Health-Based Reference Values for the Fifth Unregulated Contaminant Monitoring Rule (UCMR 5)

Introduction

EPA uses the Unregulated Contaminant Monitoring Rule (UCMR) program to collect nationally representative data for contaminants that are known or suspected to be present in drinking water, but do not have regulatory standards. UCMR 5 requires monitoring for 30 chemical contaminants (29 per- and polyfluoroalkyl substances [PFAS] and lithium) between 2023 and 2025 (see Table 1). This monitoring is used by EPA to understand the frequency and level of occurrence of unregulated contaminants in the nation's public water systems (PWSs). Every five years, EPA develops a new list of UCMR contaminants for monitoring, largely based on EPA's Contaminant Candidate List (CCL). The Safe Drinking Water Act (SDWA), as amended by Section 2021 of America's Water Infrastructure Act of 2018, calls for EPA to:

- Issue a list of unregulated contaminants to be monitored by PWSs every five years
- Require all large PWSs (*i.e.*, those that serve more than 10,000 people) to monitor
- Require all small PWSs serving between 3,300 and 10,000 people to monitor, subject to the availability of EPA appropriations and sufficient laboratory capacity
- Require a nationally representative sample of small PWSs serving less than 3,300 people to monitor
- Make analytical results available in the National Contaminant Occurrence Database (NCOD)

State and local officials may also use UCMR data to assess the need for actions to protect public health. When evaluating UCMR data, State and local officials should consider the following limitations:

- UCMR monitoring generates a robust dataset that is representative of national occurrence.
- UCMR results are available after PWSs and the laboratories that support their monitoring have reported results to EPA (up to four months after the samples are collected). Small PWS results may be available sooner relative to large PWS results since the laboratories contracted by EPA to analyze small PWS samples are contractually obligated to report results within a shorter timeframe.
- There is information about health effects and treatment techniques to address some of these unregulated contaminants.

Table 1: Contaminants and Methods

Contaminant	CASRN[1]	EPA Method	Contaminant Classification
lithium	7439-93-2	200.7	Metal/Pharmaceutical
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	763051-92-9	533	PFAS
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	39108-34-4	533	PFAS
1H, 1H, 2H, 2H-perfluorohexane sulfonic acid (4:2 FTS)	757124-72-4	533	PFAS
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	27619-97-2	533	PFAS
4,8-dioxa-3H-perfluorononanoic acid (ADONA)	919005-14-4	533	PFAS
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9Cl-PF3ONS)	756426-58-1	533	PFAS
hexafluoropropylene oxide dimer acid (HFPO-DA) (GenX chemicals)	13252-13-6	533	PFAS
nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	151772-58-6	533	PFAS
perfluoro (2-ethoxyethane) sulfonic acid (PFEESA)	113507-82-7	533	PFAS
perfluoro-3-methoxypropanoic acid (PFMPA)	377-73-1	533	PFAS
perfluoro-4-methoxybutanoic acid (PFMBA)	863090-89-5	533	PFAS
perfluorobutanesulfonic acid (PFBS)	375-73-5	533	PFAS
perfluorobutanoic acid (PFBA)	375-22-4	533	PFAS
perfluorodecanoic acid (PFDA)	335-76-2	533	PFAS
perfluorododecanoic acid (PFDoA)	307-55-1	533	PFAS
perfluoroheptanesulfonic acid (PFHpS)	375-92-8	533	PFAS
perfluoroheptanoic acid (PFHpA)	375-85-9	533	PFAS
perfluorohexanesulfonic acid (PFHxS)	355-46-4	533	PFAS
perfluorohexanoic acid (PFHxA)	307-24-4	533	PFAS
perfluorononanoic acid (PFNA)	375-95-1	533	PFAS
perfluorooctanesulfonic acid (PFOS)	1763-23-1	533	PFAS
perfluorooctanoic acid (PFOA)	335-67-1	533	PFAS
perfluoropentanesulfonic acid (PFPeS)	2706-91-4	533	PFAS
perfluoropentanoic acid (PFPeA)	2706-90-3	533	PFAS
perfluoroundecanoic acid (PFUnA)	2058-94-8	533	PFAS
n-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	2991-50-6	537.1	PFAS
n-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	2355-31-9	537.1	PFAS
perfluorotetradecanoic acid (PFTA)	376-06-7	537.1	PFAS
perfluorotridecanoic acid (PFTrDA)	72629-94-8	537.1	PFAS

[1] CASRN – Chemical Abstracts Service Registry Number

Information About UCMR 5 Results

The purpose of this document is to provide context around UCMR 5 results in relation to EPA established minimum reporting levels (MRLs) and, if available, health-based reference values, or "HBRVs" (*i.e.*, reference concentrations and reference doses [RfDs]) (see Table 2).

The UCMR 5 MRLs are the lowest concentrations that laboratories may report to EPA during UCMR 5 monitoring. UCMR MRLs are determined using data from multiple laboratories that participate in EPA's MRL-setting studies and are not associated with contaminant health effects information. EPA establishes MRLs to ensure consistency in the quality of the information reported to the Agency.

Depending on the available health and toxicological information for a UCMR 5 contaminant, a reference concentration (*e.g.*, a lifetime Health Advisory [HA] level, Health Reference Level [HRL]) in drinking water may be available. Reference concentrations can be derived from an RfD (*i.e.*, a non-cancer endpoint) or an oral cancer slope factor (CSF) (*i.e.*, a cancer endpoint), if available, and consider additional assumptions about body weight and drinking water intake. The HBRVs identified in this document do not represent regulatory limits or action levels and should not be interpreted as an indication of future Agency actions. UCMR occurrence data are used to inform the Agency's Regulatory Determination process (*i.e.*, the process that addresses potential regulatory actions for unregulated contaminants).

Community water systems (CWSs) required to monitor under UCMR must inform their customers of UCMR results (including the average and range of detections) in their annual Consumer Confidence Report (CCR). See 40 CFR 141.153(d)(7) for the CCR regulatory requirements and Section IV of EPA's guidance "Preparing Your Drinking Water Consumer Confidence Report" for details on the content of the report. Additional resources are available on EPA's CCR Compliance Help web page.

Non-transient non-community water systems and CWSs required to monitor for UCMR must inform their customers of the availability of UCMR results through Tier 3 Public Notification (PN). See 40 CFR 141.207 for the PN regulatory requirements and EPA's PN Compliance Help web page for guidance.

EPA recognizes the high interest in timely access to UCMR results and is committed to publicly posting results on the Agency's web page approximately quarterly (following large PWS review of their UCMR results and EPA review of small PWS results). EPA manages the laboratory analyses for small PWSs and will work to communicate their results in a timely manner. Large PWSs wishing to have earlier access to their data should consider making arrangements with their UCMR 5 laboratory for early notification of particular UCMR results (*i.e.*, before their contracted laboratory posts the results to the UCMR web-based reporting system).

States may establish requirements (regulatory or non-regulatory) for drinking water contaminants not yet regulated by EPA, and those requirements may be based on State-established enforceable or unenforceable levels that differ from EPA's reference concentrations. PWSs are responsible for being aware of and complying with their State's requirements, if any.

EPA's PFAS website provides additional information on Agency actions to address PFAS contamination, current PFAS research, and related tools and resources.

Health-Based Reference Values

Table 2 provides HBRVs (*i.e.*, reference concentrations and RfDs) for each contaminant monitored under UCMR 5, if available. To identify HBRVs, EPA applied the following principles:

(1) Reference concentrations and RfDs were compiled from the following publicly available resources:

   a. Drinking Water Health Advisories (HAs),
   b. Integrated Risk Information System (IRIS) Assessments,
   c. Technical Support Document for the Final CCL 5 - Contaminant Information Sheets, and
   d. Agency for Toxic Substances and Disease Registry (ATSDR) Toxicological Profiles

   The resources referenced above are the products (or compilation) of peer-reviewed health assessments. The HBRVs are subject to change as new health assessments are completed; they are not legally enforceable federal standards.

(2) If health information was available from more than one of the resources listed above, the most recent health information was used.

(3) If both cancer and non-cancer reference concentrations were available from the most recent resource, the lower (more conservative) of the two concentrations was used. Please review the "References" and footnotes in Table 2 below for additional health effects information.

(4) If an RfD (*i.e.*, a non-cancer endpoint) was the basis for the reference concentration, and both chronic and subchronic/short-term exposure values were available from the most recent resource, the lower concentration (associated with the chronic exposure) was used. Please review the "References" and footnotes in Table 2 below for additional health effects information (*e.g.*, additional short-term, subchronic, or chronic values).

(5) For the contaminants that do not have a reference concentration available from a resource listed above, only the RfDs from finalized health assessments are provided in Table 2, if available. If a health assessment is in process, additional information about its status is provided in Table 2.

EPA considers this a "living document" and will update Table 2 as new health-based information becomes available. For example, EPA is proposing a National Primary Drinking Water Regulation (NPDWR) for PFAS. The Agency is using the 2022 EPA lifetime HA levels for PFAS as reference concentrations and will update the reference concentrations when a final NPDWR is promulgated.

Table 2: Minimum Reporting Levels (MRLs) and Health-Based Reference Values

Contaminant [note: to convert to ng/L or parts per trillion (ppt), multiply by 1,000]	MRL (µg/L)	Health-Based Reference Values		Reference(s)
		Reference Concentration (µg/L)	RfD (mg/kg-day)	
lithium[1]	9	HRL = 10	Subchronic and Chronic Provisional RfD = 2×10^{-3}	Technical Support Document for the Final CCL 5 - Contaminant Information Sheets (2022)
hexafluoropropylene oxide dimer acid (HFPO-DA) (GenX)[2]	0.005	Lifetime HA = 0.01	Chronic RfD = 3×10^{-6}	Drinking Water Health Advisory: Hexafluoropropylene Oxide (HFPO) Dimer Acid and HFPO Dimer Acid Ammonium Salt, Also Known as "GenX Chemicals" (2022)
perfluorobutanesulfonic acid (PFBS)[2]	0.003	Lifetime HA = 2	Chronic RfD = 3×10^{-4}	Drinking Water Health Advisory: Perfluorobutane Sulfonic Acid and Related Compound Potassium Perfluorobutane Sulfonate (2022)
perfluorooctanesulfonic acid (PFOS)[3,4]	0.004	Lifetime Interim HA = 0.00002	Chronic RfD = 7.9×10^{-9}	INTERIM Drinking Water Health Advisory: Perfluorooctane Sulfonic Acid (PFOS) (2022)
perfluorooctanoic acid (PFOA)[3,4]	0.004	Lifetime Interim HA = 0.000004	Chronic RfD = 1.5×10^{-9}	INTERIM Drinking Water Health Advisory: Perfluorooctanoic Acid (PFOA) (2022)

[1] The reference concentration is the Health Reference Level (HRL) calculated as part of the CCL 5 process and is based on the RfD from the following health assessment: Provisional Peer-Reviewed Toxicity Values (PPRTV), 2008.

[2] The lifetime HA for GenX is more appropriate for lifetime risk assessment scenarios. However, application of the GenX HA to a shorter-term risk assessment scenario would provide a conservative, health-protective approach in the absence of other information. The lifetime HA for PFBS is applicable to short-term (including during pregnancy) as well as lifetime risk assessment scenarios. More information is available on the lifetime HAs for GenX and PFBS.

[3] Subject to change based on the proposed NPDWR for PFAS and current EPA reevaluation of toxicity information, including carcinogenic potential. The interim lifetime HAs for PFOS and PFOA are expected to be protective of children and adults of all ages in the general population; however, available data on the most sensitive population or life stage are limited. Additionally, the lifetime interim HAs for PFOS and PFOA are applicable to short-term as well as lifetime risk assessment scenarios. More information is available on the interim lifetime HAs for PFOA and PFOS.

[4] Has an available ATSDR Minimal Risk Level (Toxicological Profile for Perfluoroalkyls, 2021).

Contaminant [note: to convert to ng/L or parts per trillion (ppt), multiply by 1,000]	MRL (µg/L)	Health-Based Reference Values		Reference(s)
		Reference Concentration (µg/L)	RfD (mg/kg-day)	
perfluorobutanoic acid (PFBA)	0.005	-	Chronic RfD = 1×10^{-3} Subchronic RfD = 6×10^{-3}	Integrated Risk Information System (IRIS) Assessment (2022)
perfluorodecanoic acid (PFDA)	0.003	-	-	IN PROCESS/DRAFT Integrated Risk Information System (IRIS) Assessment
perfluorohexanesulfonic acid (PFHxS)[5,6]	0.003	-	ATSDR: Minimal Risk Level = 2×10^{-5} (intermediate duration)	ATSDR Toxicological Profile for Perfluoroalkyls (2021)
perfluorohexanoic acid (PFHxA)	0.004	-	-	IN PROCESS/DRAFT Integrated Risk Information System (IRIS) Assessment
perfluorononanoic acid (PFNA)[5,6]	0.02	-	ATSDR: Minimal Risk Level = 3×10^{-6} (intermediate duration)	ATSDR Toxicological Profile for Perfluoroalkyls (2021)
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	0.005	-	-	-
1H, 1H, 2H, 2H-perfluorodecane sulfonic acid (8:2 FTS)	0.005	-	-	-
1H, 1H, 2H, 2H-perfluorohexane sulfonic acid (4:2 FTS)	0.003	-	-	-
1H, 1H, 2H, 2H-perfluorooctane sulfonic acid (6:2 FTS)	0.005	-	-	-
4,8-dioxa-3H-perfluorononanoic acid (ADONA)	0.003	-	-	-
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9Cl-PF3ONS)	0.002	-	-	-

[5] In process/draft EPA Integrated Risk Information System (IRIS) assessments for PFHxS and PFNA.
[6] ATSDR Minimal Risk Levels for PFHxS and PFNA can be converted into drinking water concentrations.

Contaminant [note: to convert to ng/L or parts per trillion (ppt), multiply by 1,000]	MRL (µg/L)	Health-Based Reference Values		Reference(s)
		Reference Concentration (µg/L)	RfD (mg/kg-day)	
nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	0.02	-	-	-
perfluoro (2-ethoxyethane) sulfonic acid (PFEESA)	0.003	-	-	-
perfluoro-3-methoxypropanoic acid (PFMPA)	0.004	-	-	-
perfluoro-4-methoxybutanoic acid (PFMBA)	0.003	-	-	-
perfluorododecanoic acid (PFDoA)	0.003	-	-	-
perfluoroheptanesulfonic acid (PFHpS)	0.003	-	-	-
perfluoroheptanoic acid (PFHpA)	0.003	-	-	-
perfluoropentanesulfonic acid (PFPeS)	0.004	-	-	-
perfluoropentanoic acid (PFPeA)	0.003	-	-	-
perfluoroundecanoic acid (PFUnA)	0.002	-	-	-
n-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	0.005	-	-	-
n-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	0.006	-	-	-
perfluorotetradecanoic acid (PFTA)	0.008	-	-	-
perfluorotridecanoic acid (PFTrDA)	0.007	-	-	-

Terms and Definitions

a) MRL = UCMR Minimum Reporting Level. The lowest concentration that laboratories may report to EPA during UCMR 5 monitoring. MRLs are not associated with health effects information. More specifically, an MRL is the quantitation limit for a contaminant that is considered achievable, with 95% confidence, by at least 75% of laboratories nationwide using a specified analytical method (recognizing that individual laboratories may be able to measure at lower levels). **[Note that the Agency for Toxic Substances and Disease Registry (ATSDR) uses the term "MRL" for a different purpose (*i.e.*, to describe "Minimal Risk Levels"). The UCMR term and the ATSDR term have no relationship to each other.]**

b) Reference Concentration = Published EPA Drinking Water Health Advisories (HAs) and the Health Reference Levels (HRLs) from EPA's Fifth Contaminant Candidate List (CCL 5) Contaminant Information Sheets. Reference concentrations from these EPA resources are derived from peer-reviewed health assessments published by EPA or other governmental agencies. They are not legally enforceable federal standards and are subject to change as new health assessments are completed. Depending on available health effects information, a reference concentration in drinking water can be derived from a reference dose (RfD) (*i.e.*, a non-cancer endpoint) or a cancer slope factor (CSF) (*i.e.*, a cancer endpoint), and considers additional assumptions about body weight and drinking water intake.

c) HA = Health Advisory. Lifetime HAs identify the concentration of a contaminant in drinking water at which adverse health effects are not anticipated to occur over a lifetime of exposure. SDWA authorizes EPA to issue HAs for contaminants that are not subject to a National Primary Drinking Water Regulation (NPDWR). The lifetime HA for the drinking water contaminant is calculated from its associated Drinking Water Equivalent Level (DWEL), obtained from its RfD, and incorporates a drinking water Relative Source Contribution (RSC) factor of contaminant-specific data or a default of 20% of total exposure from all sources. For more information, visit: https://www.epa.gov/sdwa/drinking-water-health-advisories-has. EPA's lifetime HAs are non-enforceable and non-regulatory and provide technical information to State agencies and other public health officials on health effects, analytical methods, and treatment technologies associated with drinking water contaminants. For answers to frequently asked questions, visit: https://www.epa.gov/sdwa/questions-and-answers-drinking-water-health-advisories-pfoa-pfos-genx-chemicals-and-pfbs.

d) HRL = Health Reference Level. Derived during the CCL 5 process for screening purposes. HRLs are used in EPA's Regulatory Determination process as risk-derived concentrations against which to evaluate the occurrence data to determine if contaminants occur at levels of public health concern. To determine the HRL for a chemical, EPA considered adverse health effects that may pose a greater risk to specific life stages and other sensitive groups which represent a meaningful portion of the population. HRLs are not final determinations about the level of a contaminant in drinking water that is necessary to protect any particular population and, in some cases, are derived prior to development of a complete exposure assessment using the best available data. HRLs are not legally enforceable federal standards. For more information on HRL derivation, please see the Technical Support Document for the Final CCL 5 - Contaminant Information Sheets.

e) RfD = Reference Dose. A non-cancer estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime. It is typically derived by dividing a point-of-departure (POD) from a selected dose-response study (*e.g.*, no-observed-adverse-effect-level [NOAEL], lowest-observed-adverse-effect-level [LOAEL], benchmark dose [BMD]) by the uncertainty factors (UFs) applied to reflect database limitations. Chronic RfDs are typically derived from animal toxicological studies with an exposure duration of months to years, representing a lifetime exposure in humans. Subchronic RfDs are typically derived from animal toxicological studies with an exposure duration of 31 to

90 days, representing a less than lifetime exposure in humans (up to 10% of average lifespan). For more information about RfD derivation, visit: https://www.epa.gov/iris/reference-dose-rfd-description-and-use-health-risk-assessments.

f) Minimal Risk Level = ATSDR develops minimal risk levels as screening tools to help identify chemicals that may be of concern. A minimal risk level is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse non-cancer health effects over a specified route and duration of exposure. Minimal risk levels are derived when reliable and sufficient data exist to identify the target organ(s) of effect or the most sensitive health effect(s) for a specific duration for a given route of exposure. These substance specific estimates, which are intended to serve as screening levels, are used by ATSDR health assessors to determine areas and populations potentially at risk for health effects from exposure to a particular substance. Exposure above the minimal risk level does not mean that health problems will occur. Instead, it may act as a signal to health assessors to look more closely at a particular site where exposures may be identified. Minimal risk levels do not define regulatory or action levels for ATSDR.