Brief

Canadian Water Network

PFAS Management and Mitigation

Challenges, Considerations and Opportunities for Water Managers

What to watch for

Federal report on PFAS

The federal government has been reviewing the scientific evidence for treating PFAS as a broad class of chemicals. It will release its report on the state of PFAS in Canada in 2023 (Department of the Environment and Department of Health, 2021).

Potential regulation as a class

In light of the growing concern about PFAS and the federal consultation, PFAS substances may soon be regulated as a single class of compounds according to their chemical structure. The thousands of known PFAS in existence would be classified, regulated and treated in the same way. This would affect water, wastewater and stormwater utilities.

Updates to legislation

Current regulations and guidelines about PFAS date as far back as 1995. Our understanding has evolved considerably since then. When more evidence-based scientific research is completed, drinking water and wastewater managers can expect updated legislation. In addition to regulating PFAS as a class, updates could include a bigger list of banned PFAS substances, additional protocols for sampling, testing and treatment, and additional compliance requirements.

Stricter limits on PFAS and a broader application of limits

Municipalities and utilities are likely to expect stricter limits on PFAS that may also be applied to compounds other than PFOS and PFOA. This may require more advanced treatment processes, more comprehensive sampling and monitoring, and more collaboration with local organizations that rely on PFAS-intensive chemicals in products they use (i.e., fire departments, the agriculture sector, etc.).

Regulation of PFAS in biosolids

Wastewater utilities may soon see federal and provincial regulation of PFAS in biosolids.

Regulations for wastewater treatment

Although source control is likely a more effective approach to limit PFAS in wastewater, provinces may introduce regulations about how to manage PFAS in wastewater effluents. This may reduce uncertainty for WWTPs and increase clarity about their management processes.

The issue

Emerging scientific research has led to increasing concern about harmful elements found within water systems. Among these contaminants of concern are perfluoroalkyl and polyfluoroalkyl substances, or PFAS.

PFAS compounds—known as "forever, everywhere" chemicals because they are widely used and long-lasting—have been used for decades in consumer products and industry and are found in the environment worldwide. Because research suggests they may be harmful to the health of humans and animals, they are a potential hazard in drinking water and recreational water. It is therefore critical for water managers to determine the most effective ways to deal with PFAS chemicals in municipal systems.

In Canada, there is currently little regulation or guidance to address PFAS in water. However, municipalities and utilities should be prepared to respond to new government action on PFAS in the near future—including a federal report and stricter legislation and guidelines governing PFAS compounds, possibly as a single class of chemicals. Such measures may lead to litigation and require changes in municipal water and wastewater treatment.

Background

PFAS and their precursors are human-made chemicals considered contaminants of emerging concern. They have a tightly bonded carbon-fluorine structure—one of the strongest bonds in organic chemistry—that breaks down only slowly over time and makes PFAS difficult to remove from water with conventional treatment options.

There are more than 4,700 known types of PFAS chemicals in Canada, and many more unknown types (Canadian Environmental Law Association, 2019; Government of Canada, 2021), although they have never been manufactured in Canada (Kramer, 2020). PFAS have stain-resistant and water-repellent qualities and are found in a wide range of consumer and commercial products, such as non-stick coatings, textiles, paper products and firefighting foams (Global Water Research Coalition [GWRC], 2021a). PFAS are commonly found with microplastics (Cook & Steinle-Darling, 2021).

The two primary sources of PFAS that affect water systems are:

1. Fire-training sites that use firefighting foam.
2. Industrial sites that manufacture products using PFAS, such as metal-plating and food-packaging facilities (GWRC, 2021b).

PFAS chemicals have been found in almost all sources of drinking water worldwide, in different quantities. Conventional water treatment plants (WTPs) cannot remove more than 10 per cent of PFAS from raw waters (GWRC, 2021b; Perkins, 2021). Because PFAS may harm the health of people and ecosystems, this persistence is an important consideration for drinking water, wastewater and stormwater utilities across Canada (GWRC, 2021a, 2021b).

Impact on health

The full extent of long-term toxicological effects of PFAS on health and the environment is uncertain. However, PFAS are known to disrupt the endocrine system, with impacts linked to disorders of cognition, fertility and attention, and also to high cholesterol, thyroid disease, ulcerative colitis, and kidney and testicular cancer (Bureau, 2021; O'Keeffe, 2019; Xiao et al., 2012).

In 2013, a biomonitoring program by Health Canada found that all Canadians sampled had Perfluorooctane sulfonate (PFOS) and Perfluorooctanoic Acid (PFOA) present in their tissues or blood (Kramer, 2020). Emerging research suggests that one PFAS chemical in particular, perfluorobutanoic acid (PFBA), seems to accumulate in the lungs and may be strongly associated with severe outcomes from COVID-19 (McDonald, 2020). Research also suggests that PFAS can dampen the human antibody response to vaccinations (McDonald, 2020) at present concentrations in the human body (Kramer, 2020).

Behaviour

PFAS behaves in several ways that pose a challenge for water managers. These chemicals:

- **Enter the water cycle several ways**, from primary point sources and geographically distributed non-point sources, through effluent from wastewater treatment plants (WWTPs), biosolids, and leachate from landfill sites (GWRC, 2021b).
- **Resist removal** by most conventional water treatment and wastewater treatment processes, because the strength of their carbon-fluorine bond makes PFAS compounds highly resistant to hydrolysis, photolysis and biodegradation (Canadian Environmental Protection Act [CEPA], 1999; GWRC, 2021b; Perkins, 2021; Xiao et al., 2012).
- **Can increase in concentration after wastewater treatment** in some cases, because of the oxidation of PFAS precursors that may be in influent wastewaters, according to recent studies (Bureau Veritas North America, 2021; Coggan et. al, 2019; GWRC, 2021a). A PFAS precursor is a compound that has the potential to form a more-stable PFAS compound upon degradation (Bureau Veritas North America, 2021; van Hees, n.d.)
- **Can adsorb or desorb from solids**, and concentrate in biosolids, further exacerbating their harmful impacts. These processes affect nearby agricultural practices, landfill sites and surrounding soils. They may be particularly important to wastewater treatment plants (WWTP) involved in recycled water or water-reuse programs (GWRC, 2021a).

- **Are present in almost all drinking water sources** worldwide, in different quantities. Conventional water-treatment plants cannot remove more than 10 per cent of PFAS from raw waters (GWRC, 2021b; Perkins, 2021).
- **Persist in the environment** (soils, sediment and biosolids; air; marine and freshwater environments including drinking water, surface and groundwater; and wastewater effluent) **and bioaccumulate in living creatures** (Bureau, 2021; CEPA, 1999; Phillipps & Sigal, 2018; Xiao et al., 2012). In other words, PFAS accumulates in the blood or tissue of living organisms faster than the body can break it down and excrete it.

Routes of exposure

People may be exposed to PFAS in numerous ways:

- In places where the chemicals are found in high concentrations, including at fire-training and fire-response sites and industrial sites where products containing PFAS are produced.
- From drinking water, in communities with contaminated drinking-water supplies (GWRC, 2021a, 2021b; U.S. Department of Health and Human Services, 2022; Xiao et al., 2012).
- Through food and consumer products, including stain-resistant carpets and upholstery; water-resistant clothing; fast-food wrapping; cosmetics; cleaning products, and paints, varnishes and sealants. Research suggests that exposure through consumer products is low, especially when compared with drinking water (U.S. Department of Health and Human Services: Agency for Toxic Substances and Disease Registry, 2022).

Regulation

Most PFAS compounds are not regulated in Canada.

The federal government has taken some steps to control **PFOS and PFOA**, the two PFAS substances that have been studied rigorously and most frequently.

- Since **2008, PFOS and its salts** have been on the list of chemicals Canada has **designated for "virtual elimination"** (Perfluorooctane Sulfonate Virtual Elimination Act, 2008).
- Regulations under CEPA in **2008 restricted** the manufacture, use, sale and import of **PFOS** and products containing PFOS, **with exceptions** including firefighting foam and photography materials (CEPA: Perfluorooctane Sulfonate and its Salts and Certain Other Compounds Regulations, 2008).
- New regulations developed in **2012** contain **tighter restrictions on PFOS** and also regulate other PFAS substances (CEPA: Prohibition of Certain Toxic Substances Regulations, 2012).
- In **May 2022**, Canada **proposed tighter restrictions on PFOS and PFOA** in new draft regulations that would replace the 2012 toxic substances regulation currently in effect.

This would eliminate various existing exceptions and reduce the amounts of these chemicals permitted in some products, such as firefighting foam (CEPA: Prohibition of Certain Toxic Substances Regulations, 2022).

- In **June 2022**, **PFOS** was formally **designated for virtual elimination** under amendments to CEPA that replace the 2008 virtual elimination act (CEPA: An Act to amend the Canadian Environmental Protection Act, 2022).

No federal or provincial regulations address PFAS in drinking water, wastewater or stormwater. Canada has no legally enforceable regulations that require the monitoring or control of PFAS chemicals in municipal water systems (Bureau, 2021; Lauzon, 2019).

The federal and British Columbia governments have produced several other types of guidance for water managers:

Drinking water

- Canada has **formal drinking water guidelines** (Government of Canada, 2022; Health Canada, 2018c) and **technical documents** that address PFOS and PFOA. These identify a **maximum acceptable concentration** (MAC) of 0.2 µg/L for PFOA and 0.6 µg/L for PFOS (Health Canada 2018a, 2018b). The government says it plans to update the guidelines in the next few years (Health Canada, 2018c).
- Because of the additive nature of **PFOS and PFOA**, the government has recommended that when they are found together in drinking water, they should be **considered together** when determining their concentration (Health Canada, 2019b). See Table 1.
- **British Columbia** has adopted the federal guidelines and recommendation (British Columbia Ministry of Environment & Climate Change Strategy, 2020).
- Environment Canada has indicated that exposure to PFAS in concentrations below the MAC does not pose a significant risk to humans. At the same time, the **technical documents** for PFOA and PFOS **recommend** that if utilities find sources of either PFOA or PFOS in drinking water, they should take **samples** semi-annually and conduct **compliance monitoring** (Health Canada, 2018a, 2018b).
- Since only **PFOS and PFOA** have been rigorously studied, Health Canada has used these two compounds **as surrogates, or proxies**, when making decisions about other PFAS chemicals. With this method it has **determined drinking water screening values** (DWSV) for **nine more PFAS chemicals** (Health Canada, 2019b). Screening values provide guidance but are **not formal guidelines**. They lack the extensive research and internal peer review typically conducted when producing formal guidelines.

Wastewater

- There is no regulation for PFAS in wastewater.
- Regulations under the federal Fisheries Act govern wastewater effluent discharge that contains deleterious substances. However, they do not clearly or explicitly include PFAS

chemicals or their salts and precursors. (Fisheries Act: Wastewater Systems Effluent Regulations, 2012).

Stormwater

- There is no regulation for PFAS in stormwater.

Stormwater may contain PFAS from various sources and serve as a path of distribution. As the runoff from rainwater or snowmelt travels overland, it may convey PFAS into water-treatment facilities or local groundwater, source water and recreational water (Codling et al., 2020; McMahan, 2006). Runoff may also leave PFAS chemicals in soil.

Soil and groundwater

Soil may become contaminated with PFAS in several ways: from stormwater runoff; atmospheric deposition from industrial sites; through the application of biosolids to agricultural lands (GWRC, 2021a) and at sites where PFAS materials are used. In turn, it can contaminate groundwater.

- In relation to contaminated sites, British Columbia has **regulated three types of PFAS** — PFOS, PFOA and perfluorobutane sulfonic acid (PFBS) -- in soil and/or groundwater (Environmental Management Act: Contaminated Sites Regulation, 2020).
- In **2021**, the Canadian Council of Environment Ministers issued **guidelines for PFOS** in soil and groundwater Canadian Council of Ministers of the Environment. (2021).
- In **2019**, Health Canada drafted **screening values for 11 PFAS compounds** commonly found in soil. Screening values do not have the weight of formal guidelines, but they can be helpful for water and wastewater utilities trying to determine whether the concentrations detected in soils may be a concern for human health (Health Canada, 2019a).

Litigation

Litigation about PFAS-contaminated water has occurred in Ontario. However, lawsuits are more prevalent in the United States and Australia (Adamson et al., 2020).

The U.S., Australia and the United Kingdom have more advanced advisory limits than Canada does for PFAS in drinking water, recreational water and other water for human consumption (Environmental Protection Agency, 2022; GWRC, 2021a). Table 1 government actions on PFAS in Canada, the United States and Australia. U.S. legal claims have been related mainly to environmental contamination and human-health effects (Kramer, 2020).

Current status

Regulatory environment

There is currently little movement in Canada toward strict federal or provincial legislation and regulation of PFAS chemicals in water systems (Adamson et al., 2020; Bureau, 2021; McDonald, 2020).

The exception is British Columbia's regulation for contaminated sites (Adamson et al., 2020; Bureau, 2021; Environmental Management Act: Contaminated Sites Regulation, 2020; McDonald, 2020).

Classification

Researchers in many parts of the world are **advocating for stricter, more comprehensive limits** for PFAS. This is evidenced in The Madrid Statement (Blum et al., 2015) and the Stockholm Convention on Persistent Organic Pollutants, an international environmental treaty first signed in 2001 that lists toxic chemicals that are to be eliminated or severely restricted, including PFOA and PFOS. Canada is a signatory (Stockholm Convention on Persistent Organic Pollutants, 2001).

Many researchers and organizations, including the Canadian Environmental Law Association (2019), are calling for regulatory measures that **treat PFAS as a class** of chemicals. This would mean the thousands of known PFAS chemicals in existence would be classified, regulated and treated according to their structure.

The federal government is reviewing the scientific evidence for addressing PFAS as a class. It has invited stakeholders to provide initial feedback about this initiative. It is expected to summarize this and other relevant information in a **report in 2023** on the state of PFAS in Canada (Department of the Environment and Department of Health, 2021).

Microplastics

The federal government is taking steps toward phasing out microplastics. Since microplastics and PFAS are often found together, this may affect PFAS as well.

Emerging research

In spite of our growing understanding of these "forever, everywhere" chemicals, PFAS compounds are not well understood, and scientists are actively working to close several knowledge gaps. Research has been increasing over the past decade (Australian Government, n.d.; Environmental Protection Agency, 2019; GWRC, 2021a).

PFAS and microplastics

Emerging research by Cook and Steinle-Darling has highlighted the important link between microplastics and PFAS.

- In some instances (for example, polyvinyl fluoride [PVF] and polytetrafluoroethylene [PTFE]), microplastics occur as PFAS.
- Some microplastics (such as polyvinyl chloride [PVC]) involve PFAS in certain stages in the production process.
- PFAS chemicals that are used to repel water in textiles can ultimately be broken down into macro-, meso-, or microplastics (Cook & Steinle-Darling, 2021).

Stormwater

Research into PFAS and stormwater is limited. However, researchers across Canada (Codling et al., 2020) are currently working to determine the presence of PFAS in stormwater, and the potential impact on human and ecosystem health (Codling et al., 2020).

Stormwater is an important subject for research because runoff from rainwater or snowmelt that travels overland may convey PFAS into treatment facilities, groundwater, source water and recreational water (Codling et al., 2020; McMahan, 2006). In addition, leachate from stormwater retaining ponds may deposit PFAS into surrounding soils.

Key considerations

Although PFAS chemicals are pervasive, harmful and persistent, they are still not well understood, and most are not regulated in Canada. Research is shedding new light on the properties, presence and pathways of PFAS, and updated regulation may be on the horizon. This complex picture presents challenges for water managers, but opportunities as well.

Here are some **key considerations** for municipalities as they work to address PFAS in their jurisdictions.

Challenges

Long-term health and ecosystem impacts

PFAS chemicals are harmful to people and ecosystems, a factor that drinking water, wastewater and stormwater utilities across Canada need to consider. Since some PFAS compounds also bioaccumulate in human and animal tissue, it will be important to understand how this affects human health and the environment (GWRC, 2021a).

Pathways of PFAS contamination

PFAS contaminants spread throughout the environment in ways that are not yet fully understood. Scientists are trying to understand the pathways by which they can disperse (Bureau, 2021). As such, it is important to understand the complexity of a municipality's water systems—drinking water, wastewater and stormwater—to fully define the appropriate response from utilities' risk-management, water treatment and source-control programs.

Understanding PFAS pathways can help to:

- Identify ways that utilities can prevent PFAS from entering the environment (GWRC, 2021a).
- Control the threat to human, animal and ecosystem health.
- Identify new contaminants.

Wastewater and biosolids

Wastewater treatment plants serve as a significant pathway for PFAS contamination of water and land.

- PFAS compounds not eliminated by conventional wastewater treatment can re-enter the environment in **wastewater effluent** (GWRC, 2021a).
- Wastewater treatment may also **increase the concentration** of PFAS chemicals that are discharged **in effluent**, when precursors in influent are converted to more-stable PFAS compounds through oxidation (GWRC, 2021a; Merino et al., 2016; Tavasoli, 2020).
- Wastewater treatment plants (WWTP) that receive sewage from PFAS-producing industries or fire-training locations produce **biosolids** with high concentrations of PFAS, studies show. Biosolids from municipal WWTPs are used to augment or fertilize agricultural land (more than 40 per cent of biosolids are used as fertilizer across Canada); to restore degraded land; and may be disposed of in landfills (W. Parker, personal communication, 2021).
- **Biosolids** applied on land may also contaminate source water with PFAS.
- The nature of biosolids produced from sludge will vary, depending on the type of sludge-handling technology, and since the chemical and physical properties of PFAS are diverse (W. Parker, personal communication, 2021).

Stormwater

Stormwater generated from rainfall and melting snowpack events have carried PFAS to downstream surface waters. A recent study in Saskatoon showed that the levels were not likely to pose a risk to aquatic species (Codling et al., 2020). Storm flows that carry PFAS into combined sewer systems may be an additional source of PFAS for a wastewater treatment plant.

Source water

Understanding potential **upstream sources** of PFAS and **baseline concentrations** in source water will help to inform local risk-management strategies for these chemicals.

- Researchers have highlighted the importance of **baseline environmental surveys** to determine the presence and concentration of PFAS and PFAS precursors (GWRC, 2021b).
- Drinking water utilities that do baseline surveys may have to **determine which types of PFAS** are of concern in their local areas.
- In the absence of federal or provincial regulations or guidelines for most PFAS chemicals in water, municipalities may also have to **set their own concentration limits**.

The connection with microplastics

PFAS and microplastics have traditionally been analyzed, researched and treated separately. However, as Cook and Steinle-Darling (2021) highlight, they are commonly found together, and microplastics can increase the toxicity of PFAS. This coexistence and interaction are another key consideration in monitoring and managing stormwater, drinking water and wastewater (Cook & Steinle-Darling, 2021).

Potential litigation

Federal or provincial regulation of PFAS in water could give rise to litigation in situations that are not in compliance. Given the experience in the United States, PFAS-related litigation will occur across Canada (Kramer, 2020).

Opportunities

Treatment

- Several **water treatment options** have been offered by Merino et al. (2016), including sorption using activated carbon; advanced oxidation processes; advanced reduction processes; thermal and non-thermal destruction; microbial treatment, and others.
- For wastewater managers, a key consideration is better **understanding how to prevent PFAS precursors from transforming** into more persistent PFAS compounds during treatment. This is important when evaluating how to prevent elevated concentrations in effluent (Bureau Veritas North America, 2021; GWRC, 2021; Merino et al., 2016; Tavasoli, 2020; van Hees, n.d.).
- **The treatment of sludge** is a key consideration, given the emerging concern about the potential spread of PFAS through sludge and biosolids. Different factors affect each stage of sludge treatment and the fate of PFAS compounds. For instance, it is possible

that PFAS precursors from influent wastewater can accumulate in sludge during treatment (W. Parker, personal communication, 2021).

- Evaluating the **cost and necessity of advanced treatment options** for PFAS is important, especially since some advanced wastewater treatment methods can transform PFAS precursors into perfluoroalkyl acids (PFAA). The effectiveness of a treatment depends largely on the type(s) of PFAS being treated. Therefore, this should be explored more thoroughly at the local level (GWRC, 2021a, Lenka et al., 2021).

Prevention

- A robust program to **control the sources of PFAS** is a key consideration and opportunity for municipalities. Because conventional water treatments do not readily remove PFAS compounds (Coggan et al., 2019; Merino et al., 2016; Xiao et al., 2012), controlling the sources of PFAS in the community may help to reduce PFAS in the receiving environment.
- **Using a critical control point** to manage PFAS has been suggested as one way to reduce the risk of PFAS entering water systems. This can reduce the need for high volumes of water sampling and analysis, which often carry significant, continuing costs (GWRC, 2021b). It is particularly relevant for smaller municipalities, townships and rural communities, which often lack the funding and advanced treatment technologies typical of larger cities.
- Many researchers have suggested that the most effective approach is **to treat PFAS as a class of chemicals**, with the overall objective of virtually eliminating them, so that they cannot enter water sources (Mucaj et al., n.d.; Örmeci et al., 2021).

Table 1. Comparison of key regulatory frameworks for PFAS in water in Canada, United States and Australia

Note: This table is not a comprehensive list of all regulations in that exist. Rather, it provides a snapshot of a few broader regulations.

Country	Federal and Provincial/State Regulation	Actions
Canada	**SOR/2008-178** - Perfluorooctane Sulfonate and its Salts and Certain Other Compounds Regulation **Impact on PFAS:** The manufacture, importation and use of PFOS and PFOA-related compounds in Canada is prohibited.	**State of PFAS Report:** Will summarize relevant information on the class of PFAS. Expected date of publication is 2023. **Guidelines for Drinking Water Quality:** Provide screening values for PFOA, PFOS and nine other PFAS compounds as well as soil screening values for 11 PFAS compounds. **State of the Science Report for a Screening Health Assessment – Pefluorooctane Sulfonate (PFOS):** An assessment of information, investigations and evaluations conducted on PFOS. **Risk management strategy for perfluorooctane sulfonate and its salts and precursors**: Outlines the issue, current uses, exposure sources, why action is needed and a proposed risk management approach. **Health Canada Maximum Allowable Concentration (MAC)** • PFOS: 0.0006mg/L • PFOA: 0.0002mg/L • Note: The sum of PFOA and PFOS concentrations in drinking water divided by their respective MAC should not exceed one.
	SOR/2012-139 Wastewater Systems Effluent Regulations **Impact on PFAS:** Unclear	
	SOR/2012-285 Prohibition of Certain Toxic Chemicals Regulations **Impact on PFAS:** Prohibition of PFOS and its salts and precursors. **B.C. Reg.161/2020** Contaminated Sites Regulation **Impact on PFAS:** • Standards for soil (found in schedule 3.1). • Standards for groundwater (found in schedule 3.2).	

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<tr>
<td rowspan="4">United States</td>
<td>House Bill H.R.2467 – PFAS Action Act of 2021 (Under Comprehensive Environmental Response, Compensation, and Liability Act (CERLA) of 1980)

Impact on PFAS: Directs USEPA to
• Designate PFOA and PFOS as hazardous substances within a year.
• Assess remaining PFAS substances and designate them as hazardous within five years.
• Determine remediation obligations under CERLA.</td>
<td rowspan="3">• In August 2022, the EPA formally proposed to designate PFOA and PFOS as "hazardous substances" under CERCLA, also known as the "Superfund" law. The new rule would require companies to report to the EPA when the chemicals are released into water or soil in excess of certain amounts. This could require cleanup of the pollution.
• PFAS Action Plan: Identifies short- and long-term approaches to reduce risks related to PFAS in the environment.
• PFAS Strategic Roadmap: EPA's Commitments to Action 2021-2024: A lifecycle approach to identifying, addressing, managing and eliminating PFAS in the environment.
• Interim Recommendations to Address Groundwater Contaminated with PFOA and PFOS: Provides interim guidance for responding to groundwater contaminated with PFAS.
• Significant New Use Rules (SNUR): The EPA, Under the Toxic Substances Control Act (TSCA), is proposing a number of new rules to control the use and distribution of various PFAS chemicals, including Long-Chain Perfluoroalkyl Carboxylate and Perfluoroalkyl Sulfonate Chemical Substances.
• EPA Council on PFAS: Subject matter experts convened from across the EPA to determine the best way to mitigate and reduce PFAS pollution and protect public health and the environment.
• US Infrastructure Bill has allocated $10 billion for PFAS-related work.
• Note: Currently, no federal MAC for any PFAS chemicals (but several states have implemented their own guidelines, notably Michigan and California).</td>
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<td>42 U.S.C. §300f et seq. (1974) – Safe Drinking Water Act (SWDA)

Impact on PFAS: The USEPA, under the SWDA, had added PFOAS and PFOA to the regulatory determinations for contaminants on the contaminant candidate list. Currently, the USEPA is determining drinking water regulations for these chemicals and other classes of PFAS.</td>
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<tr>
<td>Toxic Substances Control Act 15 U.S.C. §2601 et seq. (1976)

Impact on PFAS: This Act provides the EPA with authority to require reporting, testing, monitoring and restrictions. PFAS chemicals are found under this Act.</td>
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<tr>
<td colspan="2">Of note: A summary of key bills and PFAS legislation regarding numerous parameters, including the PFAS Detection Act and the PFAS Release Disclosure Act, can be found in PFAS Federal Legislation in the 116th Congress.</td>
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Australia	**South Australia** [Environment Protection (Water Quality) Policy 2015] **and** [Environment Protection Act 1993] **Impact on PFAS:** Ban on PFAS in fire-fighting foams in South Australia.	• National Framework for Responding to PFAS Contamination: An intergovernmental agreement between the commonwealth of Australia and all its States and Territories. Includes: ○ PFAS Contamination Response Protocol: Identifies roles, responsibilities and processes across all levels of government to rapidly, effectively and consistently respond to PFAS contamination. **Source, pathway and receptor management** is included. ○ PFAS National Environmental Management Plan (PFAS NEMP): Provides state and municipal governments with consistent guidance on regulating PFAS-contaminated materials and sites. ○ PFAS information sharing, communication and engagement guidelines**:** Provide advice for all government agencies in Australia involved in responding to PFAS. ○ National PFAS Position Statement: Articulates intergovernmental recognition that ongoing use and further release of PFAS should be prevented where possible and practical including the eventual phase of use should be consistent. ○ Health Based Guidance Values for different PFAS found in food and water. Used for site investigations and human health risk assessments. **Comprehensive repository of guidance, summary, review and FAQ documents.** • Analysis, monitoring and listing of PFOS as a "persistent organic pollutant" as per the Stockholm Convention.

		• Australian Government **information** [portal on PFAS]: Generates awareness and two-way communication for stakeholders and affected communities.
		• Proposal to include PFAS in the **Industrial Chemicals Environmental Management (Register) Act 2021** that operates alongside the **Australian Industrial Chemicals Introduction Scheme (AICIS)**. Under the act, chemicals will be categorized based on the level of concern.
		• **Australian Government PFAS Taskforce:** Responsible for whole-of-government coordination and oversight of Australian Government responses to PFAS contamination.
		• Australian Government Department of Health — **Health-based guidance (MAC) values for PFAS.**
		    ○ Drinking water quality value: **0.00007µg/L** for PFOS & PFHxS and **0.00056mg/L** for PFOA.
		    ○ Recreational water quality value: **0.002mg/L** for PFOS and PFHxS and **0.01mg/L** for PFOA.

Curated resource list

Global Water Research Coalition. (2021). *PFActS 1: PFAS in the Environment.* https://cwn-rce.ca/wp-content/uploads/GWRC_WaterRA_FS_Project_1121_PFActs1.pdf

> This is the first in a series of three factsheets on PFAS. It was designed to help global water utilities navigate risks, regulations, treatment options and monitoring recommendations with respect to PFAS in drinking water, wastewater and water reuse streams. It describes what PFAS are, where they come from, where and how they accumulate, and how this affects the operations of water utilities.

Global Water Research Coalition (2021). *PFActS 2: PFAS in Drinking Water*. https://cwn-rce.ca/wp-content/uploads/GWRC_WaterRA_FS_Project_1121_PFActs2.pdf

> This is the second in a series of three factsheets on PFAS. It was designed to specifically address PFAS in drinking water by examining the ways in which PFAS can affect drinking-water production, and by providing treatment-plant operators with information to inform risk analysis and mitigation exercises concerning both human and environmental health effects.

Coggan, T.L., Moodie, D., Kolobaric, A., Szabo, D., Shimeta, J., Crosbie, N.D., Lee, E., Fernandes, M., & Clarke, B.O. (2019). An investigation into per-and polyfluoroalkyl substances (PFAS) in nineteen Australian wastewater treatment plants (WWTPs). *Heliyon*, *5*(8), e02316.

> This journal article provides information about quantifying emissions of PFAS substances at 19 wastewater treatment plants, and the potential impacts on receiving aquatic environments. The research and results were based on an analysis of 19 Australian wastewater treatment plants.

Merino, N., Qu, Y., Deeb, R.A., Hawley, E.L., Hoffmann, M.R., & Mahendra, S. (2016). Degradation and removal methods for perfluoroalkyl and polyfluoroalkyl substances in water. *Environmental Engineering Science*, *33*(9), 615-649.

> This journal article summarizes several categories of treatment approaches for the degradation and removal of PFAS in water. The authors discuss background information, mechanisms, advances and effectiveness for each treatment technology.

References

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Blum, A., Balan, S.A., Scheringer, M., Trier, X., Goldenman, G., Cousins, I.T., Diamond, M., Fletcher, T., Higgins. C., Lindeman, A.E., Peaslee, G., de Voogt, P., Wang, Z. & Weber, R. (2015). The Madrid statement on poly- and perfluoroalkyl substances (PFASs). *Environmental Health Perspectives, 123*(5), A107-11. https://doi.org/10.1289/ehp.1509934

British Columbia Ministry of Environment & Climate Change Strategy. (2020). *B.C. Source Drinking Water Quality Guidelines: Guideline Summary*. Retrieved from Government of B.C. website: https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/waterquality/water-quality-guidelines/approved-wqgs/drinking-water-and-recreation/source_drinking_water_quality_guidelines_bcenv.pdf

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