Review

Characteristics of Spatial Distribution, Health Risk Assessment, and Regulation of PFAS in Global Drinking Water

Jinsha Ma[1,2]; Muzhi Shao[3]; Weiwei Fan[1,2]; Fengge Chen[1,2]; Yuantao Hao[3]; Tong Wang[4,#]; Yongyue Wei[3,#]

ABSTRACT

This study systematically evaluated the spatial distribution, health risks, and regulation of per- and polyfluoroalkyl substances (PFAS) in global drinking water using the PubMed and Web of Science databases (January 1, 2000 to February 25, 2025). Among the 122 studies reviewed, perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) received the greatest research attention (detected in 102 and 100 studies, respectively) and showed the highest detection rates (64.69% and 60.72%, respectively). Several other compounds, including perfluorooctane sulfonamide, perfluorobutanesulfonamide, and perfluoropropane sulfonate, also exhibited high detection rates but remain underregulated, underscoring the need for further research and regulatory oversight. The three countries with the highest concentrations of $\sum$ *PFAS* were the Republic of Korea, the United States, and China. Risk assessments indicated that perfluorohexanoic acid, perfluorobutanoic acid, and perfluorobutanesulfonic acid posed negligible health risks, while perfluorohexane sulfonic acid (PFHxS), PFOA, PFOS, and perfluorononanoic acid (PFNA) showed descending levels of health risk (PFHxS > PFOA > PFOS > PFNA). Regulatory approaches are shifting from compound-specific standards to integrated mixture-based frameworks, reinforced by progressively stringent limits.

Per- and polyfluoroalkyl substances (PFAS) are widely used in food packaging, textiles, firefighting, and other industries (*1*–*2*). These compounds migrate through environmental media and pose health risks (*3*–*5*). Conventional water treatment processes fail to remove PFAS from environmental water sources, making drinking water a major human exposure pathway (*6*). In China, the *Standards for Drinking Water Quality (GB5749-2022)* established limits for perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS) at 80 ng/L and 40 ng/L, respectively (*7*–*8*). In contrast, the U.S. Environmental Protection Agency (EPA) set stricter limits of 4 ng/L for both compounds in its 2024 National Primary Drinking Water Regulation, while Denmark imposed a combined limit of 2 ng/L for four PFAS [(PFOA, PFOS, perfluorononanoic acid (PFNA), and perfluorohexane sulfonic acid [PFHxS)] in 2023 – significantly lower than China's standards. Since PFAS have not yet been routinely monitored in China's drinking water surveillance system, existing research remains limited to project-based studies with insufficient national-level data. Most existing reviews provide qualitative summaries of single countries or specific PFAS, lacking quantitative assessments (*9*–*10*). This study systematically quantifies the global spatial distribution, health risks, and regulations of PFAS in drinking water, providing critical evidence to strengthen China's regulatory framework for PFAS management.

METHOD

Literature Screening and Data Collection

We systematically reviewed original studies (January 1, 2000 to February 25, 2025) on PFAS in drinking water from PubMed and Web of Science using keywords including "PFAS" with "drinking water" or related terms. Studies were eligible if they provided original or summary data on PFAS concentrations in drinking water. Exclusion criteria were: 1) reporting only total PFAS without compound-specific concentrations, 2) omitting detection/quantitation limits while including non-detectable/non-quantifiable values, or 3) lacking both raw measurements and adequate summary statistics (defined as requiring either mean ± standard deviation or two or more percentiles). The review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (*11*). Data extracted included country, sampling date, sample size, target PFAS compounds, and concentrations. PFAS concentrations were aggregated nationally by compound, assuming a log-normal distribution.

Health Risk Assessment

Risk assessment followed the U.S. EPA's environmental health risk assessment framework (*12*) and the *Technical Guide for Environmental Health Risk Assessment of Chemical Exposure (WS/T 777-2021)* (*13*) through four steps:

Hazard identification. Evaluate potential harm of stressors to humans and ecosystems.

Dose-response assessment. Assess non-carcinogenic risks by quantifying exposure–effect relationships using Formula (1). The reference dose [*RfD*, mg/(kg·d)] was derived from the U.S. Risk Assessment Information System (RAIS) (https://rais.ornl.gov/). The No Observed Adverse Effect Level [NOAEL, mg/(kg·d)] was used when available; otherwise, the Lowest Observed Adverse Effect Level (LOAEL) was applied. Uncertainty factors (UF_i) were incorporated.

Exposure assessment. Determine frequency, timing, and levels of contact with the stressor using Formula (2): *ADD*, average daily dose [mg/(kg·d)]; *c*, PFAS concentration (mg/L); *IR*, daily water intake (L/d). *EF*, exposure frequency (365 d/a); *ED*, exposure duration (1); *BW*, body weight (kg); *AT*, averaging time (d; calculated as *EF*×*ED* for chronic effects). We calculated the population exposure parameter $BW \sim (59.96, 4.16)$, $\ln(IR) \sim N(6.50, 0.82)$ based on age-stratified and general population data from the U.S. EPA *Exposure Factors Handbook*, assuming normal and log-normal distributions, respectively (*14*).

Risk characterization. Calculate the hazard quotient (*HQ*, unitless), with $HQ \geq 1$ indicating potential health risk (acceptable or low if <1).

$$RfD = \frac{NOAEL}{\prod_{i=1}^{n} UF_i} \tag{1}$$

$$ADD = \frac{c \times IR \times EF \times \mathrm{ED}}{BW \times AT} \tag{2}$$

$$HQ = \frac{ADD}{RfD} \tag{3}$$

We performed 10,000 Monte Carlo simulations to estimate *HQ* values at the 50th and 95th percentiles using probabilistic risk quotient methodology.

RESULTS

Literature Screening and PFAS Detection Profiles

A total of 122 studies from 37 countries across six continents were included by searching the PubMed and Web of Science databases (Figure 1). Among 5,600 water samples analyzed, 102 PFAS compounds were detected (Supplementary Table S1, available at https://weekly.chinacdc.cn/). Figure 2A classifies PFAS into high-concern (>20 studies) and low-concern (≤20 studies) compounds with ≥30% detection rates. PFOA and PFOS received the highest research attention (102 and 100 studies, respectively) and showed the highest detection frequencies (64.69% and 60.72%) (Figure 2A).

Spatial Distribution of PFAS in Drinking Water

The study areas were categorized into background contamination zones (104 studies) and point-source zones (18 studies, including contamination from fluorochemical plants, firefighting training areas, paper, textile, and leather industries, or oil and gas-producing regions). Contamination patterns were characterized by nine high-priority PFAS detected in both categories: PFOA, PFOS, PFHxS, PFNA, perfluorobutanoic acid (PFBA), perfluoropentanoic acid (PFPeA), perfluorohexanoic acid (PFHxA), perfluorobutanesulfonic acid (PFBS), and perfluoroheptanoic acid (PFHpA).

In background contamination zones, research has primarily focused on Asia (particularly China), North America (notably the United States), and parts of Europe. Sixteen countries provided complete concentration data for all nine PFAS (Figure 2B), with the highest levels in the Republic of Korea (26.20 ng/L), the United States (14.34 ng/L), China (13.43 ng/L), and France (13.21 ng/L). In China, the compositional profile was PFBA (67.27%) > PFOA (15.20%) > PFPeA (5.23%) > PFOS (4.26%) (Figure 2B).

In point-source zones, peak geometric mean concentrations were observed in Japan (PFOA, 855.62 ng/L; PFHxA, 46.50 ng/L; PFHpA, 13.52 ng/L; PFNA, 8.39 ng/L), Ghana (PFOS, 86.33 ng/L), China (PFBA, 27.81 ng/L; PFPeA, 3.77 ng/L; PFBS, 7.41 ng/L), and Sweden (PFHxS, 12.24 ng/L). PFOA dominated compositional profiles in China (40.77%) and Pakistan (69.37%), while PFBS was dominant in the United States (18.01%) and the Netherlands (23.26%) (Figure 2B).

China, the Netherlands, the United States, and Burkina Faso reported all nine high-priority PFAS in both background and point-source zones. The mean

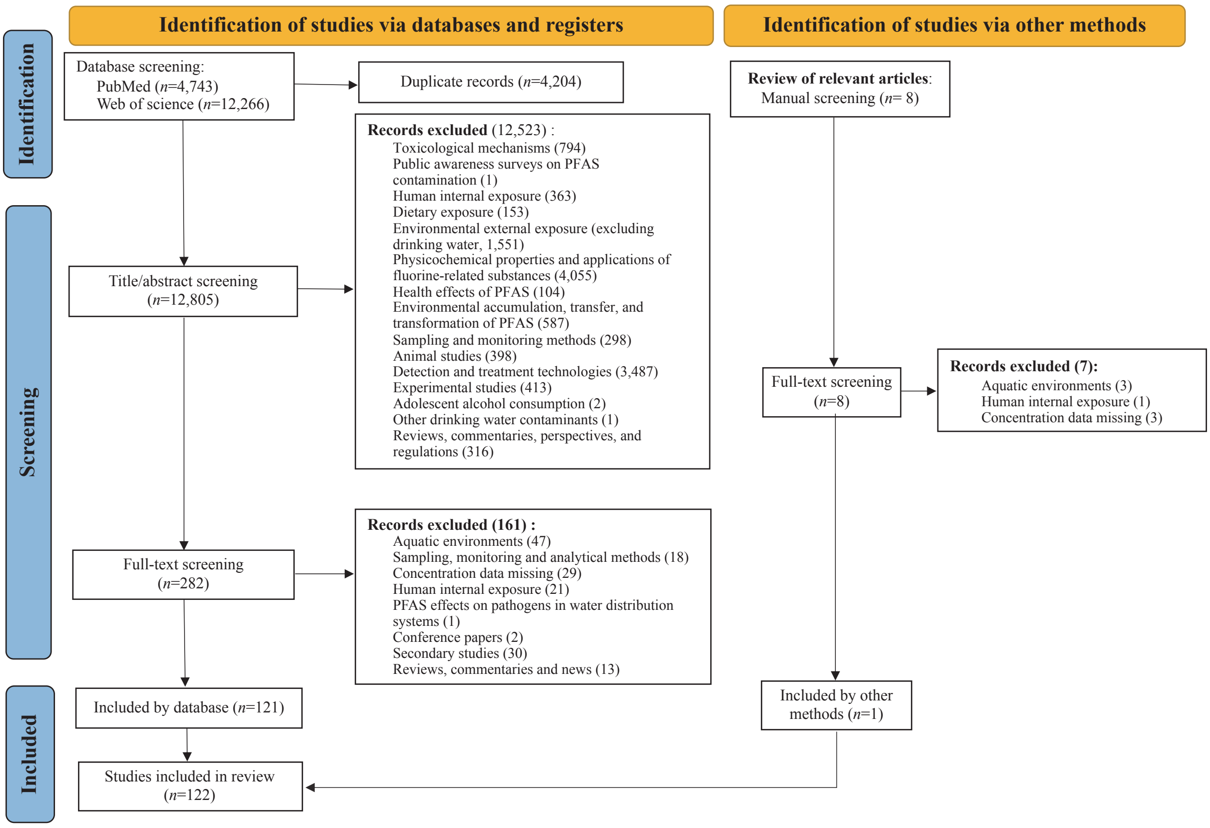

FIGURE 1. Literature screening.

(range) total concentrations of these nine PFAS across these four countries were 13.25 (1.74–29.20) ng/L in background zones and 30.11 (5.46–83.66) ng/L in point-source zones. As shown in Figure 2B, PFOA, PFBA, and PFBS were dominant in point-source zones, whereas PFBA predominated in background zones.

Health Risk Assessment

The HQ values for PFHxA, PFBS, and PFBA were below 1, indicating acceptable health risks. For PFHxS, PFOA, PFOS, and PFNA, the HQ P_{50} values were 10.30, 0.33, 0.07, and 0.001, respectively, while the HQ P_{95} values were 698.72, 9.58, 3.30, and 0.03, respectively. The contribution to overall human health risk ranked as follows: PFHxS (80.63%), PFOA (28.01%), PFOS (12.95%), and PFNA (0.07%) (Figure 2C).

PFAS Regulations in Drinking Water by Different Country/Region

The World Health Organization (WHO) recommends localized standards based on actual needs and resources, with regular reviews and timely updates (*15*). Analysis of regulatory frameworks in several countries (Supplementary Table S2, available at https://weekly.chinacdc.cn/) revealed two major trends: First, PFOA and PFOS remain the primary targets of regulation, with increasingly stringent limits reflecting scientific consensus on their risks even at very low concentrations. Second, regulation is shifting from single-compound limits to combined PFAS limits, broadening the scope of oversight.

DISCUSSION

Research on PFAS exposure in drinking water is concentrated in the United States, China, and parts of the European Union, with limited studies in most developing countries due to technological, infrastructural, or funding constraints (*16*). We identified 102 PFAS in drinking water, with significant disparities in research output across compounds (Figure 2A). These differences may reflect variations in usage, environmental persistence, and toxicity. Demand for data on PFAS exposure, toxicity, and population health effects has driven advances in testing technology, which, in turn, facilitates further research. This feedback loop reinforces focus on high-priority

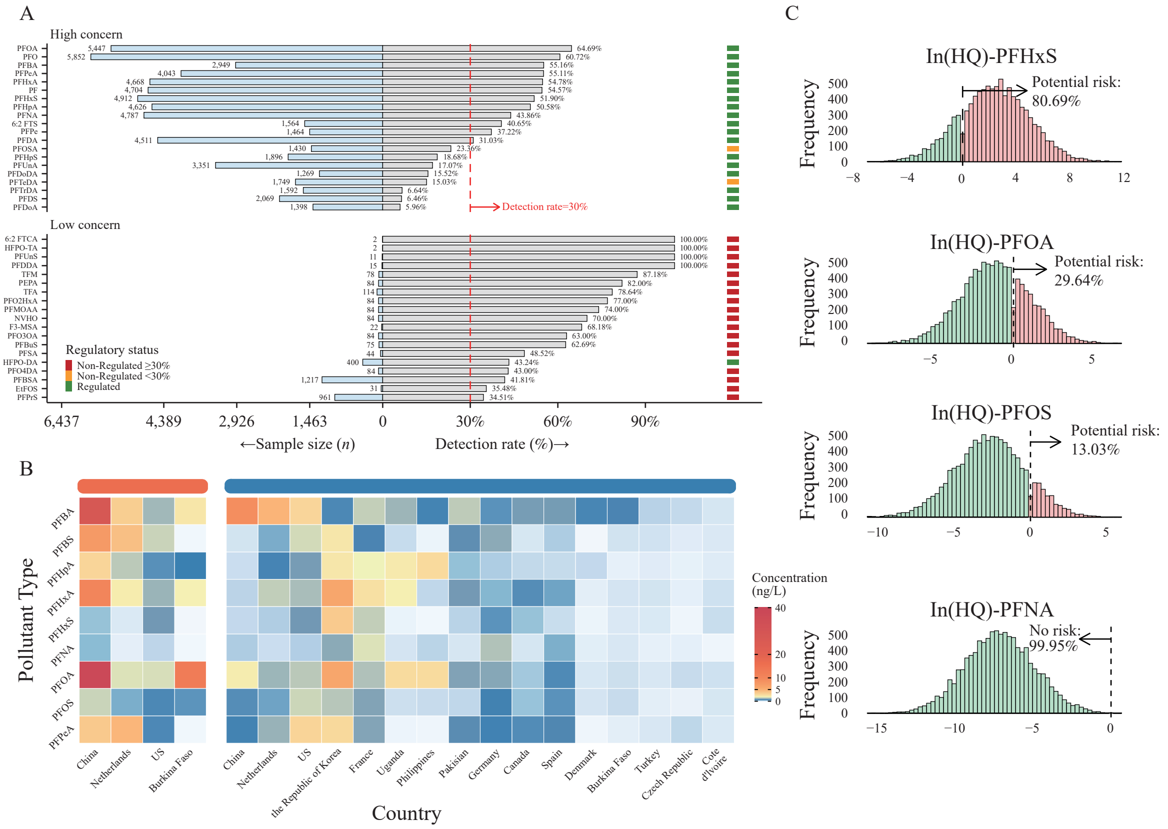

FIGURE 2. Characteristics of spatial distribution and risk assessment of PFAS. (A) Detection rates and regulatory status of PFAS; (B) Exposure in point-source pollution and background pollution; (C) Risk assessment.

Abbreviations: PFTeDA=perfluorotetradecanoic acid; 8:2 FTCA=8:2 fluorotelomer carboxylic acid; HFPO-TA=hexafluoropropylene oxide trimer acid; PFUnS=perfluoroundecanesulfonic acid; PFDDA=perfluorododecanedioic acid; TFMS=trifluorome-thanesulfonic acid; PEPA=perfluorinated ether phosphonic acid; TFA=trifluoroacetic acid; PFO2HxA=perfluoro(3,5-dioxahexanoic) acid; PFMOAA=perfluoro-2-methoxyacetic acid; NVHOS=1,1,2,2-tetrafluoro-2-(1,2,2,2-tetrafluoroethoxy) ethane sulfonate; F3-MSA=trifluoromethane sulfonic acid; PFO3OA=perfluoro(3,5,7-trioxaoctanoic) acid; PFBuS=perfluorobutanesulfonic acid; PFO4DA=perfluoro(3,5,7,9-butaoxadecanoic) acid; EtFOSE=N-Ethylperfluorooc tane sulfonamidoethanol; PFPrS=perfluoropropanesulfonic acid.

PFAS while potentially neglecting others. Notably, low-priority PFAS such as hexafluoropropylene oxide dimer acid, perfluorobutanesulfonamide, and Perfluoropropanesulfonate — detected in ≥30% of samples (n≥400) but currently unregulated (Figure 2A) — require urgent investigation.

Our risk assessment indicates negligible health risks from PFHxA, PFBS, and PFBA, but highlights potential hazards from PFHxS, PFOA, PFOS, and PFNA, ranked as PFHxS > PFOA > PFOS > PFNA. These findings align with previous studies by Thomaidi et al. (*10*) and Li et al. (*17*), which identified PFOA and PFOS as significant contributors to global and Chinese drinking water risks. The RfDs used in this study integrate comprehensive toxicological data: PFOA at 3×10^{-8} ng/L (pediatric vaccine response, birth weight, adult cholesterol), PFOS at 1×10^{-7} ng/L (immune, developmental, cardiovascular, and hepatic effects), PFHxS at 4×10^{-8} ng/L (immunotoxic and thyroid effects), and PFNA at 2×10^{-9} ng/L (immunotoxic and developmental effects). These precautionary thresholds underscore the need for cautious interpretation of risk estimates.

As toxicological and epidemiological evidence grows, regulatory standards for PFAS in drinking water are becoming more stringent worldwide. However, current Chinese standards for PFOA and PFOS — based solely on developmental endpoints such as reduced osteogenesis and altered puberty in juvenile rodents (*18*–*19*) — remain comparatively lenient. In contrast, the U.S. EPA's 2024 *Primary Drinking Water Regulations (PDWR)* set a maximum containment level of 4 ng/L for both PFOA and PFOS, based on RfD values (3×10^{-8} ng/L for PFOA and 1×10^{-7} ng/L for PFOS) derived from multiple endpoints, including immunotoxicity, developmental, hepatic, and cardiovascular effects (20–21). In China, PFOA and PFOS are currently only reference indicators in GB5749-2022 and are not included in routine national monitoring. Most PFAS data derive from small-scale studies, limiting representativeness. Enhancing local exposure data, advancing mechanistic toxicology, and adopting a risk-based, multi-endpoint dose–response approach similar to the U.S. EPA's framework are essential to support phased standard updates.

This study has limitations. First, variability in the PFAS compounds analyzed across studies limits global comparability of total PFAS exposure. Moreover, emerging contaminant surveys often target suspected contamination zones — even when classified as background — potentially inflating exposure estimates. Second, reliance on self-reported point-source contamination data from primary literature means unreported contamination cannot be excluded. Third, uniform assumptions applied across populations ignore physiological and lifestyle differences due to a lack of region-specific toxicity and exposure data. Finally, heterogeneity in sampling, pretreatment, analytical methods, and quality control across the 122 studies likely contributes to variability (22). Thus, results should be interpreted with caution.

Drinking water safety has become an urgent global health concern (23). Despite these limitations, our findings offer meaningful insights for PFAS management: First, stricter regulatory limits for PFOA and PFOS are needed, incorporating multi-system toxicity endpoints, population-specific exposure factors, technical feasibility, and cost considerations, alongside enhanced monitoring in point-source areas. Second, regulatory expansion to include PFHxS and PFNA, either as individual limits or under a combined standard, should be considered. Implementation of these recommendations requires more comprehensive, targeted exposure assessments and health risk studies. Furthermore, while our analysis focuses on drinking water as an exposure pathway to inform PFAS standards, future high-quality research should address combined risks from diet, inhalation, and dermal contact.

Conflicts of interest: No conflicts of interest.

Acknowledgements: The School of Public Health and the Center for Public Health and Epidemic Preparedness and Response of Peking University for hosting academic visits; and the support from the Hebei Provincial Administration of Disease Control and Prevention and the Shijiazhuang Municipal Center for Disease Control and Prevention.

Funding: This study was supported by the School of Public Health, Shanxi Medical University "233" Cooperation Project (No. 2024002 to Y.W.) and the Medical Scientific Research Project Plan of Hebei Province (No. 20260935 to J.M.).

doi: 10.46234/ccdcw2025.196

[#] Corresponding authors: Yongyue Wei, ywei@pku.edu.cn; Tong Wang, tongwang@sxmu.edu.cn.

[1] Department of Public Health Surveillance and Evaluation, Shijiazhuang Municipal Center for Disease Control and Prevention, Shijiazhuang City, Hebei Province, China; [2] Hebei Key Laboratory of Difficult and Complicated Pathogen Research, Shijiazhuang City, Hebei Province, China; [3] Center for Public Health and Epidemic Preparedness & Response, Department of Epidemiology and Biostatistics, School of Public Health, Peking University; Key Laboratory of Epidemiology of Major Diseases (Peking University), Ministry of Education, Beijing, China; [4] Department of Epidemiology and Health Statistics, School of Public Health, Shanxi Medical University; Key Laboratory of Coal Environmental Pathogenicity and Prevention (Shanxi Medical University), Ministry of Education, Taiyuan City, Shanxi Province, China.

Submitted: May 26, 2025
Accepted: August 29, 2025
Issued: September 05, 2025

REFERENCES

1. Langberg HA, Arp HPH, Breedveld GD, Slinde GA, Høiseter Å, Grønning HM, et al. Paper product production identified as the main source of per- and polyfluoroalkyl substances (PFAS) in a Norwegian lake: Source and historic emission tracking. Environ Pollut 2021;273:116259. https://doi.org/10.1016/j.envpol.2020.116259.
2. Jogsten IE, Perelló G, Llebaria X, Bigas E, Martí-Cid R, Kärrman A, et al. Exposure to perfluorinated compounds in Catalonia, Spain, through consumption of various raw and cooked foodstuffs, including packaged food. Food Chem Toxicol 2009;47(7):1577 – 83. https://doi.org/10.1016/j.fct.2009.04.004.
3. Fiedler H, Sadia M, Baabish A, Sobhanei S. Perfluoroalkane substances in national samples from global monitoring plan projects (2017-2019). Chemosphere 2022;307(Pt 3):136038. http://dx.doi.org/10.1016/j.chemosphere.2022.136038.
4. Lyu B, Li JG, Wu YN. Characterizing the exposome of food contamination and china total diet study: Project for improving food safety risk assessment in China. China CDC Wkly 2022;4(9):157 – 60. https://doi.org/10.46234/ccdcw2022.039.
5. Wang YX, Gao XY, Liu JY, Lyu B, Li JG, Zhao YF, et al. Exposure to emerging and legacy polyfluoroalkyl substances in the sixth total diet study—China, 2016-2019. China CDC Wkly 2022;4(9):168 – 71. https://doi.org/10.46234/ccdcw2022.042.
6. Chiu WA, Lynch MT, Lay CR, Antezana A, Malek P, Sokolinski S, et al. Bayesian estimation of human population toxicokinetics of PFOA, PFOS, PFHxS, and PFNA from studies of contaminated drinking water. Environ Health Perspect 2022;130(12):127001. https://doi.org/10.1289/EHP10103.
7. State Administration for Market Regulation, Standardization Administration. GB 5749-2022 Standards for drinking water quality. Beijing: Standards Press of China, 2022. http://www.csres.com/detail/

377337.html. (In Chinese).

8. Han JY, Zhang L, Ye BX, Gao SH, Yao XY, Shi XM. The standards for drinking water quality of China (2022 edition) will take effect. China CDC Wkly 2023;5(13):297 – 300. https://doi.org/10.46234/ccdcw2023.054.
9. Banzhaf S, Filipovic M, Lewis J, Sparrenbom CJ, Barthel R. A review of contamination of surface-, ground-, and drinking water in Sweden by perfluoroalkyl and polyfluoroalkyl substances (PFASs). Ambio 2017;46(3):335 – 46. https://doi.org/10.1007/s13280-016-0848-8.
10. Thomaidi VS, Tsahouridou A, Matsoukas C, Stasinakis AS, Petreas M, Kalantzi OI. Risk assessment of PFASs in drinking water using a probabilistic risk quotient methodology. Sci Total Environ 2020;712:136485. https://doi.org/10.1016/j.scitotenv.2019.136485.
11. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. https://doi.org/10.1136/bmj.n71.
12. EPA. Human health risk assessment. 2025. [2025-7-4].
13. National Health Commission of the People's Republic of China. WS/T 777-2021 Technical guide for environmental health risk assessment of chemical exposure. Beijing: Standards Press of China, 2021. http://www.csres.com/detail/363253.html.
14. U.S. Environmental Protection Agency. Exposure factors handbook 2011 edition. Washington: USEPA; 2011. EPA/600/R-09/052F. https://cfpub.epa.gov/ncea/risk/recordisplay.cfm?deid=236252.
15. Levin R, Villanueva CM, Beene D, Cradock AL, Donat-Vargas C, Lewis J, et al. US drinking water quality: exposure risk profiles for seven legacy and emerging contaminants. J Expo Sci Environ Epidemiol 2024;34(1):3 – 22. https://doi.org/10.1038/s41370-023-00597-z.
16. Malatji N, Mpupa A, Nomngongo PN. Poly- and per-fluoroalkyl substances in water: occurrence, analytical methodologies, and remediations strategies: a comprehensive review. Rev Anal Chem 2023;42(1):20230064. https://doi.org/10.1515/revac-2023-0064.
17. Li LQ, Cao SZ, Shang XC, Zhang LW, Guan JC, Shao K, et al. Occurrence of per- and polyfluoroalkyl substances in drinking water in China and health risk assessment based on a probabilistic approach. J Hazard Mater 2024;480(3):136072. https://doi.org/10.1016/j.jhazmat.2024.136072.
18. Luebker DJ, Case MT, York RG, Moore JA, Hansen KJ, Butenhoff JL. Two-generation reproduction and cross-foster studies of perfluorooctanesulfonate (PFOS) in rats. Toxicology 2005;215(1-2):126 – 48. https://doi.org/10.1016/j.tox.2005.07.018.
19. Lau C, Thibodeaux JR, Hanson RG, Narotsky MG, Rogers JM, Lindstrom AB, et al. Effects of perfluorooctanoic acid exposure during pregnancy in the mouse. Toxicol Sci 2006;90(2):510 – 8. https://doi.org/10.1093/toxsci/kfj105.
20. U.S. Environmental Protection Agency (EPA). Human health toxicity assessment for perfluorooctanoic acid (PFOA) and related salts [Final report]. Washington: USEPA; 2024. https://www.epa.gov/system/files/documents/2024-05/final-human-health-toxicity-assessment-pfoa.pdf.
21. U.S. Environmental Protection Agency. Human health toxicity assessment for perfluorooctane sulfonic acid (PFOS) and related salts [Final report]. Washington: USEPA; 2024. https://www.epa.gov/system/files/documents/2024-05/appendix-final-human-health-toxicity-assessment-pfos.pdf.
22. Teymoorian T, Munoz G, Vo Duy S, Liu JX, Sauvé S. Tracking PFAS in drinking water: a review of analytical methods and worldwide occurrence trends in tap water and bottled water. ACS EST Water 2023;3(2):246 – 61. https://doi.org/10.1021/acsestwater.2c00387.
23. Shi XM. The safety of drinking water in China: current status and future prospects. China CDC Wkly 2020;2(13):210 – 5. https://doi.org/10.46234/ccdcw2020.055.

SUPPLEMENTARY MATERIAL

SUPPLEMENTARY TABLE S1. PFAS detected in drinking water.

No.	PFAS	Abbreviation	Study	Sample size	Detection rate (%)	Mean±SD/median (range) (ng/L)*	Regulation
Perfluoroalkyl carboxylic acids (PFCAs)							
1	Perfluorooctanoic acid	PFOA	102	5,447	64.69	1.15±8.16	Yes
2	Perfluorononanoic acid	PFNA	85	4,787	43.86	0.24±6.89	Yes
3	Perfluorohexanoic acid	PFHxA	81	4,668	54.78	0.83±13.54	Yes
4	Perfluoroheptanoic acid	PFHpA	81	4,626	50.58	0.49±12.61	Yes
5	Perfluorodecanoic acid	PFDA	78	4,511	31.03	0.21±5.66	Yes
6	Perfluoroundecanoic acid	PFUnA	69	3,351	17.07	0.11±8.22	No
7	Perfluoropentanoic acid	PFPeA	63	4,043	55.11	1.04±9.86	Yes
8	Perfluorobutanoic acid	PFBA	61	2,949	55.16	1.87±10.06	Yes
9	Perfluorododecanoic acid	PFDoDA	33	1,269	15.52	0.12±6.68	Yes
10	Perfluorotridecanoic acid	PFTrDA	29	1,592	6.64	0.03±7.62	Yes
11	Perfluorotetradecanoic acid	PFTeDA	26	1,749	15.03	0.07±6.52	No
12	Perfluorododecanoic acid	PFDoA	22	1,398	5.96	0.10±6.85	Yes
13	Perfluorohexadecanoic acid	PFHxDA	14	1,119	9.26	0.03±6.93	No
14	Perfluoropropionic acid	PFPrA	13	851	20.14	1.25±10.76	No
15	Perfluorooctadecanoic acid	PFODA	10	454	15.85	0.07±4.55	No
16	Perfluorotetradecanoic acid	PFTDA	3	58	3.45	0.06±3.07	No
17	Perfluorodecanoic acid	PFDPA	2	97	21.65	1.06±3.53	No
18	Perfluorooctylphosphonic acid	PFOPA	2	97	18.56	0.002±52.63	No
19	Perfluorotetradecanoic acid	PFTA	2	116	8.53	1.79±2.87	No
20	Perfluorohexylphosphonic acid	PFHxPA	2	97	15.46	0.30±1.32	No
21	Perfluorotetradecanoic acid	PFTeA	2	186	3.76	2.39±1.88	No
22	Perfluoro (4-methoxybutanoic) acid	PFMBA	2	53	1.89	NA†	Yes
23	Perfluoro-3-methoxypropanoic acid	PFMPA	2	53	1.89	NA	No
24	Perfluorododecanoic acid	PFDDA	1	15	100.00	0.1 (0.069, 0.85)	No
Perfluoroalkyl sulfonic acids (PFSAs)							
25	Perfluorooctane sulfonic acid	PFOS	100	5,852	60.72	0.97±11.60	Yes
26	Perfluorohexane sulfonic acid	PFHxS	87	4,912	51.90	0.62±16.14	Yes
27	Perfluorobutanesulfonic acid	PFBS	78	4,704	54.57	0.52±16.23	Yes
28	Perfluorodecane sulfonic acid	PFDS	39	2,069	6.46	0.13±4.60	Yes
29	Perfluoroheptane sulfonic acid	PFHpS	28	1,896	18.68	0.09±7.73	Yes
30	Perfluoropentanesulfonic acid	PFPeS	16	1,464	37.22	0.11±12.00	Yes
31	Perfluorononanesulfonic acid	PFNS	15	1,078	2.69	0.01±7.50	Yes
32	Perfluoropropanesulfonate	PFPrS	12	961	34.51	0.05±2.85	No
33	Perfluorobutanesulfonamide	PFBSA	9	1,217	41.81	0.001±0.25	No
34	Perfluorohexanesulfonic acid	FHxSA	9	1,224	9.95	0.05±3.37	No
35	Perfluorobutanesulfonic acid	PFBuS	5	75	62.69	0.24±7.83	No
36	Perfluorododecane sulfonic acid	PFDoS	4	512	2.15	0.09±1.91	Yes
37	Trifluoromethanesulfonic acid	TFMS	3	78	87.18	5.53±15.62	No
38	Perfluoroethanesulfonic acid	PFEtS	3	528	2.81	0.01±2.36	No

Continued

No.	PFAS	Abbreviation	Study	Sample size	Detection rate (%)	Mean±SD/median (range) (ng/L)*	Regulation
39	Perfluoropropanesulfonic acid	PFPS	2	82	9.30	0.004±0.32	No
40	Tetrahydroperfluorooctanesulfonic acid	THPFOS	2	48	10.42	0.28±2.52	No
41	Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	2	71	8.45	0.15±2.35	Yes
42	Perfluoroundecane sulfonic acid	PFUnS	1	11	100.00	NA	No
43	Perfluoroalkane sulfonic acid	PFSA	1	44	48.52	4 (1, 32)	No
44	Fluoropentyl Sulfonamide	FPeSA	1	463	21.80	NA (0.003, 0.46)	No
45	Fluoropropyl Sulfonamide	FPrSA	1	463	18.60	NA (0.002, 0.07)	No
46	Hydrogen-substituted Undecafluorooctane Sulfonate	H-U-PFOS	1	463	1.90	NA (0.010-0.20)	No
47	Perfluoromethylcyclohexanesulfonic acid	PFMeCHS	1	463	14.00	NA (0.006, 0.3)	No
48	Perfluoromethylcyclopentanesulfonic acid	PFMeCPeS	1	463	12.70	NA (0.003, 0.9)	No
Polyfluoroalkyl ether carboxylic acids (PFECs)							
49	Hexafluoropropylene oxide dimer acid	HFPO-DA	12	400	43.24	0.10±5.25	Yes
50	Hexafluoropropylene oxide trimer acid	HFPO-TA	1	2	100.00	NA (50, 87.1)	No
51	Perfluoro-2-ethoxypropanoic acid	PEPA	1	84	82.00	81 (NA, NA)	No
52	Perfluoro-2-methoxyacetic acid	PFMOAA	1	84	74.00	43 (NA, NA)	No
53	Perfluoro(3,5-dioxahexanoic) acid	PFO2HxA	1	84	77.00	107 (NA, NA)	No
54	Perfluoro(3,5,7-trioxaoctanoic) acid	PFO3OA	1	84	63.00	8 (NA, NA)	No
55	Perfluoro-3,6-dioxaheptanoic acid	PFHO-DA	1	18	4.28	0.4 (0.03, 9.83)	No
56	Perfluoro(3,5,7,9-butaoxadecanoic) acid	PFO4DA	1	84	43.00	NA	No
57	2,2,3,3-tetrafluoro-3-((1,1,1,2,3,3-hexafluoro-3-(1,2,2,2-tetrafluoroethoxy)propan-2-yl)oxy)propanoic acid	Hydro-EVE	1	84	21.00	NA	No
58	Perfluoro(3,5,7,9,11-pentaoxadodecanoic) acid	PFO5DoA	1	84	7.00	NA	No
Polyfluoroalkyl ether sulfonic acids (PFESAs)							
59	6:2 Chlorinated polyfluoroalkyl ether sulfonic acid	6:2 Cl-PFESA	13	398	5.78	0.06±3.74	No
60	8:2 Chlorinated polyfluoroalkyl ether sulfonic acid	8:2 Cl-PFESA	8	322	2.48	0.08±5.76	No
61	4:2 Chlorinated polyfluoroalkyl ether sulfonic acid	4:2 Cl-PFESA	2	6	16.67	0.005±1	No
62	2-[1-[Difluoro(1,2,2,2-tetrafluoroethoxy)methyl]-1,2,2,2-tetrafluoroethoxy]-1,1,2,2-tetrafluoroethanesulfonic acid	Nafion byproduct 2	1	84	73.00	14 (NA, NA)	No
63	1,1,2,2-tetrafluoro-2-(1,2,2,2-tetrafluoro-ethoxy)ethane sulfonate	NVHOS	1	84	70.00	3 (NA, NA)	No
Perfluoroalkyl Sulfonamides							
64	Perfluorooctanesulfonamide	PFOSA	23	1,430	23.36	0.23±2.89	Yes
65	N-Ethyl perfluorooctane sulfonamidoacetate	EtFOSAA	9	817	2.69	0.13±4.39	No
66	N-Methyl perfluorooctane sulfonamidoacetate	MeFOSAA	8	767	2.59	0.17±1.77	No
67	N-Methyl perfluorooctane sulfonamidoacetic acid	MeFOSA	5	695	4.44	0.01±3.33	No
68	N-Ethyl perfluorooctane sulfonamide	EtFOSA	4	575	2.24	0.04±2.53	No
69	N-Ethyl perfluorooctane sulfonamidoethanol	EtFOSE	2	31	35.48	0.03±2.07	No
70	N-Methyl perfluorooctane sulfonamidoethanol	MeFOSE	2	31	22.58	0.02±3.31	No
71	N-Substituted Hydroxy-Oxy-Perfluoroalkylamidoalkyl Phosphonate – Fluorohexyl Sulfonamide Hydroxy-Oxy-Propyl Sulfonate	N-SHOPAmP-FHxSAHOPS	1	463	1.10	NA (0.003, 0.18)	No
72	N-Substituted Perfluoroalkylamidoalkyl Phosphonate – Fluorohexyl Sulfonamide	N-SPAmP-FHxSA	1	463	1.30	NA (0.005, 0.11)	No
73	N-Substituted Perfluoroalkylamidoalkyl Phosphonate – Fluorohexyl Sulfonamide Acetic Acid	N-SPAmP-FHxSAA	1	463	0.60	NA (0.003, 0.07)	No
74	N-Substituted Perfluoroalkylamidoalkyl Phosphonate – Fluoropentyl Sulfonamide	N-SPAmP-FPeSA	1	463	0.90	NA (0.007, 0.20)	No

Continued

No.	PFAS	Abbreviation	Study	Sample size	Detection rate (%)	Mean±SD/median (range) (ng/L)*	Regulation
75	N-Substituted Perfluoroalkylamidoalkyl Phosphonate – Fluoropentyl Sulfonamide Alkyl Phosphonate Sulfonate	N-SPAmP-FPeSAPS	1	463	0.90	NA (0.005, 0.04)	No
76	N-Substituted Phosphonoalkyl Hydroxyalkyl Polyfluoroalkyl Amide	NSPHAPA	1	463	4.30	NA (0.003, 0.64)	No
77	Perfluorohexanesulfonamide sulfate	PFHxSAmS	1	463	0.40	NA (ND, 0.02)	No
78	Perfluorooctane sulfonamide quaternary ammonium salt	PFOSAmS	1	463	0.40	NA (0.015, 0.02)	No
Fluorotelomer sulfonic acids (FTS)							
79	1H,1H, 2H, 2H-Perfluorooctane sulfonic acid	6:2 FTS	18	1,564	40.41	0.61±10.31	Yes
80	4:2 Fluorotelomer sulfonic acid	4:2 FTS	12	912	5.80	0.02±5.26	Yes
81	8:2 Fluorotelomer sulfonic acid	8:2 FTS	10	1,254	7.08	0.33±4.47	Yes
82	10:2 Fluorotelomer sulfonic acid	10:2 FTS	2	481	0.10	0.007±1.66	No
83	6:2 Fluorotelomer carboxylic acid	6:2 FTCA	1	2	100.00	NA(0.915, 1.31)	No
84	4:2 Fluorotelomer iodinated sulfonate	4:2 FIS	1	448	26.00	0.60 (0.12,2.10)	No
85	5:1:2 Fluorotelomer betaine	5:1:2 FtB	1	463	9.90	NA (0.023, 2.70)	No
86	5:3 Fluorotelomer carboxylate	5:3 acid	1	463	0.60	NA (0.074, 0.15)	No
87	5:3 Fluorotelomer betaine	5:3 FtB	1	463	3.50	NA (0.012, 0.58)	No
88	6:2 Fluorotelomer sulfonamidopropyl betaine	6:2 FTAB	1	463	5.40	NA (0.021, 2.10)	No
89	6:2 Fluorotelomer Sulfonamide Oxide Propionic Acid	6:2 FTSO2PA	1	463	0.60	NA (0.036, 0.06)	No
90	6:2 Fluorotelomer Sulfonamide Alkyl Sulfonate	6:2-FTSAS	1	463	0.40	NA (0.018, 0.06)	No
91	6:2 Fluorotelomer Sulfonamide Alkyl Sulfone Sulfonate	6:2-FTSAS-sulfone	1	463	8.00	NA (0.010, 15.00)	No
92	6:2 Fluorotelomer Sulfonamide Alkyl Sulfoxide Sulfonate	6:2-FTSAS-sulfoxide	1	463	0.90	NA (0.024, 14.00)	No
93	7:1:2 Fluorotelomer Betaine	7:1:2 FtB	1	463	0.90	NA (0.091, 0.84)	No
94	7:3 Fluorotelomer Betaine	7:3 FtB	1	463	0.40	NA (0.096, 0.10)	No
95	Hydroxy-4:2 Fluorotelomer Sulfonate	HO-4:2-FtS	1	463	1.30	NA (0.014, 0.17)	No
96	Hydroxy-5:2 Fluorotelomer Sulfonate	HO-5:2-FtS	1	463	1.50	NA (0.016, 0.04)	No
97	6:2 Fluorotelomer ω-Hydroxyalkyl Sulfonate	HO-6:2-FtS	1	463	0.40	NA (0.075, 0.09)	No
Polyfluoroalkyl cyclic compounds							
98	Potassium perfluoro(4-ethylcyclohexane)sulfonate	PFECHS	5	566	33.18	0.13±3.48	Yes
99	Sodium perfluoro-3,5-dioxahexanoate	NaDONA	4	612	7.34	0.01±18.58	No
100	Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	2	53	5.66	NA	Yes
Else							
101	Trifluoroacetic acid	TFA	3	114	78.64	65.78±2.72	No
102	Trifluoromethanesulfonamide	F3-MSA	1	22	68.18	32 (ND§, 165)	No

Abbreviation: SD=standard deviation.

* Report as Mean±SD when calculable; otherwise provide Median (Range);

† NA, non available;

§ ND, non detected.

SUPPLEMENTARY TABLE S2. PFAS limits in drinking water of selected countries/regions.

PFAS	Value type class	Year	Country	Department/ Institute	Guideline values (ng/L)	Value type	Legal effect	Source
PFOA	Health-technology-cost-based	2024	America	Environmental Protect Agency	4	MCL	Yes	https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations#PFAS
		2024	Australia	Department of Health	200	Proposed guideline value	No	https://www.nhmrc.gov.au/health-advice/environmental-health/water/PFAS-review?
		2022	China	National Health Commission of the People's Republic of China	80	Quality criteria	Yes	https://www.ndcpa.gov.cn/jbkzzx/c100201/common/content/content_1665979083259711488.html
		2021	America	New York	10	MCL	Yes	https://dec.ny.gov/environmental-protection/water/water-quality/standards-classifications
		2020	America	New Jersey, Department of Environmental Protection	14	MCL	Yes	https://nj.gov/health/ceohs/documents/pfas_drinking%20water.pdf
		2020	America	California	10	Health based advisory level	No	https://cpu.sjuku.top/https/77726476706e69737468656265737421e0e2438f69316b4330079bab/doi/10.1021/acsestwater.2c00387
		2019	America	New Hampshire	12	MCL	Yes	https://cpu.sjuku.top/https/77726476706e69737468656265737421e0e2438f69316b4330079bab/doi/10.1021/acsestwater.2c00387
		2018	Canada	Health Canada	200	MAC	Yes	https://gazette.gc.ca/rp-pr/p1/2018/2018-12-08/html/notice-avis-eng.html?
		2017	America	New Jersey, Department of Environmental Protection	14	MCL	Yes	https://dep.nj.gov/newsrel/17_0104/
		2015	Denmark	Environmental Protection Agency	100	Quality criteria	Yes	(1)
		2006	America	Minnesota, Department of Health	1,000	Advisory guideline	No	https://www.health.mn.gov/communities/environment/hazardous/topics/history.html#2022
	Health-based	2024	America	Environmental Protect Agency	0	MCLG	No	https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations#PFAS
		2024	America	Minnesota, Department of Health	0.0079	Health based value	No	https://www.health.mn.gov/communities/environment/hazardous/topics/history.html#2022
		2022	America	Environmental Protect Agency	0.004	Interim updated health advisory	No	https://www.epa.gov/system/files/documents/2022-06/drinking-water-ha-pfas-factsheet-communities.pdf?
		2020	America	Michigan	8	MCL	Yes	https://www.michigan.gov/-/media/Project/Websites/mdhhs/Folder4/Folder25/Folder3/Folder125/Folder2/Folder225/Folder1/Folder325/PFAS_-_Overview_of_Michigan_Values_FINAL.pdf
		2018	Australia	Department of Health	560	Health based guidance value	No	https://www.health.gov.au/sites/default/files/documents/2022/07/health-based-guidance-values-for-pfas-for-use-in-site-investigations-in-australia_0.pdf
		2017	America	Minnesota, Department of Health	35	Health based value	No	https://www.health.mn.gov/communities/environment/hazardous/topics/history.html#2022

Continued

PFAS	Value type class	Year	Country	Department/ Institute	Guideline values (ng/L)	Value type	Legal effect	Source
PFOA	Health-based	2016	America	Environmental Protect Agency	70	Provisional health advisory	No	https://www.epa.gov/sites/default/files/2016-06/documents/drinkingwaterhealthadvisories_pfoa_pfos_updated_5.31.17.pdf
		2014	Italy	National Institute of Health	500	Health based level	No	(1)
		2009	America	Environmental Protect Agency	400	Provisional health advisory	No	https://www.epa.gov/sites/default/files/2015-09/documents/pfoa-pfos-provisional.pdf
		2007	America	Minnesota, Department of Health	500	Health based value	No	https://www.health.mn.gov/communities/environment/hazardous/topics/history.html#2022
		2007	America	New Jersey, Department of Environmental Protection	40	Preliminary guidance level	No	https://dep.nj.gov/newsrel/17_0104/
		2002	America	Minnesota, Department of Health	7,000	Health based value	No	https://www.health.mn.gov/communities/environment/hazardous/topics/history.html#2022
PFOS	Health-technology-cost-based	2024	America	Environmental Protect Agency	4	MCL	Yes	https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations#PFAS
		2024	Australia	Department of Health	4	Proposed guideline value	No	https://www.nhmrc.gov.au/health-advice/environmental-health/water/PFAS-review?
		2022	China	National Health Commission of the People’s Republic of China	40	Quality criteria	Yes	https://www.ndcpa.gov.cn/jbkzzx/c100201/common/content/content_1665979083259711488.html
		2021	America	New York	10	MCL	Yes	https://dec.ny.gov/environmental-protection/water/water-quality/standards-classifications
		2020	America	New Jersey, Department of Environmental Protection	13	MCL	Yes	https://nj.gov/health/ceohs/documents/pfas_drinking%21water.pdf
		2020	America	California	40	Health based advisory level	No	https://cpu.sjuku.top/https/77726476706e69737468656265737421e0e2438f69316b4330079bab/doi/10.1021/acsestwater.2c00387
		2019	America	New Hampshire	15	MCL	Yes	https://cpu.sjuku.top/https/77726476706e69737468656265737421e0e2438f69316b4330079bab/doi/10.1021/acsestwater.2c00387
		2018	Canada	Health Canada	600	MAC	Yes	https://gazette.gc.ca/rp-pr/p1/2018/2018-12-08/html/notice-avis-eng.html?
		2017	America	New Jersey, Department of Environmental Protection	13	MCL	Yes	https://dep.nj.gov/newsrel/17_0104/
		2015	Denmark	Environmental Protection Agency	100	Quality criteria	Yes	(1)
		2006	America	Minnesota, Department of Health	600	Advisory guideline	No	https://www.health.mn.gov/communities/environment/hazardous/topics/history.html#2022

Continued

PFAS	Value type class	Year	Country	Department/ Institute	Guideline values (ng/L)	Value type	Legal effect	Source
PFOS	Health-based	2024	America	Environmental Protect Agency	0	MCLG	No	https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations#PFAS
		2024	America	Minnesota, Department of Health	2.3	Health based value	No	https://www.health.mn.gov/communities/environment/hazardous/topics/history.html#2022
		2022	America	Environmental Protect Agency	0.02	Interim updated health advisory	No	https://www.epa.gov/system/files/documents/2022-06/drinking-water-ha-pfas-factsheet-communities.pdf?
		2020	America	Michigan	16	MCL	Yes	https://www.michigan.gov/-/media/Project/Websites/mdhhs/Folder4/Folder25/Folder3/Folder125/Folder2/Folder225/Folder1/Folder325/PFAS_-_Overview_of_Michigan_Values_FINAL.pdf
		2019	America	Minnesota, Department of Health	15	Health based value	No	https://www.health.mn.gov/communities/environment/hazardous/topics/history.html#2022
		2017	America	Minnesota, Department of Health	27	Health based value	No	https://www.health.mn.gov/communities/environment/hazardous/topics/history.html#2022
		2016	America	Environmental Protect Agency	70	Provisional health advisory	No	https://www.epa.gov/sites/default/files/2016-06/documents/drinkingwaterhealthadvisories_pfoa_pfos_updated_5.31.16.pdf
		2014	Italy	National Institute of Health	30	Health based level	No	(1)
		2009	America	Environmental Protect Agency	200	Provisional health advisory	No	https://www.epa.gov/sites/default/files/2015-10/documents/pfoa-pfos-provisional.pdf
		2007	America	Minnesota, Department of Health	300	Health based value	No	https://www.health.mn.gov/communities/environment/hazardous/topics/history.html#2022
		2002	America	Minnesota, Department of Health	1,000	Health based value	No	https://www.health.mn.gov/communities/environment/hazardous/topics/history.html#2022
PFBS	Health-technology-cost-based	2024	Australia	Department of Health	1,000	Proposed guideline value	No	https://www.nhmrc.gov.au/health-advice/environmental-health/water/PFAS-review?
	Health-based	2022	America	Environmental Protect Agency	2,000	Final health advisory	No	https://www.epa.gov/system/files/documents/2022-06/drinking-water-ha-pfas-factsheet-communities.pdf?
		2022	America	Minnesota, Department of Health	100	Health based value	No	https://www.health.mn.gov/communities/environment/hazardous/topics/history.html#2022
		2020	America	Michigan	420	MCL	Yes	https://www.michigan.gov/-/media/Project/Websites/mdhhs/Folder4/Folder25/Folder3/Folder125/Folder2/Folder225/Folder1/Folder325/PFAS_-_Overview_of_Michigan_Values_FINAL.pdf
		2017	America	Minnesota, Department of Health	2,000	Health based value	No	https://www.health.mn.gov/communities/environment/hazardous/topics/history.html#2022
PFBA	Health-based	2017	America	Minnesota, Department of Health	7,000	Health based value	No	https://www.health.mn.gov/communities/environment/hazardous/topics/history.html#2022

Continued

PFAS	Value type class	Year	Country	Department/ Institute	Guideline values (ng/L)	Value type	Legal effect	Source
PFHxS	Health-technology-cost-based	2024	America	Environmental Protect Agency	10	MCL	Yes	https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations#PFAS
		2024	Australia	Department of Health	30	Proposed guideline value	No	https://www.nhmrc.gov.au/health-advice/environmental-health/water/PFAS-review?
		2019	America	New Hampshire	18	MCL	Yes	https://cpu.sjuku.top/https/77726476706e69737468656265737421e0e2438f69316b4330079bab/doi/10.1021/acsestwater.2c00387
	Health-based	2020	America	Michigan	51	MCL	Yes	https://www.michigan.gov/-/media/Project/Websites/mdhhs/Folder4/Folder25/Folder3/Folder125/Folder2/Folder225/Folder1/Folder325/PFAS_-_Overview_of_Michigan_Values_FINAL.pdf
		2019	America	Minnesota, Department of Health	47	Health based value	No	https://www.health.mn.gov/communities/environment/hazardous/topics/history.html#2022
PFHxA	Health-based	2020	America	Michigan	400,000	MCL	Yes	https://www.michigan.gov/-/media/Project/Websites/mdhhs/Folder4/Folder25/Folder3/Folder125/Folder2/Folder225/Folder1/Folder325/PFAS_-_Overview_of_Michigan_Values_FINAL.pdf
PFNA	Health-technology-cost-based	2024	America	Environmental Protect Agency	10	MCL	Yes	https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations#PFAS
		2020	America	New Jersey, Department of Environmental Protection	13	MCL	Yes	https://nj.gov/health/ceohs/documents/pfas_drinking%22water.pdf
		2019	America	New Hampshire	11	MCL	Yes	https://cpu.sjuku.top/https/77726476706e69737468656265737421e0e2438f69316b4330079bab/doi/10.1021/acsestwater.2c00387
		2018	America	New Jersey, Department of Environmental Protection	13	MCL	Yes	https://www.eikonplanning.com/blog/pfas-regulatory-standards?
	Health-based	2020	America	Michigan	6	MCL	Yes	https://www.michigan.gov/-/media/Project/Websites/mdhhs/Folder4/Folder25/Folder3/Folder125/Folder2/Folder225/Folder1/Folder325/PFAS_-_Overview_of_Michigan_Values_FINAL.pdf
HFPO-DA	Health-technology-cost-based	2024	America	Environmental Protect Agency	10	MCL	Yes	https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations#PFAS
	Health-based	2022	America	Environmental Protect Agency	10	Final health advisory	No	https://www.epa.gov/system/files/documents/2022-06/drinking-water-ha-pfas-factsheet-communities.pdf?
		2020	America	Michigan	370	MCL	Yes	https://www.michigan.gov/-/media/Project/Websites/mdhhs/Folder4/Folder25/Folder3/Folder125/Folder2/Folder225/Folder1/Folder325/PFAS_-_Overview_of_Michigan_Values_FINAL.pdf

Continued

PFAS	Value type class	Year	Country	Department/ Institute	Guideline values (ng/L)	Value type	Legal effect	Source
PFOA+PFOS	Health-based	2020	Japan	Ministry of Health, Labour and Welfare	50	Provisional target value	No	https://jsdfe.org/topics/2-3_PFAS%20policy%20Japan-221019.pdf
		2016	America	Environmental Protect Agency	70	Provisional health advisory	No	https://www.epa.gov/sites/default/files/2016-06/documents/drinkingwaterhealthadvisories_pfoa_pfos_updated_5.31.18.pdf
		2006	Germany	Ministry of Health	300	Health-based guidance value	No	https://www.umweltbundesamt.de/sites/default/files/medien/pdfs/pft-in-drinking-water.pdf
		2006	Germany	Ministry of Health	100	Health-based precautionary value	No	https://www.umweltbundesamt.de/sites/default/files/medien/pdfs/pft-in-drinking-water.pdf
PFHxS+PFNA+HPFO-DA+PFBS	Health-technology-cost-based	2024	America	Environmental Protect Agency	1 (unitless)	MCL	Yes	https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations#PFAS
PFOA + PFOS+ PFNA + PFHxS	Health-technology-cost-based	2023	Denmark	Environmental Protection Agency	2	MCL	Yes	https://www.retsinformation.dk/eli/lta/2023/1023
PFOA+PFNA+PFHxS+PFOS	Health-technology-cost-based	2023	Germany	Ministry of Health	20	Limit value	Yes	https://www.gesetze-im-internet.de/englisch_trinkwv/englisch_trinkwv.html
PFOS + PFHxS	Health-based	2018	Australia	Department of Health	70	Health based guidance value	No	https://www.health.gov.au/sites/default/files/documents/2022/07/health-based-guidance-values-for-pfas-for-use-in-site-investigations-in-australia_1.pdf
PFAS (25)*	Health-technology-cost-based	2024	Canada	Health Canada	30	MCL	Yes	https://publications.gc.ca/collections/collection_2024/sc-hc/H144-132-2024-eng.pdf
PFAS (20)†	Health-technology-cost-based	2023	Germany	Ministry of Health	100	Limit value	Yes	https://www.gesetze-im-internet.de/englisch_trinkwv/englisch_trinkwv.html
PFAS Total§	Health-technology-cost-based	2020	European Union	European Commission	500	Drinking Water Directive	Yes	https://eurlex.europa.eu/eli/dir/2020/2184
Sum of PFAS¶	Health-technology-cost-based	2020	European Union	European Commission	100	Drinking Water Directive	Yes	https://eurlex.europa.eu/eli/dir/2020/2185

Abbreviation: MAC=maximum acceptable concentration; MCL=maximum contaminant level; MCLG=maximum contaminant level goal; PFPA=perfluoropentanoic acid; PFDA=perfluorodecanoic acid; PFUnDA=perfluoroundecanoic acid; PFDoDA=perfluorododecanoic acid; PFTrDA=perfluorotridecanoic acid; PFPS=perfluoropentane sulfonic acid; PFDS=perfluorodecane sulfonic acid; PFUnDS=perfluoroundecane sulfonic acid; PFDoS=perfluorododecane sulfonic acid; PFTrDS=perfluorotridecane sulfonic acid; PFPS=perfluoropentane sulfonic acid; PFHpS=perfluoroheptane sulfonic acid; PFPeS=perfluoropentanesulfonic acid; 6:2 FTS=1H,1H,2H,2H-Perfluorooctane sulfonic acid; PFMBA=perfluoro-4-methoxybutanoic acid; 8:2 FTS=1H,1H,2H,2H-perfluorodecane sulfonic acid; NFDHA=nonafluoro-3,6-dioxaheptanoic acid; PFUnA=perfluoroundecanoic acid; HFPO-DA=hexafluoropropylene oxide dimer acid; 9Cl-PF3ONS=9-chlorohexadecafluoro-3-oxanonane-1-sulfonic acid; ADONA=4,8-dioxa-3H-perfluorononanoic acid; 11Cl-PF3OUdS=11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid; 4:2 FTS=1H,1H,2H,2H-perfluorohexane sulfonic acid; PFEESA=perfluoro (2-ethoxyethane) sulfonic acid.

* 25 PFAS: PFBA, PFNA, PFPeS, 6:2 FTS, PFMBA, PFPeA, PFDA, PFHxS, 8:2 FTS, NFDHA, PFHxA, PFUnA, PFHpS, HFPO-DA, 9Cl-PF3ONS, PFHpA, PFDoA, PFOS, ADONA, 11Cl-PF3OUdS, PFOA, PFBS, 4:2 FTS, PFMPA, PFEESA.

† 20 PFAS: PFBA, PFPA, PFHxA, PFHpA, PFOA, PFNA, PFDA, PFUnDA, PFDoDA, PFTrDA, PFBS, PFPS, PFHxS, PFHpS, PFOS, PFNS, PFDS, PFUnDS, PFDoS, and PFTrDS.

§ PFAS Total, the totality of per- and polyfluoroalkyl substances;

¶ Sum of PFAS (20): PFBA, PFPA, PFHxA, PFHpA, PFOA, PFNA, PFDA, PFUnDA, PFDoDA, PFTrDA, PFBS, PFPS, PFHxS, PFHpS, PFOS, PFNS, PFDS, PFUnDS, PFDoS, PFTrDS.

REFERENCES

1. Thomaidi VS, Tsahouridou A, Matsoukas C, Stasinakis AS, Petreas M, Kalantzi OI. Risk assessment of PFASs in drinking water using a probabilistic risk quotient methodology. Sci Total Environ 2020;712:136485. https://doi.org/10.1016/j.scitotenv.2019.136485.