Per- and Polyfluoroalkyl Substances: Significant Figures and Rounding Requirements

The per- and polyfluoroalkyl substances (PFAS) National Primary Drinking Water Regulation (NPDWR) establishes legally enforceable levels, called Maximum Contaminant Levels (MCLs), for PFAS in drinking water. The EPA has set limits for PFOA, PFOS, PFHxS, HFPO-DA and PFNA as contaminants with individual MCLs. Additionally, the EPA has set a limit for PFAS mixtures containing two or more of PFHxS, HFPO-DA, PFNA and PFBS using a Hazard Index MCL to account for the combined and co-occurring levels of these PFAS in drinking water. The rule requires community water systems (CWSs) and non-transient non-community water systems (NTNCWSs) to conduct both *initial* monitoring, for determining the beginning compliance monitoring frequency, and *ongoing* monitoring, to determine compliance with the MCLs and determine whether any changes in future monitoring frequency are needed.

Significant Figures and Rounding for PFAS MCLs and Trigger Levels

Significant figures (also often referred to as "significant digits") are the number of digits in a value that are known with a degree of reliability. The MCLs and trigger levels (levels used to determine appropriate monitoring frequency) for PFOA and PFOS are promulgated with two significant figures. The MCLs and trigger levels for PFHxS, HFPO-DA, PFNA and the Hazard Index are promulgated with one significant figure (see 40 CFR 141.61(c)(2) and 40 CFR 141.902(a)(5)).

PFAS MCLs and Trigger Levels

Regulated PFAS	MCL	Trigger Level (1/2 MCL)	Significant Figures
PFOA	4.0 ppt*	2.0 ppt	2
PFOS	4.0 ppt	2.0 ppt	2
PFHxS	10 ppt	5 ppt	1
HFPO-DA (GenX chemicals)	10 ppt	5 ppt	1
PFNA	10 ppt	5 ppt	1
Mixture of two or more: PFHxS, HFPO-DA, PFNA and PFBS	Hazard Index of 1 (unitless)	Hazard Index of 0.5 (unitless)	1

*Parts per trillion (ppt); also expressed as nanograms/liter (ng/L)

Data reported to the primacy agency for MCL compliance or used for determining monitoring frequency should be in a form **containing the same number of significant figures as the respective MCL or trigger level.** For example, PFOA and PFOS values should have two significant figures. Typically, a result reported by a laboratory or a calculated value will have more significant figures than are required, and *rounding* will need to be applied to achieve the required number of significant figures before comparing those values to trigger levels and MCLs.

Rules for rounding include:

► When rounding, the last significant digit should be increased by one unit if the digit dropped (the first non-significant digit) is 5, 6, 7, 8 or 9. If the digit dropped is 0, 1, 2, 3 or 4, no change is made to the retained digit(s). For example, if rounding 8.35 to one significant digit, the "8" is the only significant digit so the digit to evaluate for rounding purposes is "3." Since this is less than 5, no change is made and the rounded value is 8 when expressed to one significant digit.

► When performing calculations, including for determining the Hazard Index and determining compliance with all regulated PFAS MCLs, no rounding should be done until the **final step**, after all other calculation steps are completed (see 40 CFR 141.903(f)(1)(i) and 40 CFR 141.903(f)(2)(i)).

► No rounding is necessary if the data are already expressed to the required number of significant figures.

Determination of Compliance Monitoring Frequency Based on Initial Monitoring Results

By April 26, 2027, CWSs and NTNCWSs are required to complete initial monitoring at all entry points to the distribution system (EPTDS) (see 40 CFR 141.902(b)(1)). These water systems may satisfy some or all of the initial monitoring requirements through demonstration of previously acquired PFAS drinking water sample results that meet the required data quality criteria. The initial monitoring requirements are based on system size and the source water type associated with each EPTDS and require systems to conduct monitoring at each entry point either semi-annually or quarterly. Subsequently, the frequency of ongoing compliance monitoring for each EPTDS is determined by comparing initial monitoring results at that EPTDS to the rule trigger levels; results are used by primacy agencies to assess whether reduced triennial (one sample taken every three years) monitoring is appropriate. Systems with multiple entry points may establish different compliance monitoring schedules for each entry point depending on their monitoring results. For the purpose of determining compliance monitoring frequency, all monitoring results reported to the PWS by their laboratory are used, even if they are below a PFAS Practical Quantitation Level (PQL). The PQL represents the lowest level at which a contaminant can be reliably quantified within specific limits of precision and accuracy (see 40 CFR 141.902(a)(7)). Results below the PQLs can still support monitoring-frequency determinations, even if those values have a lesser degree of precision or accuracy than that deemed necessary for determining compliance with MCLs. (The PFAS PQLs are provided on page 2.)

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Determination of Original Compliance Monitoring Frequency Based on Initial Monitoring Results Cont.

Compliance monitoring must begin on April 26, 2027, and the primacy agency will use the initial monitoring results to determine the frequency of compliance monitoring (see 40 CFR 141.902(b)(2)).

► If *all* regulated PFAS results from initial monitoring at an entry point are less than the trigger levels, the system is eligible for triennial compliance monitoring for all regulated PFAS at that entry point.

► If *any* regulated PFAS results from initial monitoring at an entry point are greater than or equal to the trigger levels for any of the PFAS, the system must conduct quarterly compliance monitoring (one sample taken every quarter) for all regulated PFAS at that entry point.

The following examples illustrate how *initial monitoring* results are evaluated (including how rounding is applied) and compliance monitoring frequency is determined.

Example 1: PFOA or PFOS *initial* monitoring quarterly sample result of 1.97 ppt (rounded to two significant figures equals 2.0 ppt).

► 2.0 ppt is equal to the PFOA/S trigger levels (2.0 ppt) – Must conduct quarterly compliance monitoring for all regulated PFAS at that entry point, regardless of other quarterly results.

Example 2: PFHxS *initial* monitoring semi-annual sample results of 4.45 and 3.4 ppt (rounded to one significant figure equal 4 and 3 ppt, respectively).

► 4 and 3 ppt are both below the PFHxS trigger level (5 ppt) – May be eligible for triennial compliance monitoring if sample results for all other regulated PFAS at that entry point are also below their rule trigger levels.

Example 3: Hazard Index *initial* monitoring semi-annual sample result of 0.49 (rounded to one significant figure equals 0.5). Hazard Index is calculated using the following sample results: PFHxS (2.8 ppt), HFPO-DA (non-detect), PFNA (2.1 ppt), and PFBS (non-detect).

► 0.5 is equal to the Hazard Index trigger level (0.5) – Must conduct quarterly compliance monitoring for all regulated PFAS at that entry point, regardless of other semi-annual results.

PFAS Practical Quantitation Levels (PQLs)

Chemical	PQL (ppt)
PFOA	4.0
PFOS	4.0
PFHxS	3.0
HFPO-DA	5.0
PFNA	4.0
PFBS	3.0

Review, and Potential Adjustment, of Compliance Monitoring Frequency Based on the Most Recent Compliance Monitoring Results

Once a water system has started compliance monitoring, the primacy agency will use the ongoing compliance monitoring results to determine the frequency of future monitoring at each EPTDS.

► If *all* regulated PFAS results from quarterly compliance monitoring at an entry point are less than the MCLs, the system may be eligible to begin annual compliance monitoring for all regulated PFAS at that entry point at the discretion of the primacy agency. If any regulated PFAS results from quarterly compliance monitoring at an entry point are greater than or equal to the MCLs for any of the PFAS, the system must continue quarterly compliance monitoring for all regulated PFAS at that entry point.

► If *all* regulated PFAS results from annual compliance monitoring at an entry point are less than all trigger levels for three consecutive years, the primacy agency may allow the system to begin triennial compliance monitoring for all regulated PFAS at that entry point. If any regulated PFAS results from annual compliance monitoring at an entry point are greater than or equal to any trigger level and less than the MCLs for all of the regulated PFAS, the system may be eligible to continue annual compliance monitoring for all regulated PFAS at that entry point. If any regulated PFAS results from annual compliance monitoring at an entry point are greater than or equal to the MCLs for any of the regulated PFAS, the system must begin quarterly compliance monitoring for all regulated PFAS at that entry point and the sample result is to be used as the first quarterly sample.

► If *all* regulated PFAS results from triennial compliance monitoring at an entry point are less than the trigger levels, the system is eligible to continue triennial compliance monitoring for all regulated PFAS at that entry point. If any regulated PFAS results from triennial compliance monitoring at an entry point are greater than or equal to a trigger level for any of the PFAS, the system must begin quarterly compliance monitoring for all regulated PFAS at that entry point and the sample result is to be used as the first quarterly sample.

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The following examples illustrate how **ongoing compliance monitoring** results are evaluated (including how rounding is applied) and compliance monitoring frequency is determined.

Example 1: PFOA or PFOS **compliance** monitoring quarterly sample result of 3.42 ppt (rounded to two significant figures equals 3.4 ppt which is above the trigger level), with all other PFOA and PFOS quarterly sample results reported below the trigger level.

► All quarterly results are less than the PFOA/S MCLs (4.0 ppt) – If all other regulated PFAS results from quarterly compliance monitoring are also less than the MCLs, the system may be eligible to begin annual compliance monitoring for all regulated PFAS at that entry point.

Example 2: Hazard Index **compliance** monitoring triennial sample result of 0.445 (rounded to one significant figure equals 0.4). Hazard Index is calculated using the following samples results: PFHxS (2.1 ppt), HFPO-DA (non-detect), PFNA (2.3 ppt), and PFBS (10 ppt).

► 0.4 is below the Hazard Index trigger level (0.5) – System may be eligible to continue triennial compliance monitoring if all other regulated PFAS are also below their rule trigger levels at that entry point.

Example 3: HFPO-DA annual **compliance** monitoring sample results of 4.2 ppt (rounded to one significant figure equals 4 ppt), 3.2 (rounded to one significant figure equals 3 ppt), and 2.5 ppt (rounded to one significant figure equals 3 ppt) for the previous three years.

► All three consecutive annual results are less than the HFPO-DA trigger level (5 ppt) – If all other regulated PFAS results from annual compliance monitoring over the previous three years are less than the trigger levels, the system may be eligible to begin triennial compliance monitoring for all regulated PFAS at that entry point.

Determination of Compliance Monitoring Frequency Summary Note

In summary, using both initial monitoring results and ongoing compliance monitoring results, the determination of compliance monitoring frequency is based on evaluation of single result(s) for each regulated PFAS, not the average of results as is done for the determination of MCL compliance. (See the Compliance Determination for Individual MCLs and the Hazard Index MCL sections below.)

Compliance Determination for Individual PFAS MCLs

Compliance with PFAS MCLs is determined based on a running annual average (RAA) of quarterly sample results obtained at each sampling point (see 40 CFR 141.903). If the water system is conducting annual or triennial compliance monitoring at the sample location, the RAA is not calculated, provided the result does not trigger quarterly monitoring. For compliance determination purposes (unlike for monitoring frequency determinations, described above), a sample result less than a PQL is treated as zero when calculating the RAA (see 40 CFR 141.903(f)(1)(iv) and 40 CFR 141.903(f)(2)(iv)). If the RAA for any regulated PFAS is greater than the respective MCL, the system is in violation of that MCL and must continue quarterly monitoring for all regulated PFAS and take action to reduce levels to at or below the MCLs (see 40 CFR 141.905(e)). See below for example individual PFAS MCL compliance calculations (including how rounding is applied in the *final step* of the RAA calculation).

Example 1: PFOA MCL Compliance Determination

► System conducts quarterly compliance monitoring at entry point but did not collect second quarter results.
► PFOA results for first, third and fourth quarters at sample location are: 2.0, 2.5 and 5.2 ppt.
► Since the PQL for PFOA is 4.0 ppt, the values used in the RAA calculation for that entry point are: 0, 0 and 5.2 ppt.
► Resulting PFOA RAA equals 1.7333 ppt (i.e., (0 + 0 + 5.2)/3 = 1.7333 ppt).
► RAA value rounded to two significant figures is 1.7 ppt.
► **System has not violated the MCL of 4.0 ppt for PFOA but has violated the monitoring requirements.**

Example 2: HFPO-DA MCL Compliance Determination

► System conducts quarterly compliance monitoring at entry point.
► HFPO-DA results for last four quarters at sample location are: 10.3, 11.1, 8.3 and 14.2 ppt.
► Since the PQL for HFPO-DA is 5.0 ppt, the values used in the RAA calculation for that entry point are: 10.3, 11.1, 8.3 and 14.2 ppt.
► Resulting HFPO-DA RAA equals 10.975 ppt (*i.e.,* (10.3 + 11.1 + 8.3 + 14.2)/4 = 10.975 ppt).
► RAA value rounded to one significant figure equals 10 ppt.
► **System has not violated the MCL of 10 ppt for HFPO-DA.**

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Example 3: PFNA MCL Compliance Determination

► System conducts quarterly monitoring at entry point.
► PFNA results for last four quarters at sample location are: 3, 16, 18 and 24 ppt.
► Since the PQL for PFNA is 4.0 ppt, the values used in the RAA calculation for that entry point are: 0, 16, 18 and 24 ppt.
► Resulting PFNA RAA equals 14.5 ppt (*i.e.,* (0 + 16 + 18 + 24)/4 = 14.5 ppt).
► RAA value rounded to one significant figure equals 10 ppt.
► **System has not violated the MCL of 10 ppt for PFNA.**

Example 4: PFHxS MCL Compliance Determination

► System conducts quarterly compliance monitoring at entry point.
► PFHxS results for three quarters at sample location are: 22.7, 20.8 and 19.9 ppt. The fourth quarter result is 2.9 ppt and the state requires a confirmation sample with a result of 4.0 ppt.
► Since the PQL for PFHxS is 3.0 ppt, the values used in the RAA calculation for that entry point are: 22.7, 20.8, 19.9 and 2.0 ppt (the average of 0 and 4.0 ppt).
► Resulting PFHxS RAA equals 16.35 ppt (*i.e.,* (22.7 + 20.8 + 19.9 + 2.0)/4 = 16.35 ppt).
► RAA value rounded to one significant figure equals 20 ppt.
► **System has violated the MCL of 10 ppt for PFHxS.**
► Note: This could also be a simultaneous violation of the Hazard Index MCL if one of the other Hazard Index PFAS is present in any quarter at or above its respective PQL.

Compliance Determination for the Hazard Index MCL

The Hazard Index is calculated by adding the hazard quotients (HQs) for each of the four PFAS; the HQ is the ratio of the measured concentration of the PFAS in drinking water to its health-based water concentration (HBWC) (see below for equation). Compliance with the Hazard Index MCL is determined for each entry point as an RAA, calculated by performing the Hazard Index calculation for each set of quarterly samples and averaging the quarterly Hazard Index results from the most recent four quarters. If the RAA Hazard Index exceeds the MCL and two or more Hazard Index PFAS had sample results at or above their PQLs in <u>any</u> of the quarterly samples used to determine the RAA, the system is in violation of the Hazard Index MCL (see 40 CFR 141.905(e)). When evaluating compliance with the Hazard Index MCL, no rounding should occur until the final step of the compliance calculation and the unrounded quarterly values should be carried over to the next quarter's calculation. See below for example Hazard Index MCL compliance calculations (including how rounding is applied in the *final step* of the RAA calculation).

$$\text{Hazard Index (unitless)} = \left(\frac{[\text{PFHxS}_{ppt}]}{[10\ ppt]}\right) + \left(\frac{[\text{HFPO-DA}_{ppt}]}{[10\ ppt]}\right) + \left(\frac{[\text{PFNA}_{ppt}]}{[10\ ppt]}\right) + \left(\frac{[\text{PFBS}_{ppt}]}{[2{,}000\ ppt]}\right)$$

Example 1: Hazard Index MCL Compliance Determination

Contami-nant	Quarter 1		Quarter 2		Quarter 3		Quarter 4	
	Conc. (ppt)	Q1 HQ	Conc. (ppt)	Q2 HQ	Conc. (ppt)	Q3 HQ	Conc. (ppt)	Q4 HQ
PFHxS	10	10 ÷ 10 = 1	6	6 ÷ 10 = 0.6	4	4 ÷ 10 = 0.4	6	6 ÷ 10 = 0.6
HFPO-DA	5	5 ÷ 10 = 0.5	5	5 ÷ 10 = 0.5	5	5 ÷ 10 = 0.5	5	5 ÷ 10 = 0.5
PFNA	4	4 ÷ 10 = 0.4	4	4 ÷ 10 = 0.4	4	4 ÷ 10 = 0.4	4	4 ÷ 10 = 0.4
PFBS	5	5 ÷ 2000 = 0.0025	5	5 ÷ 2000 = 0.0025	5	5 ÷ 2000 = 0.0025	5	5 ÷ 2000 = 0.0025
Hazard Index	1 + 0.5 + 0.4 + 0.0025 = 1.9025		0.6 + 0.5 + 0.4 + 0.0025 = 1.5025		0.4 + 0.5 + 0.4 + 0.0025 = 1.3025		0.6 + 0.5 + 0.4 + 0.0025 =1.5025	

RAA = (1.9025 + 1.5025 + 1.3025 + 1.5025 / 4) = 1.5525, rounded to one significant figure equals 2. Since the Hazard Index RAA result of 2 exceeds the Hazard Index MCL of 1, the system has violated the MCL.

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Example 2: Hazard Index MCL Compliance Determination

Contaminant	Quarter 1		Quarter 2		Quarter 3		Quarter 4	
	Conc. (ppt)	Q1 HQ	Conc. (ppt)	Q2 HQ	Conc. (ppt)	Q3 HQ	Conc. (ppt)	Q4 HQ
PFHxS	4	$4 \div 10 = 0.4$	6.7	$6.7 \div 10 = 0.67$	2.9*	$0 \div 10 = 0$	5.1	$5.1 \div 10 = 0.51$
HFPO-DA	7.3	$7.3 \div 10 = 0.73$	5.9	$5.9 \div 10 = 0.59$	3.2*	$0 \div 10 = 0$	6.4	$6.4 \div 10 = 0.64$
PFNA	3.7*	$0 \div 10 = 0$	4.6	$4.6 \div 10 = 0.46$	11.5	$11.5 \div 10 = 1.15$	6.5	$6.5 \div 10 = 0.65$
PFBS	7.2	$7.2 \div 2000 = 0.0036$	2.8*	$0 \div 2000 = 0$	2.5*	$0 \div 2000 = 0$	6	$6 \div 2000 = 0.003$
Hazard Index	$0.4 + 0.73 + 0 + 0.0036 = 1.1336$		$0.67 + 0.59 + 0.46 + 0 = 1.72$		$0 + 0 + 1.15 + 0 = 1.15$		$0.51 + 0.64 + 0.65 + 0.003 = 1.803$	

RAA = (1.1336 + 1.72 + 1.15 + 1.803 / 4) = 1.45165, rounded to one significant figure equals 1. Since the Hazard Index RAA result of 1 does not exceed the Hazard Index MCL of 1, the system has not violated the MCL.

Since this value is below the PQL, the value used in the RAA calculation is 0.

Additional Resources

The EPA's PFAS homepage	https://www.epa.gov/pfas
Homepage for PFAS Rule	https://www.epa.gov/sdwa/and-polyfluoroalkyl-substances-pfas
Homepage for PFAS Rule Implementation	https://www.epa.gov/dwreginfo/pfas-rule-implementation
PFAS NPDWR Overview Quick Reference Guide	https://www.epa.gov/system/files/documents/2024-12/pfas-overview-qrg-dec24.pdf
PFAS NPDWR Hazard Index Quick Reference Guide	https://www.epa.gov/system/files/documents/2024-12/hazard-index-qrg-dec24.pdf

Note: The statutory provisions and EPA regulations described in this document contain legally binding requirements. This document is not a regulation itself, nor does it change or substitute for those provisions and regulations.

For additional information on the PFAS Rule

Please visit the EPA Web site at https://www.epa.gov/dwreginfo/pfas-rule-implementation; or contact your drinking water primacy agency.