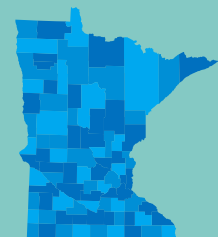


May 2024

Water Quality Standards: Human Health Protective Water Quality Criteria for Per- and Polyfluoroalkyl Substances (PFAS), Appendix B

This appendix provides the site-specific water quality criteria for five PFAS and lists the surface waters where they apply.



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Photo

Minnesota Pollution Control Agency
(Rebecca Higgins, Lake Elmo, Washington
County, MN)

Revisions

May 2024

- Removal of portion of Mississippi River that has new, separate water quality criteria

Minnesota Pollution Control Agency

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Appendix B: Application of per- and polyfluoroalkyl substance water quality criteria to specific water bodies

Background information on per- and polyfluoroalkyl substances (PFAS) covered in this appendix.

PFAS		Aliphatic Carbon No. (Chain length)	CAS Numbers
PFBS	perfluorobutane sulfonate	4	45187-15-3 (anion) 375-73-5 (acid) 29420-49-3 (potassium salt) 68259-10-9 (ammonium salt) 60453-92-1 (sodium salt)
PFBA	perfluorobutanoate	4	45048-62-2 (anion) 375-22-4 (acid)
PFHxS	perfluorohexane sulfonate	6	108427-53-8 (anion) 355-46-4 (acid) 3871-99-6 (potassium salt)
PFHxA	perfluorohexanoate	6	92612-52-7 (anion) 307-24-4 (acid)
PFOA	perfluorooctanoate	8	45285-51-6 (anion) 335-67-1 (free acid) 335-66-0 (acid fluoride) 3825-26-1 (ammonium salt, APFO) 2395-00-8 (potassium salt) 335-93-3 (silver salt) 335-95-5 (sodium salt)
PFOS	perfluorooctane sulfonate	8	45298-90-6 (anion) 1763-23-1 (acid) 29081-56-9 (ammonium salt) 70225-14-8 (diethanolamine salt) 2795-39-3 (potassium salt) 29457-72-5 (lithium salt)

Appendix B1. Application of per- and polyfluoroalkyl substance water quality criteria to specific water bodies: Lake Elmo (Washington County)

Water body: Lake Elmo, Washington County (DNR Lake ID: 82010600)

Water body use class: 2B#

Pollutants:

- Perfluorobutane sulfonate (PFBS)
- Perfluorobutanoate (PFBA)
- Perfluorohexane sulfonate (PFHxS)
- Perfluorohexanoate (PFHxA)
- Perfluorooctanoate (PFOA)

Beneficial uses/use classes: Aquatic consumption and recreation

Reason for application: The Minnesota Pollution Control Agency (MPCA) has developed site-specific water quality criteria (WQC) for application in Lake Elmo as the basis for remediation and other efforts to reduce per- and polyfluoroalkyl substance (PFAS) contamination. The WQC address PFAS with Minnesota Department of Health (MDH) toxicological values and health-based guidance.

The MPCA must protect all surface waters so that they are safe for people recreating, eating fish affected by contamination, and used as source waters for drinking (designated for domestic consumption) as described in Minn. R. chapters 7050 and 7052 (Lake Superior Basin).¹ The MPCA has documented high concentrations of PFAS in Minnesota's surface waters. This WQC is based on the information found in *Water Quality Standard: Human Health Protective Water Quality Criteria for Per- and Polyfluoroalkyl Substances (PFAS)* (available at <https://www.pca.state.mn.us/water/site-specific-criteria>).

The area around Lake Elmo has been broadly affected by PFAS contamination. In October 2020, the MPCA applied WQC for perfluorooctane sulfonate (PFOS). For more information, see; MPCA, 2020 *Water Quality Standard Technical Support Document: Human Health Protective Water Quality Criteria for Perfluorooctane Sulfonate (PFOS)*. Online, <https://www.pca.state.mn.us/water/site-specific-criteria>.

Criteria information:

The WQC are chronic criteria (CC) (see Minn. R. 7050.0217 to 7050.0219). There are three categories of CC that provide the basis for regulatory action under Minnesota's WQS methods and rules; when used for a pollutant with acute, short-term, or subchronic ("less-than-chronic") toxicity, higher early-life exposure rates, or developmental toxicity as a Health Risk Index Endpoint the CC include "DEV":

- A fish-tissue based CC_{FT} or CC_{FT-DEV} applicable in all Class 2 surface waters
- Water column-based CC_{DFR} or CC_{DFR-DEV} applicable in surface waters classified as Classes 1/2A and 1/2Bd
- Water column-based CC_{FR} or CC_{FR-DEV} applicable in surface waters classified as Classes 2B or Class 2D wetlands

The applicable site-specific WQC are found in Table B-1.

¹ The MPCA's Water Quality Standard rules also address impacts to aquatic life and fish-eating wildlife. Those evaluations are not covered in this WQC based only on human health.

Table B-1: PFAS water quality criteria for the protection of surface water and fish consumers.

PFAS	Site-specific water quality criteria: <i>Chronic Criteria (CC)</i>			<i>Health Risk Index Endpoints</i> (Additive risk)
	Class 1/2A or Class 1/2Bd – drinking water, fish and recreational exposure (Applied as a 30-day average) (information only)	Class 2B/2D# – fish and recreational exposure (Applied as a 30-day average) (applicable to Lake Elmo)	Class 2 fish-tissue (fillet) (Applied as the 90 th percentile of 5 or more fish per water body) (applicable to Lake Elmo)	
PFOS (October 2020)	0.05 ng/L (CC _{DFR-DEV})	0.05 ng/L (CC _{FR-DEV})	0.37 ng/g (CC _{FT-DEV})	developmental, adrenal (endocrine), hepatic (liver) system, immune system, thyroid (endocrine)
PFBS (January 2023)	140 ng/L (CC _{DFR-DEV})	350 ng/L (CC _{FR-DEV})	not applicable	thyroid (endocrine)
PFBA (January 2023)	5,700 ng/L (CC _{DFR-DEV})	10,000 ng/L (CC _{FR-DEV})	not applicable	developmental, hematological (blood) system, hepatic (liver) system, thyroid (endocrine)
PFHxS (January 2023)	20 ng/L (CC _{DFR-DEV})	36 ng/L (CC _{FR-DEV})	not applicable	hepatic (liver), thyroid (endocrine)
PFHxA (January 2023)	220 ng/L (CC _{DFR-DEV})	950 ng/L (CC _{FR-DEV})	not applicable	developmental, hepatic (liver) system, respiratory system, thyroid (endocrine)
PFOA (January 2023)	25 ng/L (CC _{DFR-DEV})	88 ng/L (CC _{FR-DEV})	not applicable	developmental, hepatic (liver), immune, pancreas, renal (kidney), thyroid (endocrine)

Description of CC:

CC_{DFR-DEV} : Applied in Class 1/2A and Class 1/2Bd surface waters (D: Domestic Consumption, drinking water/food processing, F: Fish consumption, and R: Recreational exposure); used for a pollutant with acute, short-term, or subchronic developmental (“less-than-chronic”) toxicity and higher early-life exposure rates (developmental toxicity as a Health Risk Index Endpoint)

CC_{FR-DEV} : Applied in Class 2B surface waters (F: Fish consumption and R: Recreational exposure); used for a pollutant with acute, short-term, or subchronic (“less-than-chronic”) toxicity, higher early-life exposure rates, or developmental toxicity as a Health Risk Index Endpoint.

CC_{FT-DEV}: Applied for Bioaccumulative Chemicals of Concern (BCC) in fish (fillet/muscle) for all Class 2 waters (FT: fish-tissue); used for a pollutant with acute, short-term, or subchronic (“less-than-chronic”) toxicity, higher early-life exposure rates, or developmental toxicity as a Health Risk Index Endpoint.

- see Section 10 of the technical support document

Application of the CC in regards to comparing to water and fish monitoring data should follow Minn. R. chs. 7050 and 7052 *Human Health-based Water Quality Standards Technical Support Document* (Final June 2017) (MPCA 2017), available online at <https://www.pca.state.mn.us/sites/default/files/wq-s6-12a.pdf>.

Appendix B2. Application of per- and polyfluoroalkyl substance water quality criteria to specific water bodies: Washington County surface waters in 3M Settlement area (Project 1007)

Water bodies (MPCA WID or DNR Lake ID): Beutel's Pond (82039900); Brown's Pond (82011100); Downs Lake (82011000); Friedrich Pond (82010800); Goose Lake (bayed lake: 82011301 and 82011302); Horseshoe Lake (82007400); Legion Pond (82046200); Margaret Lake (82041900); Rest Area Pond (82051400); Rose Lake (82011200); Sunfish Lake (82010700); Unnamed creek (headwaters to Farney Creek)(07030005-805; Unnamed (Farney) creek (07030005-795); Unnamed creek (headwaters to Raleigh Creek)(07030005-806); Unnamed (Raleigh) creek (07030005-558, 633, 635); Unnamed creek (0703005-613, 615, 616); Unnamed (Tartan) pond (82047100); West Lakeland Ponds (82048800); Lake Edith (82000400); Unnamed creek (0703005-773, 774); Lake St. Croix (82000100)

Water body use class: 2B/2D (wetland definition may apply to additional waters)

Water bodies (DNR Lake ID): Eagle Point Lake (82010900)

Water body use class: 2D

Water bodies (MPCA WID or DNR Lake ID): Valley Branch Creek (07030005-566, 560); Valley Creek (07030005-567, 622); Valley Creek Unnamed tributaries (07030005-618, 621, 623, 676, 677, 678, 679)

Water body use class: 1/2A

Water bodies (DNR Lake ID): St. Croix River (07030005-785; Lake St. Croix to Mississippi River)

Water body use class: 1/2Bd

Pollutants:

- Perfluorobutane sulfonate (PFBS)
- Perfluorobutanoate (PFBA)
- Perfluorohexane sulfonate (PFHxS)
- Perfluorohexanoate (PFHxA)
- Perfluorooctanoate (PFOA)

Beneficial uses/use classes: Aquatic consumption and recreation

Reason for application: The Minnesota Pollution Control Agency (MPCA) has developed site-specific water quality criteria (WQC) for application in the waters listed above (project 1007) as the basis for remediation and other efforts to reduce per- and polyfluoroalkyl substance (PFAS) contamination. The WQC address PFAS with Minnesota Department of Health (MDH) toxicological values and health-based guidance.

The MPCA must protect all surface waters so that they are safe for people recreating, eating fish affected by contamination, and used as source waters for drinking (designated for domestic consumption) as described in Minn. R. chs. 7050 and 7052 (Lake Superior Basin).² The MPCA has documented high concentrations of PFAS in Minnesota's surface waters. This WQC is based on the information found in *Water Quality Standard: Human Health Protective Water Quality Criteria for Per-*

² The MPCA's Water Quality Standard rules also address impacts to aquatic life and fish-eating wildlife. Those evaluations are not covered in this WQC based only on human health.

and Polyfluoroalkyl Substances (PFAS) (available at <https://www.pca.state.mn.us/water/site-specific-criteria>).

The area around waters listed above (project 1007) have been broadly affected by PFAS contamination. In October 2020, the MPCA applied WQC for perfluorooctane sulfonate (PFOS). For more information, see; MPCA, 2020 *Water Quality Standard Technical Support Document: Human Health Protective Water Quality Criteria for Perfluorooctane Sulfonate (PFOS)*. Online, <https://www.pca.state.mn.us/water/site-specific-criteria>.

Criteria information:

The WQC are chronic criteria (CC) (see Minn. R. 7050.0217 to 7050.0219). There are three categories of CC that provide the basis for regulatory action under Minnesota’s WQS methods and rules; when used for a pollutant with acute, short-term, or subchronic (“less-than-chronic”) toxicity, higher early-life exposure rates, or developmental toxicity as a Health Risk Index Endpoint the CC include “DEV”:

- A fish-tissue based CC_{FT} or CC_{FT-DEV} applicable in all Class 2 surface waters
- Water column-based CC_{DFR} or CC_{DFR-DEV} applicable in surface waters classified as Classes 1/2A and 1/2Bd
- Water column-based CC_{FR} or CC_{FR-DEV} applicable in surface waters classified as Classes 2B or Class 2D wetlands

The applicable site-specific WQC are found in Table B-2.

Table B-2: PFAS water quality criteria for the protection of surface water and fish consumers.

PFAS	Site-specific water quality criteria: <i>Chronic Criteria (CC)</i>			<i>Health Risk Index Endpoints</i> (Additive risk)
	Class 1/2A or Class 1/2Bd – drinking water, fish and recreational exposure (Applied as a 30-day average)	Class 2B/2D# – fish and recreational exposure (Applied as a 30-day average)	Class 2 fish-tissue (fillet) (Applied as the 90 th percentile of 5 or more fish per water body)	
PFOS (October 2020)	0.05 ng/L (CC _{DFR-DEV})	0.05 ng/L (CC _{FR-DEV})	0.37 ng/g (CC _{FT-DEV})	developmental, adrenal (endocrine), hepatic (liver) system, immune system, thyroid (endocrine)
PFBS (January 2023)	140 ng/L (CC _{DFR-DEV})	350 ng/L (CC _{FR-DEV})	not applicable	thyroid (endocrine)
PFBA (January 2023)	5,700 ng/L (CC _{DFR-DEV})	10,000 ng/L (CC _{FR-DEV})	not applicable	developmental, hematological (blood) system, hepatic (liver) system, thyroid (endocrine)
PFHxS (January 2023)	20 ng/L (CC _{DFR-DEV})	36 ng/L (CC _{FR-DEV})	not applicable	hepatic (liver), thyroid (endocrine)
PFHxA (January 2023)	220 ng/L (CC _{DFR-DEV})	950 ng/L (CC _{FR-DEV})	not applicable	developmental, hepatic (liver) system, respiratory system, thyroid (endocrine)
PFOA (January 2023)	25 ng/L (CC _{DFR-DEV})	88 ng/L (CC _{FR-DEV})	not applicable	developmental, hepatic (liver), immune, pancreas, renal (kidney), thyroid (endocrine)

Description of CC:

CC_{DFR-DEV} : Applied in Class 1/2A and Class 1/2Bd surface waters (D: Domestic Consumption, drinking water/food processing, F: Fish consumption, and R: Recreational exposure); used for a pollutant with acute, short-term, or subchronic developmental (“less-than-chronic”) toxicity and higher early-life exposure rates (developmental toxicity as a Health Risk Index Endpoint)

CC_{FR-DEV} : Applied in Class 2B surface waters (F: Fish consumption and R: Recreational exposure); used for a pollutant with acute, short-term, or subchronic (“less-than-chronic”) toxicity, higher early-life exposure rates, or developmental toxicity as a Health Risk Index Endpoint.

CC_{FT-DEV} : Applied for Bioaccumulative Chemicals of Concern (BCC) in fish (fillet/muscle) for all Class 2 waters (FT: fish-tissue); used for a pollutant with acute, short-term, or subchronic (“less-than-chronic”) toxicity, higher early-life exposure rates, or developmental toxicity as a Health Risk Index Endpoint.

- see Section 10 of the technical support document

Application of the CC in regards to comparing to water and fish monitoring data should follow Minn. R. chs. 7050 and 7052 *Human Health-based Water Quality Standards Technical Support Document* (Final June 2017) (MPCA 2017), available online at <https://www.pca.state.mn.us/sites/default/files/wq-s6-12a.pdf>.

Appendix B3. Application of per- and polyfluoroalkyl substance water quality criteria to specific water bodies: Bde Maka Ska (Hennepin County)

Water body: Bde Maka Ska, Hennepin County (DNR Lake ID: 27003100)

Water body use class: 2B

Pollutants:

- Perfluorobutane sulfonate (PFBS)
- Perfluorobutanoate (PFBA)
- Perfluorohexane sulfonate (PFHxS)
- Perfluorohexanoate (PFHxA)
- Perfluorooctanoate (PFOA)

Beneficial uses/use classes: Aquatic consumption and recreation

Reason for application: The Minnesota Pollution Control Agency (MPCA) has developed site-specific water quality criteria (WQC) for application in Bde Maka Ska as the basis for remediation and other efforts to reduce per- and polyfluoroalkyl substance (PFAS) contamination. The WQC address PFAS with Minnesota Department of Health (MDH) toxicological values and Health Based Guidance.

The MPCA must protect all surface waters so that they are safe for people recreating, eating fish affected by contamination, and used as source waters for drinking (designated for domestic consumption) as described in Minn. R. chs. 7050 and 7052 (Lake Superior Basin).³ The MPCA has documented high concentrations of PFAS in Minnesota's surface waters. This WQC is based on the information found in *Water Quality Standard: Human Health Protective Water Quality Criteria for Per- and Polyfluoroalkyl Substances (PFAS)* (available at <https://www.pca.state.mn.us/water/site-specific-criteria>).

Bde Maka Ska has been broadly affected by PFAS contamination. In October 2020, the MPCA applied WQC for perfluorooctane sulfonate (PFOS). For more information, see; MPCA, 2020 *Water Quality Standard Technical Support Document: Human Health Protective Water Quality Criteria for Perfluorooctane Sulfonate (PFOS)*. Online, <https://www.pca.state.mn.us/water/site-specific-criteria>.

Criteria information:

The WQC are chronic criteria (CC)(see Minn. R. 7050.0217 to 7050.0219). There are three categories of CC that provide the basis for regulatory action under Minnesota's WQS methods and rules; when used for a pollutant with acute, short-term, or subchronic ("less-than-chronic") toxicity, higher early-life exposure rates, or developmental toxicity as a Health Risk Index Endpoint the CC include "DEV":

- A fish-tissue based CC_{FT} or CC_{FT-DEV} applicable in all Class 2 surface waters
- Water column-based CC_{DFR} or CC_{DFR-DEV} applicable in surface waters classified as Classes 1/2A and 1/2Bd
- Water column-based CC_{FR} or CC_{FR-DEV} applicable in surface waters classified as Classes 2B or Class 2D wetlands

The applicable site-specific WQC are found in Table B-3.

³ The MPCA's Water Quality Standard rules also address impacts to aquatic life and fish-eating wildlife. Those evaluations are not covered in this WQC based only on human health.

Table B-3: PFAS water quality criteria for the protection of surface water and fish consumers.

PFAS	Site-specific water quality criteria: <i>Chronic Criteria (CC)</i>			<i>Health Risk Index Endpoints</i> (Additive risk)
	Class 1/2A or Class 1/2Bd – drinking water, fish and recreational exposure (Applied as a 30-day average) (information only)	Class 2B/2D[#] – fish and recreational exposure (Applied as a 30-day average) (applicable to Bde Maka Ska)	Class 2 fish-tissue (fillet) (Applied as the 90 th percentile of 5 or more fish per water body) (applicable to Bde Maka Ska)	
PFOS (October 2020)	0.05 ng/L (CC _{DFR-DEV})	0.05 ng/L (CC _{FR-DEV})	0.37 ng/g (CC _{FT-DEV})	developmental, adrenal (endocrine), hepatic (liver) system, immune system, thyroid (endocrine)
PFBS (January 2023)	140 ng/L (CC _{DFR-DEV})	350 ng/L (CC _{FR-DEV})	not applicable	thyroid (endocrine)
PFBA (January 2023)	5,700 ng/L (CC _{DFR-DEV})	10,000 ng/L (CC _{FR-DEV})	not applicable	developmental, hematological (blood) system, hepatic (liver) system, thyroid (endocrine)
PFHxS (January 2023)	20 ng/L (CC _{DFR-DEV})	36 ng/L (CC _{FR-DEV})	not applicable	hepatic (liver), thyroid (endocrine)
PFHxA (January 2023)	220 ng/L (CC _{DFR-DEV})	950 ng/L (CC _{FR-DEV})	not applicable	developmental, hepatic (liver) system, respiratory system, thyroid (endocrine)
PFOA (January 2023)	25 ng/L (CC _{DFR-DEV})	88 ng/L (CC _{FR-DEV})	not applicable	developmental, hepatic (liver), immune, pancreas, renal (kidney), thyroid (endocrine)

Description of CC:

CC_{DFR-DEV} : Applied in Class 1/2A and Class 1/2Bd surface waters (D: Domestic Consumption, drinking water/food processing, F: Fish consumption, and R: Recreational exposure); used for a pollutant with acute, short-term, or subchronic developmental (“less-than-chronic”) toxicity and higher early-life exposure rates (developmental toxicity as a Health Risk Index Endpoint)

CC_{FR-DEV} : Applied in Class 2B surface waters (F: Fish consumption and R: Recreational exposure); used for a pollutant with acute, short-term, or subchronic (“less-than-chronic”) toxicity, higher early-life exposure rates, or developmental toxicity as a Health Risk Index Endpoint.

CC_{FT-DEV}: Applied for Bioaccumulative Chemicals of Concern (BCC) in fish (fillet/muscle) for all Class 2 waters (FT: fish-tissue); used for a pollutant with acute, short-term, or subchronic ("less-than-chronic") toxicity, higher early-life exposure rates, or developmental toxicity as a Health Risk Index Endpoint.

- see Section 10 of the technical support document

Application of the CC in regards to comparing to water and fish monitoring data should follow Minn. R. chs. 7050 and 7052 *Human Health-based Water Quality Standards Technical Support Document* (Final June 2017) (MPCA 2017), available online at <https://www.pca.state.mn.us/sites/default/files/wq-s6-12a.pdf>.

Appendix B4. Application of per- and polyfluoroalkyl substance water quality criteria to specific water bodies: Mississippi River, Pool 2 (Dakota, Ramsey, and Washington Counties)

Water body (MPCA WID): Mississippi River, Pool 2 (07010206-814, Ford Dam (L&D 1) to Hastings Dam (L&D 2)), excluding Mississippi River Mile 820 to Hastings Dam (see Human Health Protective Water Quality Criteria for PFAS in Mississippi River, Miles 820 to 812 (wq-s6-69a) for criteria in the excluded section of Pool 2)

Water body use class: 2B#

Pollutants:

- Perfluorobutane sulfonate (PFBS)
- Perfluorobutanoate (PFBA)
- Perfluorohexane sulfonate (PFHxS)
- Perfluorohexanoate (PFHxA)
- Perfluorooctanoate (PFOA)

Beneficial uses/use classes: Aquatic consumption and recreation

Reason for application: The Minnesota Pollution Control Agency (MPCA) has developed site-specific water quality criteria (WQC) for application in a portion of Pool 2 of the Mississippi River, as the basis for remediation and other efforts to reduce per- and polyfluoroalkyl substance (PFAS) contamination. The WQC address PFAS with Minnesota Department of Health (MDH) toxicological values and health-based guidance.

The MPCA must protect all surface waters so that they are safe for people recreating, eating fish affected by contamination, and used as source waters for drinking (designated for domestic consumption) as described in Minn. R. chs. 7050 and 7052 (Lake Superior Basin).⁴ The MPCA has documented high concentrations of PFAS in Minnesota's surface waters. This WQC is based on the information found in *Water Quality Standard: Human Health Protective Water Quality Criteria for Per- and Polyfluoroalkyl Substances (PFAS)* (available at <https://www.pca.state.mn.us/water/site-specific-criteria>).

The area around Mississippi River, Pool 2 has been broadly affected by PFAS contamination. In October 2020, the MPCA applied WQC for perfluorooctane sulfonate (PFOS). For more information, see; MPCA, 2020 *Water Quality Standard Technical Support Document: Human Health Protective Water Quality Criteria for Perfluorooctane Sulfonate (PFOS)*. Online, <https://www.pca.state.mn.us/water/site-specific-criteria>.

Criteria information:

The WQC are chronic criteria (CC) (see Minn. R. 7050.0217 to 7050.0219). There are three categories of CC that provide the basis for regulatory action under Minnesota's WQS methods and rules; when used for a pollutant with acute, short-term, or subchronic ("less-than-chronic") toxicity, higher early-life exposure rates, or developmental toxicity as a Health Risk Index Endpoint the CC include "DEV":

- A fish-tissue based CC_{FT} or CC_{FT-DEV} applicable in all Class 2 surface waters

⁴ The MPCA's Water Quality Standard rules also address impacts to aquatic life and fish-eating wildlife. Those evaluations are not covered in this WQC based only on human health.

- Water column-based CC_{DFR} or $CC_{DFR-DEV}$ applicable in surface waters classified as Classes 1/2A and 1/2Bd
- Water column-based CC_{FR} or CC_{FR-DEV} applicable in surface waters classified as Classes 2B or Class 2D wetlands

The applicable site-specific WQC are found in Table B-4.

Table B-4: PFAS water quality criteria for the protection of surface water and fish consumers.

PFAS	Site-specific water quality criteria: <i>Chronic Criteria (CC)</i>			<i>Health Risk Index Endpoints</i> (Additive risk)
	Class 1/2A or Class 1/2Bd – drinking water, fish and recreational exposure (Applied as a 30-day average) (information only)	Class 2B/2D# – fish and recreational exposure (Applied as a 30-day average) (applicable to Mississippi River, Pool 2)	Class 2 fish-tissue (fillet) (Applied as the 90 th percentile of 5 or more fish per water body) (applicable to Mississippi River, Pool 2)	
PFOS (October 2020)	0.05 ng/L (CC _{DFR-DEV})	0.05 ng/L (CC _{FR-DEV})	0.37 ng/g (CC _{FT-DEV})	developmental, adrenal (endocrine), hepatic (liver) system, immune system, thyroid (endocrine)
PFBS (January 2023)	140 ng/L (CC _{DFR-DEV})	350 ng/L (CC _{FR-DEV})	not applicable	thyroid (endocrine)
PFBA (January 2023)	5,700 ng/L (CC _{DFR-DEV})	10,000 ng/L (CC _{FR-DEV})	not applicable	developmental, hematological (blood) system, hepatic (liver) system, thyroid (endocrine)
PFHxS (January 2023)	20 ng/L (CC _{DFR-DEV})	36 ng/L (CC _{FR-DEV})	not applicable	hepatic (liver), thyroid (endocrine)
PFHxA (January 2023)	220 ng/L (CC _{DFR-DEV})	950 ng/L (CC _{FR-DEV})	not applicable	developmental, hepatic (liver) system, respiratory system, thyroid (endocrine)
PFOA (January 2023)	25 ng/L (CC _{DFR-DEV})	88 ng/L (CC _{FR-DEV})	not applicable	developmental, hepatic (liver), immune, pancreas, renal (kidney), thyroid (endocrine)

Description of CC:

CC_{DFR-DEV} : Applied in Class 1/2A and Class 1/2Bd surface waters (D: Domestic Consumption, drinking water/food processing, F: Fish consumption, and R: Recreational exposure); used for a pollutant with acute, short-term, or subchronic developmental (“less-than-chronic”) toxicity and higher early-life exposure rates (developmental toxicity as a Health Risk Index Endpoint)

CC_{FR-DEV} : Applied in Class 2B surface waters (F: Fish consumption and R: Recreational exposure); used for a pollutant with acute, short-term, or subchronic (“less-than-chronic”) toxicity, higher early-life exposure rates, or developmental toxicity as a Health Risk Index Endpoint.

CC_{FT-DEV}: Applied for Bioaccumulative Chemicals of Concern (BCC) in fish (fillet/muscle) for all Class 2 waters (FT: fish-tissue); used for a pollutant with acute, short-term, or subchronic ("less-than-chronic") toxicity, higher early-life exposure rates, or developmental toxicity as a Health Risk Index Endpoint.

- see Section 10 of the technical support document

Application of the CC in regards to comparing to water and fish monitoring data should follow Minn. R. chs. 7050 and 7052 *Human Health-based Water Quality Standards Technical Support Document* (Final June 2017) (MPCA 2017), available online at <https://www.pca.state.mn.us/sites/default/files/wq-s6-12a.pdf>.