%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 18 PFAS FILTRATION MARKET, BY REMEDIATION TECHNOLOGY, 2024–2029 (USD MILLION)

REMEDIATION TECHNOLOGY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Activated Carbon	718.6	771.2	826.3	884.0	944.4	1,007.5	7.0%
Ion Exchange Resin	272.7	294.2	317.0	341.0	366.3	392.9	7.6%
RO membrane & Nanofiltration	167.2	181.3	196.3	212.2	229.1	247.0	8.1%
In-situ Chemical Oxidation	201.1	216.8	233.5	251.1	269.6	289.1	7.5%
Bioremediation	211.0	227.5	245.0	263.4	282.7	303.1	7.5%
Others	420.0	447.4	475.9	505.3	535.6	566.9	6.2%
Total	**1,990.6**	**2,138.5**	**2,294.0**	**2,457.0**	**2,627.8**	**2,806.5**	**7.1%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 19 PFAS FILTRATION MARKET, BY REMEDIATION TECHNOLOGY, 2021–2023 (KILOTON)

REMEDIATION TECHNOLOGY	2021	2022	2023	CAGR (2021–2023)
Activated Carbon	279.1	297.0	302.3	4.1%
Ion Exchange Resin	85.7	91.7	93.9	4.7%
RO membrane & Nanofiltration	11.4	12.2	12.6	5.3%
In-situ Chemical Oxidation	38.4	41.0	41.9	4.5%
Bioremediation	12.3	13.2	13.4	4.4%
Others	51.4	54.4	55.1	3.5%
Total	**478.3**	**509.5**	**519.2**	4.2%

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 20 PFAS FILTRATION MARKET, BY REMEDIATION TECHNOLOGY, 2024–2029 (KILOTON)

REMEDIATION TECHNOLOGY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Activated Carbon	321.9	342.4	363.9	386.1	409.2	433.0	6.1%
Ion Exchange Resin	100.5	107.5	114.8	122.4	130.4	138.6	6.6%
RO membrane & Nanofiltration	13.6	14.6	15.7	16.8	17.9	19.2	7.1%
In-situ Chemical Oxidation	44.8	47.9	51.1	54.4	57.9	61.5	6.5%
Bioremediation	14.4	15.3	16.4	17.4	18.5	19.7	6.5%
Others	58.4	61.8	64.9	68.1	71.2	74.5	5.0%
Total	**553.7**	**589.5**	**626.7**	**665.3**	**705.2**	**746.4**	**6.2%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

9.2 MEMBRANES

9.2.1 ADOPTION OF MEMBRANE TECHNOLOGIES DRIVEN BY STRINGENT ENVIRONMENTAL REGULATIONS

Membrane technologies are integral to PFAS remediation, leveraging their capability to effectively filter and separate contaminants from water. These technologies utilize semi-permeable membranes that act as barriers, allowing water molecules to pass while blocking PFAS compounds. This separation process ensures the efficient removal of a wide range of PFAS, contributing to cleaner and safer water supplies. The impact of membrane filtration in PFAS remediation is significant due to its high efficiency and reliability in consistently achieving low levels of contaminants. The adoption and development of these membrane technologies are driven by stringent environmental regulations and the need for effective water treatment solutions. US-based companies such as Koch Membrane Systems, Dupont, Veolia, and Pall Corporation are leaders in the field, continually innovating to enhance membrane performance and durability. So, advancements in membrane materials and design have led to increased durability and reduced operational costs, making these technologies more accessible and sustainable for long-term use.

9.2.2 RO MEMBRANES

Reverse Osmosis (RO) membranes are instrumental in the field of water treatment, particularly in the removal of PFAS, a group of persistent contaminants with widespread environmental and health implications. RO membranes operate through a combination of size exclusion and electrostatic interactions. PFAS molecules, typically larger than water molecules, are effectively rejected by the RO membrane due to their size, thereby ensuring their removal from the treated water. This method has proven highly efficient in reducing PFAS concentrations to below regulatory limits, making it a preferred technology for mitigating PFAS contamination in water sources across the US.

The demand for PFAS remediation technologies has intensified due to growing awareness of their adverse health effects and regulatory pressures. Within the US, regulations such as the Safe Drinking Water Act (SDWA) and guidelines established by the Environmental Protection Agency (EPA) set maximum contaminant levels (MCLs) for various substances, including PFAS. Beyond federal regulations, specific states like California, Michigan, and New Jersey have enacted their own regulations and guidelines pertaining to PFAS contamination and remediation efforts. These regulations drive industries and municipalities to adopt advanced water treatment solutions like RO membranes to ensure compliance and safeguard public health. Companies such as Veolia and TRC are pivotal in this sector, offering specialized RO membrane systems tailored for PFAS removal. Veolia, a global leader in environmental services, leverages advanced membrane technologies within its water treatment solutions to effectively address PFAS contamination challenges. Similarly, TRC combines engineering expertise with environmental consulting to deliver comprehensive remediation strategies, emphasizing the integration of cutting-edge RO membrane technologies for optimal PFAS mitigation.

9.3 CHEMICALS

9.3.1 COST-EFFECTIVE FOR LARGE-SCALE REMEDIATION

Chemical remediation technology includes activated carbon adsorption, chemical oxidation, ion exchange, bioremediation, and others. The common benefits of these PFAS removal methods include high efficiency in reducing PFAS concentrations, versatility in treating various types of contaminated media, and the ability to target a broad spectrum of PFAS compounds. These methods often produce minimal secondary waste, making them environmentally friendly. Additionally, they can be cost-effective solutions for large-scale remediation efforts, providing sustainable options for mitigating the health and environmental impacts of PFAS contamination.

9.3.2 ACTIVATED CARBON ADSORPTION

Activated carbon is a highly effective adsorbent widely utilized for the removal of PFAS from contaminated water sources. Activated carbon is derived from carbonaceous materials like coal, wood, or coconut shells, processed to create a porous structure with a large internal surface area. In the PFAS removal process, contaminated water passes through activated carbon beds where PFAS molecules are adsorbed onto the carbon surfaces. This process is particularly effective due to the high affinity of activated carbon for PFAS compounds, enabling a significant reduction of PFAS concentrations in treated water.

The efficiency of activated carbon adsorption depends on factors such as contact time, flow rate, and the specific characteristics of the PFAS contaminants present. Several prominent companies in the US specialize in providing activated carbon adsorption technologies for PFAS remediation. Veolia, Clean Earth, Xylem, TRC Companies, and Battelle Memorial Institute are notable players in this field. Battelle Memorial Institute, for instance, offers the GAC Renew technology, which involves regenerating granular activated carbon (GAC) to extend its lifespan and optimize its effectiveness in PFAS removal processes. Various research indicates that activated carbon adsorption is one of the most reliable methods for PFAS removal, supported by numerous studies and applications across industrial and municipal settings. Its versatility and proven effectiveness make it a preferred choice for addressing PFAS contamination in water treatment systems.

9.3.3 CHEMICAL OXIDATION

Chemical oxidation for PFAS removal involves the use of powerful oxidizing agents to break down the persistent and stable carbon-fluorine bonds in PFAS, transforming them into less harmful byproducts. This process can be implemented through advanced oxidation processes (AOPs) that generate highly reactive species, such as hydroxyl radicals (OH·), capable of degrading PFAS molecules. Electro-oxidation, for instance, uses an electric current passed through water containing PFAS with electrodes coated with materials like boron-doped diamond. This electrical energy generates oxidizing agents directly at the electrode surface, enhancing the degradation of PFAS compounds.

Another method, Supercritical Water Oxidation (SCWO), involves heating water above its critical temperature and pressure to create a supercritical fluid that acts as an excellent solvent for organic compounds, including PFAS. In this state, organic contaminants are rapidly oxidized by agents like oxygen, converting PFAS into carbon dioxide, water, and inorganic salts. The benefits of chemical oxidation for PFAS removal include high efficiency, comprehensive degradation, minimal waste generation, and versatility. Chemical oxidation processes achieve high removal efficiencies for a broad spectrum of PFAS compounds, including those typically resistant to other treatment methods. These processes break down PFAS into benign byproducts such as carbon dioxide, water, and fluoride ions, ensuring that the harmful effects of PFAS are entirely mitigated.

In North America, several companies are at the forefront of developing and implementing chemical oxidation technologies for PFAS removal. In North America, several companies such as WSP and Clean Earth provide boron-doped electro-oxidation technology and supercritical oxidation solution for PFAS removal, respectively. In addition, Battelle has developed PFAS Annihilator technology, utilizing supercritical water oxidation to ensure complete and efficient degradation of PFAS compounds. These companies contribute significantly to mitigating the environmental and health impacts of PFAS contamination through innovative chemical oxidation solutions.

9.3.4 ION EXCHANGE RESIN

Ion exchange is an effective technology for removing PFAS from water resources. The ion exchange process involves passing contaminated water through a resin bed containing synthetic polymers that exchange ions with PFAS molecules. These resins are typically designed with functional groups that have a high affinity for PFAS ions, allowing for selective removal of these contaminants from water. During the ion exchange process, PFAS molecules in the water are attracted to and bind with the resin's active sites, displacing other ions (such as chloride or sulfate) that were originally present on the resin. This exchange effectively removes PFAS from the water, capturing them on the resin. Ion exchange resins are particularly advantageous for PFAS removal due to their high selectivity, efficiency, and ability to handle varying water chemistries. They can target a wide range of PFAS compounds, making them versatile for different contamination scenarios.

Several US-based companies specialize in providing ion exchange resin technologies for PFAS remediation. Veolia, for instance, offers specialty ion exchange resins specifically designed for high-affinity PFAS removal. These resins are engineered to optimize performance and longevity, making them suitable for both municipal and industrial applications. Xylem also provides advanced ion exchange solutions that effectively capture and remove PFAS from water, leveraging its expertise in water treatment technologies to address this critical environmental issue. TRC Companies, Inc. offers comprehensive ion exchange resin services as part of its broader suite of environmental remediation solutions, ensuring efficient and effective PFAS removal from contaminated sites.

9.3.5 BIOREMEDIATION

Bioremediation is an emerging approach for the removal of PFAS from contaminated environments, utilizing the natural metabolic processes of microorganisms to degrade these persistent compounds. The process begins with the identification and cultivation of specific microorganisms, such as bacteria or fungi, which are capable of breaking down PFAS. These microbes can be either naturally occurring or genetically engineered to enhance their degradative capabilities. The microorganisms utilize specific metabolic pathways involving enzymatic reactions that target the strong carbon-fluorine bonds in PFAS molecules, transforming them into less harmful substances like carbon dioxide, fluoride ions, and water. Bioremediation can be performed in-situ, directly at the contamination site, or ex-situ, in controlled environments such as bioreactors. In-situ methods involve stimulating the native microbial population by adding nutrients or electron donors to boost their activity, a process known as biostimulation. Ex-situ methods require excavating the contaminated material and treating it in bioreactors where conditions are optimized for microbial degradation. Additionally, bioaugmentation, the introduction of specific PFAS-degrading microorganisms, can be employed to accelerate the remediation process. The efficiency of bioremediation is influenced by various environmental factors including pH, temperature, oxygen levels, and the presence of co-contaminants. Maintaining optimal conditions is crucial for supporting microbial growth and activity. The benefits of bioremediation include its eco-friendly nature, as it uses natural processes with minimal environmental impact, and its cost-effectiveness, especially for large-scale contamination, as it reduces the need for expensive chemical treatments and extensive waste disposal.

9.3.6 OTHER REMEDIATION TECHNOLOGIES

Others include ball milling, modified clay technology, and foam fractionation. These are all the innovative processes for PFAS removal. Ball milling involves mechanically grinding materials with PFAS-contaminated media, breaking down PFAS compounds through physical and chemical interactions. Modified clay technology uses clays that have been chemically altered to increase their affinity for PFAS molecules, effectively adsorbing and immobilizing PFAS from contaminated water and soil. Foam fractionation is another effective technique, involving the generation of foam to separate and concentrate PFAS from contaminated water. PFAS molecules, due to their surfactant properties, preferentially migrate to the air-water interface within the foam. This foam, enriched with PFAS, is then removed, reducing the concentration of PFAS in the water. These innovative technologies, supported by companies such as WSP and Clean Earth, represent advanced and efficient methods for mitigating PFAS contamination in North America.

10 PFAS FILTRATION MARKET, BY SERVICE TYPE

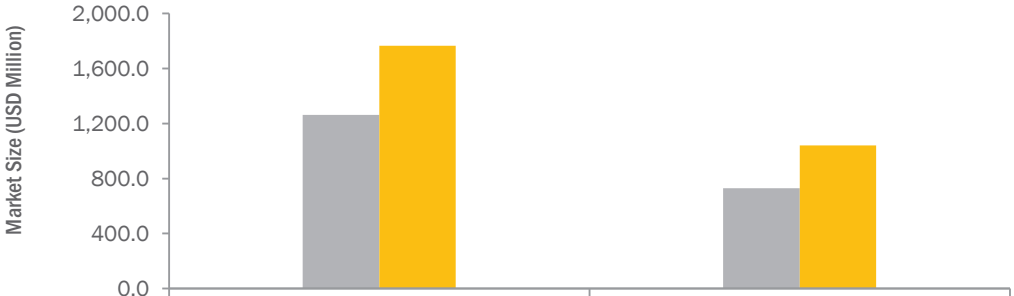
KEY FINDINGS

- In terms of value, the off-site segment accounted for a larger share of more than a quarter of the total PFAS filtration market in 2023.
- The market size of the off-site segment was USD 1,175 million in 2023 and is projected to reach USD 1,765 million by 2029, registering a CAGR of 6.9% from 2024.
- The market for on-site compounds is projected to grow at the highest rate.
- The market size of the on-site segment was USD 674 million in 2023 and is projected to reach USD 1,041 million by 2029, registering a CAGR of 7.4% from 2024.
- One significant advantage of off-site PFAS removal over on-site treatment is the ability to handle large volumes of contaminated water efficiently.

10.1 INTRODUCTION

The PFAS filtration market is segmented based on service type into on-site and off-site treatment. On-site treatment involves installing filtration systems directly at the contamination source or point of use, while off-site treatment typically involves transporting contaminated water to a central facility for purification.

FIGURE 38 OFF-SITE SEGMENT TO DRIVE PFAS FILTRATION MARKET BETWEEN 2024 AND 2029



	Off-site	On-site
2024	1,262.0	728.6
2029	1,765.3	1,041.2
CAGR (2024–2029)	6.9%	7.4%

Source: Secondary Research, Primary Interviews, and MarketsandMarkets Analysis

TABLE 21 PFAS FILTRATION MARKET, BY SERVICE TYPE, 2021–2023 (USD MILLION)

Service Type	2021	2022	2023	CAGR (2021–2023)
On-site	605.1	653.2	674.3	5.6%
Off-site	1,068.8	1,146.2	1,175.7	4.9%
Total	**1,673.9**	**1,799.4**	**1,850.0**	**5.1%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 22 PFAS FILTRATION MARKET, BY SERVICE TYPE, 2024–2029 (USD MILLION)

Service Type	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
On-site	728.6	784.8	844.2	906.6	972.3	1,041.2	7.4%
Off-site	1,262.0	1,353.7	1,449.8	1,550.4	1,655.5	1,765.3	6.9%
Total	**1,990.6**	**2,138.5**	**2,294.0**	**2,457.0**	**2,627.8**	**2,806.5**	**7.1%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

10.2 ON-SITE

10.2.1 IMMEDIACY AND CONVENIENCE TO DRIVE DEMAND

The primary advantage of on-site treatment is its immediacy and convenience, as it allows for the direct treatment of contaminated water at the source. This can be particularly beneficial for residential or small community applications where immediate water safety is crucial. However, on-site treatment systems can be costly to install and maintain, particularly for advanced technologies like RO. They also require regular monitoring and maintenance to ensure continued efficacy, which can be resource-intensive.

On-site PFAS removal technologies include granular activated carbon (GAC) filters, ion exchange resins, and reverse osmosis (RO) systems. GAC filters absorb PFAS compounds, effectively reducing their concentrations in water. Ion exchange resins operate by exchanging PFAS ions with other less harmful ions, thus removing contaminants from the water. RO systems use semi-permeable membranes to filter out PFAS, providing a high degree of purification. However, the disposal of spent media, such as used GAC or ion exchange resins, poses environmental challenges and requires careful handling.

10.3 OFF-SITE

10.3.1 SUITABILITY FOR MUNICIPAL & INDUSTRIAL END-USE INDUSTRIES TO DRIVE MARKET

The advantages of off-site treatment include the ability to handle large volumes of contaminated water, making it suitable for municipal or industrial-scale applications. Centralized treatment facilities can also benefit from economies of scale, reducing the per-unit cost of treatment. Furthermore, off-site facilities are typically managed by specialized personnel, ensuring consistent and high-quality operation and maintenance. However, the transportation of contaminated water to these facilities can be logistically complex and expensive. This approach also introduces the risk of spillage or leakage during transport, potentially exacerbating contamination issues. Additionally, off-site treatment can delay the purification process, as contaminated water must first be collected and transported before treatment begins, which might not be suitable for urgent contamination scenarios.

Off-site PFAS removal involves transporting contaminated water to a central treatment facility where advanced purification technologies are employed. Common technologies used in off-site treatment include large-scale activated carbon adsorption, advanced oxidation processes (AOPs), and sophisticated membrane filtration systems. These facilities are often equipped with more comprehensive and high-capacity treatment technologies than those feasible for on-site use.

11 PFAS FILTRATION MARKET, BY TECHNOLOGY TYPE

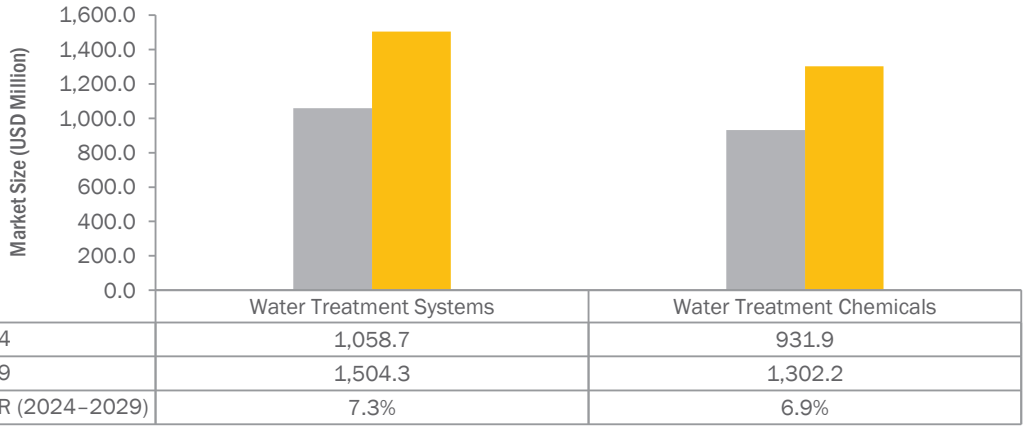
KEY FINDINGS

- The water treatment systems segment accounted for the larger share of 53% in 2023.
- The market size of the water treatment systems segment was USD 978 million in 2023 and is projected to reach USD 1,504 million by 2029, registering a CAGR of 7.3% from 2024 to 2029.
- The market for water treatment systems is projected to grow at the higher rate.
- The market size of the water treatment chemicals segment was USD 871 million in 2023 and is projected to reach USD 1,302 million by 2029, registering a CAGR of 6.9% from 2024.
- The technology market for PFAS is growing due to increasing awareness of PFAS contamination and the demand for effective filtration solutions to address environmental and public health concerns.

11.1 INTRODUCTION

The PFAS filtration market is segmented based on technology into water treatment systems and water treatment chemicals. Water treatment systems encompass a variety of technologies designed to purify water by removing contaminants such as PFAS. Systems include activated carbon filters for adsorption, ion exchange resins for ion removal, reverse osmosis for membrane filtration, nanofiltration for selective particle removal, advanced oxidation processes for chemical breakdown, and electrochemical treatment for molecular degradation. These systems are complemented by water treatment chemicals like coagulants, flocculants, oxidizing agents, adsorbents, and pH adjusters for process optimization. Together, they provide comprehensive solutions for improving water quality across various industrial, municipal, and residential applications.

FIGURE 39 WATER TREATMENT SYSTEMS SEGMENT TO LEAD PFAS FILTRATION MARKET BETWEEN 2024 AND 2029



	Water Treatment Systems	Water Treatment Chemicals
2024	1,058.7	931.9
2029	1,504.3	1,302.2
CAGR (2024–2029)	7.3%	6.9%

Source: Secondary Research, Primary Interviews, and MarketsandMarkets Analysis

TABLE 23 PFAS FILTRATION MARKET, BY TECHNOLOGY TYPE, 2021–2023 (USD MILLION)

TECHNOLOGY TYPE	2021	2022	2023	CAGR (2021–2023)
Water Treatment Systems	883.2	952.5	978.7	5.3%
Water Treatment Chemicals	790.7	847.0	871.4	5.0%
Total	**1,673.9**	**1,799.4**	**1,850.0**	**5.1%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 24 PFAS FILTRATION MARKET, BY TECHNOLOGY TYPE, 2024–2029 (USD MILLION)

TECHNOLOGY TYPE	2024	2025	2026	2027	2028	2029	CAGR (2024–2028)
Water Treatment Systems	1,058.7	1,139.1	1,223.8	1,312.8	1,406.3	1,504.3	7.3%
Water Treatment Chemicals	931.9	999.4	1,070.2	1,144.2	1,221.5	1,302.2	6.9%
Total	**1,990.6**	**2,138.5**	**2,294.0**	**2,457.0**	**2,627.8**	**2,806.5**	**7.1%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

11.2 WATER TREATMENT SYSTEMS

11.2.1 ACTIVATED CARBON FILTERS SUITABLE FOR LARGE-SCALE WATER TREATMENT APPLICATIONS

The growth of water treatment systems in PFAS filtration has surged due to rising concerns about the widespread contamination of water sources by these persistent chemicals. Recent developments in this field have focused on enhancing filtration efficacy, scalability, and sustainability. Additionally, there is a growing emphasis on the development of decentralized and modular treatment solutions to cater to diverse applications and settings, including industrial facilities, municipal water treatment plants, and residential areas affected by PFAS contamination. These modular systems offer flexibility, scalability, and cost-effectiveness, enabling tailored solutions for specific contamination scenarios.

Water treatment systems for PFAS filtration employ a variety of advanced technologies such as activated carbon filters, RO, nanofiltration, ion exchange, and advanced oxidation. Each method offers unique advantages for effectively removing these persistent contaminants from drinking water sources. Activated carbon filters are favored for their efficient adsorption of PFAS compounds as water flows through porous carbon materials. This method is versatile and effective across a wide range of PFAS concentrations, making it suitable for both large-scale and smaller-scale water treatment applications.

Activated carbon filters are widely recognized for their reliability, although they require periodic replacement of the carbon media to maintain optimal performance. Ion exchange resins offer another effective approach by selectively capturing PFAS molecules through ion exchange processes. This method provides predictable performance and is highly adaptable to various water qualities, making it suitable for treating specific contaminants in diverse environmental conditions. Reverse osmosis (RO) systems utilize a semipermeable membrane to block PFAS contaminants based on their size and charge. RO systems provide exceptionally high removal efficiency, even for concentrated PFAS streams, and are effective in treating water with complex mixtures of contaminants.

Advanced oxidation processes (AOPs) involve using oxidants such as ozone or hydrogen peroxide to break down PFAS compounds into less harmful byproducts. This method is effective for treating a wide range of contaminants and can be tailored to specific PFAS compounds, although it requires careful control of reaction conditions and may incur higher operational costs compared to other methods.

Nanofiltration employs membranes with smaller pores than traditional filtration methods, effectively removing PFAS through both size exclusion and surface interactions. This technology offers moderate energy consumption and is suitable for treating water with low to moderate PFAS concentrations, providing a balance between efficiency and operational costs. Integrating these advanced technologies into comprehensive water treatment strategies ensures the effective removal of PFAS contaminants, safeguarding public health by providing clean and safe drinking water. Companies such as Veolia, AECOM, Clean Earth, WSP, Battelle, Wood, and Xylem are recognized leaders in the field of water treatment systems for PFAS filtration.

11.3 WATER TREATMENT CHEMICALS

11.3.1 TECHNOLOGICAL ADVANCEMENTS IN WATER TREATMENT CHEMICALS TO DRIVE MARKET

Water treatment chemicals are essential components in the process of removing PFAS contaminants. Oxidizing agents like chlorine-based compounds, ozone, and hydrogen peroxide play a crucial role in breaking down PFAS molecules through oxidation reactions, transforming them into less harmful substances. Adsorbents such as activated carbon and certain ion exchange resins are employed to physically or chemically capture PFAS from the water, utilizing their high surface area and affinity for the contaminants. pH adjusting chemicals ensure optimal conditions for these processes by adjusting the water's acidity or alkalinity.

The growth of water treatment chemicals, particularly granular activated carbon (GAC), AOP, and ion exchange resins, in PFAS filtration, has seen significant momentum in recent years, driven by the urgent need to address PFAS contamination in water sources. Recent developments in this domain have focused on enhancing the performance and efficiency of these chemical filtration methods.

For GAC, advancements have been made in optimizing the pore structure and surface chemistry of activated carbon to maximize PFAS adsorption capacity. This includes the development of specialized carbon formulations with tailored pore sizes and functional groups to target specific PFAS compounds more effectively.

Similarly, advancements in ion exchange resins have centered on enhancing their selectivity and regeneration capabilities for PFAS removal. New resin formulations with improved affinity for PFAS molecules and enhanced durability under harsh operating conditions have been developed to enhance the efficiency and longevity of ion exchange processes.

Furthermore, recent developments have explored the synergistic effects of combining GAC and ion exchange processes within integrated treatment systems, leveraging the complementary strengths of each method to achieve higher PFAS removal efficiencies.

12 PFAS FILTRATION MARKET, BY REGION

KEY FINDINGS

- The global PFAS filtration market was estimated at USD 1,990 million in 2023 and is projected to reach USD 2,806 million by 2029, at a CAGR of 7.1% from 2024.
- North America accounted for the largest share (42.1%) of the global market, in terms of value, in 2023.
- Asia Pacific is projected to be the fastest-growing market, recording a CAGR of 7.9% in terms of value during the forecast period.
- The US is the largest market in the North American region and is projected to record a CAGR of 7.3% during the forecast period, in terms of value.
- The PFAS filtration market in the Middle East & Africa is projected to record a CAGR of 3.2%, in terms of value, between 2024 and 2029.

12.1 INTRODUCTION

The PFAS filtration market is segmented into five regions: Asia Pacific, North America, Europe, South America, and the Middle East & Africa. PFAS filtration is utilized in industries and municipal sectors where water is processed and utilized for consumption by the public. Increasing demand for clean water, stringent government regulations, population growth, urbanization, and socio-economic development are driving the market for PFAS filtration. In 2023, North America led the market for PFAS filtration, followed by Europe and Asia Pacific. Asia Pacific is the fastest-growing market due to its high population, increasing industrial growth, and stringent environmental norms.

North America is leading the PFAS (Per- and Polyfluoroalkyl Substances) filtration market, driven by stringent regulations and heightened awareness of the environmental and health impacts of PFAS contamination. In the US, the Environmental Protection Agency (EPA) has set rigorous standards and guidelines for PFAS levels in drinking water, pushing municipalities and industries to adopt advanced filtration technologies. This regulatory landscape, coupled with substantial public concern, has spurred significant investment and innovation in PFAS filtration solutions across North America. Major manufacturers in the region are continuously developing and refining technologies such as activated carbon filtration, ion exchange resins, and high-pressure membranes to meet the growing demand for effective PFAS removal.

Australia is emerging as the fastest-growing country in the Asia Pacific region for PFAS filtration, reflecting its proactive approach to managing PFAS contamination. Australian regulatory bodies have been increasingly vigilant in monitoring and addressing PFAS pollution, particularly in areas impacted by firefighting foam usage and industrial activities. This growth is supported by a combination of government initiatives, public awareness campaigns, and investments in cutting-edge research, positioning Australia as a key player in the Asia Pacific PFAS filtration market.

TABLE 25 PFAS FILTRATION MARKET, BY REGION, 2021–2023 (USD MILLION)

Region	2021	2022	2023	CAGR (2021–2023)
North America	703.6	757.0	778.9	2.1%
Europe	499.4	533.8	545.8	1.8%
Asia	354.0	383.3	396.9	2.3%
South America	60.7	65.7	68.0	2.3%
Middle East & Africa	56.2	59.6	60.5	1.5%
Total	**1,673.9**	**1,799.4**	**1,850.0**	**2.0%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 26 PFAS FILTRATION MARKET, BY REGION, 2024–2029 (USD MILLION)

Region	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
North America	839.0	903.3	971.0	1,042.2	1,117.1	1,195.6	7.3%
Europe	584.2	624.4	666.3	710.0	755.4	802.7	6.6%
Asia	430.2	465.5	502.9	542.5	584.4	628.7	7.9%
South America	73.7	79.3	85.3	91.6	98.3	105.2	7.4%
Middle East & Africa	63.5	66.0	68.4	70.6	72.6	74.4	3.2%
Total	**1,990.6**	**2,138.5**	**2,294.0**	**2,457.0**	**2,627.8**	**2,806.5**	**7.1%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 27 PFAS FILTRATION MARKET, BY REGION, 2021–2023 (KILOTON)

Region	2021	2022	2023	CAGR (2021–2023)
North America	195.9	208.8	212.9	4.2%
Europe	133.8	141.7	143.6	3.6%
Asia	114.1	122.5	125.6	4.9%
South America	17.2	18.5	19.0	4.9%
Middle East & Africa	17.2	18.0	18.1	2.8%
Total	**478.3**	**509.5**	**519.2**	**4.2%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 28 PFAS FILTRATION MARKET, BY REGION, 2024–2029 (KILOTON)

Region	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
North America	227.3	242.4	258.2	274.6	291.7	309.3	6.4%
Europe	152.3	161.3	170.6	180.1	189.9	199.9	5.6%
Asia	134.9	144.6	154.8	165.5	176.7	188.3	6.9%
South America	20.3	21.7	23.1	24.6	26.2	27.8	6.4%
Middle East & Africa	18.9	19.4	19.9	20.4	20.8	21.1	2.3%
Total	**553.7**	**589.5**	**626.7**	**665.3**	**705.2**	**746.4**	**6.2%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

12.2 NORTH AMERICA

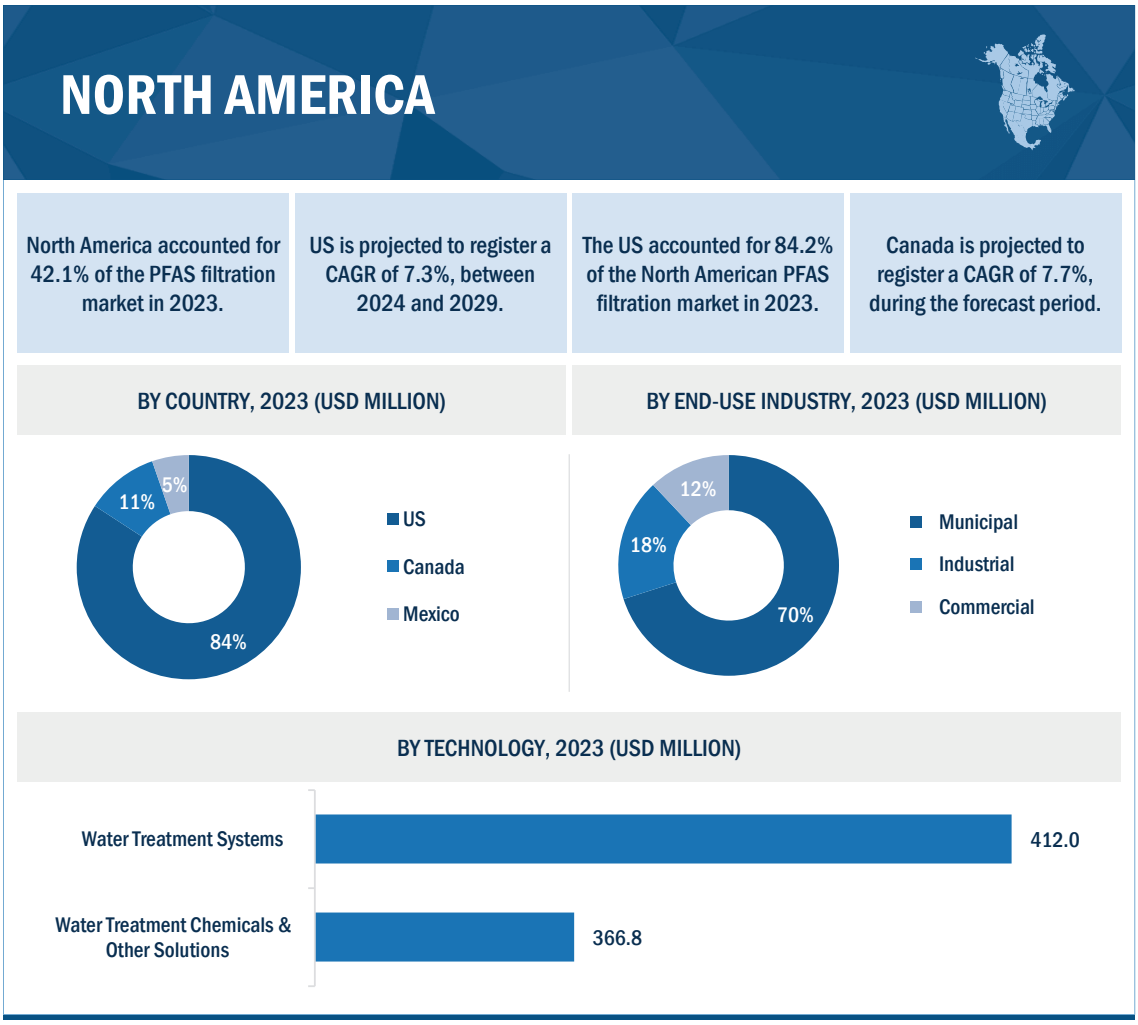
North America was the largest PFAS filtration market in 2023, accounting for 42.1% of the global market, in terms of value. The market in the region is segmented into the US, Canada, and Mexico. The major end users of PFAS filtration in North America are the municipal, industrial, and commercial sectors. In the North American PFAS filtration market, major industry players, including Veolia, Batelle, Calgon Carbon Corporation, Regenesis, and Mineral Technologies Inc., hold substantial market shares.

The growth of the PFAS filtration market in North America is significantly driven by stringent regulations regarding PFAS contamination. Governments and environmental agencies are increasingly recognizing the health risks posed by PFAS, which are linked to various serious health conditions, including cancer, thyroid disease, and immune system impairments. This has led to the implementation of rigorous regulatory frameworks aimed at controlling and reducing PFAS levels in water sources. The regulatory pressures compel industries, municipalities, and water treatment facilities to adopt advanced PFAS filtration technologies. Innovations in filtration methods, such as granular activated carbon (GAC), ion exchange resins, and reverse osmosis, are increasingly being deployed to meet the stringent regulatory requirements. The push for regulatory compliance has accelerated the development and adoption of these technologies, making the PFAS filtration market one of the fastest-growing segments in the water treatment industry in North America.

12.2.1 RECESSION IMPACT

The North American PFAS filtration market could experience a downturn during a recession, with businesses tightening budgets and prioritizing cost-cutting measures. The reduced industrial activities and financial constraints may dampen the demand for PFAS filtration systems. Companies could defer or scale back investments in sustainable practices, affecting market growth.

FIGURE 40 NORTH AMERICA: PFAS FILTRATION MARKET SNAPSHOT



Source: Secondary Research, Primary Interviews, and MarketsandMarkets Analysis

TABLE 29 NORTH AMERICA: PFAS FILTRATION MARKET, BY COUNTRY, 2021–2023 (USD MILLION)

COUNTRY	2021	2022	2023	CAGR (2021–2023)
US	595.7	639.1	655.8	4.9%
Canada	71.0	77.9	81.8	7.3%
Mexico	36.9	39.9	41.3	5.8%
Total	**703.6**	**757.0**	**778.9**	**5.2%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 30 NORTH AMERICA: PFAS FILTRATION MARKET, BY COUNTRY, 2024–2029 (USD MILLION)

COUNTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
US	705.9	759.4	815.7	874.8	936.8	1,001.9	7.3%
Canada	88.4	95.4	102.9	110.8	119.2	127.9	7.7%
Mexico	44.8	48.5	52.4	56.6	61.1	65.8	8.0%
Total	**839.0**	**903.3**	**971.0**	**1,042.2**	**1,117.1**	**1,195.6**	**7.3%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 31 NORTH AMERICA: PFAS FILTRATION MARKET, BY COUNTRY, 2021–2023 (KILOTON)

COUNTRY	2021	2022	2023	CAGR (2021–2023)
US	163.5	173.8	176.6	3.9%
Canada	20.9	22.8	23.7	6.3%
Mexico	11.5	12.3	12.6	4.8%
Total	**195.9**	**208.8**	**212.9**	**4.2%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 32 NORTH AMERICA: PFAS FILTRATION MARKET, BY COUNTRY, 2024–2029 (KILOTON)

COUNTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
US	188.4	200.8	213.7	227.1	241.0	255.3	6.3%
Canada	25.3	27.1	29.0	30.9	32.9	35.0	6.7%
Mexico	13.5	14.5	15.6	16.7	17.8	19.0	7.0%
Total	**227.3**	**242.4**	**258.2**	**274.6**	**291.7**	**309.3**	**6.4%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 33 NORTH AMERICA: PFAS FILTRATION MARKET, BY TECHNOLOGY TYPE, 2021–2023 (USD MILLION)

TECHNOLOGY TYPE	2021	2022	2023	CAGR (2021–2023)
Water Treatment Systems	371.2	400.7	412.0	5.3%
Water Treatment Chemicals	332.3	356.3	366.8	5.1%
Total	**703.6**	**757.0**	**778.9**	**5.2%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 34 NORTH AMERICA: PFAS FILTRATION MARKET, BY TECHNOLOGY TYPE, 2024–2029 (USD MILLION)

TECHNOLOGY TYPE	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Water Treatment Systems	446.2	481.1	518.0	556.9	597.8	640.8	7.5%
Water Treatment Chemicals	392.8	422.2	453.0	485.4	519.3	554.7	7.1%
Total	**839.0**	**903.3**	**971.0**	**1,042.2**	**1,117.1**	**1,195.6**	**7.3%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 35 NORTH AMERICA: PFAS FILTRATION MARKET, BY CONTAMINANT TYPE, 2021–2023 (USD MILLION)

CONTAMINANT TYPE	2021	2022	2023	CAGR (2021–2023)
PFOA & PFOS	364.0	390.3	400.3	4.9%
Multiple PFAS Compounds	339.6	366.6	378.5	5.6%
Total	**703.6**	**757.0**	**778.9**	**5.2%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 36 NORTH AMERICA: PFAS FILTRATION MARKET, BY CONTAMINANT TYPE, 2024–2029 (USD MILLION)

CONTAMINANT TYPE	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
PFOA & PFOS	430.6	462.8	496.7	532.3	569.5	608.5	7.2%
Multiple PFAS Compounds	408.5	440.5	474.3	510.0	547.5	587.0	7.5%
Total	**839.0**	**903.3**	**971.0**	**1,042.2**	**1,117.1**	**1,195.6**	**7.3%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 37 NORTH AMERICA: PFAS FILTRATION MARKET, BY REMEDIATION TECHNOLOGY, 2021–2023 (USD MILLION)

REMEDIATION TECHNOLOGY	2021	2022	2023	CAGR (2021–2023)
Activated Carbon	609.3	653.2	669.7	4.8%
Ion Exchange Resin	226.8	244.7	252.5	5.5%
RO membrane & Nanofiltration	135.6	147.5	153.5	6.4%
In-situ Chemical Oxidation	167.8	180.8	186.4	5.4%
Bioremediation	176.2	189.8	195.6	5.4%
Others	358.3	383.3	392.3	4.6%
Total	**1,673.9**	**1,799.4**	**1,850.0**	**5.1%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

.

TABLE 38 NORTH AMERICA: PFAS FILTRATION MARKET, BY REMEDIATION TECHNOLOGY, 2024–2029 (USD MILLION)

REMEDIATION TECHNOLOGY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Activated Carbon	718.6	771.2	826.3	884.0	944.4	1,007.5	7.0%
Ion Exchange Resin	272.7	294.2	317.0	341.0	366.3	392.9	7.6%
RO membrane & Nanofiltration	167.2	181.3	196.3	212.2	229.1	247.0	8.1%
In-situ Chemical Oxidation	201.1	216.8	233.5	251.1	269.6	289.1	7.5%
Bioremediation	211.0	227.5	245.0	263.4	282.7	303.1	7.5%
Others	420.0	447.4	475.9	505.3	535.6	566.9	6.2%
Total	**1,990.6**	**2,138.5**	**2,294.0**	**2,457.0**	**2,627.8**	**2,806.5**	**7.1%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 39 NORTH AMERICA: PFAS FILTRATION MARKET, BY REMEDIATION TECHNOLOGY, 2021–2023 (KILOTON)

REMEDIATION TECHNOLOGY	2021	2022	2023	CAGR (2021–2023)
Activated Carbon	114.5	121.9	124.2	4.1%
Ion Exchange Resin	34.6	37.0	37.9	4.7%
RO membrane & Nanofiltration	4.9	5.3	5.4	5.4%
In-situ Chemical Oxidation	13.8	14.7	15.1	4.6%
Bioremediation	4.9	5.2	5.3	4.5%
Others	23.2	24.6	25.0	3.7%
Total	**195.9**	**208.8**	**212.9**	**4.2%**

Note: Pricing includes materials, membranes & chemicals used in this process.

Note: Volume estimates are not cumulative rater its indicative in nature.

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 40 NORTH AMERICA: PFAS FILTRATION MARKET, BY REMEDIATION TECHNOLOGY, 2024–2029 (KILOTON)

REMEDIATION TECHNOLOGY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Activated Carbon	132.4	141.1	150.2	159.7	169.6	179.8	6.3%
Ion Exchange Resin	40.6	43.5	46.6	49.8	53.1	56.6	6.8%
RO membrane & Nanofiltration	5.9	6.3	6.8	7.3	7.8	8.3	7.3%
In-situ Chemical Oxidation	16.2	17.3	18.5	19.8	21.1	22.5	6.8%
Bioremediation	5.7	6.1	6.5	7.0	7.4	7.9	6.7%
Others	26.5	28.1	29.6	31.1	32.7	34.3	5.3%
Total	**227.3**	**242.4**	**258.2**	**274.6**	**291.7**	**309.3**	**6.4%**

Note: Pricing includes materials, membranes & chemicals used in this process.

Note: Volume estimates are not cumulative rater its indicative in nature.

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 41 NORTH AMERICA: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2021–2023 (USD MILLION)

END-USE INDUSTRY	2021	2022	2023	CAGR (2021–2023)
Industrial	124.8	135.0	139.7	5.8%
Municipal	493.6	530.7	545.7	5.1%
Commercial	85.2	91.3	93.5	4.8%
Total	**703.6**	**757.0**	**778.9**	**5.2%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 42 NORTH AMERICA: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2024–2029 (USD MILLION)

END-USE INDUSTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Industrial	151.3	163.6	176.6	190.4	204.9	220.3	7.8%
Municipal	587.4	631.3	677.5	726.0	776.8	829.9	7.2%
Commercial	100.3	108.4	116.9	125.9	135.4	145.4	7.7%
Total	**839.0**	**903.3**	**971.0**	**1,042.2**	**1,117.1**	**1,195.6**	**7.3%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 43 NORTH AMERICA: PFAS FILTRATION MARKET, BY END-USE INDUSTRY TYPE, 2021–2023 (KILOTON)

END-USE INDUSTRY	2021	2022	2023	CAGR (2021–2023)
Industrial	30.5	32.7	33.5	4.8%
Municipal	143.2	152.6	155.5	4.2%
Commercial	22.2	23.5	23.9	3.9%
Total	**195.9**	**208.8**	**212.9**	**4.2%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 44 NORTH AMERICA: PFAS FILTRATION MARKET, BY END-USE INDUSTRY TYPE, 2024–2029 (KILOTON)

END-USE INDUSTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Industrial	36.0	38.5	41.2	44.1	47.0	50.1	6.8%
Municipal	165.9	176.7	187.9	199.5	211.6	224.1	6.2%
Commercial	25.4	27.2	29.1	31.0	33.1	35.2	6.7%
Total	**227.3**	**242.4**	**258.2**	**274.6**	**291.7**	**309.3**	**6.4%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

12.2.2 US

12.2.2.1 Stringent regulations on PFAS contamination to drive market

The US is the largest market for PFAS filtration in North America, accounting for a share of 84.2%, in terms of value, in 2023. The country plays a pivotal role in the PFAS filtration market due to stringent wastewater regulations and the well-established nature of the market. Key industry players, such as Veolia, Batelle, Calgon Carbon Corporation, Regenesis, and Mineral Technologies Inc., are significant contributors to this market's landscape. Their presence underscores the market's maturity and reliance on established leaders. The principal end users of PFAS filtration in the US include the municipal, industrial (energy, mineral processing, and pharma sectors), and commercial end-use industries.

In the US, the Environmental Protection Agency (EPA) has been at the forefront of establishing guidelines and standards for PFAS levels in drinking water. The EPA's PFAS Action Plan outlines measures to address the contamination, including setting enforceable limits for PFAS in drinking water, conducting nationwide monitoring, and providing technical assistance for water treatment facilities. Additionally, individual states have enacted their own regulations, often setting even stricter limits than federal guidelines. For instance, states like Michigan, New York, and New Jersey have imposed rigorous standards and mandated regular testing and reporting of PFAS levels.

The country also has a huge and mature market for municipal water treatment. The US is increasingly adopting different technologies, including reverse osmosis and nano-filtration for drinking and wastewater treatment, due to the presence of stringent governmental regulations in the country. PFAS filtration plays a major role in addressing scaling and cost issues within various water treatment technologies, making them crucial for effective water treatment solutions. It plays a crucial role in this industry, helping to maintain the efficiency and environmental compliance of power plants and ensure the quality of water used in various processes. As the industry continues to evolve, the demand for PFAS filtration in the US is expected to remain significant.

TABLE 45 US: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2021–2023 (USD MILLION)

END-USE INDUSTRY	2021	2022	2023	CAGR (2021–2023)
Industrial	107.8	116.3	120.0	5.5%
Municipal	416.7	446.7	458.1	4.8%
Commercial	71.2	76.1	77.7	4.5%
Total	**595.7**	**639.1**	**655.8**	**4.9%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 46 US: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2024–2029 (USD MILLION)

END-USE INDUSTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Industrial	129.9	140.3	151.4	163.1	175.4	188.4	7.7%
Municipal	492.7	529.1	567.4	607.4	649.4	693.3	7.1%
Commercial	83.3	89.9	96.9	104.3	112.1	120.2	7.6%
Total	**705.9**	**759.4**	**815.7**	**874.8**	**936.8**	**1,001.9**	**7.3%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

12.2.3 CANADA

12.2.3.1 Rising government initiatives for PFAS removal to drive market

Canada is the second-largest market for PFAS Filtration in North America. According to the World Bank, the GDP of Canada was USD 2.16 trillion in 2022. Municipal wastewater treatment in Canada is a crucial issue affecting both large and small communities nationwide. With approximately 75% of Canadians relying on municipal sewer systems and the remainder on septic systems, the need for effective wastewater treatment is high. As of September 2021, the government had invested USD 2.16 billion to support water and wastewater-related infrastructure projects. The country has 796 water and wastewater-related infrastructure projects, of which 437 have been completed, and 359 are ongoing.

The Canadian government has been allocating substantial funding for water infrastructure projects, which include PFAS treatment and removal. Programs such as the Clean Water and Wastewater Fund (CWWF) provide financial assistance to municipalities to improve water and wastewater infrastructure, including projects aimed at mitigating PFAS contamination. Furthermore, the federal government supports research & development (R&D) initiatives focused on innovative PFAS treatment technologies. Grants and funding are available through organizations like the Natural Sciences and Engineering Research Council of Canada (NSERC) and Environment and Climate Change Canada (ECCC). These funds are directed toward studying PFAS impacts, developing new filtration methods, and improving existing technologies.

In Canada, provinces such as Ontario and Quebec are investing in PFAS monitoring and remediation programs. Ontario, for example, has dedicated funds toward assessing and mitigating PFAS contamination in industrial effluents and waste management practices. Quebec is similarly investing in regular monitoring and upgrading water treatment facilities to address PFAS in drinking water. Municipalities are increasingly prioritizing investments in water treatment upgrades to handle PFAS contamination. Cities like Toronto, Vancouver, and Montreal are implementing advanced filtration systems, such as granular activated carbon (GAC) and ion exchange resins, to ensure safe drinking water for their residents. These investments are often supported by both federal and provincial funding programs.

TABLE 47 CANADA: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2021–2023 (USD MILLION)

END-USE INDUSTRY	2021	2022	2023	CAGR (2021–2023)
Industrial	11.1	12.2	12.9	8.0%
Municipal	50.4	55.3	57.9	7.2%
Commercial	9.6	10.4	10.9	6.9%
Total	**71.0**	**77.9**	**81.8**	**7.3%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 48 CANADA: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2024–2029 (USD MILLION)

END-USE INDUSTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Industrial	14.1	15.3	16.5	17.9	19.3	20.9	8.2%
Municipal	62.6	67.5	72.6	78.1	83.8	89.8	7.5%
Commercial	11.8	12.7	13.8	14.9	16.0	17.3	8.0%
Total	**88.4**	**95.4**	**102.9**	**110.8**	**119.2**	**127.9**	**7.7%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

12.2.4 MEXICO

12.2.4.1 Increasing demand across industries to drive market

Mexico is a high-potential market for PFAS filtration. According to the World Bank, the country registered a GDP of USD 1.47 trillion in 2022. Mexico's PFAS filtration market is shaped by factors such as the need for effective municipal wastewater treatment, operational challenges, and the increasing adoption of ecological treatment systems. The Mexican government, through its environmental protection agency, SEMARNAT (Secretaría de Medio Ambiente y Recursos Naturales), is working on establishing regulations and guidelines for PFAS levels in water. These regulations are necessary to standardize treatment efforts and ensure safe drinking water for the population.

TABLE 49 MEXICO: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2021–2023 (USD MILLION)

END-USE INDUSTRY	2021	2022	2023	CAGR (2021–2023)
Industrial	5.9	6.5	6.7	6.5%
Municipal	26.5	28.7	29.7	5.8%
Commercial	4.4	4.7	4.9	5.4%
Total	**36.9**	**39.9**	**41.3**	**5.8%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 50 MEXICO: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2024–2029 (USD MILLION)

END-USE INDUSTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Industrial	7.3	8.0	8.7	9.4	10.2	11.0	8.5%
Municipal	32.1	34.8	37.5	40.5	43.6	46.8	7.8%
Commercial	5.3	5.7	6.2	6.8	7.3	7.9	8.4%
Total	**44.8**	**48.5**	**52.4**	**56.6**	**61.1**	**65.8**	**8.0%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

12.3 EUROPE

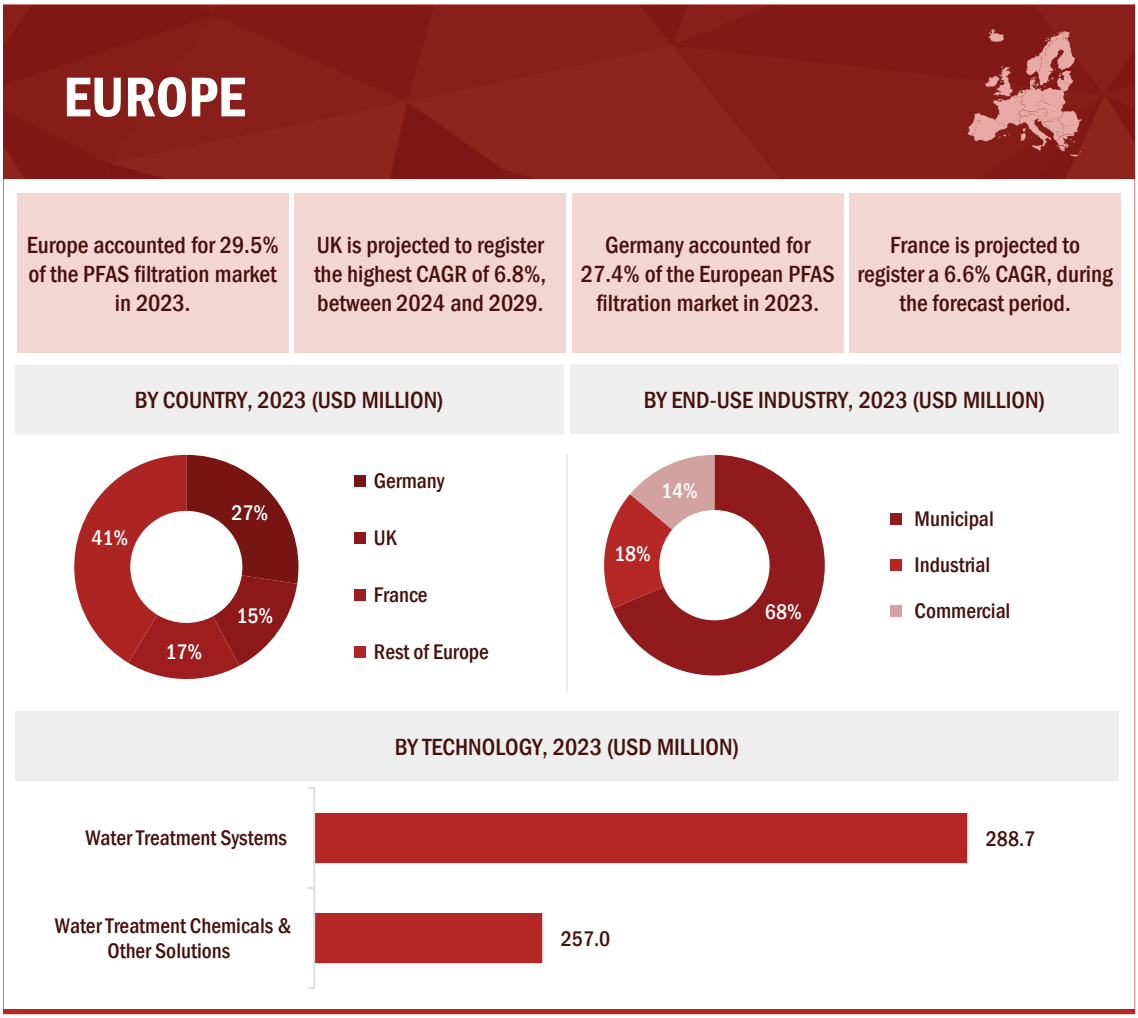
Europe is one of the major markets for PFAS filtration, accounting for 29.5% of the global market, in terms of value, in 2023. The market's robust performance is attributed to the growing awareness of the importance of environmental protection, public health, and technological advancements. Key end-user industries fueling the demand for PFAS filtration include municipal, industrial, and commercial.

The European industrial PFAS filtration market is poised for growth, driven by tightening regulations in various European countries mandating proper industrial water treatment. Germany, the UK, and France are the major countries considered in the European PFAS filtration market. Germany is the largest market, followed by France and the UK. The increased demand for PFAS filtration from the industrial sector and the increasing municipal water & commercial treatment initiatives by Germany are some of the major factors driving this market. Veolia, Eurowater, WSP, and Calgon Carbon Corporation are some of the major players operating in the PFAS filtration market in Europe.

12.3.1 RECESSION IMPACT

Europe suffered significantly from the economic effects of Russia's invasion of Ukraine after making a remarkable recovery from the pandemic. Growth abruptly stalled, prices skyrocketed, and periods of financial crises appeared. However, the majority of the economies narrowly averted recessions during the winter of 2022 as a consequence of determined policy action. Europe must maintain the economy, stop inflation, and maintain financial stability.

FIGURE 41 EUROPE: PFAS FILTRATION MARKET SNAPSHOT



Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 51 EUROPE: PFAS FILTRATION MARKET, BY COUNTRY, 2021–2023 (USD MILLION)

COUNTRY	2021	2022	2023	CAGR (2021–2023)
Germany	136.8	146.3	149.6	4.6%
UK	73.2	78.5	80.5	4.9%
France	82.4	88.2	90.2	4.6%
Rest of Europe	206.9	220.9	225.5	4.4%
Total	**499.4**	**533.8**	**545.8**	**4.5%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 52 EUROPE: PFAS FILTRATION MARKET, BY COUNTRY, 2024–2029 (USD MILLION)

COUNTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Germany	160.2	171.2	182.8	194.8	207.3	220.3	6.6%
UK	86.5	92.7	99.1	105.9	113.0	120.4	6.8%
France	96.6	103.3	110.3	117.6	125.2	133.2	6.6%
Rest of Europe	241.0	257.2	274.1	291.6	309.9	328.8	6.4%
Total	**584.2**	**624.4**	**666.3**	**710.0**	**755.4**	**802.7**	**6.6%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 53 EUROPE: PFAS FILTRATION MARKET, BY COUNTRY, 2021–2023 (KILOTON)

COUNTRY	2021	2022	2023	CAGR (2021–2023)
Germany	34.6	36.7	37.2	3.6%
UK	18.2	19.3	19.6	3.9%
France	22.6	23.9	24.2	3.6%
Rest of Europe	58.4	61.8	62.5	3.4%
Total	**133.8**	**141.7**	**143.6**	**3.6%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 54 EUROPE: PFAS FILTRATION MARKET, BY COUNTRY, 2024–2029 (KILOTON)

COUNTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Germany	39.4	41.8	44.2	46.7	49.2	51.8	5.6%
UK	20.9	22.2	23.5	24.9	26.3	27.8	5.9%
France	25.7	27.3	28.9	30.5	32.2	33.9	5.7%
Rest of Europe	66.2	70.0	74.0	78.0	82.1	86.3	5.4%
Total	**152.3**	**161.3**	**170.6**	**180.1**	**189.9**	**199.9**	**5.6%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 55 EUROPE: PFAS FILTRATION MARKET, BY TECHNOLOGY TYPE, 2021–2023 (USD MILLION)

TECHNOLOGY TYPE	2021	2022	2023	CAGR (2021–2023)
Water Treatment Systems	263.5	282.6	288.7	4.7%
Water Treatment Chemicals	235.9	251.3	257.0	4.4%
Total	**499.4**	**533.8**	**545.8**	**4.5%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 56 EUROPE: PFAS FILTRATION MARKET, BY TECHNOLOGY TYPE, 2024–2029 (USD MILLION)

TECHNOLOGY TYPE	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Water Treatment Systems	310.7	332.6	355.5	379.4	404.3	430.2	6.7%
Water Treatment Chemicals	273.5	291.8	310.8	330.6	351.2	372.4	6.4%
Total	**584.2**	**624.4**	**666.3**	**710.0**	**755.4**	**802.7**	**6.6%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 57 EUROPE: PFAS FILTRATION MARKET, BY CONTAMINANT TYPE, 2021–2023 (USD MILLION)

CONTAMINANT TYPE	2021	2022	2023	CAGR (2021–2023)
PFOA & PFOS	258.3	275.3	280.5	4.2%
Multiple PFAS Compounds	241.0	258.5	265.2	4.9%
Total	**499.4**	**533.8**	**545.8**	**4.5%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 58 EUROPE: PFAS FILTRATION MARKET, BY CONTAMINANT TYPE, 2024–2029 (USD MILLION)

CONTAMINANT TYPE	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
PFOA & PFOS	299.8	319.9	340.8	362.6	385.2	408.6	6.4%
Multiple PFAS Compounds	284.4	304.5	325.5	347.4	370.3	394.1	6.7%
Total	**584.2**	**624.4**	**666.3**	**710.0**	**755.4**	**802.7**	**6.6%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 59 EUROPE: PFAS FILTRATION MARKET, BY REMEDIATION TECHNOLOGY, 2021–2023 (USD MILLION)

REMEDIATION TECHNOLOGY	2021	2022	2023	CAGR (2021–2023)
Activated Carbon	189.8	202.3	206.3	4.3%
Ion Exchange Resin	72.4	77.7	79.7	4.9%
RO membrane & Nanofiltration	44.9	48.6	50.2	5.7%
In-situ Chemical Oxidation	54.9	58.9	60.3	4.8%
Bioremediation	57.4	61.5	63.0	4.8%
Others	79.9	84.9	86.2	3.9%
Total	**499.4**	**533.8**	**545.8**	**4.5%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

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TABLE 60 EUROPE: PFAS FILTRATION MARKET, BY REMEDIATION TECHNOLOGY, 2024–2029 (USD MILLION)

REMEDIATION TECHNOLOGY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Activated Carbon	220.2	234.8	250.3	266.4	283.1	300.5	6.4%
Ion Exchange Resin	85.6	91.8	98.3	105.2	112.4	119.9	7.0%
RO membrane & Nanofiltration	54.3	58.7	63.2	67.9	72.8	78.0	7.5%
In-situ Chemical Oxidation	64.7	69.3	74.2	79.4	84.8	90.4	6.9%
Bioremediation	67.6	72.4	77.6	82.9	88.5	94.4	6.9%
Others	91.7	97.4	102.8	108.2	113.8	119.5	5.4%
Total	**584.2**	**624.4**	**666.3**	**710.0**	**755.4**	**802.7**	**6.6%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 61 EUROPE: PFAS FILTRATION MARKET, BY REMEDIATION TECHNOLOGY, 2021–2023 (KILOTON)

REMEDIATION TECHNOLOGY	2021	2022	2023	CAGR (2021–2023)
Activated Carbon	78.0	82.5	83.5	3.5%
Ion Exchange Resin	22.8	24.2	24.7	4.1%
RO membrane & Nanofiltration	3.2	3.4	3.5	4.7%
In-situ Chemical Oxidation	10.9	11.6	11.7	3.9%
Bioremediation	3.2	3.4	3.5	3.8%
Others	15.8	16.7	16.8	3.0%
Total	**133.8**	**141.7**	**143.6**	**3.6%**

Note: Pricing includes materials, membranes & chemicals used in this process.

Note: Volume estimates are not cumulative rater its indicative in nature.

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 62 EUROPE: PFAS FILTRATION MARKET, BY REMEDIATION TECHNOLOGY, 2024–2029 (KILOTON)

REMEDIATION TECHNOLOGY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Activated Carbon	88.4	93.5	98.9	104.4	110.0	115.8	5.5%
Ion Exchange Resin	26.3	27.9	29.7	31.5	33.4	35.3	6.1%
RO membrane & Nanofiltration	3.7	4.0	4.3	4.5	4.8	5.1	6.5%
In-situ Chemical Oxidation	12.5	13.3	14.1	14.9	15.8	16.7	6.0%
Bioremediation	3.7	3.9	4.1	4.4	4.6	4.9	5.9%
Others	17.7	18.7	19.5	20.4	21.2	22.1	4.5%
Total	**152.3**	**161.3**	**170.6**	**180.1**	**189.9**	**199.9**	**5.6%**

Note: Pricing includes materials, membranes & chemicals used in this process.

Note: Volume estimates are not cumulative rater its indicative in nature.

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 63 EUROPE: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2021–2023 (USD MILLION)

END-USE INDUSTRY	2021	2022	2023	CAGR (2021–2023)
Industrial	86.7	93.3	95.9	5.1%
Municipal	342.9	366.3	374.2	4.5%
Commercial	69.7	74.3	75.6	4.2%
Total	**499.4**	**533.8**	**545.8**	**4.5%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 64 EUROPE: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2024–2029 (USD MILLION)

END-USE INDUSTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Industrial	103.2	110.8	118.8	127.2	135.9	145.1	7.0%
Municipal	400.3	427.1	454.9	483.9	514.0	545.1	6.4%
Commercial	80.7	86.5	92.6	98.9	105.5	112.4	6.9%
Total	**584.2**	**624.4**	**666.3**	**710.0**	**755.4**	**802.7**	**6.6%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 65 EUROPE: PFAS FILTRATION MARKET, BY END-USE INDUSTRY TYPE, 2021–2023 (KILOTON)

END-USE INDUSTRY	2021	2022	2023	CAGR (2021–2023)
Industrial	20.4	21.8	22.2	4.2%
Municipal	95.9	101.5	102.8	3.5%
Commercial	17.5	18.5	18.6	3.2%
Total	**133.8**	**141.7**	**143.6**	**3.6%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 66 EUROPE: PFAS FILTRATION MARKET, BY END-USE INDUSTRY TYPE, 2024–2029 (KILOTON)

END-USE INDUSTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Industrial	23.7	25.2	26.7	28.4	30.0	31.8	6.1%
Municipal	108.9	115.2	121.6	128.2	135.0	141.9	5.4%
Commercial	19.7	20.9	22.2	23.5	24.9	26.2	5.9%
Total	**152.3**	**161.3**	**170.6**	**180.1**	**189.9**	**199.9**	**5.6%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

12.3.2 GERMANY

12.3.2.1 Rising demand from end-use industries to fuel market growth

As per the Central Intelligence Agency (CIA), Germany is Europe's largest economy and the third-largest in the world. The country's GDP was USD 4.08 trillion in 2022. Germany is the most technologically advanced country in Europe and is a manufacturing hub for the automotive, chemicals, and pharmaceutical industries. The country boasts a well-developed wastewater treatment system. Approximately 97% of municipal wastewater in the country adheres to the highest EU standards. The system is characterized by small and medium-sized enterprises (SMEs), with over 9,100 municipal wastewater treatment facilities processing about 9.6 billion cubic meters of wastewater annually. Complementing these are approximately 2,600 industrial wastewater treatment plants handling 1.5 billion cubic meters of commercial wastewater. Germany's wastewater treatment system is renowned for advanced treatment and low distribution losses. As the system thrives on stringent regulations and exacting standards, the PFAS filtration market in Germany plays a pivotal role in maintaining these high treatment standards and preserving environmental integrity.

Stringent regulations related to PFAS treatment mandate the use of PFAS filtration, which further increases their demand. Germany's Drinking Water Ordinance sets strict limits on contaminants in drinking water, including PFAS. The ordinance aligns with the recommendations of the European Union and incorporates standards from the World Health Organization (WHO). The current regulatory limit for individual PFAS compounds, such as PFOA and PFOS, is set at very low concentrations, typically in the range of nanograms per liter (ng/L). Municipalities across Germany are upgrading their water treatment facilities to include advanced PFAS removal technologies. Commonly used methods include granular activated carbon (GAC), ion exchange resins, and high-pressure membrane filtration such as reverse osmosis. These upgrades are often supported by federal and state funding programs. The country's strong manufacturing base and R&D

are expected to drive various end-use industries, which, in turn, is expected to increase the demand for PFAS filtration in the country.

TABLE 67 GERMANY: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2021–2023 (USD MILLION)

END-USE INDUSTRY	2021	2022	2023	CAGR (2021–2023)
Industrial	24.1	25.9	26.6	5.2%
Municipal	93.7	100.1	102.3	4.5%
Commercial	19.1	20.3	20.7	4.2%
Total	**136.8**	**146.3**	**149.6**	**4.6%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 68 GERMANY: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2024–2029 (USD MILLION)

END-USE INDUSTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Industrial	28.7	30.8	33.0	35.3	37.8	40.3	7.1%
Municipal	109.4	116.8	124.4	132.4	140.6	149.2	6.4%
Commercial	22.1	23.7	25.4	27.1	28.9	30.8	6.9%
Total	**160.2**	**171.2**	**182.8**	**194.8**	**207.3**	**220.3**	**6.6%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

12.3.3 FRANCE

12.3.3.1 Growing focus on adherence to EU drinking water regulations to drive demand

France is the seventh-largest economy worldwide and plays an important role in industry, trade, and political integration within the EU. According to the World Bank, the country's GDP was USD 2.7 trillion in 2022. France has a well-established treatment infrastructure with a water distribution system catering to 99% of the population. The French government is planning a 20% increase in spending on the creation of new networks and decontamination and water treatment facilities by 2030. The water treatment industry is witnessing significant innovations owing to the increased demand and stringent environmental regulations enforced by the EU.

France's regulatory framework for managing PFAS contamination aligns with broader European Union directives while also incorporating specific national measures. The French government has set regulatory limits for PFAS in drinking water, informed by guidelines from the World Health Organization (WHO) and European regulations. France adheres to the EU Drinking Water Directive and the REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals) regulation, which govern the management of PFAS within the EU. These regulations set specific limits for PFAS concentrations in drinking water and require member states to monitor and report PFAS levels regularly.

TABLE 69 FRANCE: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2021–2023 (USD MILLION)

END-USE INDUSTRY	2021	2022	2023	CAGR (2021–2023)
Industrial	15.0	16.1	16.6	5.2%
Municipal	55.4	59.2	60.6	4.5%
Commercial	12.0	12.8	13.0	4.2%
Total	**82.4**	**88.2**	**90.2**	**4.6%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 70 FRANCE: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2024–2029 (USD MILLION)

END-USE INDUSTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Industrial	17.9	19.2	20.6	22.0	23.6	25.2	7.1%
Municipal	64.8	69.2	73.7	78.5	83.4	88.6	6.4%
Commercial	13.9	14.9	16.0	17.1	18.2	19.4	6.9%
Total	**96.6**	**103.3**	**110.3**	**117.6**	**125.2**	**133.2**	**6.6%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

12.3.4 UK

12.3.4.1 Universities and government are funding PFAS removal projects

According to the World Bank, the UK is the sixth-largest economy globally, with a GDP of USD 3.09 trillion in 2022. It is one of the most prominent economies in Europe. The focus on services and manufacturing sectors presents opportunities for water treatment in various industrial and public utility applications. Growing urbanization, increasing investments in the manufacturing sector, and stringent environmental policies are helping the growth of the country's industrial sector, further boosting the PFAS filtration market. The Environment Agency, the Scottish Environment Protection Agency, and the Department for the Environment for Northern Ireland are major regulatory bodies that implement discharge standards for wastewater to meet the standards of European Directives. The Urban Wastewater Treatment Directive for the mandatory treatment of industrial wastewater, demand for high-quality drinking water, and renewed government expenditure on water treatment utilities are expected to propel the market.

The UK government is also focusing on plans for wastewater treatment with an investment of more than USD 50 billion on improving services between 2020 and 2025. Universities like Swansea and Dŵr Cymru Welsh Water are offering a fully funded PhD scholarship to develop effective treatment technologies to reduce or remove PFAS from drinking water, wastewater, and sludge. Furthermore. the UK government has convened the PFAS Chemicals Stakeholders Forum (CSF) Working Group to inform policy development and identify priorities for the UK REACH 2024 WORK PROGRAMME, which will include the development of PFAS restriction proposals.

TABLE 71 UK: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2021–2023 (USD MILLION)

END-USE INDUSTRY	2021	2022	2023	CAGR (2021–2023)
Industrial	13.1	14.1	14.6	5.5%
Municipal	50.3	53.9	55.3	4.8%
Commercial	9.8	10.4	10.7	4.5%
Total	**73.2**	**78.5**	**80.5**	**4.9%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 72 UK: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2024–2029 (USD MILLION)

END-USE INDUSTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Industrial	15.7	16.9	18.2	19.5	20.9	22.4	7.3%
Municipal	59.3	63.5	67.8	72.3	77.0	81.9	6.7%
Commercial	11.4	12.3	13.2	14.1	15.1	16.1	7.2%
Total	**86.5**	**92.7**	**99.1**	**105.9**	**113.0**	**120.4**	**6.8%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

12.3.5 REST OF EUROPE

The PFAS filtration market in Rest of Europe is considered for Spain, Italy, the Netherlands, Poland, Denmark, Sweden, and Romania. Rapid industrialization in these countries is creating a demand for water, which exceeds the available quantities. There is a need for comprehensive planning of water resources considering the economic, social, and environmental issues in the region. The major drivers for the PFAS filtration market include increasing urbanization, stringent regulatory measures by governments on the treatment of wastewater and drinking water, water scarcity, and increasing industrial requirements. Volatile economic conditions in these countries have slowed down market growth over the past few years. However, the improving economic conditions and subsequent growth in various end-use industries, such as chemicals and pharmaceuticals, are expected to increase the consumption of PFAS filtration in the Rest of Europe.

TABLE 73 REST OF EUROPE: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2021–2023 (USD MILLION)

END-USE INDUSTRY	2021	2022	2023	CAGR (2021–2023)
Industrial	34.6	37.1	38.1	5.0%
Municipal	143.5	153.1	156.1	4.3%
Commercial	28.9	30.7	31.2	4.0%
Total	**206.9**	**220.9**	**225.5**	**4.4%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 74 REST OF EUROPE: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2024–2029 (USD MILLION)

END-USE INDUSTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Industrial	41.0	43.9	47.0	50.3	53.7	57.2	6.9%
Municipal	166.8	177.7	189.0	200.8	212.9	225.5	6.2%
Commercial	33.3	35.6	38.0	40.6	43.3	46.0	6.7%
Total	**241.0**	**257.2**	**274.1**	**291.6**	**309.9**	**328.8**	**6.4%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

12.4 ASIA PACIFIC

Asia Pacific is the third-largest PFAS filtration market, and accounted for a share of 21.5% in 2023, in terms of value. The PFAS filtration market in the region is experiencing significant growth due to a combination of rapid industrialization and urbanization in countries like China, India, Japan, and South Korea. These countries have seen extensive use of PFAS in various industries, leading to considerable environmental contamination that necessitates effective filtration solutions. Stringent environmental regulations being implemented across the region compel industries to adopt advanced PFAS filtration technologies to comply with legal requirements and avoid penalties.

12.4.1 RECESSION IMPACT

One of the major recession impacts on the Asia Pacific region is a decline in trade and investment. The region is a key exporter of goods and services. A slowdown in economic activity can lead to reduced export demand from other countries, resulting in a decline in global trade volumes and economic growth in other regions. A decline in economic activity can decrease the demand for commodities, such as oil, metals, and agricultural products, produced in this region. This can result in lower prices, significantly affecting the economies of countries that rely heavily on commodity exports. The impact of recession in the Asia Pacific region can vary depending on the severity and duration of the downturn and the countries and industries most affected.

TABLE 75 ASIA PACIFIC: PFAS FILTRATION MARKET, BY COUNTRY, 2021–2023 (USD MILLION)

COUNTRY	2021	2022	2023	CAGR (2021–2023)
China	110.6	120.0	124.4	6.1%
Japan	70.9	76.5	78.9	5.5%
Australia	43.8	47.7	49.7	6.5%
Rest of Asia Pacific	128.7	139.2	143.9	5.7%
Total	**354.0**	**383.3**	**396.9**	**5.9%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 76 ASIA PACIFIC: PFAS FILTRATION MARKET, BY COUNTRY, 2024–2029 (USD MILLION)

COUNTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
China	135.1	146.4	158.5	171.3	184.9	199.3	8.1%
Japan	85.2	92.0	99.2	106.8	114.8	123.2	7.7%
Australia	54.2	59.0	64.2	69.7	75.5	81.7	8.6%
Rest of Asia Pacific	155.7	168.0	181.1	194.8	209.2	224.4	7.6%
Total	**430.2**	**465.5**	**502.9**	**542.5**	**584.4**	**628.7**	**7.9%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 77 ASIA PACIFIC: PFAS FILTRATION MARKET, BY COUNTRY, 2021–2023 (KILOTON)

COUNTRY	2021	2022	2023	CAGR (2021–2023)
China	38.4	41.3	42.4	5.1%
Japan	21.0	22.5	23.0	4.5%
Australia	13.1	14.1	14.6	5.5%
Rest of Asia Pacific	41.6	44.5	45.6	4.8%
Total	**114.1**	**122.5**	**125.6**	**4.9%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 78 ASIA PACIFIC: PFAS FILTRATION MARKET, BY COUNTRY, 2024–2029 (KILOTON)

COUNTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
China	45.7	49.0	52.6	56.3	60.2	64.3	7.1%
Japan	24.6	26.3	28.1	29.9	31.9	33.9	6.7%
Australia	15.8	17.0	18.3	19.7	21.2	22.7	7.6%
Rest of Asia Pacific	48.9	52.3	55.9	59.5	63.4	67.4	6.6%
Total	**134.9**	**144.6**	**154.8**	**165.5**	**176.7**	**188.3**	**6.9%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 79 ASIA PACIFIC: PFAS FILTRATION MARKET, BY TECHNOLOGY TYPE, 2021–2023 (USD MILLION)

TECHNOLOGY TYPE	2021	2022	2023	CAGR (2021–2023)
Water Treatment Systems	183.3	199.1	206.0	6.0%
Water Treatment Chemicals	170.8	184.3	190.9	5.7%
Total	**354.0**	**383.3**	**396.9**	**5.9%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 80 ASIA PACIFIC: PFAS FILTRATION MARKET, BY TECHNOLOGY TYPE, 2024–2029 (USD MILLION)

TECHNOLOGY TYPE	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Water Treatment Systems	224.5	243.3	263.3	284.5	306.9	330.7	8.1%
Water Treatment Chemicals	205.7	222.2	239.6	258.1	277.5	298.0	7.7%
Total	**430.2**	**465.5**	**502.9**	**542.5**	**584.4**	**628.7**	**7.9%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 81 ASIA PACIFIC: PFAS FILTRATION MARKET, BY CONTAMINANT TYPE, 2021–2023 (USD MILLION)

CONTAMINANT TYPE	2021	2022	2023	CAGR (2021–2023)
PFOA & PFOS	186.7	201.5	208.0	5.5%
Multiple PFAS Compounds	167.3	181.8	188.9	6.3%
Total	**354.0**	**383.3**	**396.9**	**5.9%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 82 ASIA PACIFIC: PFAS FILTRATION MARKET, BY CONTAMINANT TYPE, 2024–2029 (USD MILLION)

CONTAMINANT TYPE	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
PFOA & PFOS	225.1	243.1	262.3	282.5	303.8	326.3	7.7%
Multiple PFAS Compounds	205.1	222.3	240.6	260.0	280.6	302.4	8.1%
Total	**430.2**	**465.5**	**502.9**	**542.5**	**584.4**	**628.7**	**7.9%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 83 ASIA PACIFIC: PFAS FILTRATION MARKET, BY REMEDIATION TECHNOLOGY, 2021–2023 (USD MILLION)

REMEDIATION TECHNOLOGY	2021	2022	2023	CAGR (2021–2023)
Activated Carbon	137.7	148.7	153.6	5.6%
Ion Exchange Resin	54.5	59.2	61.5	6.2%
RO membrane & Nanofiltration	28.7	31.4	32.9	7.2%
In-situ Chemical Oxidation	42.1	45.7	47.4	6.1%
Bioremediation	47.1	51.1	53.0	6.1%
Others	43.9	47.2	48.4	5.0%
Total	**354.0**	**383.3**	**396.9**	**5.9%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

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TABLE 84 ASIA PACIFIC: PFAS FILTRATION MARKET, BY REMEDIATION TECHNOLOGY, 2024–2029 (USD MILLION)

REMEDIATION TECHNOLOGY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Activated Carbon	166.1	179.2	193.4	208.4	224.3	241.0	7.7%
Ion Exchange Resin	66.9	72.6	78.8	85.3	92.2	99.6	8.3%
RO membrane & Nanofiltration	36.1	39.6	43.1	47.0	51.1	55.4	8.9%
In-situ Chemical Oxidation	51.5	55.9	60.5	65.5	70.8	76.4	8.2%
Bioremediation	57.5	62.4	67.6	73.1	79.0	85.2	8.2%
Others	52.1	55.9	59.5	63.2	67.0	70.9	6.4%
Total	**430.2**	**465.5**	**502.9**	**542.5**	**584.4**	**628.7**	**7.9%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 85 ASIA PACIFIC: PFAS FILTRATION MARKET, BY REMEDIATION TECHNOLOGY, 2021–2023 (KILOTON)

REMEDIATION TECHNOLOGY	2021	2022	2023	CAGR (2021–2023)
Activated Carbon	66.1	70.9	72.6	4.8%
Ion Exchange Resin	21.4	23.1	23.8	5.4%
RO membrane & Nanofiltration	2.5	2.7	2.8	6.2%
In-situ Chemical Oxidation	10.3	11.1	11.4	5.2%
Bioremediation	3.2	3.4	3.5	5.1%
Others	10.7	11.4	11.6	4.1%
Total	**114.1**	**122.5**	**125.6**	**4.9%**

Note: Pricing includes materials, membranes & chemicals used in this process.

Note: Volume estimates are not cumulative rater its indicative in nature.

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 86 ASIA PACIFIC: PFAS FILTRATION MARKET, BY REMEDIATION TECHNOLOGY, 2024–2029 (KILOTON)

REMEDIATION TECHNOLOGY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Activated Carbon	77.9	83.4	89.2	95.4	101.8	108.4	6.8%
Ion Exchange Resin	25.6	27.6	29.7	31.9	34.1	36.6	7.4%
RO membrane & Nanofiltration	3.0	3.3	3.5	3.8	4.1	4.4	8.0%
In-situ Chemical Oxidation	12.3	13.2	14.2	15.2	16.3	17.4	7.3%
Bioremediation	3.8	4.1	4.4	4.7	5.0	5.4	7.2%
Others	12.4	13.2	13.9	14.6	15.4	16.1	5.5%
Total	**134.9**	**144.6**	**154.8**	**165.5**	**176.7**	**188.3**	**6.9%**

Note: Pricing includes materials, membranes & chemicals used in this process.

Note: Volume estimates are not cumulative rater its indicative in nature.

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 87 ASIA PACIFIC: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2021–2023 (USD MILLION)

END-USE INDUSTRY	2021	2022	2023	CAGR (2021–2023)
Industrial	57.7	62.8	65.4	6.5%
Municipal	249.0	269.5	278.8	5.8%
Commercial	47.3	51.1	52.7	5.5%
Total	**354.0**	**383.3**	**396.9**	**5.9%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 88 ASIA PACIFIC: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2024–2029 (USD MILLION)

END-USE INDUSTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Industrial	71.3	77.6	84.2	91.3	98.8	106.8	8.4%
Municipal	302.0	326.2	351.8	378.9	407.4	437.5	7.7%
Commercial	56.9	61.7	66.9	72.4	78.2	84.4	8.2%
Total	**430.2**	**465.5**	**502.9**	**542.5**	**584.4**	**628.7**	**7.9%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 89 ASIA PACIFIC: PFAS FILTRATION MARKET, BY END-USE INDUSTRY TYPE, 2021–2023 (KILOTON)

END-USE INDUSTRY	2021	2022	2023	CAGR (2021–2023)
Industrial	16.3	17.6	18.2	5.6%
Municipal	83.6	89.6	91.9	4.8%
Commercial	14.3	15.2	15.6	4.5%
Total	**114.1**	**122.5**	**125.6**	**4.9%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 90 ASIA PACIFIC: PFAS FILTRATION MARKET, BY END-USE INDUSTRY TYPE, 2024–2029 (KILOTON)

END-USE INDUSTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Industrial	19.6	21.1	22.7	24.4	26.2	28.1	7.4%
Municipal	98.6	105.6	112.8	120.4	128.4	136.6	6.7%
Commercial	16.7	17.9	19.3	20.6	22.1	23.6	7.2%
Total	**134.9**	**144.6**	**154.8**	**165.5**	**176.7**	**188.3**	**6.9%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

12.4.2 CHINA

12.4.2.1 Stringent water treatment policies to drive demand

According to the World Bank, China is the world's second-largest economy, with a GDP of USD 17.9 trillion in 2022. China was the largest market for PFAS filtration in the Asia Pacific, accounting for a share of 31.3% in terms of value, in 2023. The country's PFAS filtration market has been significantly influenced by robust government policies, particularly those related to environmental protection and water management. Faced with severe water scarcity and pollution issues, China has implemented stringent regulations to address these challenges. The Environmental Protection Law (EPL) supports the growth of environmental infrastructure in the country. In the water & wastewater treatment sector, the Clean Water Action Plan provides a target for achieving excellent water quality of level-3 by 2030 throughout the urban areas of the country. In 2020, the State Council of China released the 14th Five-Year Plan, identifying water and wastewater treatment as one of the important areas for environmental protection. Such government policies are expected to drive the PFAS filtration market in the country.

China has a strong manufacturing sector, and it is the world's largest manufacturer in terms of manufacturing output. The country accounted for a 28.7% share of the global manufacturing output in 2019, as per the United Nations Statistics Division. The country has various end-use industries such as textiles, oil & gas, metals & mining, pharmaceuticals, and chemicals & petrochemicals. These industries utilize PFAS for their unique properties like resistance to heat, water, and oil. This widespread use results in significant environmental and water contamination, driving the need for advanced PFAS filtration technologies, and thus propelling the growth of the PFAS filtration market.

TABLE 91 CHINA: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2021–2023 (USD MILLION)

END-USE INDUSTRY	2021	2022	2023	CAGR (2021–2023)
Industrial	19.5	21.2	22.1	6.7%
Municipal	78.1	84.6	87.7	6.0%
Commercial	13.1	14.2	14.6	5.6%
Total	**110.6**	**120.0**	**124.4**	**6.1%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 92 CHINA: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2024–2029 (USD MILLION)

END-USE INDUSTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Industrial	24.2	26.3	28.6	31.1	33.7	36.5	8.6%
Municipal	95.1	102.9	111.2	120.0	129.3	139.1	7.9%
Commercial	15.8	17.2	18.7	20.3	21.9	23.7	8.5%
Total	**135.1**	**146.4**	**158.5**	**171.3**	**184.9**	**199.3**	**8.1%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

12.4.3 JAPAN

12.4.3.1 Growing pharmaceutical industry to drive market

Japan is the second-largest market, in terms of value, for PFAS filtration in Asia Pacific due to the rapid growth of various industries. According to IMF's World Economic Outlook 2022, Japan is the third-largest economy in the world by nominal GDP and the fourth-largest by purchasing power parity. According to the World Bank, the GDP of Japan in 2022 was USD 4.2 trillion.

Japan is one of the largest pharmaceutical markets in the world. According to the Ministry of Health, Labor, and Welfare (MHLW), the pharmaceuticals market in the country was estimated to be USD 107 billion in 2020. The pharmaceutical industry utilizes PFAS for their non-stick and heat-resistant properties in manufacturing processes, as well as in packaging materials for their excellent barrier properties. These uses result in PFAS contamination through effluent discharge from manufacturing waste and cleaning processes, as well as through the improper disposal of packaging and expired products. As the pharmaceutical sector in Japan continues to grow, the increased production volumes and the resulting potential for PFAS contamination necessitate expanded and robust filtration infrastructure, thus propelling the PFAS filtration market.

TABLE 93 JAPAN: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2021–2023 (USD MILLION)

END-USE INDUSTRY	2021	2022	2023	CAGR (2021–2023)
Industrial	12.5	13.5	14.0	6.1%
Municipal	49.8	53.7	55.3	5.4%
Commercial	8.6	9.3	9.5	5.1%
Total	**70.9**	**76.5**	**78.9**	**5.5%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 94 JAPAN: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2024–2029 (USD MILLION)

END-USE INDUSTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Industrial	15.2	16.5	17.9	19.4	20.9	22.5	8.1%
Municipal	59.7	64.4	69.3	74.5	79.9	85.6	7.5%
Commercial	10.2	11.1	12.0	12.9	14.0	15.0	8.0%
Total	**85.2**	**92.0**	**99.2**	**106.8**	**114.8**	**123.2**	**7.7%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

12.4.4 AUSTRALIA

12.4.4.1 Stringent government regulations to drive market

Australia is the third-largest market, in terms of value, for PFAS filtration in Asia Pacific. As per the World Bank, the GDP of Australia in 2022 was USD 1.6 trillion. Australia's economy is robust and diverse, characterized by a strong services sector, significant natural resource wealth, and a well-developed infrastructure. Australia is one of the world's leading exporters of commodities such as iron ore, coal, and liquefied natural gas, which play a crucial role in its trade dynamics, particularly with major partners like China. The country has a stable political environment, a high standard of living, and a skilled workforce, which contribute to its economic resilience.

The market for PFAS (per- and polyfluoroalkyl substances) filtration in Australia is experiencing significant growth, driven primarily by stringent government regulations aimed at addressing environmental and health concerns associated with PFAS contamination. PFAS are persistent chemicals known for their resistance to heat, water, and oil, making them challenging to degrade once released into the environment. In response to growing public awareness and scientific evidence of their adverse effects, Australian regulatory bodies have implemented robust measures to control and reduce PFAS pollution. One pivotal regulation driving the PFAS filtration market is the National Environmental Management Plan (NEPM) for PFAS. Introduced by the Australian government, this plan provides a comprehensive framework for managing PFAS contamination across various sectors, including industrial sites, airports, and defense facilities. It mandates strict monitoring, assessment, and remediation protocols, compelling industries to invest in advanced filtration technologies to comply with stringent discharge limits and ensure environmental safety. Furthermore, state-level regulations supplement the NEPM with specific guidelines tailored to local conditions and contamination levels. For instance, in states like Queensland and New South Wales, regulatory bodies have enacted legislation requiring proactive measures for PFAS remediation in affected areas. These regulations not only emphasize prevention and mitigation but also stimulate demand for innovative filtration solutions capable of effectively removing PFAS from water sources and industrial effluents. As regulatory frameworks continue to evolve and enforcement measures tighten, the demand for advanced PFAS filtration technologies is expected to escalate, driving further innovation and investment in this critical sector.

TABLE 95 AUSTRALIA: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2021–2023 (USD MILLION)

END-USE INDUSTRY	2021	2022	2023	CAGR (2021–2023)
Industrial	6.5	7.2	7.5	7.2%
Municipal	30.8	33.5	34.9	6.4%
Commercial	6.5	7.1	7.3	6.2%
Total	**43.8**	**47.7**	**49.7**	**6.5%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 96 AUSTRALIA: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2024–2029 (USD MILLION)

END-USE INDUSTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Industrial	8.2	9.0	9.9	10.8	11.7	12.7	9.1%
Municipal	38.0	41.3	44.8	48.6	52.6	56.8	8.4%
Commercial	8.0	8.7	9.5	10.3	11.2	12.2	8.9%
Total	**54.2**	**59.0**	**64.2**	**69.7**	**75.5**	**81.7**	**8.6%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

12.4.5 REST OF ASIA PACIFIC

Rest of Asia Pacific includes India, South Korea, Indonesia, the Philippines, and Thailand. These countries are projected to experience significant growth in the PFAS filtration market. Increasing demand for treated water, rising industrialization, urbanization, stringent regulations, and various government initiatives will boost the market for PFAS filtration in the Rest of Asia Pacific. The region is projected to grow at a high rate as most of the economies are in the developing phase and offer various opportunities for growth. Increasing investments and growing industrialization are expected to offer significant opportunities for the growth of the market during the forecast period. This region has a rising urban population and established industries such as food & beverage, textiles, pharmaceuticals, and chemicals, which utilize PFAS for various operations. These factors are increasing the demand for PFAS filtration in these countries.

TABLE 97 REST OF ASIA PACIFIC: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2021–2023 (USD MILLION)

END-USE INDUSTRY	2021	2022	2023	CAGR (2021–2023)
Industrial	19.2	20.9	21.7	6.4%
Municipal	90.4	97.7	100.9	5.7%
Commercial	19.1	20.6	21.2	5.4%
Total	**128.7**	**139.2**	**143.9**	**5.7%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 98 REST OF ASIA PACIFIC: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2024–2029 (USD MILLION)

END-USE INDUSTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Industrial	23.7	25.7	27.8	30.1	32.5	35.0	8.1%
Municipal	109.2	117.6	126.5	135.8	145.7	156.0	7.4%
Commercial	22.9	24.8	26.8	28.9	31.1	33.4	7.9%
Total	**155.7**	**168.0**	**181.1**	**194.8**	**209.2**	**224.4**	**7.6%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

12.5 MIDDLE EAST & AFRICA

The Middle East & Africa accounted for 3.3% of the global PFAS filtration market, in terms of value, in 2023. The key markets covered in this region are the UAE, Saudi Arabia, South Africa, and Rest of the Middle East & Africa. The region has abundant natural resources, which has enabled the establishment of various manufacturing facilities. Oil & gas and petrochemicals are the major industries; these require water for various industrial processes, thus increasing the consumption of PFAS filtration. The water and wastewater treatment sectors offer significant potential owing to changes in demographics and increasing water scarcity. According to the Middle East Economic Digest, the Gulf Cooperation Council (GCC) is focusing on the expansion of water and wastewater treatment plants and implementing new projects worth USD 80 billion. The water & wastewater treatment sector is expected to grow by 62% by 2025. The expansion of the water treatment infrastructure is expected to provide growth opportunities for the PFAS filtration market in the region.

12.5.1 RECESSION IMPACT

Trends and developments in 2023 are anticipated to impact various subregions of the Middle East & Africa in diverse ways. The ongoing Russia-Ukraine conflict is forecast to persist throughout much of the year, contributing to elevated food and energy prices. As expectations continue for high global interest rates, populations in these countries are likely to grapple with heightened inflation, while their economies may struggle amid a global economic landscape that could range from stagnant to recessionary.

TABLE 99 MIDDLE EAST & AFRICA: PFAS FILTRATION MARKET, BY COUNTRY, 2021–2023 (USD MILLION)

COUNTRY	2021	2022	2023	CAGR (2021–2023)
GCC countries	20.1	21.5	22.0	4.6%
–Saudi Arabia	7.5	8.1	8.2	4.6%
–UAE	3.3	3.6	3.6	4.9%
–Rest of GG Countries	9.3	9.9	10.1	4.4%
South Africa	7.3	7.8	8.0	4.5%
Rest of Middle East & Africa	28.8	30.3	30.5	2.9%
Total	**56.2**	**59.6**	**60.5**	**3.7%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 100 MIDDLE EAST & AFRICA: PFAS FILTRATION MARKET, BY COUNTRY, 2024–2029 (USD MILLION)

COUNTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
GCC countries	23.3	24.3	25.3	26.2	27.0	27.8	3.6%
–Saudi Arabia	8.7	9.1	9.5	9.9	10.2	10.5	3.7%
–UAE	3.9	4.1	4.2	4.4	4.6	4.7	4.0%
–Rest of GG Countries	10.7	11.1	11.6	11.9	12.3	12.6	3.4%
South Africa	8.4	8.8	9.2	9.6	9.9	10.3	4.0%
Rest of Middle East & Africa	31.8	32.9	33.9	34.8	35.6	36.3	2.7%
Total	**63.5**	**66.0**	**68.4**	**70.6**	**72.6**	**74.4**	**3.2%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 101 MIDDLE EAST & AFRICA: PFAS FILTRATION MARKET, BY COUNTRY, 2021–2023 (KILOTON)

COUNTRY	2021	2022	2023	CAGR (2021–2023)
GCC countries	6.3	6.6	6.7	3.6%
Saudi Arabia	2.2	2.3	2.3	3.7%
UAE	1.0	1.1	1.1	3.9%
Rest of GG Countries	3.1	3.3	3.3	3.4%
South Africa	2.2	2.4	2.4	3.5%
Rest of MEA	8.7	9.0	9.0	1.9%
Total	**23.5**	**24.7**	**24.8**	**2.8%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 102 MIDDLE EAST & AFRICA: PFAS FILTRATION MARKET, BY COUNTRY, 2024–2029 (KILOTON)

COUNTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
GCC countries	7.0	7.3	7.5	7.7	7.9	8.0	2.6%
Saudi Arabia	2.4	2.5	2.6	2.7	2.7	2.8	2.8%
UAE	1.1	1.2	1.2	1.3	1.3	1.3	3.0%
Rest of GG Countries	3.5	3.6	3.7	3.8	3.9	3.9	2.4%
South Africa	2.5	2.6	2.7	2.8	2.9	2.9	3.0%
Rest of MEA	9.3	9.5	9.7	9.9	10.0	10.1	1.8%
Total	**25.8**	**26.7**	**27.4**	**28.2**	**28.7**	**29.0**	**2.3%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 103 MIDDLE EAST & AFRICA: PFAS FILTRATION MARKET, BY REMEDIATION TECHNOLOGY, 2021–2023 (USD MILLION)

REMEDIATION TECHNOLOGY	2021	2022	2023	CAGR (2021–2023)
Activated Carbon	22.5	23.9	24.1	3.5%
Ion Exchange Resin	9.3	9.9	10.1	4.0%
RO membrane & Nanofiltration	5.2	5.6	5.7	4.8%
In-situ Chemical Oxidation	7.4	7.8	8.0	3.9%
Bioremediation	8.2	8.7	8.8	3.9%
Others	3.6	3.8	3.8	2.1%
Total	**56.2**	**59.6**	**60.5**	**3.7%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

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TABLE 104 MIDDLE EAST & AFRICA: PFAS FILTRATION MARKET, BY REMEDIATION TECHNOLOGY, 2024–2029 (USD MILLION)

REMEDIATION TECHNOLOGY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Activated Carbon	25.3	26.2	27.1	28.0	28.7	29.4	3.1%
Ion Exchange Resin	10.6	11.1	11.5	11.9	12.3	12.7	3.6%
RO membrane & Nanofiltration	6.1	6.4	6.7	7.0	7.2	7.5	4.1%
In-situ Chemical Oxidation	8.4	8.7	9.1	9.4	9.7	9.9	3.5%
Bioremediation	9.3	9.6	10.0	10.4	10.7	11.0	3.5%
Others	3.9	4.0	4.0	4.0	4.0	3.9	0.3%
Total	**63.5**	**66.0**	**68.4**	**70.6**	**72.6**	**74.4**	**3.2%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 105 MIDDLE EAST & AFRICA: PFAS FILTRATION MARKET, BY REMEDIATION TECHNOLOGY, 2021–2023 (KILOTON)

REMEDIATION TECHNOLOGY	2021	2022	2023	CAGR (2021–2023)
Activated Carbon	10.2	10.7	10.8	2.6%
Ion Exchange Resin	3.5	3.7	3.7	3.2%
RO membrane & Nanofiltration	0.4	0.4	0.5	3.9%
In-situ Chemical Oxidation	1.7	1.8	1.8	3.0%
Bioremediation	0.5	0.5	0.6	3.0%
Others	0.8	0.9	0.9	1.2%
Total	**17.16**	**18.04**	**18.12**	**2.8%**

Note: Pricing includes materials, membranes & chemicals used in this process.

Note: Volume estimates are not cumulative rater its indicative in nature.

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 106 MIDDLE EAST & AFRICA: PFAS FILTRATION MARKET, BY REMEDIATION TECHNOLOGY, 2024–2029 (KILOTON)

REMEDIATION TECHNOLOGY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Activated Carbon	11.2	11.5	11.8	12.1	12.3	12.5	2.2%
Ion Exchange Resin	3.9	4.0	4.1	4.2	4.3	4.4	2.7%
RO membrane & Nanofiltration	0.5	0.5	0.5	0.5	0.5	0.6	3.2%
In-situ Chemical Oxidation	1.9	1.9	2.0	2.1	2.1	2.1	2.6%
Bioremediation	0.6	0.6	0.6	0.6	0.6	0.6	2.5%
Others	0.9	0.9	0.9	0.9	0.9	0.9	0.6%
Total	**18.9**	**19.4**	**19.9**	**20.4**	**20.8**	**21.1**	**2.3%**

Note: Pricing includes materials, membranes & chemicals used in this process.

Note: Volume estimates are not cumulative rater its indicative in nature.

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 107 MIDDLE EAST & AFRICA: PFAS FILTRATION MARKET, BY TECHNOLOGY TYPE, 2021–2023 (USD MILLION)

TECHNOLOGY TYPE	2021	2022	2023	CAGR (2021–2023)
Water Treatment Systems	32.5	34.6	35.0	3.8%
Water Treatment Chemicals	23.7	25.1	25.5	3.5%
Total	**56.2**	**59.6**	**60.5**	**3.7%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 108 MIDDLE EAST & AFRICA: PFAS FILTRATION MARKET, BY TECHNOLOGY TYPE, 2024–2029 (USD MILLION)

TECHNOLOGY TYPE	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Water Treatment Systems	37.0	38.5	39.9	41.2	42.5	43.6	3.4%
Water Treatment Chemicals	26.6	27.6	28.5	29.3	30.1	30.8	3.0%
Total	**63.5**	**66.0**	**68.4**	**70.6**	**72.6**	**74.4**	**3.2%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 109 MIDDLE EAST & AFRICA: PFAS FILTRATION MARKET, BY CONTAMINANT TYPE, 2021–2023 (USD MILLION)

CONTAMINANT TYPE	2021	2022	2023	CAGR (2021–2023)
PFOA & PFOS	31.1	32.8	33.2	3.4%
Multiple PFAS Compounds	25.2	26.8	27.3	4.1%
Total	**56.2**	**59.6**	**60.5**	**3.7%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 110 MIDDLE EAST & AFRICA: PFAS FILTRATION MARKET, BY CONTAMINANT TYPE, 2024–2029 (USD MILLION)

CONTAMINANT TYPE	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
PFOA & PFOS	34.8	36.1	37.4	38.5	39.6	40.5	3.0%
Multiple PFAS Compounds	28.7	29.9	31.0	32.1	33.0	33.9	3.4%
Total	**63.5**	**66.0**	**68.4**	**70.6**	**72.6**	**74.4**	**3.2%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 111 MIDDLE EAST & AFRICA: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2021–2023 (USD MILLION)

END-USE INDUSTRY	2021	2022	2023	CAGR (2021–2023)
Industrial	7.2	7.7	7.8	4.5%
Municipal	43.7	46.3	46.9	3.6%
Commercial	5.3	5.6	5.7	3.2%
Total	**56.2**	**59.6**	**60.5**	**3.7%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 112 MIDDLE EAST & AFRICA: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2024–2029 (USD MILLION)

END-USE INDUSTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Industrial	8.3	8.7	9.0	9.4	9.7	10.0	3.8%
Municipal	49.3	51.1	52.9	54.5	56.0	57.3	3.0%
Commercial	5.9	6.2	6.4	6.7	6.9	7.1	3.6%
Total	**63.5**	**66.0**	**68.4**	**70.6**	**72.6**	**74.4**	**3.2%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 113 MIDDLE EAST & AFRICA: PFAS FILTRATION MARKET, BY END-USE INDUSTRY TYPE, 2021–2023 (KILOTON)

END-USE INDUSTRY	2021	2022	2023	CAGR (2021–2023)
Industrial	1.9	2.0	2.0	3.6%
Municipal	13.7	14.4	14.5	2.7%
Commercial	1.5	1.6	1.6	2.2%
Total	**17.2**	**18.0**	**18.1**	**2.8%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 114 MIDDLE EAST & AFRICA: PFAS FILTRATION MARKET, BY END-USE INDUSTRY TYPE, 2024–2029 (KILOTON)

END-USE INDUSTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Industrial	2.1	2.2	2.3	2.4	2.4	2.5	2.9%
Municipal	15.1	15.5	15.9	16.2	16.5	16.8	2.1%
Commercial	1.6	1.7	1.7	1.8	1.8	1.9	2.7%
Total	**18.9**	**19.4**	**19.9**	**20.4**	**20.8**	**21.1**	**2.3%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

12.5.2 GCC COUNTRIES

TABLE 115 GCC COUNTRIES: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2021–2023 (USD MILLION)

END-USE INDUSTRY	2021	2022	2023	CAGR (2021–2023)
Industrial	2.7	2.9	3.0	5.4%
Municipal	15.4	16.5	16.9	4.5%
Commercial	2.0	2.1	2.1	4.0%
Total	**20.1**	**21.5**	**22.0**	**4.6%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 116 GCC COUNTRIES: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2024–2029 (USD MILLION)

END-USE INDUSTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Industrial	3.2	3.4	3.5	3.7	3.8	3.9	4.2%
Municipal	17.9	18.6	19.3	20.0	20.6	21.1	3.4%
Commercial	2.3	2.4	2.5	2.6	2.7	2.8	4.0%
Total	**23.3**	**24.3**	**25.3**	**26.2**	**27.0**	**27.8**	**3.6%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

12.5.2.1 Saudi Arabia

12.5.2.1.1 Government focus on water and wastewater treatment to drive market

Saudi Arabia accounted for 13.6% of the Middle East & Africa PFAS filtration market, in terms of value, in 2023, and is projected to record a CAGR of 3.7% during the forecast period. The country has scarce water resources, and regular supply for domestic and various industrial purposes is a challenge. The demand for water services in Saudi Arabia is high due to increasing urbanization, tourism, and population. Saudi Arabia is one of the largest producers of desalinated water globally. Desalination demands significant energy, with a quarter of the country's oil and gas production dedicated to cogeneration power desalination plants (CPDPs). The nation has invested USD 39.3 billion in desalination projects to improve its water resources.

The Saudi Arabian government's focus on water and wastewater treatment is expected to provide opportunities for the growth of the PFAS filtration market.

The oil & gas industry is pivotal to the Saudi Arabian economy, as the country boasts around 17% of the world's proven petroleum reserves. With the second-largest confirmed oil reserves globally, Saudi Arabia plays a vital role in the global energy landscape. Within this industry, PFAS (Per- and polyfluoroalkyl substances) are utilized in various applications, primarily as surfactants and in firefighting foams. These substances are valued for their unique properties, such as resistance to heat, oil, and water, making them effective in enhancing the performance and safety of oil extraction and refining processes. However, the use of PFAS in firefighting foams, specifically aqueous film-forming foams (AFFF), poses significant environmental concerns. During firefighting operations at oil and gas facilities, AFFF containing PFAS is commonly used to suppress flammable liquid fires. Unfortunately, this practice can lead to the release of PFAS into the environment, particularly into soil and groundwater, through accidental spills, training exercises, or firefighting activities.

Given the global concern over PFAS contamination, including its impact on water resources and ecosystems, Saudi Arabia is increasingly aligning its regulatory approaches with international best practices and agreements. This includes considerations under global frameworks like the Stockholm Convention on Persistent Organic Pollutants, which aims to restrict the production and use of harmful chemicals like PFAS. Moving forward, Saudi Arabia is expected to enhance its regulatory framework to specifically address PFAS, possibly introducing more stringent standards for monitoring, remediation, and management of these substances.

12.5.3 UAE

12.5.3.1 Strong oil & gas sector to drive market

The UAE is one of the key markets for PFAS filtration in the Middle East & Africa. The country accounted for a share of 6.0% in terms of value, of the region's market in 2023. The UAE has a strong oil & gas sector. The country is among the top ten oil producers globally and is a member of the Organization of the Petroleum Exporting Countries (OPEC). The UAE is estimated to hold the seventh-largest proven oil and natural gas reserves worldwide. The country produces approximately 3 million barrels of petroleum and liquids per day and has oil reserves of 100 billion barrels. The contribution of the oil & gas sector to the GDP is approximately 30%; it accounts for almost 13% of exports.

The country's refining capacity increased to 1.27 million b/d in 2020, as per OPEC. Within this sector, PFAS are commonly used in firefighting foams (such as Aqueous Film-Forming Foams - AFFF) to suppress flammable liquid fires, which are a critical safety measure in oil & gas facilities. However, the use of PFAS-containing AFFF poses environmental risks, as these compounds can leach into groundwater and soil during firefighting operations or accidental releases. To mitigate these environmental impacts, The UAE's oil & gas industry is increasingly investing in PFAS filtration technologies. These technologies are essential for treating wastewater streams contaminated with PFAS before discharge or reuse in industrial processes. Moreover, the UAE government emphasizes sustainable development and environmental stewardship, which includes regulations aimed at controlling and monitoring pollutants like PFAS. Regulatory bodies such as the Environment Agency - Abu Dhabi (EAD) and the Federal Authority for Nuclear Regulation (FANR) oversee environmental compliance and set guidelines to manage and mitigate the impact of industrial activities on the environment.

12.5.4 REST OF GCC COUNTRIES

Rest of GCC countries include Kuwait, Qatar, Bahrain, and Oman. The demand for PFAS filtration in the region can be attributed to the government regulations related to water and increasing demand from various end-use sectors such as chemical, oil & gas, and municipal water treatment.

12.5.5 SOUTH AFRICA

12.5.5.1 Growth in mining industry to drive market

South Africa is one of the emerging markets for PFAS filtration and is projected to register a CAGR of 4.0% between 2024 and 2029. In South Africa, 67.3% of the country's population was living in urban areas in 2021. The rising demand for freshwater, mainly due to the rapid increase in industrialization and population, is expected to drive the market for PFAS filtration in the country. South Africa is rich in a variety of minerals. Major commodities mined include gold, platinum group metals (PGMs), coal, iron ore, manganese, chrome, and diamonds. These resources contribute significantly to the country's export earnings and Gross Domestic Product (GDP). The mining industry's prominent role in South Africa's economy significantly impacts the PFAS filtration market.

In mining operations, PFAS is commonly found in chemicals used for mineral extraction, processing, and separation processes. These chemicals, which include frothers, flotation agents, and dust suppressants, often contain PFAS to enhance their effectiveness in various mining processes. However, the use of PFAS in mining activities can lead to their release into the environment through wastewater discharges, accidental spills, and runoffs, posing risks to water resources and ecosystems. South Africa has stringent environmental regulations and guidelines enforced by authorities such as the Department of Environment, Forestry and Fisheries (DEFF) and the Minerals Council of South Africa. These regulations mandate monitoring and control measures for pollutants, including PFAS, to minimize environmental impacts and safeguard public health. To address environmental challenges and comply with regulatory requirements, the mining industry in South Africa is increasingly adopting PFAS filtration technologies.

TABLE 117 SOUTH AFRICA: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2021–2023 (USD MILLION)

END-USE INDUSTRY	2021	2022	2023	CAGR (2021–2023)
Industrial	0.9	1.0	1.0	5.3%
Municipal	5.8	6.2	6.3	4.4%
Commercial	0.6	0.6	0.7	3.9%
Total	**7.3**	**7.8**	**8.0**	**4.5%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 118 SOUTH AFRICA: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2024–2029 (USD MILLION)

END-USE INDUSTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Industrial	1.1	1.1	1.2	1.2	1.3	1.3	4.6%
Municipal	6.7	7.0	7.3	7.6	7.8	8.1	3.8%
Commercial	0.7	0.7	0.8	0.8	0.8	0.9	4.5%
Total	**8.4**	**8.8**	**9.2**	**9.6**	**9.9**	**10.3**	**4.0%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

12.5.6 REST OF MIDDLE EAST & AFRICA

Nigeria, Algeria, and Morocco have been considered in the Rest of the Middle East & Africa. These are developing economies and offer a high scope for the growth of the market for PFAS filtration. Market growth is mainly backed by rising income levels, demographic changes, and increasing manufacturing & industrial activities, which are leading to the rising consumption of PFAS filtration in these countries. The growing population has increased the demand for clean water, which has resulted in the adoption of non-conventional water resources such as recycled water for irrigational purposes. Stringent government regulations and policies related to the treatment of wastewater and environmental sustainability are driving the market for PFAS filtration in the Rest of the Middle East & Africa.

TABLE 119 REST OF MIDDLE EAST & AFRICA: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2021–2023 (USD MILLION)

END-USE INDUSTRY	2021	2022	2023	CAGR (2021–2023)
Industrial	3.6	3.8	3.8	3.7%
Municipal	22.5	23.6	23.8	2.8%
Commercial	2.7	2.9	2.9	2.4%
Total	**28.8**	**30.3**	**30.5**	**2.9%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 120 REST OF MIDDLE EAST & AFRICA: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2024–2029 (USD MILLION)

END-USE INDUSTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Industrial	4.0	4.2	4.4	4.5	4.6	4.8	3.3%
Municipal	24.7	25.6	26.3	27.0	27.6	28.1	2.5%
Commercial	3.0	3.1	3.2	3.3	3.4	3.5	3.1%
Total	**31.8**	**32.9**	**33.9**	**34.8**	**35.6**	**36.3**	**2.7%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

12.6 SOUTH AMERICA

The South American region, for the purpose of this study, is segmented into Brazil, Argentina, and Rest of South America. The demand for PFAS filtration in this region is projected to grow at a rate of 3.7%, in terms of value, during the forecast period. Rising industrialization and infrastructural developments in the manufacturing industries, such as food & beverage, mining, oil & gas, and chemical, are expected to increase the demand for PFAS filtration in the region. Demographic factors, such as the growing middle-class population, rising disposable income, and improving economies, are expected to support the growth of end-use industries, in turn, supporting the growth of the PFAS filtration market during the forecast period.

12.6.1 RECESSION IMPACT

Ukraine conflict, increased prices, tighter financial conditions, economic slowdowns in major trading partners, and social unrest may dampen growth expectations. The economic future for South America is becoming more unclear because of the conflict in Ukraine. The region's economic recovery was already losing momentum before the war, due to the lingering effects of the pandemic. After a sharp rebound last year, growth is returning to its pre-pandemic trend rate as policies shift, slowing to 2.5% for 2022. Exports and investments are resuming their role as main growth drivers, but central banks have had to tighten monetary policy to combat an increase in inflation.

TABLE 121 SOUTH AMERICA: PFAS FILTRATION MARKET, BY COUNTRY, 2021–2023 (USD MILLION)

COUNTRY	2021	2022	2023	CAGR (2021–2023)
Brazil	19.6	21.4	22.4	6.8%
Argentina	10.0	10.9	11.4	6.5%
Rest of South America	31.1	33.4	34.3	5.0%
Total	**60.7**	**65.7**	**68.0**	**5.9%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 122 SOUTH AMERICA: PFAS FILTRATION MARKET, BY COUNTRY, 2024–2029 (USD MILLION)

COUNTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Brazil	24.5	26.5	28.6	30.8	33.2	35.7	7.8%
Argentina	12.4	13.4	14.5	15.7	16.9	18.2	8.0%
Rest of South America	36.8	39.5	42.3	45.2	48.2	51.4	6.9%
Total	**73.7**	**79.3**	**85.3**	**91.6**	**98.3**	**105.2**	**7.4%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 123 SOUTH AMERICA: PFAS FILTRATION MARKET, BY COUNTRY, 2021–2023 (KILOTON)

COUNTRY	2021	2022	2023	CAGR (2021–2023)
Brazil	5.1	5.6	5.8	5.9%
Argentina	3.0	3.2	3.3	5.5%
Rest of South America	9.1	9.7	9.8	4.1%
Total	**17.2**	**18.5**	**19.0**	**4.9%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 124 SOUTH AMERICA: PFAS FILTRATION MARKET, BY COUNTRY, 2024–2029 (KILOTON)

COUNTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Brazil	6.3	6.7	7.2	7.7	8.2	8.7	6.9%
Argentina	3.6	3.9	4.1	4.4	4.7	5.1	7.1%
Rest of South America	10.5	11.1	11.8	12.5	13.2	14.0	5.9%
Total	**20.3**	**21.7**	**23.1**	**24.6**	**26.2**	**27.8**	**6.4%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 125 SOUTH AMERICA: PFAS FILTRATION MARKET, BY TECHNOLOGY TYPE, 2021–2023 (USD MILLION)

TECHNOLOGY TYPE	2021	2022	2023	CAGR (2021–2023)
Water Treatment Systems	33.8	36.7	38.0	6.0%
Water Treatment Chemicals	26.8	28.9	30.0	5.7%
Total	**60.7**	**65.7**	**68.0**	**5.9%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 126 SOUTH AMERICA: PFAS FILTRATION MARKET, BY TECHNOLOGY TYPE, 2024–2029 (USD MILLION)

TECHNOLOGY TYPE	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Water Treatment Systems	41.4	44.6	48.1	51.7	55.5	59.6	7.6%
Water Treatment Chemicals	32.3	34.7	37.2	39.9	42.7	45.7	7.2%
Total	**73.7**	**79.3**	**85.3**	**91.6**	**98.3**	**105.2**	**7.4%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 127 SOUTH AMERICA: PFAS FILTRATION MARKET, BY CONTAMINANT TYPE, 2021–2023 (USD MILLION)

CONTAMINANT TYPE	2021	2022	2023	CAGR (2021–2023)
PFOA & PFOS	32.6	35.2	36.3	5.5%
Multiple PFAS Compounds	28.1	30.5	31.7	6.2%
Total	**60.7**	**65.7**	**68.0**	**5.9%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 128 SOUTH AMERICA: PFAS FILTRATION MARKET, BY CONTAMINANT TYPE, 2024–2029 (USD MILLION)

CONTAMINANT TYPE	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
PFOA & PFOS	39.3	42.2	45.4	48.6	52.1	55.7	7.2%
Multiple PFAS Compounds	34.4	37.1	40.0	43.0	46.2	49.6	7.6%
Total	**73.7**	**79.3**	**85.3**	**91.6**	**98.3**	**105.2**	**7.4%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 129 SOUTH AMERICA: PFAS FILTRATION MARKET, BY REMEDIATION TECHNOLOGY, 2021–2023 (USD MILLION)

REMEDIATION TECHNOLOGY	2021	2022	2023	CAGR (2021–2023)
Activated Carbon	24.3	26.3	27.1	5.6%
Ion Exchange Resin	10.1	10.9	11.4	6.2%
RO membrane & Nanofiltration	5.6	6.2	6.5	7.0%
In-situ Chemical Oxidation	7.9	8.6	8.9	6.1%
Bioremediation	8.8	9.5	9.9	6.0%
Others	3.9	4.1	4.2	4.2%
Total	**60.7**	**65.7**	**68.0**	**5.9%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 130 SOUTH AMERICA: PFAS FILTRATION MARKET, BY REMEDIATION TECHNOLOGY, 2024–2029 (USD MILLION)

REMEDIATION TECHNOLOGY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Activated Carbon	29.3	31.5	33.8	36.3	38.9	41.6	7.3%
Ion Exchange Resin	12.3	13.3	14.4	15.5	16.7	17.9	7.8%
RO membrane & Nanofiltration	7.1	7.7	8.3	9.0	9.8	10.5	8.3%
In-situ Chemical Oxidation	9.7	10.5	11.3	12.2	13.1	14.1	7.7%
Bioremediation	10.7	11.6	12.5	13.5	14.5	15.5	7.7%
Others	4.5	4.8	5.0	5.2	5.4	5.6	4.3%
Total	**73.7**	**79.3**	**85.3**	**91.6**	**98.3**	**105.2**	**7.4%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 131 SOUTH AMERICA: PFAS FILTRATION MARKET, BY REMEDIATION TECHNOLOGY, 2021–2023 (KILOTON)

REMEDIATION TECHNOLOGY	2021	2022	2023	CAGR (2021–2023)
Activated Carbon	10.3	11.0	11.3	4.8%
Ion Exchange Resin	3.5	3.7	3.9	5.3%
RO membrane & Nanofiltration	0.4	0.5	0.5	6.0%
In-situ Chemical Oxidation	1.7	1.8	1.9	5.2%
Bioremediation	0.5	0.6	0.6	5.1%
Others	0.8	0.9	0.9	3.3%
Total	**17.2**	**18.5**	**19.0**	**4.9%**

Note: Pricing includes materials, membranes & chemicals used in this process.

Note: Volume estimates are not cumulative rater its indicative in nature.

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 132 SOUTH AMERICA: PFAS FILTRATION MARKET, BY REMEDIATION TECHNOLOGY, 2024–2029 (KILOTON)

REMEDIATION TECHNOLOGY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Activated Carbon	12.1	12.9	13.7	14.6	15.5	16.5	6.4%
Ion Exchange Resin	4.2	4.5	4.8	5.1	5.4	5.8	6.9%
RO membrane & Nanofiltration	0.5	0.6	0.6	0.6	0.7	0.7	7.4%
In-situ Chemical Oxidation	2.0	2.2	2.3	2.5	2.6	2.8	6.8%
Bioremediation	0.6	0.7	0.7	0.8	0.8	0.9	6.7%
Others	0.9	1.0	1.0	1.1	1.1	1.1	3.4%
Total	**20.3**	**21.7**	**23.1**	**24.6**	**26.2**	**27.8**	**6.4%**

Note: Pricing includes materials, membranes & chemicals used in this process.

Note: Volume estimates are not cumulative rater its indicative in nature.

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 133 SOUTH AMERICA: PFAS FILTRATION MARKET, BY END-USE INDUSTRY TYPE, 2021–2023 (KILOTON)

END-USE INDUSTRY	2021	2022	2023	CAGR (2021–2023)
Industrial	1.9	2.1	2.1	5.7%
Municipal	13.8	14.8	15.2	4.8%
Commercial	1.5	1.6	1.6	4.3%
Total	**17.2**	**18.5**	**19.0**	**4.9%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 134 SOUTH AMERICA: PFAS FILTRATION MARKET, BY END-USE INDUSTRY TYPE, 2024–2029 (KILOTON)

END-USE INDUSTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Industrial	2.3	2.5	2.7	2.8	3.0	3.2	7.1%
Municipal	16.3	17.4	18.5	19.6	20.8	22.1	6.3%
Commercial	1.8	1.9	2.0	2.1	2.3	2.4	6.9%
Total	**20.3**	**21.7**	**23.1**	**24.6**	**26.2**	**27.8**	**6.4%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 135 SOUTH AMERICA: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2021–2023 (USD MILLION)

END-USE INDUSTRY	2021	2022	2023	CAGR (2021–2023)
Industrial	7.7	8.4	8.8	6.7%
Municipal	47.2	51.1	52.8	5.8%
Commercial	5.7	6.2	6.4	5.3%
Total	**60.7**	**65.7**	**68.0**	**5.9%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 136 SOUTH AMERICA: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2024–2029 (USD MILLION)

END-USE INDUSTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Industrial	9.6	10.4	11.3	12.2	13.1	14.1	8.1%
Municipal	57.2	61.5	66.1	70.8	75.9	81.1	7.2%
Commercial	6.8	7.4	8.0	8.6	9.3	10.0	7.8%
Total	**73.7**	**79.3**	**85.3**	**91.6**	**98.3**	**105.2**	**7.4%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

12.6.2 BRAZIL

12.6.2.1 Government support and regulations to drive market

Brazil accounted for a share of 32.9%, in terms of value, of South America's PFAS filtration market in 2023. It is the largest PFAS filtration market in South America and is projected to register a CAGR of 7.8% during the forecast period. Brazil is the largest and most developed country in South America. According to the CIA World Factbook, the GDP (PPP) of Brazil was the largest in South America and ranked eighth globally in 2020. The World Bank estimated the country's GDP at USD 1.92 trillion in 2022. Brazil has a population of about 213 million, which creates a high demand for commodities and manufactured goods; this has boosted industrialization in the country. Brazil is a developing free-market economy and one of the world leaders in mining, agriculture, and manufacturing. The government is focusing on investments to improve its sanitization projects. According to its 'New Sanitation Legal Framework' launched in 2020, Brazil aims to provide clean water access to 99% of the population by 2033. Stringent regulations,

industrialization, and a growing population are expected to drive the demand for PFAS filtration in the country.

The PFAS filtration market in Brazil is experiencing robust growth driven by several factors, prominently including stringent government regulations aimed at environmental protection and public health. The government has introduced the National PFAS Control Policy Bill No. 2726/2023. This bill represents a comprehensive effort to establish a cohesive national strategy aimed at controlling PFAS across various sectors. The proposed policy outlines several critical areas of focus, including environmental impact mitigation and the promotion of sustainable practices. It mandates federal, state, and municipal authorities to enact and enforce regulations effectively. For industries utilizing PFAS, stringent requirements are imposed, necessitating annual reports on the consumption and disposal of these substances. Key provisions of the bill aim to progressively reduce PFAS presence in products and production processes. Furthermore, the bill also emphasizes funding for research into contamination remediation technologies.

TABLE 137 BRAZIL: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2021–2023 (USD MILLION)

END-USE INDUSTRY	2021	2022	2023	CAGR (2021–2023)
Industrial	2.6	2.9	3.0	7.6%
Municipal	15.0	16.4	17.1	6.8%
Commercial	1.9	2.1	2.2	6.3%
Total	**19.6**	**21.4**	**22.4**	**6.8%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 138 BRAZIL: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2024–2029 (USD MILLION)

END-USE INDUSTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Industrial	3.3	3.6	4.0	4.3	4.7	5.0	8.5%
Municipal	18.7	20.2	21.8	23.5	25.3	27.1	7.7%
Commercial	2.4	2.6	2.8	3.0	3.3	3.5	8.3%
Total	**24.5**	**26.5**	**28.6**	**30.8**	**33.2**	**35.7**	**7.8%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

12.6.3 ARGENTINA

12.6.3.1 Stringent environmental regulations to drive market

Argentina is the second-largest market for PFAS filtration in South America, accounting for a share of 16.7% of the regional market, in terms of value, in 2023. The GDP of Argentina was USD 632.8 billion in 2022 (Source: World Bank). Argentina is one of the five largest economies in South America. The country is a favorable destination for investments for globally established manufacturing companies because of the availability of low-cost raw materials and labor compared with other South American countries.

In Argentina, the regulation of PFAS has been evolving to address concerns over environmental and public health risks associated with these persistent chemicals. Specific regulations include measures to monitor and control PFAS levels in water sources, driven by laws that set limits and guidelines for their presence. For instance, Argentina's National Water Law (Law 25.688) establishes the framework for water resource management, including provisions for monitoring water quality and enforcing standards to protect against contaminants like PFAS. Moreover, Argentina's Environmental Protection Law (Law 25.675) empowers

authorities to regulate and mitigate pollution, encompassing measures aimed at controlling industrial discharges. This legislation reinforces the obligation of industries to adopt technologies and practices that prevent environmental contamination, thereby fostering the adoption of PFAS filtration systems.

TABLE 139 ARGENTINA: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2021–2023 (USD MILLION)

END-USE INDUSTRY	2021	2022	2023	CAGR (2021–2023)
Industrial	1.2	1.4	1.4	7.3%
Municipal	7.9	8.6	9.0	6.4%
Commercial	0.8	0.9	0.9	5.9%
Total	**10.0**	**10.9**	**11.4**	**6.5%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 140 ARGENTINA: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2024–2029 (USD MILLION)

END-USE INDUSTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Industrial	1.6	1.7	1.9	2.0	2.2	2.4	8.7%
Municipal	9.8	10.6	11.4	12.3	13.3	14.3	7.9%
Commercial	1.0	1.1	1.2	1.3	1.4	1.5	8.6%
Total	**12.4**	**13.4**	**14.5**	**15.7**	**16.9**	**18.2**	**8.0%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

12.6.4 REST OF SOUTH AMERICA

Rest of South America, for this study, includes Chile, Colombia, and Ecuador. Chile is one of the fastest-growing economies in South America. The Colombian economy has thrived in the last few years mainly due to the strong growth in the oil and mining sectors, foreign direct investments, and government initiatives. In Chile, PFAS are primarily governed under the country's environmental legislation, which includes laws aimed at protecting water resources and regulating industrial discharges. Specifically, the Environmental Law (Law 19.300) and the Water Code (Law 21.064) provide the legal framework for environmental management and water quality standards. In Colombia, the regulation of PFAS falls under the broader framework of environmental and water management laws. The Environmental Management Law (Law 99 of 1993) establishes principles and guidelines for environmental protection, including the control of pollutants in water resources. So, stringent regulations coupled with rising industrialization and urbanization will boost the market for PFAS filtration in the Rest of South America.

TABLE 141 REST OF SOUTH AMERICA: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2021–2023 (USD MILLION)

END-USE INDUSTRY	2021	2022	2023	CAGR (2021–2023)
Industrial	3.9	4.2	4.3	5.9%
Municipal	24.2	26.0	26.7	5.0%
Commercial	3.0	3.2	3.2	4.5%
Total	**31.1**	**33.4**	**34.3**	**5.0%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 142 REST OF SOUTH AMERICA: PFAS FILTRATION MARKET, BY END-USE INDUSTRY, 2024–2029 (USD MILLION)

END-USE INDUSTRY	2024	2025	2026	2027	2028	2029	CAGR (2024–2029)
Industrial	4.7	5.0	5.4	5.8	6.3	6.7	7.5%
Municipal	28.7	30.7	32.8	35.0	37.3	39.7	6.7%
Commercial	3.5	3.7	4.0	4.3	4.6	4.9	7.3%
Total	**36.8**	**39.5**	**42.3**	**45.2**	**48.2**	**51.4**	**6.9%**

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

13 COMPETITIVE LANDSCAPE

13.1 KEY PLAYER STRATEGIES/RIGHT TO WIN

The competitive landscape of PFAS filtration covers important growth strategies adopted by the key players. This section presents the trending growth strategies adopted by companies involved in manufacturing and distributing PFAS filtration from 2019 to 2023. The critical growth strategies adopted by the players are product launches, mergers & acquisitions, and partnerships.

Veolia (France), AECOM (US), WSP (Canada), Clean Earth (US), Wood (UK), Xylem (US), Jacobs (US), TRC Companies, Inc. (US), Battelle Memorial Institute (US), and Cyclopure, Inc. (US) are the key players in the PFAS filtration market.

TABLE 143 COMPANIES ADOPTED PRODUCT LAUNCHES AND ACQUISITIONS AS KEY GROWTH STRATEGIES BETWEEN 2019 AND 2023

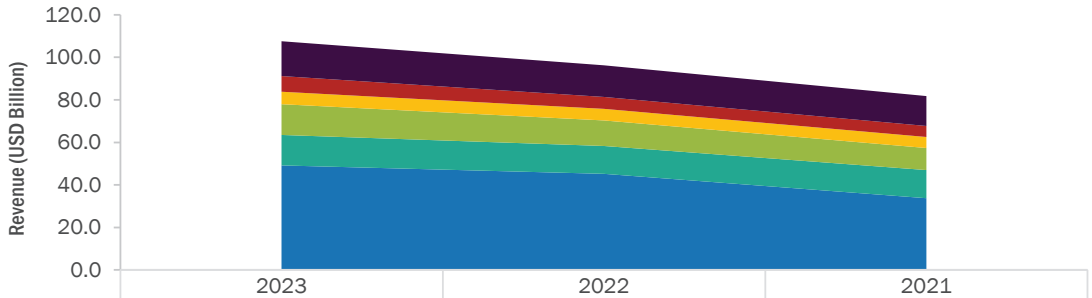
COMPANY NAME	INORGANIC	
	ACQUISITION/JOINT VENTURE/ COLLABORATION/PARTNERSHIP	PRODUCT LAUNCH
Veolia	Veolia North America, a subsidiary of Veolia group acquired Suez. These acquisitions strengthen its position in North America to transform the delivery of environmental services. This combination will bring innovation and enhanced resources to support the US water sector.	
AECOM	The company announced a joint venture with Brown and Caldwell. This move will support a landmark program to create a new -high quality, climate-resilient water supply for up to 15 million people.	The company launched DE-FLUORO, a PFAS solution that effectively and permanently removes per- and poly-fluoroalkyl substances. The company has developed this technology in collaboration with the University of Georgia in the US. The company launched DE-FLUORO, a PFAS solution that effectively and permanently removes per- and poly-fluoroalkyl substances. The company has developed this technology in collaboration with the University of Georgia in the US.
WSP	The company announced the acquisition of the Environment & Infrastructure business of John Wood. With this, WSP expanded its environmental leadership. This move will also enable the company to further seize opportunities in the fast-growing environmental and water sectors.	
Xylem	Xylem acquired Evoqua, a leader a leader in mission-critical water treatment solutions and services. Under the agreement, Xylem will acquire Evoqua in an all-stock transaction that reflects an implied enterprise value of approximately USD 7.5 billion. This acquisition creates a transformative global platform to address water scarcity, affordability and resilience at even greater scale.	

Jacobs	Jacobs was participating in research study with Principal Investigator Dr. David Hanigan with the University of Nevada to develop new instrumentation and methods for PFAS site characterization.

Source: Secondary Research and MarketsandMarkets Analysis

13.2 REVENUE ANALYSIS

FIGURE 42 REVENUE ANALYSIS



	2023	2022	2021
Jacobs	16.4	14.9	14.0
Xylem	7.4	5.5	5.2
Wood	5.9	5.5	5.2
WSP	14.4	12.0	10.3
AECOM	14.4	13.1	13.3
Veolia	49.1	45.2	33.7

Note: Revenue of the group is considered.

Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

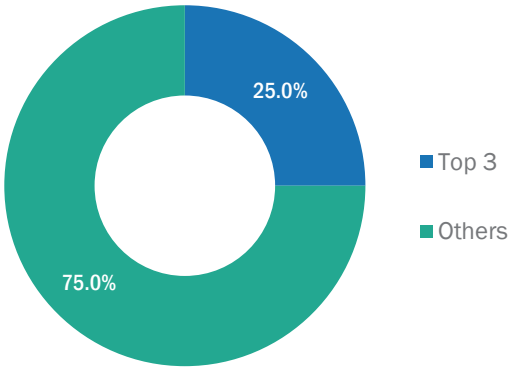
The leading companies in the PFAS filtration market have largely benefited from their well-recognized brands, a wide range of products and services, and strong distribution capabilities in the expanding market. Their margins appear to improve as they leverage their scale to lower the marginal cost of production, cut better deals with suppliers, and negotiate better prices with their trade partners.

13.3 MARKET SHARE ANALYSIS

The PFAS filtration market is competitive, owing to the presence of many global and local market players. Some major players dominate the PFAS filtration market. However, the growing global demand has changed the intensity of competition, with local manufacturers entering the market in emerging regions.

Veolia (France), AECOM (US), WSP (Canada), Clean Earth (US), Wood (UK), Xylem (US), Jacobs (US), TRC Companies, Inc. (US), Battelle Memorial Institute (US), and Cyclopure, Inc. (US) are the top players in the PFAS filtration market. They offer a wide range of products to their customers. The market share is calculated by considering the PFAS filtration business unit and its segmental revenue. Information collected through secondary research and primary interviews is also deemed for estimating the market share.

FIGURE 43 MARKET SHARE OF KEY PLAYERS, 2023



Source: Secondary Research, Interviews with Experts, and MarketsandMarkets Analysis

TABLE 144 PFAS FILTRATION MARKET: DEGREE OF COMPETITION

DEGREE OF COMPETITION	FRAGMENTED
Top 3	20–25%
Others	75–80%

Notes: The degree of competition is defined as below:

Fragmented: When the top five players have a total market share < 25%.

Competitive: When the top five players have a total of 25–50% market share.

Consolidated: When the top five players have a total market share > 50%.

Veolia

Veolia is a leader in environmental services. It provides a complete range of solutions for managing water, waste, and energy. The company offers PFAS remediation through its subsidiary, Veolia Water Technologies. The company operates through three business segments: water, energy, and waste management. It has developed and introduced a range of treatment and PFAS remediation technologies to address contamination in industrial, military, and municipal applications. The company has developed three technologies, namely, carbon adsorption, specialty anion ion exchange resin, and reverse osmosis or nanofiltration. The company managed 2,750 wastewater treatment plants, 2,211 industrial facilities, and 691 treatment plants. The company has treated 2.1 billion gallons of water in New York, New Jersy, and Pennsylvania across more than 30 sites. Veolia produced 48 million megawatt hours of energy, processing almost 48 million metric tons of waste. Veolia offers its products and solutions in 52 countries across North America, the Middle East & Africa, Latin America, Asia Pacific, Europe, and Australia.

AECOM

AECOM stands as a globally respected infrastructure consulting firm, offering comprehensive professional services across the entirety of project development phases. The company is the second-largest general architectural and engineering design firm in the world, ranked by 2022 design revenue. Also, it is the number one ranked transportation design, facilities design, environmental engineering, environmental consulting and environmental science firm in the world. The company offers various services such as architecture & design, construction management, engineering, environmental services, IT & cybersecurity, planning and consulting, program management, industrial & commercial operations and maintenance, remediation, restoration, and redevelopment and program management. The company has developed DE-FLUORO technology, a viable PFAS destruction technology. DE-FLUORO is a proven on-site PFAS destruction

technology for industrial wastewater, concentrated waste derived from separation technologies, landfill leachate, and reverse osmosis brine concentrates. Currently, the company has over 1,200 successful PFAS projects at more than 600 locations globally. The company operates in North America, Europe, the Middle East & Africa, Asia Pacific, and South America.

WSP

WSP is the leading engineering and professional services firm. The company operates through 4 business segments: transportation & infrastructure, earth & environment, property & building, and power, energy & industry. It provides PFAS treatment services through earth & environment business segments. It provides technical practical solutions with groundbreaking technologies for PFAS destruction. The company also supports its clients through the project life cycle, from design, permitting, planning, operations, to decommissioning and asset remediation. It provides various advanced technologies for PFAS destruction, namely, electro-oxidation, ball milling, modified clay for reactive treatment, and superior sorption. The company boasts an extensive network of over 500 PFAS specialists spread across 200+ office locations. With a wealth of knowledge and strong experience in addressing PFAS challenges, the company caters to a range of industries, including government, transportation, infrastructure, manufacturing, waste management, utilities, power generation, oil & gas, and mining. The company has a global presence, operating in North America, South America, Asia Pacific, the Middle East & Africa, and Europe.

Xylem

Xylem is a leading water technology company that provides highly engineered products and solutions across a wide variety of critical applications in the water and energy sector. The company runs its operations through three business segments: Water Infrastructure, Applied Water and Measurement & Control solutions. The company offers PFAS treatment solutions through the water infrastructure segment. It is a leading provider of PFAS technologies. It provides granular activated carbon (GAC) and single-pass ion exchange resin technology for PFAS treatment. Xylem production facilities are present in Europe, North America, Latin America, Asia Pacific, and the Middle East. The company has a strong global distribution network that serves its customers in 150 countries.

JACOBS

Jacobs offers a full spectrum of professional services, including consulting, technical, scientific, and project delivery for the government and private sectors. The company is known for its expertise in project management, engineering solutions, and sustainable development practices across its diverse portfolio of services. The company offers its products and services to advanced manufacturing, energy & power, environment, health & life sciences, infrastructure, national security, and space. The company leads the PFAS treatment industry with PFAS assessment, characterization, treatment, and research. The company offers various PFAS treatment methods such as GAC, ion exchange resin, low temperature thermal desorption (LTTD) and is currently developing a bioremediation approach. The company's technologists have been supporting municipal, federal, and commercial clients with PFAS assessment and treatment around the globe. It has been working on multiple US defense research projects for PFAS characterization, treatment, and remediation. The company operates in 40 countries across North America, Asia Pacific, Middle East & Africa, and Europe.

13.4 COMPANY EVALUATION MATRIX, 2023

13.4.1 STARS

This group consists of companies that undertake more strategic activities in the market. Veolia, WSP, AECOM, Xylem, and Jacobs are recognized as the stars in this market. They have a strong product portfolio and adopt robust business strategies to achieve continued growth.

13.4.2 EMERGING LEADERS

These companies have a strong product portfolio and geographical presence. They have the potential to strengthen their business strategies to compete with the other key market players. However, Clean Earth, Wood, Xylem, TRC Companies, Inc., Battelle Memorial Institute, Cyclopure, Inc., Calgon Carbon Corporation, Regenesis, CDM Smith, Lanxess, and Pentair are, fall in this quadrant.

13.4.3 PERVASIVE PLAYERS

These companies have established vendors with strong business strategies. However, they have weaker product portfolios than other leading players. No company from the top 10 is considered to fall in this quadrant.

13.4.4 PARTICIPANTS

Participants have limited product portfolios and market reach compared to the leading PFAS filtration market players. However, no company from the top 10 is considered to fall in this quadrant.

FIGURE 44 PFAS FILTRATION MARKET: COMPANY EVALUATION MATRIX, 2023

Source: Secondary Research and MarketsandMarkets Analysis

13.4.5 COMPANY FOOTPRINT

TABLE 145 COMPANY END-USE INDUSTRY FOOTPRINT

COMPANY	INDUSTRIAL	COMMERCIAL	MUNICIPAL	OVERALL FOOTPRINT
Veolia	Y	Y	Y	5.00
AECOM	Y	Y	Y	5.00
WSP	Y	Y	Y	5.00
Clean Earth	Y	Y	Y	5.00
Wood	Y	Y	Y	5.00
Xylem	Y	Y	Y	5.00
TRC Companies, Inc.	Y	Y	Y	5.00
Battelle Memorial Institute	Y	Y	Y	5.00
Jacobs	Y	Y	Y	5.00
Cyclopure	Y	Y	Y	5.00
Calgon Carbon Corporation	Y	Y	Y	5.00
Regenesis	Y	Y	Y	5.00
CDM Smith	Y	Y	Y	5.00
Lanxess	Y	Y	Y	5.00
Pentair	Y	Y	Y	5.00
Mineral Technologies, Inc.	Y	Y	Y	5.00
Aquasana Inc.	Y	Y	Y	5.00
Newterra Corporation	Y	Y	Y	5.00
Eurowater	Y	Y	Y	5.00
Aqua-Aerobic Systems, Inc.	Y	Y	Y	5.00
Hydroviv	Y	Y	Y	5.00
Saltworks Technologies, Inc.	Y	Y	Y	5.00
Aclarity, Inc.	Y	Y	Y	5.00
Aquagga, Inc.	Y	Y	Y	5.00
Onvector LLC.	Y	Y	Y	5.00

Source: Secondary Research and MarketsandMarkets Analysis

TABLE 146 COMPANY REGION FOOTPRINT

COMPANY	NORTH AMERICA	EUROPE	ASIA PACIFIC	MIDDLE EAST & AFRICA	SOUTH AMERICA	OVERALL, REGION FOOTPRINT
Veolia	Y	Y	Y	Y	Y	5.00
AECOM	Y	Y	Y	Y	Y	5.00
WSP	Y	Y	Y	Y	Y	5.00
Clean Earth	Y	N	N	N	N	1.00
Wood	Y	Y	Y	Y	Y	5.00
Xylem	Y	Y	Y	Y	Y	5.00
TRC Companies, Inc.	Y	N	N	N	N	1.00
Battelle Memorial Institute	Y	Y	N	N	N	2.00
Jacobs	Y	Y	Y	Y	N	4.00
Cyclopure	Y	N	N	N	N	1.00
Calgon Carbon Corporation	Y	N	N	N	N	1.00
Regenesis	Y	Y	N	N	N	2.00
CDM Smith	Y	Y	Y	Y	Y	5.00
Lanxess	Y	Y	Y	Y	N	4.00
Pentair	Y	Y	Y	Y	Y	5.00
Mineral Technologies, Inc.	Y	Y	Y	Y	Y	5.00
Aquasana Inc.	Y	N	N	N	N	1.00
Newterra Corporation	Y	N	N	N	N	1.00
Eurowater	N	Y	N	N	N	1.00
Aqua-Aerobic Systems, Inc.	Y	N	N	N	N	1.00
Hydroviv	Y	N	N	N	N	1.00
Saltworks Technologies, Inc.	Y	N	N	N	N	1.00
Aclarity, Inc.	Y	N	N	N	N	1.00
Aquagga, Inc.	Y	N	N	N	N	1.00
Onvector LLC.	Y	N	N	N	N	1.00

Source: Secondary Research and MarketsandMarkets Analysis

TABLE 147 COMPANY OVERALL FOOTPRINT

COMPANY	END-USE INDUSTRY FOOTPRINT	REGION FOOTPRINT
Veolia	5.00	5.00
AECOM	5.00	5.00
WSP	5.00	5.00
Clean Earth	5.00	1.00
Wood	5.00	5.00
Xylem	5.00	5.00
TRC Companies, Inc.	5.00	1.00
Battelle Memorial Institute	5.00	2.00
Jacobs	5.00	4.00
Cyclopure	5.00	1.00
Calgon Carbon Corporation	5.00	1.00
Regenesis	5.00	2.00
CDM Smith	5.00	5.00
Lanxess	5.00	4.00
Pentair	5.00	5.00
Mineral Technologies, Inc.	5.00	5.00
Aquasana Inc.	5.00	1.00
Newterra Corporation	5.00	1.00
Eurowater	5.00	1.00
Aqua-Aerobic Systems, Inc.	5.00	1.00
Hydroviv	5.00	1.00
Saltworks Technologies, Inc.	5.00	1.00
Aclarity, Inc.	5.00	1.00
Aquagga, Inc.	5.00	1.00
Onvector LLC.	5.00	1.00

Source: Secondary Research and MarketsandMarkets Analysis

13.5 START-UPS/SMES EVALUATION MATRIX, 2023

13.5.1 PROGRESSIVE COMPANIES

These companies have substantial partner ecosystems and well-developed marketing channels. They have been achieving growth and have attained high partner attractiveness. Mineral Technologies, Inc.is considered to fall in this quadrant.

13.5.2 RESPONSIVE COMPANIES

Aquasana Inc., Newterra Corporation, Eurowater, Aqua-Aerobic System, Inc. Hydroviv, Saltworks Technologies, Inc., Aclarity, Inc., Aquagga, Inc., and Onvector LLC are the responsive companies. These companies have a wide range of products available. They show exceptional performance in the product excellence parameter. However, they are slightly low in business excellence compared to progressive companies.

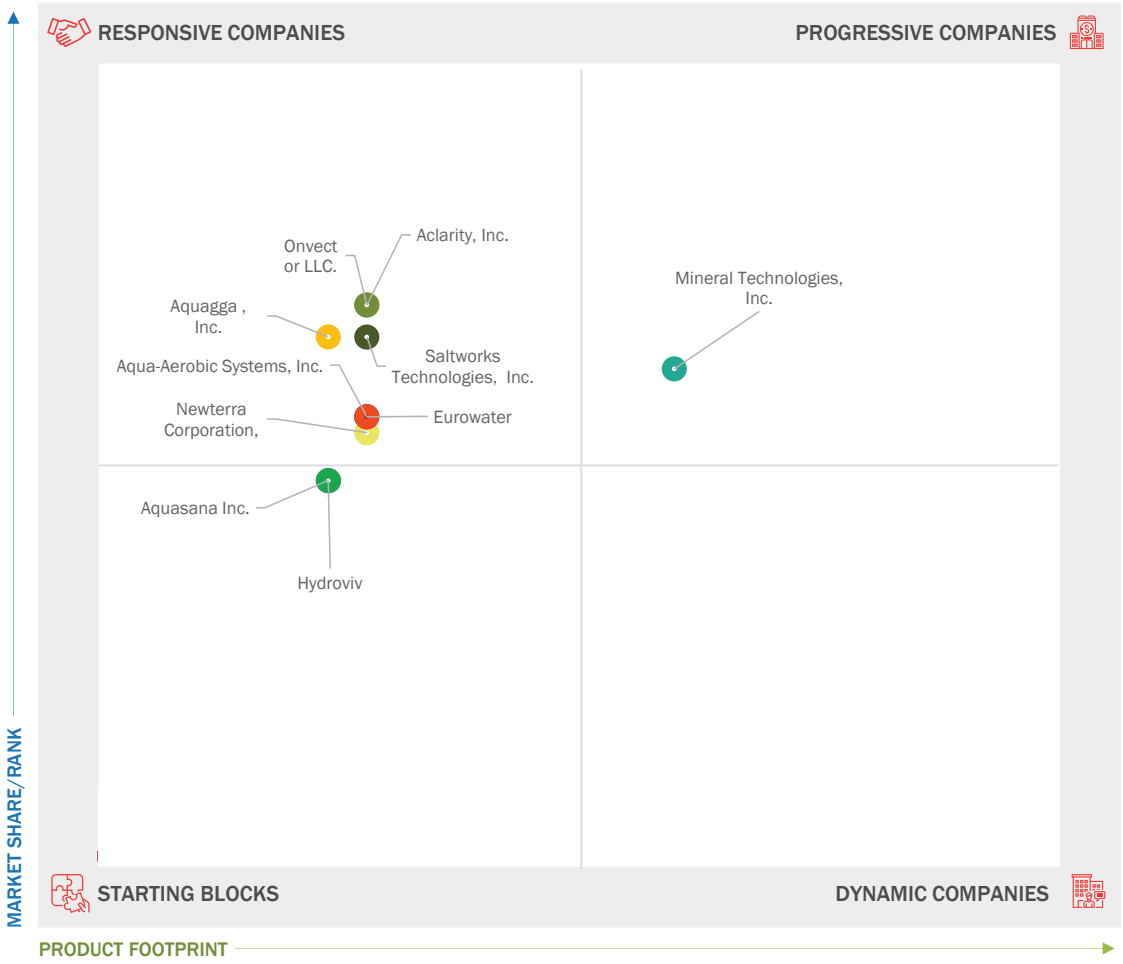
13.5.3 DYNAMIC COMPANIES

Dynamic companies perform well in the business excellence parameter. They have significant traction in the market. However, no company falls under this category in the PFAS filtration market.

13.5.4 STARTING BLOCKS

These companies have niche offerings and have started gaining a noticeable market share. Unlike other companies, starting blocks do not adopt strong business strategies and provide robust products. However, they are always seeking the opportunity to consolidate their space. However, no company falls under this category in the PFAS filtration market.

FIGURE 45 PFAS FILTRATION MARKET: START-UPS/SMES MATRIX, 2023



Source: Secondary Research and MarketsandMarkets Analysis

13.5.5 COMPETITIVE BENCHMARKING

TABLE 148 PFAS FILTRATION MARKET: COMPETITIVE BENCHMARKING OF KEY START-UPS/SMES

	END-USE INDUSTRY			GEOGRAPHY				
COMPANY NAME	INDUSTRIAL	COMMERCIAL	MUNICIPAL	NORTH AMERICA	EUROPE	ASIA PACIFIC	MIDDLE EAST & AFRICA	LATIN AMERICA
Mineral Technologies, Inc.	Y	Y	Y	Y	Y	Y	Y	Y
Aquasana Inc.	Y	Y	Y	Y	-	-	-	-
Newterra Corporation	Y	Y	Y	Y	-	-	-	-
Eurowater	Y	Y	Y	-	Y	-	-	-
Aqua-Aerobic Systems, Inc.	Y	Y	Y	Y	-	-	-	-
Hydroviv	Y	Y	Y	Y	-	-	-	-
Saltworks Technologies, Inc.	Y	Y	Y	Y	-	-	-	-
Aclarity, Inc.	Y	Y	Y	Y	-	-	-	-
Aquagga, Inc.	Y	Y	Y	Y	-	-	-	-
Onvector LLC.	Y	Y	Y	Y	-	-	-	-

Source: MarketsandMarkets Analysis, Factiva, and Company Websites

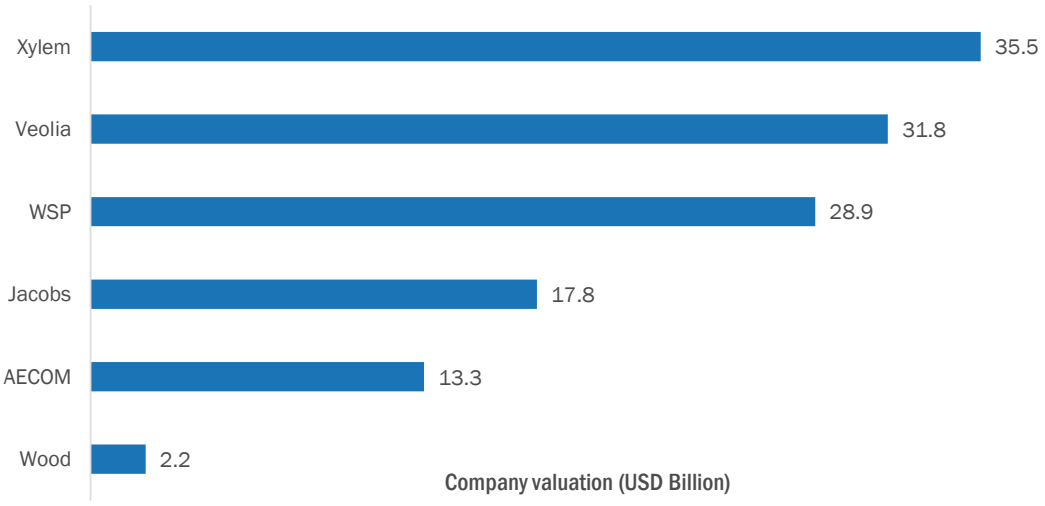
TABLE 149 DETAILED LIST OF COMPANIES

COMPANY NAME	CATEGORY	OWNERSHIP STATUS	HQ LOCATION	YEAR FOUNDED	EMPLOYEES	FINANCIAL STATUS	LATEST FUNDING ROUND	TOTAL FUNDING/CAPITAL
Mineral Technologies, Inc.	Manufacturer	Public	US	1992	4000	–	–	–
Aquasana Inc.	Manufacturer	Private	US	1998	51-200	Private Equity	–	USD 11 million
Newterra Corporation	Manufacturer	Private	France	1863	201-500	Private Equity	–	–
Eurowater	Manufacturer	Private	Denmark	1936	525	Private Equity	–	–
Aqua-Aerobic Systems, Inc.	Manufacturer	Private	US	1969	51-200	Private Equity	–	–
Hydroviv	Manufacturer	Private	US	2015	11-50	Private Equity	–	USD 400 thousand
Saltworks Technologies, Inc.	Manufacturer	Private	Canada	2008	51-200	Private Equity	–	USD 2.58 million
Aclarity, Inc.	Manufacturer	Private	US	2017	11-50	Seed	–	USD 3.3 million
Aquagga, Inc.	Manufacturer	Private	US	2019	11-50	Private Equity	–	–
Onvector LLC.	Manufacturer	Private	US	2012	2-10	Seed	–	USD 2.5 million

13.6 COMPANY VALUATION AND FINANCIAL MATRIX

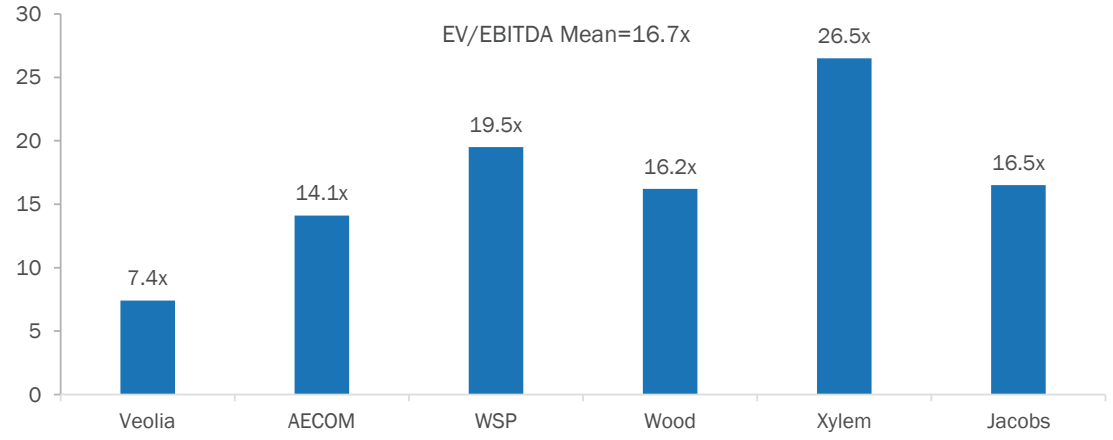
Company valuation emerges as a pivotal exercise, providing a comprehensive insight into a business' intrinsic worth. This process entails a thorough evaluation of financial performance, market dynamics, and growth prospects. These valuation insights become instrumental for investors, guiding strategic decisions, facilitating mergers and acquisitions, and offering a profound understanding of a company's financial standing within the broader market.

FIGURE 46 COMPANY VALUATION



Source: Secondary Sources and MarketsandMarkets Analysis

FIGURE 47 FINANCIAL METRICS



Source: Secondary Sources and MarketsandMarkets Analysis

13.7 BRAND/PRODUCT COMPARISON

This brand/product comparison provides a detailed assessment of PFAS filtration technologies/products in the market, examining essential attributes and performance benchmarks. Through a thorough exploration of individual strengths, drawbacks, and distinguishing features, consumers gain valuable insights to make well-informed decisions.

FIGURE 48 BRAND/PRODUCT COMPARISON

PARAMETER	DE-FLUORO	PFAS ANNIHILATOR	PLASMA VORTEX TECHNOLOGY
OUTPUT QUALITY			
OUTPUT SPEED			
OUTPUT COMPLEXITY			
USE CASES	Environmental remediation projects	Wastewater treatment, Leachate management	Water treatment plants, Environmental remediation
STRENGTHS	Flexibility, on-site treatment	Closed loop system, Versatility,	Effective PFAS treatment, Environmental safety
WEAKNESSES	Initial set up cost, Operational expertise	Operational cost, Maintenance and monitoring	Initial capital cost, Maintenance and technical expertise

EXCELLENT | GOOD | FAIR | POOR

Source: Secondary Sources and MarketsandMarkets Analysis

13.8 COMPETITIVE SCENARIO AND TRENDS

The leading players in the market adopted mergers & acquisitions, product launches, and investments & expansions as the key strategies in the PFAS filtration market between 2019 and 2023. Companies adopted these strategies to expand their product portfolio and cater to the increasing demand for PFAS filtration. The strategies of mergers & acquisitions and product launches have helped companies expand their geographical reach in the PFAS filtration market.

13.8.1 PRODUCT LAUNCHES

TABLE 150 PFAS FILTRATION MARKET: PRODUCT LAUNCHES, JANUARY 2019–DECEMBER 2023

MONTH & YEAR	DEVELOPMENT TYPE	COMPANY NAME	PRODUCT/SERVICE NAME (PRODUCT TYPE)	DESCRIPTION
January 2024	Service Launch	Clean Earth	Resolve PFAS Services (Service)	The company launched Resolve, a new program that offers a toolbox of innovative solutions to treat and remediate PFAS, and a website detailing news, updates, and guidance on PFAS in the US.
September 2019	Product Launch	AECOM	DE-FLUORO (Technology)	The company launched DE-FLUORO, a PFAS solution that effectively and permanently removes per- and poly-fluoroalkyl substances. The company has developed this technology in collaboration with the University of Georgia in the US.
September 2019	Product Launch	Battelle	Passive Sampler for PFAS (Testing product)	The company introduced a new passive sampler for PFAS. This product can be used to understand the potential for exposure of PFAS to humans and other biological species.
July 2019	Product Launch	Battelle	PFAS Predict Modeling Program	Battelle has invented a new tool, called “PFAS Predict Modeling Program.” It supports the organization’s ongoing work to find solutions for PFAS assessment, site characterization, and remediation applications as part of an integrated approach to addressing PFAS.

Source: Annual Reports, Press Releases, and MarketsandMarkets Analysis

13.8.2 DEALS

TABLE 151 PFAS FILTRATION MARKET: DEALS, JANUARY 2019—DECEMBER 2023

MONTH & YEAR	DEAL TYPE	COMPANY 1	COMPANY 2	DESCRIPTION	DEAL SIZE
February 2024	Partnership	Clean Earth (US)	Department of Defense Study (US)	The company has partnered with the Department of Defense and other environmental and regulated waste providers in a prototype project to demonstrate remediation technologies for PFAS. Clean Earth, alongside Aquagga, Arcadis, 374Water, Battelle, and General Atomics, has been selected to collaborate on the remediation of PFAS-impacted waste gathered from two Department of Defense bases in Pennsylvania, specifically Naval Air Station Joint Reserve Base Willow Grove and Biddle Air National Guard Base in Horsham Township. The waste collected will undergo treatment at Clean Earth's offsite facilities as part of this joint effort.	NA
April 2023	Joint Venture	AECOM (US)	Brown and Caldwell (US)	The company announced a joint venture with Brown and Caldwell. This move will support a landmark program to create a new, high-quality, climate-resilient water supply for up to 15 million people.	NA
December 2022	Acquisition	WSP (Canada)	BG Bonnard & Gardel Holding SA (Switzerland)	The company has entered into an agreement to acquire BG Bonnard & Gardel Holding SA, one of Switzerland's leading engineering consulting firms, with a great presence in France. This acquisition capitalizes on WSP's strengths, and further scales its capabilities in key sectors, with significant growth opportunities, in the buildings, environment, renewable energy, water, and industry sectors.	NA
September 2022	Acquisition	WSP (Canada)	Environment & Infrastructure Business of John Wood Group PLC (UK)	The company has announced the acquisition of the environment & infrastructure business of John Wood. With this, WSP expanded its environmental leadership. This move will also enable the company to further seize opportunities in the fast-growing environmental and water sectors.	NA

Sep 2022	Partnership	Veolia Water Technologies (France)	Orange Business Services (France)	Veolia Water Technologies announced a partnership with Orange Business Services. This partnership strengthens Veolia Water Technologies' business data collection infrastructure and hubgrade digital solutions platform. The hubgrade digital platform allows its customers to remotely view, anticipate, and optimize water treatment plants and equipment.	NA
March 2022	Acquisition	Veolia North America	Suez	Veolia North America, a subsidiary of Veolia group, acquired Suez. This acquisition strengthened its position in North America to transform the delivery of environmental services. This combination will bring innovation and enhanced resources to support the US water sector.	–
March 2022	Partnership	Battelle	Heritage-Crystal Clean, Inc.	Battelle announced partnership with Heritage-Crystal Clean, Inc. Battelle has selected Heritage-Crystal Clean, Inc. (Crystal Clean) as its partner to utilize, market, and service Battelle's PFAS destruction technology for commercial use. Crystal Clean will implement these key technologies in its own wastewater treatment plants, as well as at third-party landfills, wastewater treatment plants, and other commercial facilities. Additionally, Crystal Clean will collaborate with Battelle to apply the technology at various other sites and for additional applications.	NA
April 2020	Partnership	Jacobs (US)	University of Nevada (US)	Jacobs participated in a research study with University of Nevada principal investigator Dr. David Hanigan to develop new instrumentation and methods for PFAS site characterization.	NA
Feb 2019	Partnership	Veolia Water Technologies	European Membrane Institute	Veolia Water Technologies announced a partnership with the European Membrane Institute, a laboratory with an international reference in the field of membrane materials and processes. This partnership includes reciprocal exchanges between researchers and the creation of platforms for testing industrial prototypes and characterization.	NA

Source: Annual Reports, Press Releases, and MarketsandMarkets Analysis

14 COMPANY PROFILES

14.1 MAJOR PLAYERS

14.1.1 VEOLIA

14.1.1.1 Business overview

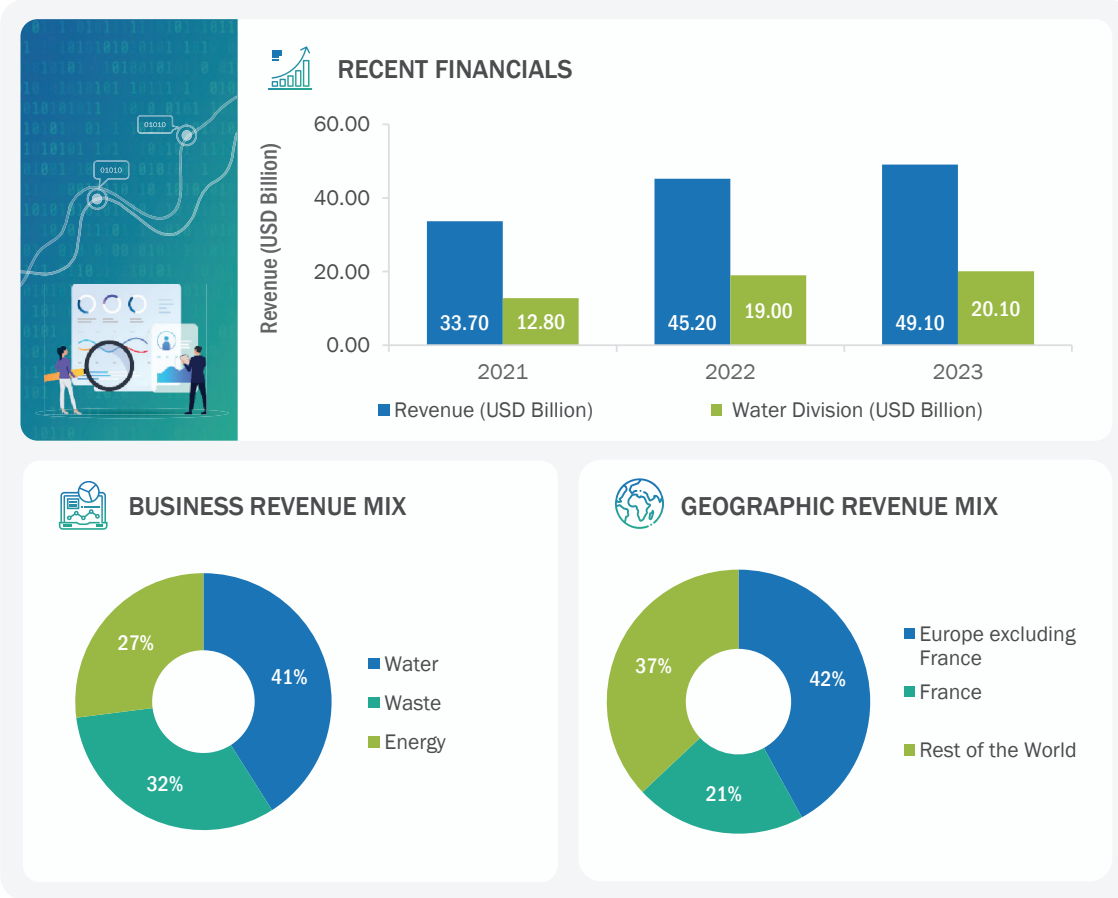
Veolia is a leader in environmental services. It provides complete range of solutions for managing water, waste, and energy. The company offers PFAS remediation through its subsidiary, Veolia Water Technologies. The company operates through three business segments: water, energy, and waste management. It has developed and introduced a range of treatment and PFAS remediation technologies to address contamination in industrial, military, and municipal applications. The company has developed three technologies, namely, carbon adsorption, specialty anion ion exchange resin, and reverse osmosis or nanofiltration. It manages 2,750 wastewater treatment plants, 2,211 industrial facilities, and 691 treatment plants. The company has treated 2.1 billion gallons of water in New York, New Jersey, and Pennsylvania across more than 30 sites. Veolia produced 48 million megawatt hours of energy, processing almost 48 million metric tons of waste. The company offers its products and solutions in 52 countries across North America, the Middle East & Africa, Latin America, Asia Pacific, Europe, and Australia.

TABLE 152 VEOLIA: COMPANY OVERVIEW

Founded	1853
Headquarters Country	France
Headquarters City/State	Aubervilliers
Ownership	Public

Source: Company Website

FIGURE 49 VEOLIA: COMPANY SNAPSHOT



Note: The currency conversion rates used for 2021, 2022, and 2023 were EUR 1 = USD 1.18318, EUR = US 1.053783, and EUR 1 = USD 1.082245, respectively.

Source: Company Website and Annual Reports

14.1.1.2 Products/Solutions/Services offered

TABLE 153 VEOLIA: PRODUCTS/SOLUTIONS/SERVICES OFFERED

SOLUTION NAME	DESCRIPTION	APPLICATION
Reverse Osmosis (RO)	Reverse osmosis (RO) efficiently removes PFAS contaminants, achieving over 99.9% removal in a single pass due to PFAS molecules' characteristics such as high molecular weight and charge. RO also eliminates other contaminants like TOC and suspended solids, improving water quality.	▪ Municipal wastewater treatment ▪ Industrial wastewater treatment ▪ Military application
Carbon Adsorption	Carbon adsorption technology is effective in PFAS (per- and polyfluoroalkyl substances) remediation by capturing these contaminants from water or air streams. It utilizes activated carbon, which has a high affinity for PFAS molecules, trapping them on its porous surface. This method offers versatility, scalability, and cost-effectiveness in treating contaminated environments. Carbon adsorption can remove various PFAS compounds, including those with complex chemical structures. Additionally, it is widely	▪ Municipal wastewater treatment ▪ Industrial wastewater treatment ▪ Military application

	applicable in both point-of-use and large-scale treatment systems for addressing PFAS pollution.	
Speciality Anion Ion Exchange Resin	Specialty anion ion exchange resins effectively remove PFAS contaminants from water through a process known as ion exchange. In this process, negatively charged PFAS ions in the water are attracted to and captured by the resin's positively charged functional groups, displacing other anions present. This selective adsorption mechanism enables the resin to selectively target and remove PFAS molecules from the water matrix. The captured PFAS ions remain bound to the resin until it becomes saturated, at which point the resin is regenerated or replaced to restore its capacity for further PFAS removal. This technology offers a reliable and efficient solution for PFAS remediation in water treatment applications	▪ Municipal wastewater treatment ▪ Industrial wastewater treatment ▪ Military application

Source: Company Website

14.1.1.3 Recent developments

14.1.1.3.1 Deals

TABLE 154 VEOLIA: DEALS

MONTH & YEAR	DEAL TYPE	COMPANY NAME 1	COMPANY NAME 2	DESCRIPTION	DEAL SIZE
Sep 2022	Partnership	Veolia Water Technologies (France)	Orange Business Services (France)	Veolia Water Technologies announced a partnership with Orange Business Services. This partnership strengthens Veolia Water Technologies' business data collection infrastructure and hubgrade digital solutions platform. The hubgrade digital platform allows its customers to remotely view, anticipate, and optimize water treatment plants and equipment.	NA
March 2022	Acquisition	Veolia North America	Suez	Veolia North America, a subsidiary of Veolia group, acquired Suez. This acquisition strengthened its position in North America to transform the delivery of environmental services. This combination will bring innovation and enhanced resources to support the US water sector.	–
Feb 2019	Partnership	Veolia Water Technologies	European Membrane Institute	Veolia Water Technologies announced a partnership with the European Membrane Institute, a laboratory with an international reference in the field of membrane materials and processes. This partnership includes reciprocal exchanges between researchers and the creation of platforms for testing industrial prototypes and characterization.	NA

Source: Company Website and Press Releases

14.1.1.4 MnM view

14.1.1.4.1 Key strengths

Veolia is one of the leading wastewater treatment and solution providers. It has a strong emphasis on R&D for the development of new technologies and products for wastewater treatment, which offers it a competitive edge on a global level. The strong balance sheet, along with the segment revenue, boosts the overall growth of the company. The balance sheet shows strong 2023 performance on social, commercial, environmental, and HR performance. The company develops sustainable products to cater to the energy, water, and waste sectors. Veolia Water Technologies has a global reach in sales and distribution and is investing increasingly in R&D every year.

14.1.1.4.2 Strategic choices

The core element of Veolia's strategy involves achieving strong growth by consistently delivering high-quality products to its customer base The company entered into an agreement with SUEZ for the merger of both companies to create new business opportunities, increase geographic penetration, and create a more diversified product portfolio to cater to industrial and municipal clients globally. In 2022, the company announced a partnership with orange business services to strengthen infrastructure.

14.1.1.4.3 Weaknesses and competitive threats

The major share of Veolia's revenue is received from France and the Europe region; this region accounted for higher than 50% of the global revenue in 2023. Over-reliance on one market can lead to saturation, limiting growth opportunities and making it difficult to increase sales further in that region. The company faces major competition from other major players, including WSP, AECOM, Wood, Xylem, and regional players in the water treatment market.

14.1.2 AECOM

14.1.2.1 Business overview

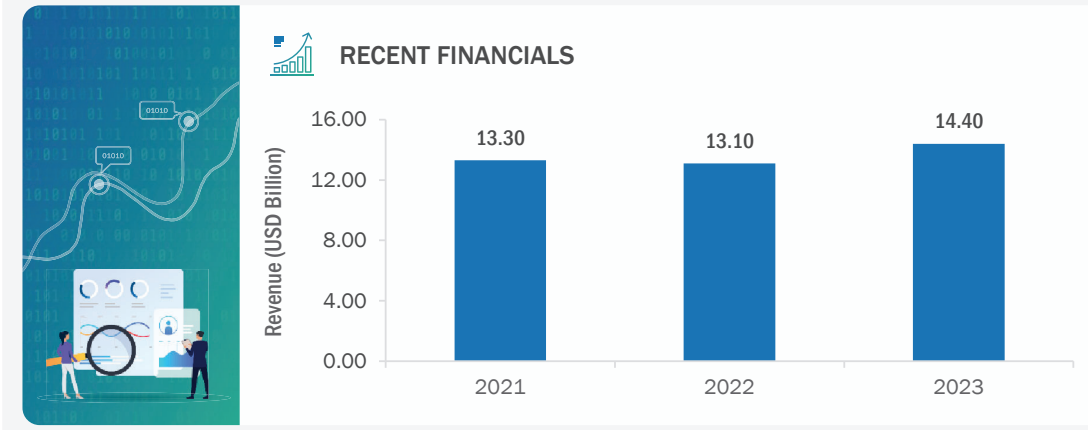
AECOM stands as a globally respected infrastructure consulting firm, offering comprehensive professional services across the entirety of project development phases. The company is the second-largest general architectural and engineering design firm in the world, ranked by 2022 design revenue. Also, the company is the number one ranked transportation design, facilities design, environmental engineering, environmental consulting and environmental science firm in the world. The company offers various services such as architecture & design, construction management, engineering, environmental services, IT & cybersecurity, planning and consulting, program management, industrial & commercial operations and maintenance, remediation, restoration, and redevelopment and program management and others. The company has developed DE-FLUORO technology, a viable PFAS destruction technology. DE-FLUORO is a proven-on site PFAS destruction technology for industrial wastewater, concentrated waste derived from separation technologies, landfill leachate, and reverse osmosis brine concentrates. Currently, the company has over 1,200 successful PFAS projects at more than 600 locations globally. The company operates in North America, Europe, the Middle East & Africa, India, Asia Pacific, and South America.

TABLE 155 AECOM: COMPANY OVERVIEW

Founded	1990
Headquarters Country	US
Headquarters City/State	Texas
Ownership	Public

Source: Company Website

FIGURE 50 AECOM: COMPANY SNAPSHOT



Source: Company Website and Annual Reports

14.1.2.2 Products/Solutions/Services offered

TABLE 156 AECOM: PRODUCTS/SOLUTIONS/SERVICES OFFERED

SOLUTION NAME	DESCRIPTION	APPLICATION
DE-FLUORO	This technology removes 98% to 100% of all regulated PFAS mass. It treats both measurable and unmeasurable PFAS compounds. It also treats solutions composed of a range of PFAS compound signatures, including solutions containing a mixture of or dominated by sulfonic acids, carboxylates, sulfonamides, and fluorotelomers.	▪ Landfill leachate ▪ Industrial wastewater ▪ Concentrated waste derived from separation technologies ▪ Liquid waste

Source: Company Website

14.1.2.3 Recent developments

14.1.2.3.1 Product Launches

TABLE 157 AECOM: PRODUCT LAUNCHES

MONTH & YEAR	DEVELOPMENT TYPE	COMPANY NAME	PRODUCT NAME (PRODUCT TYPE)	PRODUCT DESCRIPTION
September 2019	Product Launch	AECOM	DE-FLUORO (Technology)	The company launched DE-FLUORO, a PFAS solution that effectively and permanently removes per- and poly-fluoroalkyl substances. The company has developed this technology in collaboration with the University of Georgia in the US.

14.1.2.3.2 Deals

TABLE 158 AECOM: DEALS

MONTH & YEAR	DEAL TYPE	COMPANY NAME 1	COMPANY NAME 2	DESCRIPTION	DEAL SIZE
April 2023	Joint Venture	AECOM (US)	Brown and Caldwell (US)	The company announced a joint venture with Brown and Caldwell. This move will support a landmark program to create a new, high-quality, climate-resilient water supply for up to 15 million people.	NA

Source: Company Website and Press Releases

14.1.2.4 MnM view

14.1.2.4.1 Key strengths

It is a globally respected infrastructure firm. The company's robust revenue growth, record-setting design backlog, and near-all-time high win rates highlight its strong market position. This success is driven by AECOM's talented teams, whose technical expertise, agility, and teamwork fuel innovation and superior client service. AECOM has enhanced its service delivery with innovative products and tools, by embracing digital advancements which reinforces its leadership in digital consulting. Catering to 1,200 successful PFAS projects at more than 600 locations globally, the company has established itself as a leader on the international stage for PFAS treatment.

14.1.2.4.2 Strategic choices

The company focuses on product launches and joint ventures to strengthen its business. For example, the company launched DE-FLUORO, a PFAS solution that effectively and permanently removes per- and poly-fluoroalkyl substances. This technology minimizes cost, reduces environmental impact, and is more cost-effective than other methods. The company prioritizes technical excellence and professional development, to ensure continuous innovation.

14.1.2.4.3 Weaknesses and competitive threats

The ongoing conflict between Russia and Ukraine, compounded by international sanctions and political instability in the Middle East and Hong Kong, presents a series of challenges for AECOM. Firstly, it causes disruptions in the global supply chain, leading to soaring prices of raw materials, increased costs, and reduced efficiency. Secondly, political unrest in Hong Kong, where AECOM has a significant presence, introduces operational uncertainties such as workforce stability and potential disruptions to project schedules.

14.1.3 WSP

14.1.3.1 Business overview

WSP is the leading engineering and professional services firm. The company operates through four business segments: transportation & infrastructure, earth & environment, property & building, and power, energy & industry. It provides PFAS treatment services through the earth & environment business segment. It provides technical practical solutions with groundbreaking technologies for PFAS destruction. The company also supports its clients through project life cycle—from design, permitting, planning, and operations to decommissioning and asset remediation. It provides various advanced technologies for PFAS destruction, namely, electro-oxidation, ball milling, modified clay for reactive treatment, and superior sorption.

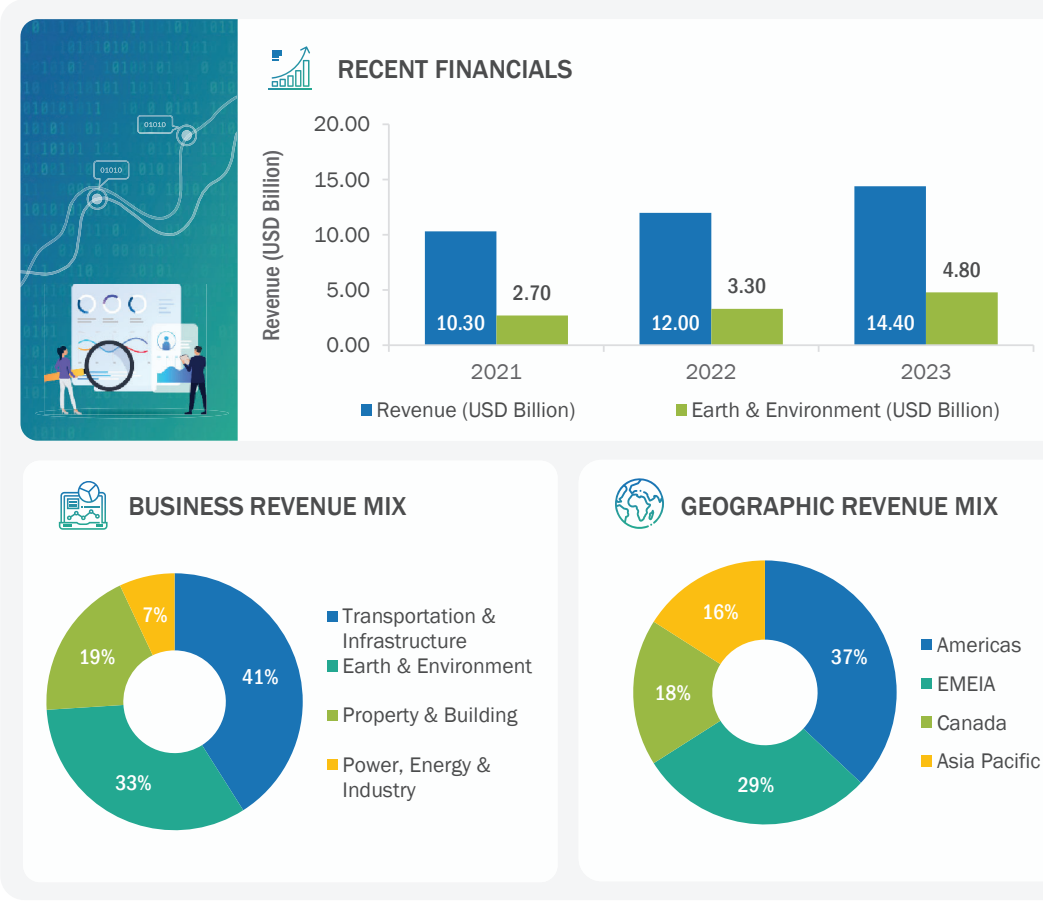
The company boasts an extensive network of over 500 PFAS specialists spread across 200+ office locations. With a wealth of knowledge and strong experience in addressing PFAS challenges, the company caters to a range of industries, including, government, transportation and infrastructure, manufacturing, waste management, utilities, power generation, oil & gas, and mining. The company has a global presence, operating in North America, South America, Asia Pacific, the Middle East & Africa, and Europe.

TABLE 159 WSP CORPORATION: COMPANY OVERVIEW

Founded	1959
Headquarters Country	Canada
Headquarters City/State	Quebec
Ownership	Public

Source: Company Website

FIGURE 51 WSP: COMPANY SNAPSHOT



Note: EMEIA includes Europe, Middle East, India, and Africa.

Note: Asia Pacific includes Asia, Australia, and New Zealand.

Source: Company Website and Annual Reports

14.1.3.2 Products/Solutions/Services offered

TABLE 160 WSP: PRODUCTS/SOLUTIONS/SERVICES OFFERED

SOLUTION NAME	DESCRIPTION	APPLICATION
Boron-doped Electro-oxidation	This technology efficiently eliminates PFAS molecules without any risk of transfer. It removes the need for expensive media purchase, transportation, and disposal, as well as the costs associated with chemical usage and sludge production. Its scalability is unmatched, enabling easy expansion to treat larger water flows by adding more boron-doped diamond plates or reactors and increasing electricity application. Moreover, its operation is highly efficient, relying solely on electricity with no human intervention required, resulting in low operating costs. With the option for equipment leasing to mitigate initial capital expenses, this technology offers a cost-effective and environmentally friendly solution to address PFAS pollution.	▪ Wastewater & groundwater treatment ▪ Industrial wastewater

Ball Milling	It is an effective method for PFAS destruction in impacted soils. In this method, trials were conducted on aqueous film-forming foam (AFFF), contaminated sand and clay soils from firefighting training areas. Recovery of fluoride using a fluoride ion selective electrode provided evidence of defluorination, with higher quantities retrieved when potassium hydroxide (KOH) was introduced as a co-milling reagent. These studies highlighted that co-milling with KOH significantly enhances destruction kinetics, achieving a remarkable 94% destruction level within just 15 minutes, compared to an hour without KOH.	▪ Soil treatment
Modified Clay Technology	Modified clay technology involves altering the structure and properties of natural clays to enhance their ability to adsorb pollutants, particularly per- and polyfluoroalkyl substances (PFAS), from contaminated environments. Through various chemical treatments and modifications, such as cation exchange or surface functionalization, the clay's surface area and affinity for PFAS molecules are significantly increased. This process allows the modified clay to effectively capture and immobilize PFAS contaminants, preventing their migration and reducing environmental exposure risks. Modified clay technology shows promise as a cost-effective and environmentally friendly approach to remediate PFAS-contaminated sites, offering a versatile solution that can be tailored to specific pollutants and site conditions.	▪ Soil treatment ▪ Wastewater treatment

Source: Company Website

14.1.3.3 Recent developments

14.1.3.3.1 Deals

TABLE 161 WSP: DEALS

MONTH & YEAR	DEAL TYPE	COMPANY NAME 1	COMPANY NAME 2	DESCRIPTION	DEAL SIZE
December 2022	Acquisition	WSP (Canada)	BG Bonnard & Gardel Holding SA (Switzerland)	The company has entered into an agreement to acquire BG Bonnard & Gardel Holding SA, one of Switzerland's leading engineering consulting firms, with a great presence in France. This acquisition capitalizes on WSP's strengths, and further scales its capabilities in key sectors, with significant growth opportunities, in the buildings, environment, renewable energy, water, and industry sectors.	NA
September 2022	Acquisition	WSP (Canada)	Environment & Infrastructure Business of John Wood Group PLC (UK)	The company has announced the acquisition of the environment & infrastructure business of John Wood. With this, WSP expanded its environmental leadership. This move will also enable the company to further seize opportunities in the fast-growing environmental and water sectors.	NA

14.1.3.4 MnM view

14.1.3.4.1 Key strengths

It is the world's leading engineering and professional services firm. The strong balance sheet, along with the segment revenue, boosts the overall growth of the company. Another core strength of the company is diversification in revenue generation sources. With strong experience in addressing PFAS challenges, the company caters to a range of industries, including government, transportation and infrastructure, manufacturing, waste management, utilities, power generation, oil & gas, and mining across North America, South America, Asia Pacific, the Middle East & Africa, and Europe.

14.1.3.4.2 Strategic choices

The key primary strategy undertaken by the company is acquisitions. For instance, the company acquired the environment & infrastructure business of John Wood. With this, WSP expanded its environmental leadership. This move will also enable the company to further seize opportunities in the fast-growing environmental and water sectors. In addition, it also acquired BG Bonnard & Gardel Holding SA, one of Switzerland's leading engineering consulting firms, with a great presence in France. This acquisition capitalizes on WSP's strengths and further scales its capabilities in key sectors, with significant growth opportunities in buildings, environment, renewable energy, water, and industry sectors. The company continuously monitors global trends and anticipates the resulting growth opportunities and risks.

14.1.3.4.3 Weaknesses and competitive threats

The company operates in highly competitive markets and has numerous competitors for all of the services it offers. Some of the competitors such as Veolia and AECOM have longer operating histories, greater brand recognition, larger customer bases, and have achieved substantially more market penetration in certain areas or locations in which the corporation competes.

14.1.4 XYLEM

14.1.4.1 Business overview

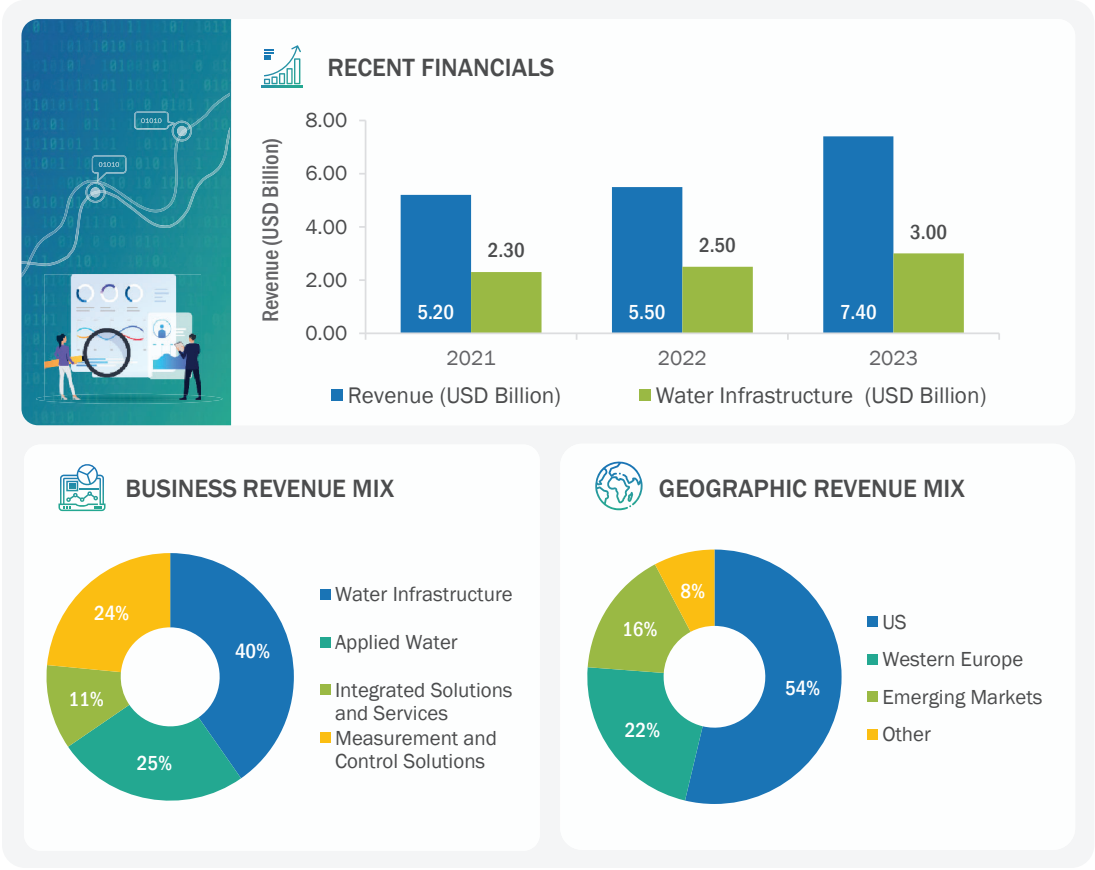
Xylem is a leading water technology company. The company provides highly engineered products and solutions across a wide variety of critical applications in the water and energy sectors. The company runs its operations through four business segments: water infrastructure, applied water, integrated solution & services, and measurement & control solutions. The company offers PFAS treatment solutions through the water infrastructure segment. It is a leading provider of PFAS technologies. It provides granular activated carbon (GAC) and single-pass ion exchange resin technology for PFAS treatment. Xylem production facilities are present in Europe, North America, Latin America, Asia Pacific, and the Middle East. The company has a strong global distribution network which serves its customers in 150 countries.

TABLE 162 XYLEM: COMPANY OVERVIEW

Founding Year	1981
Headquarters Country	US
Headquarters City/State	Rye Brook
Ownership	Public

Source: Company Website

FIGURE 52 XYLEM: COMPANY SNAPSHOT



Note: Emerging Markets includes results from the following regions: Eastern Europe, the Middle East and Africa, Latin America, and Asia Pacific (excluding Japan, Australia, and New Zealand, which are presented in "Other")

Source: Company Website and Annual Reports

14.1.4.2 Products/Solutions/Services offered

TABLE 163 XYLEM: PRODUCTS/SOLUTIONS/SERVICES OFFERED

SOLUTION NAME	DESCRIPTION	APPLICATION
Granular Activated Carbon (GAC)	GAC stands as a highly effective method for treating PFAS contamination. The company utilizes premium virgin activated carbons derived from high-quality bituminous coal, coconut shell, and anthracite coal. GAC consists of porous carbon particles with a large surface area, allowing for efficient adsorption of PFAS pollutants. Xylem's GAC treatment method effectively removes PFAS compounds from water and air, safeguarding public health and the environment.	▪ Wastewater & groundwater treatment ▪ Industrial wastewater
Ion Exchange Resin	In this process, dedicated resin beads are employed to selectively extract PFAS compounds from water by swapping them with less harmful ions within the resin structure. Within the ion exchange treatment, polluted water traverses through columns containing these resin beads. As the water interacts with the resin, PFAS molecules adhere to the resin's surface, displacing the ions previously bound to the resin. Consequently, PFAS are extracted from the water, leading to a noticeable reduction in their concentration within the treated effluent.	▪ Wastewater & groundwater treatment ▪ Industrial wastewater

Source: Company Website

14.1.4.3 Recent developments

14.1.4.3.1 Deals

TABLE 164 XYLEM: DEALS

MONTH & YEAR	DEAL TYPE	COMPANY NAME 1	COMPANY NAME 2	DESCRIPTION	DEAL SIZE
January 2023	Acquisition	Xylem (US)	Evoqua (US)	Xylem acquired Evoqua, a leader a leader in mission-critical water treatment solutions and services. Under the agreement, Xylem will acquire Evoqua in an all-stock transaction that reflects an implied enterprise value of approximately USD 7.5 billion. This acquisition creates a transformative global platform to address water scarcity, affordability, and resilience at an even greater scale.	USD 7.5 Billion

14.1.4.4 MnM view

14.1.4.4.1 Key strengths

Xylem is one of the leading providers of PFAS technologies. The company has a strong global distribution network consisting of direct sales forces and independent channel partners serving a customer base in approximately 150 countries. The company has a strong financial position that enables it to fund organic and inorganic initiatives. Xylem is involved in continuous R&D to develop new products and technologies. The company focuses on emerging markets in the Middle East & Africa and Asia Pacific. The company's business is not dependent upon a single or few customers. No individual customer accounted for more than 10% of the company's consolidated revenues.

14.1.4.4.2 Strategic choices

The key primary strategy undertaken by the company is acquisitions. For instance, the company Evoqua, a leader a leader in mission-critical water treatment solutions and services. This acquisition creates a transformative global platform for Xylem to address water scarcity, affordability, and resilience at an even greater scale.

14.1.4.4.3 Weaknesses and competitive threats

Xylem faces significant threats from established companies that are pioneering advanced and specialized PFAS filtration technologies such as Veolia, AECOM, WSP. These companies have well established market presence along with strong product portfolio for PFAS filtration. In addition, emerging technologies like renewable cyclodextrins for PFAS adsorption present a threat, as they offer potentially more sustainable and efficient alternatives to traditional methods.

14.1.5 JACOBS

14.1.5.1 Business overview

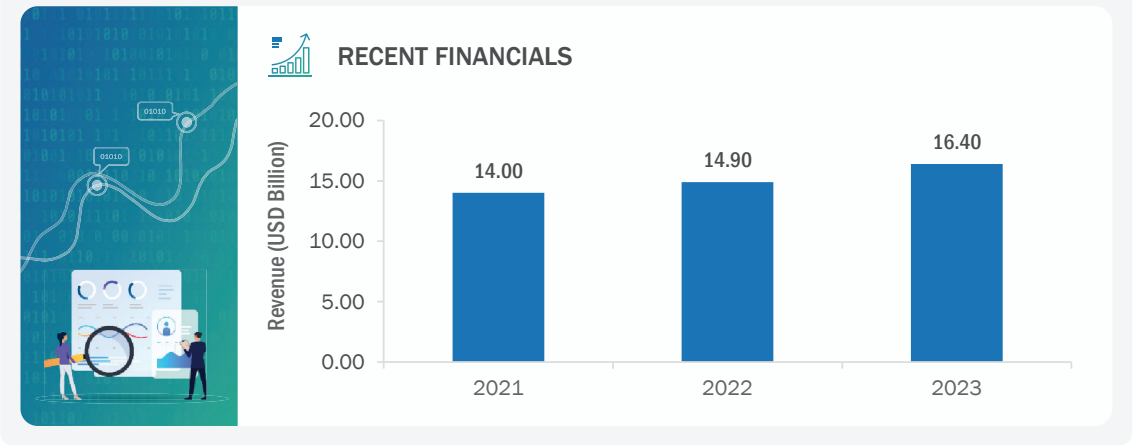
Jacobs offers a full spectrum of professional services, including consulting, technical, scientific, and project delivery for the government and private sectors. The company is known for its expertise in project management, engineering solutions, and sustainable development practices across its diverse portfolio of services. The company offers its products and services to advanced manufacturing, cities & places, energy & power, environment, health & life sciences, infrastructure, national security, and space. The company leads the PFAS treatment industry with PFAS assessment, characterization, treatment, and research. The company offers various PFAS treatment methods such as GAC, ion exchange resin, and low temperature thermal desorption (LTTD) and is currently developing a bioremediation approach. The company's technologists have been supporting municipal, federal, and commercial clients with PFAS assessment and treatment around the globe. It has been working on multiple US defense research projects for PFAS characterization, treatment, and remediation. The company operates in 40 countries across North America, Asia Pacific, Middle East & Africa, and Europe.

TABLE 165 JACOBS: COMPANY OVERVIEW

Founded	1947
Headquarters Country	US
Headquarters City/State	Dallas
Ownership	Public

Source: Company Website

FIGURE 53 JACOBS: COMPANY SNAPSHOT



Source: Company Website and Annual Reports

14.1.5.2 Products/Solutions/Services offered

TABLE 166 JACOBS: PRODUCTS/SOLUTIONS/SERVICES OFFERED

SOLUTION NAME	DESCRIPTION	APPLICATION
Carbon Adsorption	Carbon adsorption technology is effective in PFAS (per- and polyfluoroalkyl substances) remediation by capturing these contaminants from water or air streams. It utilizes activated carbon, which has a high affinity for PFAS molecules, trapping them on its porous surface. This method offers versatility, scalability, and cost-effectiveness in treating contaminated environments. Carbon adsorption can remove various PFAS compounds, including those with complex chemical structures. Additionally, it is widely applicable in both point-of-use and large-scale treatment systems for addressing PFAS pollution.	▪ Municipal wastewater treatment ▪ Industrial wastewater treatment ▪ Military application
Ion Exchange Resin	Ion exchange resins effectively remove PFAS contaminants from water through a process known as ion exchange. In this process, negatively charged PFAS ions in the water are attracted to and captured by the resin's positively charged functional groups, displacing other anions present. This selective adsorption mechanism enables the resin to selectively target and remove PFAS molecules from the water matrix. The captured PFAS ions remain bound to the resin until it becomes saturated, at which point the resin is regenerated or replaced to restore its capacity for further PFAS removal. This technology offers a reliable and efficient solution for PFAS remediation in water treatment applications.	▪ Municipal wastewater treatment ▪ Industrial wastewater treatment ▪ Military application

Source: Company Website

14.1.5.3 Recent developments

TABLE 167 JACOBS: DEALS

MONTH & YEAR	DEAL TYPE	COMPANY NAME 1	COMPANY NAME 2	DESCRIPTION	DEAL SIZE
April 2020	Partnership	Jacobs (US)	University of Nevada (US)	Jacobs participated in a research study with University of Nevada principal investigator Dr. David Hanigan to develop new instrumentation and methods for PFAS site characterization.	NA

Source: Company Website

14.1.5.4 MnM view

14.1.5.4.1 Key strengths

Jacobs, a leader in global engineering and technology solutions, excels at addressing complex environmental challenges. Its key strengths lie in their comprehensive expertise in environmental remediation, encompassing advanced methodologies for PFAS detection, monitoring, and cleanup. It is accelerating contaminated sediment clean-ups for environmental projects, thereby demonstrating a strong commitment to mitigating risks to public health and welfare. By actively supporting the US EPA, Jacobs positions itself as a reliable and effective partner in addressing critical environmental challenges, enhancing its reputation and credibility in the industry. The company is continuously investing in big data, AI, and generative design which modernizes critical infrastructure across higher-margin markets. This enables it to enjoy additional market share.

14.1.5.4.2 Strategic choices

The core element of Jacobs strategy includes strong growth through consistent high-quality products for across their customer base. To strengthen the market presence, the company participated in a research study with University of Nevada principal investigator Dr. David Hanigan to develop new instrumentation and methods for PFAS site characterization.

14.1.5.4.3 Weaknesses and competitive threats

The major concern for the company is inflation of raw material costs, and logistics. Increased raw material costs directly hamper the profitability of the company. The company also has not adopted business strategies such as acquisitions, product launch, and expansions in the last three years for the PFAS filtration market, which gives its competitors an advantage.

14.1.6 CLEAN EARTH

14.1.6.1 Business overview

Clean Earth is a division of Enviri Corporation. It ranks among the nation's leading providers of environmental and regulated waste management solutions. It offers various services, including comprehensive hazardous and non-hazardous waste disposal and recycling solutions, dredged material processing, customized, full-service soil disposal and recycling solutions, and also industry-certified secure IT asset management and disposal solutions. With over 30 years of specialized experience in the remediation and handling of toxic waste, the company stands as a foremost expert in PFAS solutions. The company offers a toolbox of innovative solutions to treat and remediate PFAS through its "ReSolve" Program. Through this, the company provides in-house state-of-the-art testing and efficient, nationwide mobile treatment units. The company offers various technologies to treat PFAS, namely, foam fractionation, granular activated carbon, supercritical water oxidation, and thermal desorption. The company offers its PFAS treatment solutions to pharmaceutical, energy & utilities, chemical, government, and manufacturing & industrial segments. Clean Earth has a strong presence in North America.

TABLE 168 CLEAN EARTH: COMPANY OVERVIEW

Founded	1990
Headquarters Country	US
Headquarters City/State	Pennsylvania
Ownership	Private

Source: Company Website

14.1.6.2 Products/Solutions/Services offered

TABLE 169 CLEAN EARTH: PRODUCTS/SOLUTIONS/SERVICES OFFERED

SOLUTION NAME	DESCRIPTION	APPLICATION
Foam Fractionation	It is an innovative method for treating PFAS contamination in water. This technique involves the generation of foam, typically through the introduction of gas bubbles, which selectively capture PFAS compounds from the water. The foam containing PFAS is then separated from the water, allowing for the concentrated removal of these contaminants. Foam fractionation offers several advantages, including its ability to effectively target PFAS molecules, its scalability for different water volumes, and its potential for use in both onsite and offsite treatment applications. Additionally, this method can be combined with other treatment technologies to enhance overall efficiency in PFAS remediation efforts, making it a promising solution for addressing PFAS contamination in various environmental settings.	▪ Wastewater & groundwater treatment ▪ Industrial wastewater
Activated Carbon Technology	Activated carbon is a porous material with a large surface area, allowing it to adsorb pollutants onto its surface. In water treatment, activated carbon filters are commonly used to trap PFAS molecules as water passes through the filter media. This technology is known for its versatility, efficiency, and reliability in removing PFAS compounds from contaminated water sources. Moreover, activated carbon can be regenerated and reused, making it a cost-effective solution for long-term PFAS remediation projects.	▪ Wastewater & groundwater treatment ▪ Industrial wastewater

Super Critical Water Oxidation	This process operates at high temperatures and pressures above the critical point of water, creating a supercritical fluid state where water exhibits unique properties, such as increased solubility and reactivity. In this process, PFAS compounds are subjected to intense heat, pressure, and oxygen in supercritical water, leading to their rapid and complete destruction. This process breaks down PFAS molecules into harmless byproducts such as carbon dioxide, water, and mineral acids. SCWO offers several advantages for PFAS remediation, including its ability to treat a wide range of PFAS compounds effectively and efficiently, as well as minimal secondary waste generation.	▪ Wastewater & groundwater treatment ▪ Industrial wastewater
Stabilization	This approach involves immobilizing PFAS contaminants within the soil matrix to prevent their migration and reduce their bioavailability. In the stabilization process, amendments such as activated carbon, clay, or organic materials are mixed with contaminated soil to bind with PFAS molecules, effectively reducing their mobility and potential for leaching into groundwater or uptake by plants.	▪ Soil treatment
Thermal Desorption	This process involves heating the contaminated soil to high temperatures, in a controlled environment, to volatilize and separate the PFAS compounds from the soil matrix. During thermal desorption, the heat causes the PFAS contaminants to vaporize, leaving behind clean soil. The vaporized PFAS compounds are then captured and condensed for further treatment or destruction, typically through methods such as activated carbon adsorption or thermal oxidation.	▪ Soil treatment

Source: Company Website

14.1.6.3 Recent developments

14.1.6.3.1 Product launches

TABLE 170 CLEAN EARTH: PRODUCT LAUNCHES

MONTH & YEAR	DEVELOPMENT TYPE	COMPANY NAME	PRODUCT NAME (PRODUCT TYPE)	PRODUCT DESCRIPTION
January 2024	Service Launch	Clean Earth	Resolve PFAS Services	The company launched Resolve, a new program that offers a toolbox of innovative solutions to treat and remediate PFAS, and a website detailing news, updates, and guidance on PFAS in the US.

14.1.6.3.2 Deals

TABLE 171 CLEAN EARTH: DEALS

MONTH & YEAR	DEAL TYPE	COMPANY NAME 1	COMPANY NAME 2	DESCRIPTION	DEAL SIZE
February 2024	Partnership	Clean Earth (US)	Department of Defense Study (US)	The company has partnered with the Department of Defense and other environmental and regulated waste providers in a prototype project to demonstrate remediation technologies for PFAS. Clean Earth, alongside Aquagga, Arcadis, 374Water, Battelle, and General Atomics, has been selected to collaborate on the remediation of PFAS-impacted waste gathered from two Department of Defense bases in Pennsylvania, specifically Naval Air Station Joint Reserve Base Willow Grove and Biddle Air National Guard Base in Horsham Township. The waste collected will undergo treatment at Clean Earth's offsite facilities as part of this joint effort.	NA

Source: Company Website

14.1.6.4 MnM view

It ranks among the largest companies in the US specializing in managing hazardous and non-hazardous waste, offering solutions that include remediation, disposal, recycling, and the beneficial reuse of contaminated materials. The company is renowned for its national reach, experienced team, and unwavering dedication to customer service. It has more than three decades of expertise in remediation and management of toxic waste. The company has a strong nationwide network of treatment facilities that are available for remediation and management of PFAS through its proprietary processes.

14.1.7 JOHN WOOD GROUP PLC

14.1.7.1 Business overview

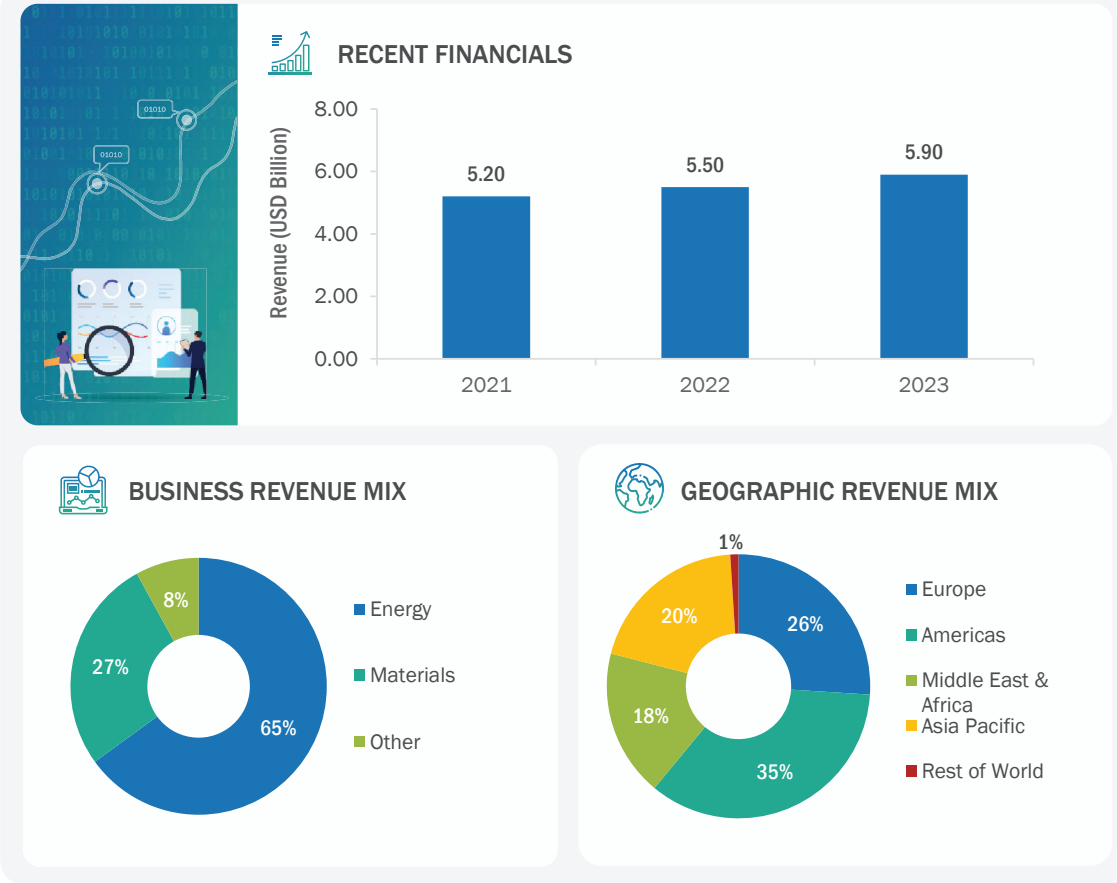
Wood is a prominent leader on a global scale in consulting and engineering, providing essential solutions across energy and materials markets. The company operates through three business divisions: energy, materials, and other. The company has great experience in PFAS consulting. It developed new generation techniques and strategies. It includes cost-effective regenerable ion-exchange treatment to remove PFAS from groundwater and on-site mobile treatment systems to treat more than 400,000 gallons of spent firewater contaminated with PFAS to manage, mitigate, and eliminate environmental liabilities associated with the release. The company has PFAS consulting experience across 70% of US states and 3 continents. It offers consulting, projects, and operations solutions in 60 countries, employing around 35,000 people.

TABLE 172 JOHN WOOD GROUP PLC: COMPANY OVERVIEW

Founded	1912
Headquarters Country	UK
Headquarters City/State	Aberdeen
Ownership	Public

Source: Secondary Research

FIGURE 54 JOHN WOOD GROUP PLC: COMPANY SNAPSHOT



Source: Company Website and Annual Reports

14.1.7.2 Products/Solutions/Services offered

TABLE 173 JOHN WOOD GROUP PLC: PRODUCTS/SOLUTIONS/SERVICES OFFERED

SOLUTION NAME	DESCRIPTION	APPLICATION
Ion Exchange Treatment	This process involves the use of specialized ion exchange resins that selectively remove PFAS compounds from water by exchanging them with less harmful ions in the resin matrix. During ion exchange treatment, contaminated water passes through columns filled with ion exchange resins. As the water flows through the resin, PFAS molecules are attracted to the resin surface and replace the ions present on the resin. This results in the removal of PFAS from the water, effectively reducing their concentration in the treated effluent.	▪ Wastewater & groundwater treatment ▪ Industrial wastewater

Source: Company Website

14.1.7.3 MnM view

Wood Group excels in its broad expertise and worldwide presence, offering consulting and engineering solutions across various sectors, including the critical area of PFAS contamination remediation. The company has emerged as an industry leader in addressing PFAS challenges. Its dedication to innovation and sustainability, combined with its customized problem-solving approach, ensures the provision of efficient and impactful PFAS remediation solutions to meet clients' changing demands globally. Leveraging its extensive industry insight and comprehensive services, Wood Group remains committed to delivering excellence and value to its clients and stakeholders. Additionally, the company continuously strengthens its balance sheet with a robust order book, solidifying its financial stability and reinforcing its position as a trusted industry leader.

14.1.8 TRC COMPANIES, INC.

14.1.8.1 Business overview

TRC is a worldwide consulting, engineering, program, and construction management company that delivers environmentally driven and digitally enabled solutions. The company provides various services such as intelligent grid solutions, operations support, planning, procurement & construction, remediation and material management, and specialized consulting. The company leverages its top-tier proficiency across a spectrum of disciplines including characterization, remediation, toxicology, forensics, regulations, and strategic planning to develop innovative solutions tailored to mitigate business and environmental risks associated with PFAS and other emerging contaminants. It provides reverse osmosis, activated carbon, and ion exchange resin filtration methods to reduce PFAS in water. The company provides its service to the government, power & industry, real estate, transportation, and water segments. It has a great presence in North America.

TABLE 174 TRC COMPANIES, INC.: COMPANY OVERVIEW

Founded	1969
Headquarters Country	US
Headquarters City/State	Windsor
Ownership	Private

Source: Company Website

14.1.8.2 Products/Solutions/Services offered

TABLE 175 TRC COMPANIES, INC.: PRODUCTS/SOLUTIONS/SERVICES OFFERED

SOLUTION NAME	DESCRIPTION	APPLICATION
Reverse Osmosis	In this process, water is forced through a semi-permeable membrane under pressure, allowing only pure water molecules to pass through while trapping contaminants like PFAS. As a result, the concentration of PFAS in the treated water is significantly reduced, providing a clean and safe drinking water supply. Reverse osmosis is widely recognized for its efficiency and reliability in removing a wide range of pollutants, making it a preferred method for PFAS filtration in both residential and industrial settings.	▪ Wastewater & groundwater treatment ▪ Industrial wastewater
Activated Carbon	It is a highly effective approach for filtering per- and polyfluoroalkyl substances (PFAS) from water. Activated carbon, typically in granular or powdered form, is utilized as a filter medium. PFAS compounds are absorbed onto the surface of the activated carbon particles as water passes through the filter. This process effectively traps and removes PFAS contaminants from the water, resulting in a significant reduction in their concentration.	▪ Wastewater & groundwater treatment ▪ Industrial wastewater

Ion Exchange Resins	This method involves the use of specialized ion exchange resin beads that selectively remove PFAS compounds from water by exchanging them with less harmful ions in the resin matrix. During ion exchange treatment, contaminated water flows through columns filled with ion exchange resins. As the water passes through the resin, PFAS molecules are attracted to the resin surface and replace the ions present on the resin. This results in the removal of PFAS from the water, effectively reducing their concentration in the treated effluent.	▪ Wastewater & groundwater treatment ▪ Industrial wastewater

Source: Company Website

14.1.8.3 MnM view

It is a leading global engineering, consulting, and construction management firm. The company serves diverse markets such as power & utilities, transportation, real estate, water, and the environment. This broad market presence allows it to leverage its expertise across multiple sectors, ensuring a stable and diversified revenue stream. It also positions it well to adapt to changing market conditions and regulatory environments, enhancing its resilience and growth potential. Additionally, its wide-ranging market reach enables the company to offer comprehensive solutions tailored to specific needs and challenges, which provide competitive edge.

14.1.9 BATTELLE MEMORIAL INSTITUTE

14.1.9.1 Business overview

Battelle is one of the largest independent nonprofit applied science and technology organizations in the world. It has a cutting-edge expertise in engineering, advanced materials, data science, biology, and chemistry. The company conducts research and development, designs and manufactures products, and delivers critical services for government and commercial customers. Battelle possesses a comprehensive knowledge of PFAS. It provides various PFAS-related services through Revive Environmental. The company developed exclusive, patented technologies, which include “GAC Renew” for the removal of PFAS.

TABLE 176 BATTELLE MEMORIAL INSTITUTE: COMPANY OVERVIEW

Founded	1929
Headquarters Country	US
Headquarters City/State	Ohio
Ownership	Private

Source: Company Website

14.1.9.2 Products/Solutions/Services offered

TABLE 177 BATTELLE MEMORIAL INSTITUTE: PRODUCTS/SOLUTIONS/SERVICES OFFERED

SOLUTION NAME	DESCRIPTION	APPLICATION
GAC Renew Technology	It is an innovative, solvent-based method for regenerating GAC (Granular Activated Carbon) on-site, which saves both time and money while extending the system's lifespan.	▪ Wastewater & groundwater treatment ▪ Industrial wastewater

Source: Company Website

14.1.9.3 Recent developments

14.1.9.3.1 Product launches

TABLE 178 BATTELLE MEMORIAL INSTITUTE: PRODUCT LAUNCHES

MONTH & YEAR	DEVELOPMENT TYPE	COMPANY NAME	PRODUCT NAME (PRODUCT TYPE)	PRODUCT DESCRIPTION
September 2019	Product Launch	Battelle	Passive Sampler for PFAS	The company introduced a new passive sampler for PFAS. This product can be used to understand the potential for exposure of PFAS to humans and other biological species.
July 2019	Product Launch	Battelle	PFAS Predict Modeling Program	Battelle has invented a new tool, called "PFAS Predict Modeling Program." It supports the organization's ongoing work to find solutions for PFAS assessment, site characterization, and remediation applications as part of an integrated approach to addressing PFAS.

Source: Company Website

14.1.9.3.2 Deals

TABLE 179 BATTELLE MEMORIAL INSTITUTE: DEALS

MONTH & YEAR	DEAL TYPE	COMPANY NAME 1	COMPANY NAME 2	DESCRIPTION	DEAL SIZE
March 2022	Partnership	Battelle	Heritage-Crystal Clean, Inc.	Battelle announced partnership with Heritage-Crystal Clean, Inc. Battelle has selected Heritage-Crystal Clean, Inc. (Crystal Clean) as its partner to utilize, market, and service Battelle's PFAS destruction technology for commercial use. Crystal Clean will implement these key technologies in its own wastewater treatment plants, as well as at third-party landfills, wastewater treatment plants, and other commercial facilities. Additionally, Crystal Clean will collaborate with Battelle to apply the technology at various other sites and for additional applications.	NA

Source: Company Website

14.1.9.4 MnM view

Battelle is one of the prominent nonprofit applied science and technology organizations. The company has a stronghold in the PFAS filtration market with a high emphasis on continuous R&D. It continuously develops new and improved products and processes to enhance customer product offerings. The company maintains long-standing relationships with a diverse base of global customers, many of whom are leaders in the markets, providing a competitive edge. It collaboratively works with its customers to build market insights.

14.1.10 CYCLOPURE

14.1.10.1 Business overview

Cyclopure is an environmental engineering and material science firm. The company specializes in water treatment specifically to target PFAS and other harmful microtoxins. The company has introduced a new adsorbent called Dexsorb. This product has high selectivity for diverse PFAS structures, regardless of chain length, structure, or functional group. It is commercialized for multiple PFAS-related issues, such as household filtration products, municipal & industrial treatment systems, and environmental monitoring. Dexsorb is also being tested in water treatment systems in collaboration with leading environmental firms, municipalities, the Department of Defense, and other government agencies. The company also offers PFAS treatment-related other products under the brands Purefast and Purefast Home.

TABLE 180 CYCLOPURE: COMPANY OVERVIEW

Founded	2016
Headquarters Country	US
Headquarters City/State	Chicago
Ownership	Private

Source: Company Website

14.1.10.2 Products/Solutions/Services offered

TABLE 181 CYCLOPURE: PRODUCTS/SOLUTIONS/SERVICES OFFERED

SOLUTION NAME	DESCRIPTION	APPLICATION
Dexsorb	It is the first-ever, corn-based adsorbent to purify water. It uses renewable cyclodextrins for adsorption of PFAS and helps keep access to drinking water affordable. This adsorbent can be regenerated for multiple cycles of use, providing cost-effective treatment efficiencies.	▪ Municipal wastewater treatment ▪ Industrial wastewater treatment
Purefast Filter	This filter is tested by NSF International to a capacity of 53 gallons for the reduction of PFOA/PFOS. This filter is also effective for the removal of PFHxA, PFHxS, PFNA, PFDA, PFHpA, PFPeA, PFBS, PFBA, and HFPO-DA (GenX). It is compatible with Brita Pitchers.	▪ Water treatment
Purefast Home	This product uses Cyclopure's patented technology, DEXSORB, to remove PFAS from water to non-detect levels. By installing this technology, PFAS can be captured at the point of entry.	▪ Water treatment

Source: Company Website

14.1.10.3 Recent developments

TABLE 182 CYCLOPURE: DEALS

MONTH & YEAR	DEAL TYPE	COMPANY NAME 1	COMPANY NAME 2	DESCRIPTION	DEAL SIZE
September 2023	Partnership	Cyclopure (US)	Regenesis (Canada)	The company partnered with Regenesis, an expert provider of in-situ soil, groundwater, and vapor intrusion remediation products and services. Aim of this partnership is to develop FluxTracer a passive sampler that uses Dexsorb for PFAS mass flux measurement in groundwater. Integrating Dexsorb into FluxTracer delivers a highly advanced and precise groundwater monitoring tool for the industry.	NA

Source: Company Website

14.1.10.4 MnM view

Cyclopure is one of the leading players in the wastewater treatment market. The company is well-positioned in the wastewater treatment market. It addresses the pain points of the customers and takes proactive efforts to upgrade technology that makes the company stand out from others. For instance, a company developed the first-ever corn-based adsorbent to purify water. This adsorbent utilizes renewable cyclodextrins to capture PFAS. Cyclopure also provides various other PFAS filtration products, which makes its product portfolio strong and provides an upper edge.

14.2 OTHER PLAYERS

14.2.1 CALGON CARBON CORPORATION

TABLE 183 CALGON CARBON CORPORATION: COMPANY OVERVIEW

Founded	1942
Headquarters – Country	US
Headquarters – City/State	Pennsylvania
Business Overview	The company has been a pioneer in developing advanced products, systems, and services for air and water purification. The company's product portfolio includes GAC, reactivation services, powered activated carbon, activated carbon health, ion exchange, pelletized activated carbon, and other services. The company provides activated carbon products for removing PFAS under the brand Filtrasorb 400. Its efficiency is greater than 99.99%. The company also provides services to exchange spent carbon and reactivate the material, removing PFAS from the carbon and thermally destroying the PFAS. The company has 25 global offices and 17 manufacturing and reactivation facilities. Its carbon technologies are used in more than 700 distinct market applications, including biogas, municipal water treatment, environmental water treatment, environmental air treatment, refinery process, food & beverage, personal protection equipment, medical, and others. The company has over 240 patents.

Source: Company Website

14.2.2 REGENESIS

TABLE 184 REGENESIS: COMPANY OVERVIEW

Founded	1994
Headquarters – Country	US
Headquarters – City/State	California
Business Overview	The company is a world leader in technology-based solutions for the environment with an emphasis on contaminated site remediation. It has developed a range of widely used specialty chemicals for the proven and low-cost cleanup of contaminated soil and groundwater. The company offers various PFAS treatment methods such as colloidal activated carbon (CAC) for soil and water treatment under the brand "SourceStop" and groundwater plume treatment. Many environmental consulting firms around the world have successfully used Regenesis technologies on thousands of polluted sites ranging from large department of defense and superfund projects to corner gas stations and dry-cleaning operations. The company operates in North America and Europe. EnBio-Engineering is international distributor of the company.

Source: Company Website

14.2.3 MINERAL TECHNOLOGIES, INC.

TABLE 185 MINERAL TECHNOLOGIES, INC.: COMPANY OVERVIEW

Founded	1992
Headquarters – Country	US
Headquarters – City/State	New York
Business Overview	The company is a global leader in water treatment-related technologies and solutions. It operates under two business segments: consumer & specialties and engineered solutions. The company offers PFAS treatment-related solutions under the engineered solutions segment. It offers Fluoro-sorb adsorbent which is a proprietary, NSF-certified product that effectively treats multiple variants of PFAS. This product binds the entire spectrum of PFAS efficiently and in a wide variety of removal and remediation processes. It also can control the source of contamination via a Permeable Reactive Barrier (PRB) or In Situ Stabilization and Solidification (ISS). Fluoro-sorb adsorbant is 3 to 4 times more adsorptive than granular activated carbon (GAC), thereby reducing the number of changeouts required for a positive impact on operational costs and lower disposal costs for spent media. The company has operations in 32 countries across Latin America, North America, Asia Pacific and EMEA. with more than 4,000 employees globally

Source: Company Website

14.2.4 CDM SMITH, INC.

TABLE 186 CDM SMITH, INC. COMPANY OVERVIEW

Founded	1947
Headquarters – Country	US
Headquarters – City/State	Boston
Business Overview	CDM Smith is a full-service engineering and construction firm. The company is primarily engaged in providing lasting and integrated solutions in water, environment, transportation, energy, and facilities to public and private clients worldwide. The company has experience in more than 170 PFAS investigations and treatment projects across the globe. Its Bellevue Research and Testing Laboratory is fully equipped to customize PFAS treatability studies and is actively leading state-of-the-art research and pre-design studies. It provides foam fractionation treatment method. The company has 6,000 employees working from offices across North America, South America, Europe, the Middle East & Africa, and Asia Pacific.

Source: Company Website

14.2.5 PENTAIR

TABLE 187 PENTAIR: COMPANY OVERVIEW

Founded	1966
Headquarters – Country	UK
Headquarters – City/State	London
Business Overview	Pentair is one of the prominent players in providing water treatment solutions. The company operates in three business segments: pool& spa equipment, water softening & filtration, and water supply & disposal. The company's product line includes filters, pumps, pool cleaners, pool heaters & heat pumps, pool lights, pool valves, water softening agents, and others. It provides PFAS reduction filtration system under the brand "Everpure. " The company provides this system to various applications such as drinking water, office coffee service, fountain beverages, and ice machines. The company operates in Europe, North America, Asia Pacific, and Middle East & Africa.

Source: Company Website

14.2.6 AQUASANA INC.

TABLE 188 AQUASANA INC.: COMPANY OVERVIEW

Founded	1998
Headquarters – Country	US
Headquarters – City/State	Texas
Business Overview	Aquasana is a leading company in the water filtration industry, specializing in the design and manufacture of high-performance water filtration systems for residential and commercial use. Aquasana provides a range of home water filtration solutions that are tested and certified to NSF/ANSI Standards 53 and 58 for reducing PFOA/PFOS. This includes all Aquasana drinking water filters, such as the Claryum 3-Stage Under Sink System and the Countertop Clean Water Machine, both of which are certified to Standard 53 for reducing PFOA/PFOS. The company's executive and marketing team operates out of Austin, Texas and its sales and operations facility is located in Haltom City, Texas.

Source: Company Website

14.2.7 NEWTERRA CORPORATION

TABLE 189 NEWTERRA CORPORATION: COMPANY OVERVIEW

Founded	1863
Headquarters – Country	US
Headquarters – City/State	Pennsylvania
Business Overview	The company designs, engineers, manufactures, and services environmental, water and wastewater treatment solutions. It offers a comprehensive range of reliable, hassle-free technologies and a complete suite of lifecycle solutions for global municipal and industrial customers. These solutions cater to diverse applications, including drinking water, industrial process water, wastewater, stormwater, and remediation. It offers a GAC adsorber system to remove PFAS from municipal water sources. The company provides various GAC filter media, including virgin coal-based, wood-based, and coconut-based. It offers GAC under the brand Cansorb. In addition, the company also provides ion exchange media for removing the short-chain compounds of PFAS using a selective resin.

Source: Company Website

14.2.8 LANXESS

TABLE 190 LANXESS.: COMPANY OVERVIEW

Founded	2004
Headquarters – Country	Germany
Headquarters – City/State	Cologne
Business Overview	It is a leading specialty company. The main business of the company is the development, manufacturing, and marketing of chemical intermediates, additives, and consumer protection products. The company offers anion exchange resin for the PFAS treatment under the brand Lewatit. This resin has a greater effective absorption capacity of up to 100 g/l – even in the presence of chlorides and sulfates. Lanxess currently has about 12,800 employees in 32 countries.

Source: Company Website

14.2.9 EUROWATER

TABLE 191 EUROWATER: COMPANY OVERVIEW

Founded	1936
Headquarters – State	Aarhus
Headquarters – City/ State	Denmark
Business Overview	In October 2020, Grundfos acquired Eurowater. Eurowater develops and manufactures reliable water treatment plants. It supplies complete solutions to a broad range of industries and application areas, including boiler water, process water, cooling water, rinse water, and drinking water. The company also has expertise in PFAS water treatment. It has designed a purification method that can eliminate PFAS in drinking water for residents of Danish Island Fanoe. The plant, comprising two specially built units, can purify 150,000 liters of drinking water per hour. The water passes through small ion exchange resins that absorb PFAS substances, reducing the concentration of each PFAS-4 compound to below 0.1 nanograms per liter. It has subsidiary companies in 14 countries servicing customers through 24 local offices.

Source: Company Website

14.2.10 AQUA-AEROBIC SYSTEMS, INC.

TABLE 192 AQUA-AEROBIC SYSTEMS, INC.: COMPANY OVERVIEW

Founded	1969
Headquarters – Country	US
Headquarters – City/ State	Illinois
Business Overview	The company is one of the prominent players in the water and wastewater treatment industry. It serves its global customers with proven, quality products and adaptable systems for the water and wastewater treatment industry. The company's product line includes filtration systems, control systems, membrane systems, and oxidation & disinfection. It serves its products to various applications such as drinking water, industrial, wet weather treatment, biological nutrient removal, and others. It offers the PFAS removal system under the brand "AquaPRS. " This system utilizes a unique sorbent suspension to adsorb pre- and polyfluoroalkyl substances (PFAS) and a robust separator to extract clean water from the suspension.

Source: Company Website

14.2.11 HYDROVIV

TABLE 193 HYDROVIV: COMPANY OVERVIEW

Founded	2015
Headquarters – Country	US
Headquarters – City/ State	Washington
Business Overview	The company is primarily engaged in producing water filters specific to customer needs. It offers water filters under the brand "Hydroviv. " Researchers from Duke University and NC State recently published a study examining the effectiveness of residential water filters in reducing PFAS levels. Five Hydroviv filters were tested as a part of this study, four of which use currently available active media blends. In all cases, any water containing PFAS in the unfiltered samples showed undetectable levels (below the Method Detection Limit (<MDL)) of PFAS after being filtered through a Hydroviv filter.

Source: Company Website

14.2.12 SALTWORKS TECHNOLOGIES, INC.

TABLE 194 SALTWORKS TECHNOLOGIES, INC.: COMPANY OVERVIEW

Founded	2008
Headquarters – Country	Canada
Headquarters – City/ State	Richmond
Business Overview	The company provides cutting-edge products and solutions for industrial wastewater treatment and lithium refining. The company has a special focus on recycling and reuse, removing specific contaminants, and concentrating brine for minimal and zero liquid discharge. The company's product range includes chemical, membrane, and thermal technologies, robust sensors, and smart process controls. Saltworks provides multiple choices to treat PFAS, including GAC, ion exchange resin, nanofiltration, and RO. The company sells its products worldwide, with an established history of designing, building, and operating full-scale plants for major international customers.

Source: Company Website

14.2.13 ACLARITY, INC.

TABLE 195 ACLARITY, INC.: COMPANY OVERVIEW

Founded	2017
Headquarters – Country	US
Headquarters – City/ State	Francis AV
Business Overview	It is one of the prominent water technology companies. It provides a complete PFAS destruction system under the brand "The Aclarity Octa. " It is the first PFAS destruction technology in the world that is being deployed in a full-scale system. This system removes PFAS using a proprietary electrochemical process to break down contaminants. The company provides its PFAS treatment products and services to various applications such as landfill, industrial, wastewater, drinking water, and aviation.

Source: Company Website

14.2.14 AQUAGGA, INC.

TABLE 196 AQUAGGA, INC.: COMPANY OVERVIEW

Founded	2019
Headquarters – Country	US
Headquarters – City/ State	Tacoma
Business Overview	It is a "Zebra Company" with an explicit mission of positive social impact. It primarily engages in developing various water treatment related technologies. The company provides hydrothermal alkaline treatment for complete PFAS destruction. This process is known as the Halt Process. This process harnesses the unique properties of hot, compressed water to break the strong carbon-fluorine bonds that hold PFAS together. This system provides various benefits such as no byproducts, no air emission, rapid complete destruction of long, short, and ultra short chain of PFAS compounds, and minimal energy consumption. This technology is backed by two world-leading research institutions and six federal agencies.

Source: Company Website

14.2.15 ONVECTOR LLC.

TABLE 197 ONVECTOR LLC.: COMPANY OVERVIEW

Founded	2012
Headquarters – Country	US
Headquarters – City/ State	Massachusetts
Business Overview	It is a science based cleantech company. It develops non-chemical water treatment technologies that utilize plasma, an advanced oxidation and disinfection process (AOP) that is more robust than ozone or UV. Plasma Vortex technology is a plasma hydrocyclone that utilizes the power of arc lightning within a controlled cyclone to eliminate the most difficult-to-treat contaminants in water and wastewater, such as PFAS forever chemicals and other emerging contaminants. This technology is reliable, energy-efficient, and cost-effective. The company offers this technology to AFFF remediation, industrial remediation, and industrial process water.

Source: Company Website

15 APPENDIX

Q. 1. What are your views on the growth prospects of the PFAS filtration market? What is the current scenario, and how will it grow in the future?

Your viewpoint: _____

Q. 2. What was the percentage contribution of the following technologies to the PFAS filtration market in terms of value, in 2023? (Kindly validate the market segmentation and add anything, if required or if there is any overlapping segment.)

TECHNOLOGY	MARKET SHARE, 2023	CAGR (2024–2029)
Water Treatment Systems		
Water Treatment Chemicals and Other Solutions		

Q. 3. What was the percentage contribution of the following places of treatment to the PFAS filtration market in terms of value, in 2023? (Kindly validate the market segmentation and add anything, if required or if there is any overlapping segment.)

PLACE OF TREATMENT	MARKET SHARE, 2023	CAGR (2024–2029)
In-situ		
Ex-situ		

Q. 4. What was the percentage contribution of the following remediation technologies to the PFAS filtration market in terms of value, in 2023? (Kindly validate the market segmentation and add anything, if required or if there is any overlapping segment.)

REMEDIATION TECHNOLOGY	MARKET SHARE, 2023	CAGR (2024–2029)
Membranes		
Chemicals		

Q. 5. What was the percentage contribution of the following environmental mediums to the PFAS filtration market in terms of value, in 2023? (Kindly validate the market segmentation and add anything, if required or if there is any overlapping segment.)

ENVIRONMENTAL MEDIUM	MARKET SHARE, 2023	CAGR (2024–2029)
Groundwater Remediation		
Soil Remediation		
Surface Water and Sediment Remediation		

Q. 6. What was the percentage contribution of the following contaminant types to the PFAS filtration market in terms of value, in 2023? (Kindly validate the market segmentation and add anything, if required or if there is any overlapping segment.)

CONTAMINANT TYPE	MARKET SHARE, 2023	CAGR (2024–2029)
PFOA & PFOS		
Multiple PFAS Compounds		

Q. 7. What was the percentage contribution of the following end-use industries to the PFAS filtration market in terms of value, in 2023? (Kindly validate the market segmentation and add anything, if required or if there is any overlapping segment.)

END-USE INDUSTRY	MARKET SHARE, 2023	CAGR (2024–2029)
Industrial		
Commercial		
Municipal		

Q. 8. What was the percentage contribution of the following service types to the PFAS filtration market in terms of value, in 2023? (Kindly validate the market segmentation and add anything, if required or if there is any overlapping segment.)

SERVICE TYPE	MARKET SHARE, 2023	CAGR (2024–2029)
On-site		
Off-site		

Q. 9. What was the percentage contribution of the following regions to the PFAS filtration market in terms of value, in 2023? (Kindly validate the market segmentation and add anything, if required or if there is any overlapping segment.)

REGION	MARKET SHARE, 2023	CAGR (2024–2029)
Asia Pacific		
North America		
Europe		
Middle East & Africa		
South America		

Your viewpoint: _____

Q. 10. What are the drivers, restraints, opportunities, and challenges, in the PFAS filtration market?

PARAMETER
Drivers
Restraints
Opportunities
Challenges

Your viewpoint: _____

Q. 11. Name the major manufacturers of PFAS filtration.

Your viewpoint: _____

Q. 12. What are the upcoming technologies/product areas that will have a significant effect on the PFAS filtration market in the future?

Your viewpoint: _____

Q. 13. What will be the revenue pockets for the PFAS filtration market in the next five years (2024–2029)?

Your viewpoint: _____

Q. 14. Where do you see your company's position in this market in the next five years (2024–2029)?

Your viewpoint: _____

15.1 KNOWLEDGESTORE: MARKETSANDMARKETS' SUBSCRIPTION PORTAL

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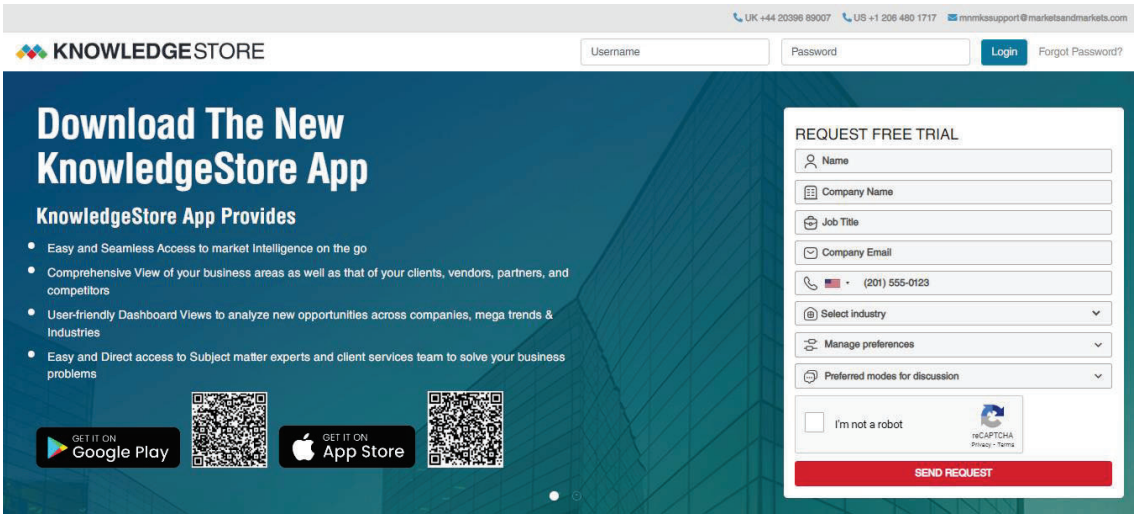

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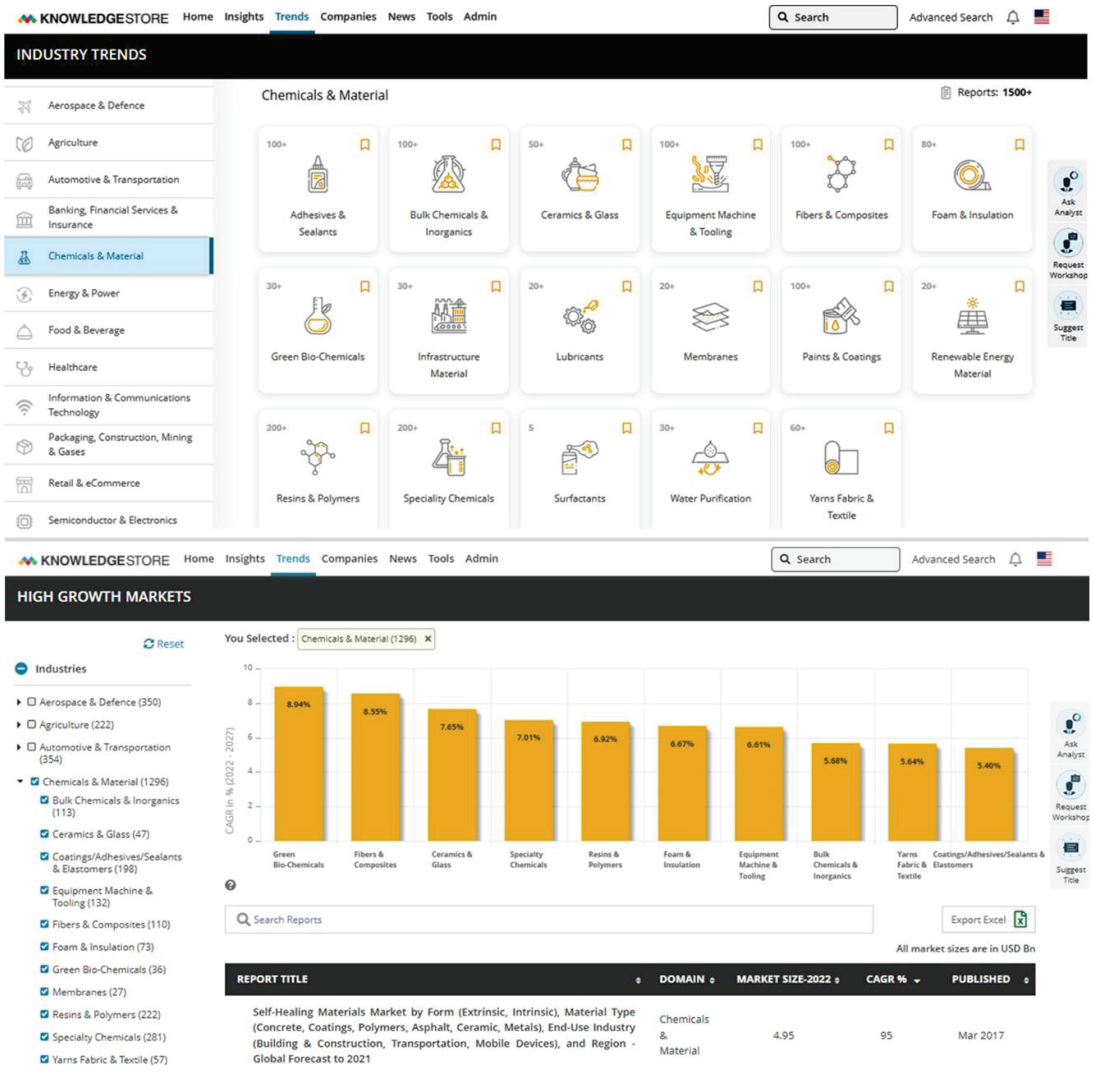

15.2 CUSTOMIZATION OPTIONS

With the given market data, MarketsandMarkets offers customizations according to the company's specific needs. The following customization options are available for the report:

PRODUCT ANALYSIS

- Product Matrix, which gives a detailed comparison of the product portfolio of each company.

REGIONAL ANALYSIS

- Further breakdown of the regions in the PFAS filtration market

COMPANY INFORMATION

- Detailed analysis and profiles of additional market players (Up to five)

15.3 RELATED REPORTS

SR. NO.	REPORT TITLE	PUBLISHED DATE
1	**PFAS TESTING MARKET - GLOBAL FORECAST TO 2028** By Consumable Type (Sample Preparation, Chromatography, Columns), Techniques (LC-MS-MS, GC/MS, NMR, ELISA), Analyte Type (PFOS, PFOA, PFNA, PFHxS), Application and Region https://www.marketsandmarkets.com/Market-Reports/pfas-testing-market-168277170.html	December 2023
2	**FLOCCULANT & COAGULANT MARKET** By Type (Coagulant, Flocculant), End-use Industry (Municipal Water Treatment, Paper & Pulp, Textile, Oil & Gas, Mining), and Region https://www.marketsandmarkets.com/Market-Reports/flocculant-and-coagulant-market-243584994.html	October 2023

15.4 AUTHOR DETAILS

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"A technically proficient and result-driven professional with over 15 years of experience and has been associated on key roles with firms like IPCL, Anabond Ltd, Frost & Sullivan, Bussetti GmbH, and Jet Airways.

He holds rich experience in technology, market research experience in the Chemicals and Materials domain and leads a global, cross-functional team of consultants for projects with major chemical companies with actionable insights. Most of the projects are in the sales & marketing, business development, and strategic planning and implementation functions; Key consulting projects undertaken are distribution channel optimization, new product development, new market entry strategy, pricing strategy, growth strategy, identification of acquisition targets, and due diligence of targets."

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"PhD in Chemical Technology with over 25 years of experience in bio-chemicals, specialist having a detailed knowledge of the broad spectrum of chemical products and material derivatives that can be produced from crude oil-based feedstocks. This expertise extends from the full range of feedstocks through to intermediaries – "platform" chemicals and the major end-use products: lubricants, plastics, solvents, surfactants, and coatings.

Designed and executed many market research projects in the chemicals vertical, including coatings for leading industry players. He has authored over 100 techno-commercial papers on a variety of chemicals and related industries. He has a strong hold on automotive refinish, packaging, can and coil, packaging and marine coatings.

He provides objective analysis of the full value chain of the bio-chemical industry in different parts of the world. He helps clients plan effectively and successfully to identify and seize opportunities and to pre-empt threats."

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