Documentation for Massachusetts Maximum Contaminant Level (MMCL) for Six Per- and Polyfluoroalkyl Substances (PFAS6) in Drinking Water

PFAS included[1]:	CASRN:	**Update: October 2020**
Perfluorooctane Sulfonic Acid (PFOS)	1763-23-1	
Perfluorooctanoic Acid (PFOA)	335-67-1	
Perfluorohexane Sulfonic Acid (PFHxS)	355-46-4	
Perfluorononanoic Acid (PFNA)	375-95-1	
Perfluoroheptanoic Acid (PFHpA)	375-85-9	
Perfluorodecanoic Acid (PFDA)	335-76-2	

[1]The compounds and associated CAS registry numbers (CASRN) listed refer to the acid form of these PFAS compounds. The information presented in this document and the MMCL are also applicable to the respective anionic forms of these compounds. These anions may form salts with any of a number of cations resulting in a variety of possible chemical species, each having a unique CASRN.

MMCL: 0.000020 mg/L (20 ppt). When all or some of the listed compounds occur together in drinking water, the detected concentrations for these PFAS should be summed and compared to 0.000020 mg/L. This value is also applicable to the individual compounds.

To be protective of shorter-term effects associated with these compounds, particularly developmental effects, the PFAS6 MMCL is violated when the average of three months of PFAS6 concentrations exceeds 20 ppt within the same quarter (for instance, Quarter 2 includes April, May and June) or if PFAS6 concentrations from one or two months would cause the quarterly average to exceed 20 ppt.

Federal Regulatory Limit: The United States Environmental Protection Agency (US EPA) has not published a Federal Maximum Contaminant Level (MCL) for any PFAS.

Basis for Criteria - Non-Cancer Health Risk:

In January 2020, the Massachusetts Department of Environmental Protection (MassDEP) updated its PFAS6 Office of Research and Standards (ORS) Guideline (ORSG) and in October 2020 promulgated a MMCL for these compounds. This MMCL is based on an extensive assessment of the available data by MassDEP ORS. The ORS assessment reflects technical input from the MassDEP Health Effects Advisory Committee. Detailed supporting information can be found in the Technical Support Document Per- and Polyfluoroalkyl Substances (PFAS): An Updated Subgroup Approach to Groundwater and Drinking Water Values (the TSD) (https://www.mass.gov/info-details/per-and-polyfluoroalkyl-substances-pfas#massachusetts-drinking-water-standard-and-health-information-).

In summary, MassDEP ORS concluded that the Reference Dose (RfD), the toxicity value for non-cancer effects, for compounds in this subgroup of longer-chain PFAS should be adjusted

downward from that used in the 2018 ORSG derivation, to 5 x 10^{-6} milligrams per kilogram body weight per day (mg/kg-day). The revised MassDEP RfD value results from the application of an additional uncertainty factor (UF) of $10^{1/2}$ in the RfD derivations for PFOA and PFOS as detailed in the TSD. This was done to account for considerable and convincing evidence associating exposures to these compounds with adverse responses in laboratory animals at levels of exposure lower than those used to derive the previous RfD. ORS also concluded that one additional compound, PFDA, should be included in the subgroup, based on structural and toxicological similarity. As discussed in the TSD, the revised MassDEP ORS RfD is applied to the noted subgroup of six closely-related PFAS. Based on their similarities MassDEP ORS also concluded that it is appropriate to treat these six compounds additively.

Application of the revised RfD, using the same water ingestion rate and body weight parameters for a lactating woman (i.e., a water ingestion rate of 54 mL/kg-day) and relative source contribution factor of 0.2 previously applied, results in a drinking value of 20 ppt.

Cancer Risk:

MassDEP ORS also considered the potential carcinogenicity of these compounds. A study of people exposed to PFOA and other PFAS concluded that the data supported a probable link between exposure and cancers of the kidney and testes (Barry et al. 2013). No potency estimates were derived. Animal bioassay data from the National Toxicology Program (NTP 2019c) reported elevated pancreatic and liver tumor rates following high dose exposures to PFOA. Although NTP had issued summary data tables for this study, a final report had not been issued during preparation of the TSD. The cancer data is concerning to MassDEP and ORS is closely following the developing science on this topic to better understand the level of cancer risk posed by these compounds.

ORS is assessing this data as part of three-year review required under the MassDEP PFAS6 MMCL, to determine if revisions to the drinking water values are needed.

Analytical Information:

Analytical Methods: US EPA Method 537 (US EPA, 2009)
US EPA Method 537.1 (US EPA, 2018)

Laboratories should achieve a Minimum Reporting Level (MRL) of 2.0 ppt.

Updated analytical methods for drinking water may be found at https://www.epa.gov/measurements-modeling/collection-methods#2
Note US EPA Method 533 (https://www.epa.gov/sites/production/files/2019-12/documents/method-533-815b19020.pdf) was issued too late to be included as an approved method under the MassDEP PFAS6 MMCL.

Other Information:

Information and data referenced in this document pertain to the derivation of the current MassDEP PFAS6 drinking water values may not reflect the most current information regarding

these compounds or other PFAS. Additional relevant information may be available from the following sources:

HAs – The US EPA provides guidance for exposures for chemicals based on their non-cancer effects. More current HAs may be found at https://www.epa.gov/sites/production/files/2018-03/documents/dwtable2018.pdf.

Toxicity values and assessments – For specific information pertaining to derivation of drinking water criteria, consult the Federal Register notice that announces the availability of the most current guidance for that chemical. In addition, information on other current RfDs, as well as cancer assessments for specific chemicals, may be found in the US EPA Integrated Risk Information System (IRIS) at https://www.epa.gov/iris. Please note that the information in IRIS may differ from that used in the derivation process as published in the Federal Register notice.

Class: Organic

References:

MassDEP (2019). Massachusetts Department of Environmental Protection (MassDEP). Technical Support Document - Per- and Polyfluoroalkyl Substances (PFAS): An Updated Subgroup Approach to Groundwater and Drinking Water Values. Office of Research and Standards.

US EPA (2009). United States Environmental Protection Agency. Method 537, Determination of Selected Perfluorinated Alkyl Acids in Drinking Water by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry (LC/MS/MS) Version 1. US EPA, Office of Research and Development, National Exposure Research Laboratory. EPA/600/R-08/092.

US EPA. (2016a). United States Environmental Protection Agency. Drinking Water Health Advisory for Perfluorooctaanoic Acid (PFOA) and Health Effects Support Document for Perfluorooctaanoic Acid (PFOA). US EPA Office of Water. EPA 822-R-16-005

US EPA. (2016b). United States Environmental Protection Agency. Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS) and Health Effects Support Document for Perfluorooctane Sulfonate (PFOS). US EPA Office of Water. EPA 822-R-16-004.